



Defining Middle-Skill STEM Occupations in Texas

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TEXAS WORKFORCE INVESTMENT COUNCIL

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Executive Summary

Technological advances across all industries have increased the need for further workplace specialization. Specifically, industry specialization has revolved around education and occupations that emphasize science, technology, engineering, and mathematics (STEM). Stakeholders and policymakers at every level are pursuing methods to improve education and training programs that produce qualified workers. Across every educational level, STEM-oriented postsecondary awards continue to increase.

Despite concerted efforts, industries around the nation are still struggling to find qualified workers to fill critical jobs. At the same time, the demand for middle-skill workers with STEM-related training continues to increase. This creates a situation where in-demand middle-skill jobs—those requiring workers with education beyond high school but less than a four-year degree—remain vacant. Consequently, middle-skill STEM occupations have become a major priority for workforce system stakeholders and policymakers.

While concerns over the available supply of middle-skill STEM workers have increased, consistent and accurate research regarding these occupations remains limited. The majority of workforce research has focused on issues relating to educational attainment at or above a four-year degree and occupations associated with those credentials. Therefore, the goal of this report is to present research on middle-skill STEM occupations in the workforce. In particular, this report offers a method for identifying and analyzing middle-skill STEM occupations important to the Texas economy.

This report will first establish the research purpose and provide a clear definition of middle-skill STEM occupations. Next, the process for classifying workers and STEM occupations is described. Middle-skill STEM occupations are then identified and evaluated. Finally, employment and wage information are applied to a list of middle-skill STEM occupations relevant to Texas. Selected occupations are evaluated to understand their importance to the state's economy.

Section 1: Understanding Middle-Skill STEM Occupations

Research Scope

As the national economy continues to improve and grow, more workers will be needed for new and replacement positions in the workforce. New advancements in technology further accelerate economic expansion, often resulting in adjustments to the very nature of work. The rising demand for science, technology, engineering, and mathematics (STEM) trained workers reflects these changes.

Recent reports and surveys indicate that businesses around the nation are having difficulty locating people with the STEM skills and knowledge to fill jobs. A national skills gap is often identified as a cause for various economic issues.¹ However, conflicting research suggests there is insufficient evidence to indicate any significant labor shortages or hiring difficulties for STEM occupations. These data indicate an oversupply of native- and foreign-born STEM workers with four-year or advanced degrees compared to the number of available STEM jobs. The linkage of employment projections and gaps for middle-skill STEM jobs is an area that remains obscure.²

While STEM graduates and workers are key components of the national economy, this report does not explore the debate over national skill gaps or employment shortages. Instead, the purpose of this report is to present research conducted on middle-skill STEM occupations. As a critical segment of the workforce, middle-skill STEM occupations are often understudied and misunderstood. National attention has largely focused on the supply of four-year and graduate-level STEM workers, often overlooking middle-skill STEM occupations where employment shortages may be more prevalent. To improve workforce analyses and decision making, this report offers a method to identify and classify middle-skill STEM occupations in Texas.

What Are Middle-Skill STEM Occupations?

Defining middle-skill STEM occupations is important before any occupations can be classified or analyzed. This report utilizes the most widely accepted definition of middle-skill occupations—those that require education and training greater than a high school diploma but less than a postsecondary four-year degree. This can include subbaccalaureate occupations that require industry-based certifications, associate degrees, or significant on-the-job training, among other credentials.

Conversely, a universally agreed upon definition of STEM occupations does not exist. Instead, traditional conceptualizations of STEM only broadly identify common characteristics. The most basic description of STEM involves high-skill jobs in the fields of science, technology, engineering, and mathematics. These fields are often cross-cutting and build upon each other. Additionally, STEM occupations usually require workers to have knowledge of and utilize computers or other advanced machines. These occupations also generally emphasize training equivalent to or greater than a postsecondary four-year degree.

However, traditional conceptualizations of STEM occupations are losing their relevance as industries continue to evolve and science and technology increasingly permeate all aspects of the workforce. STEM fields are no longer viewed as professions reserved primarily for individuals with four-year degrees or higher. Many occupations once considered non-STEM now require STEM-related skills and knowledge. Continued evaluations based on a limited definition of STEM can be problematic and create workforce analyses that are outdated and inconsistent. Improved evaluations of the workforce must move beyond traditional definitions of STEM to include middle-skill jobs that require STEM knowledge. Middle-skill STEM occupations are a critical segment of the workforce that have not received sufficient attention. These occupations are not only in-demand, they often provide higher wages compared to non-STEM jobs with similar educational requirements.

¹ Business Roundtable (3 December 2014); ManpowerGroup (2015).

² North (2013); Teitelbaum (19 March 2014); Robinson (10 July 2014).

Middle-Skill STEM in the Workforce System: Background and Employment Information

Further research into middle-skill STEM occupations can provide invaluable information and data for workforce stakeholders. The remainder of this section provides a broad description of the way middle-skill STEM occupations are viewed by various entities. It also illustrates the current status of middle-skill STEM occupations as it pertains to several employment-related indicators. Middle-skill STEM occupations are presented separately for context. While the economic and workforce benefits related to middle-skill STEM occupations are discernible, determining the size of the middle-skill STEM workforce has been difficult due to different classification methods.

Explaining Middle-Skill Occupations

Generally, middle-skill occupations are described in terms of educational or training levels. The International Standard Classification of Occupations organizes occupations, including those that are considered middle-skill, based on components that include training, skill levels, and any job related tasks or duties. This multinational database exists as a statistical repository for countries to report, exchange, and better understand labor information. The system has even fostered research on international middle-skill occupations.³

In the United States, middle-skill occupations have been defined by the U.S. Department of Labor and Department of Commerce as jobs requiring workers with more than a high school diploma but less than a postsecondary degree.⁴ The Federal Reserve and other institutions have added both cognitive and manual routine descriptors to identify middle-skill jobs that, in principle, may be carried out by computers.⁵

Middle-skill occupations are associated with a wide range of workforce credentials, from industry-based certifications to apprenticeships to college certificates and associate degrees. Acquiring training or valid credentials are commonly accomplished by passing third-party administered exams, completing course work through community colleges, or fulfilling on-the-job learning requirements. Many of these occupations have consistent or growing job opportunities, especially those that require substantial levels of science and math.⁶

Middle-Skill Employment

Maintaining a well-trained workforce is vital to economic growth. Over the past several decades, the national economy and workforce has changed. While middle-skill occupations have been traditionally associated with technical or manual jobs, an increasing number of administrative and professional occupations are now viewed as middle-skill. As a critical component of the workforce, middle-skill jobs have generally been considered the primary pathway to the middle class. In the past, a high school education was typically sufficient for workers to earn middle class wages. But national expansion and development have fueled economic growth causing many industries to require greater levels of education and training.

Over a 10 year period, from 2012 through 2022, national employment is predicted to increase by nearly 11 percent, approximately 16 million workers.⁷ At the same time, 65 percent of all future jobs will require some type of postsecondary education or training. Of those jobs requiring postsecondary education, nearly half will be in middle-skill occupations.⁸ Current national data indicates that approximately 70 million people are employed in middle-skill occupations, representing over 45 percent of all employment.⁹ Middle-class wages are generally characterized as earnings between \$35,000 and \$95,000 per year.¹⁰ Based on median wage estimates, the percent

³ ILO (18 September 2004); Benton, et al. (July 2014).

⁴ Perez and Pritzker (11 September 2013).

⁵ Autor, et al. (November 2003); Autor (April 2010); Cheremukhin (May 2014).

⁶ Holzer and Lerman (March 2008); NSC (August 2011).

⁷ BLS (19 December 2013).

⁸ Carnevale, et al. (26 June 2013).

⁹ BLS (7 May 2015). Middle-skill occupations relative to low- and high-skill occupations.

¹⁰ Carnevale, et al. (September 2012).

of workers with an associate's degree earning between \$75,000 and \$100,000 are slightly greater than the percentage of those with bachelor's or master's degrees.¹¹ In terms of median hourly wages, middle-skill occupations typically range from \$13.84 to \$21.13.¹² By obtaining postsecondary education and training for middle-skill jobs, workers can improve their job opportunities and increase their average annual earnings by \$24,000 to \$37,000.

Despite competing perspectives regarding the overall decline of available middle-skill jobs over the past several decades, they still represent a larger share of new openings and replacements compared to low- and high-skill occupations.¹³ Many future new and replacement middle-skill jobs will be concentrated in several occupational fields, such as, manufacturing, healthcare, and construction.¹⁴ Middle-skill data for states also reflect similar trends—projections indicate that middle-skill occupations will continue to make up the majority of all skilled workers for nearly every state. As the largest segment of the national workforce, most estimates show a strong current and future demand for middle-skill jobs.

Categorizing STEM Occupations

The creation and popularization of the term STEM is often credited to the National Science Foundation. It crosses all grade levels in the educational spectrum and, in some form, encompasses one of the four subjects that make up the acronym.¹⁵ Depending on the source, STEM occupations may be described very narrowly or broadly. The America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Reauthorization Act of 2010 broadly views STEM to include academic and professional disciplines.¹⁶ This characterization provides federal entities wide latitude to approach and determine STEM occupations.

For instance, the National Science and Technology Council limits STEM to technology, engineering, mathematics, and physical and natural science disciplines. This cabinet-level council of the executive branch recognizes formal or informal and in-school or out-of-school options for education and training for STEM occupations.¹⁷ The U.S. Department of Commerce views STEM occupations as technical support and professional jobs in computer science, mathematics, engineering, and life and physical sciences. This characterization includes several occupations considered to be indirectly related to STEM and jobs that require or utilize STEM-related training, but excludes social scientists and educational jobs.¹⁸

Alternatively, the National Science Foundation's interpretation does include social scientists and certain educational professions. This broader approach not only encompasses core science fields, but also disciplines such as economics, political science, and psychology.¹⁹ Moreover, the U.S. Department of Homeland Security recently expanded its original classification of STEM to include fields of study that lead to professions in pharmaceuticals and economics.²⁰

STEM Workforce Statistics

As stakeholders around the nation discuss ways to increase interest and employment in STEM, many disagree on the number of STEM workers in the workforce due to the method by which STEM occupations are classified. Private sector estimations indicate that total national employment in STEM ranges from five million to over 10

¹¹ Sommers and Morisi (April 2012).

¹² NELP (August 2012).

¹³ Holzer and Lerman (February 2009); NSC (2014).

¹⁴ Carnevale, et al. (November 2011).

¹⁵ Dugger (2010); Gonzalez and Kuenzi (15 November 2012); TIES (2015).

¹⁶ 111th Congress (2010).

¹⁷ NSTC (31 May 2013).

¹⁸ Langdon, et al. (July 2011).

¹⁹ NSF (6 August 2013).

²⁰ U.S. DHS (11 May 2012).

million workers in all fields.²¹ Estimates based on federal data illustrates an even wider range of workers employed in STEM or STEM-related occupations—between seven and 16 million workers.²² Despite variations in employment figures, STEM occupations are expected to increase significantly in the future.

Led by fields such as computing, engineering, research, and physical science, estimates of job growth in STEM through 2024 are promising, significantly outpacing all other occupations. Approximately 80 percent of the fastest growing occupations are in STEM fields.²³ Most states are also anticipating substantial STEM growth; for instance, Texas is expected to represent nearly 10 percent of future STEM opportunities in the nation.²⁴ Additionally, when compared to all occupations, jobseekers for STEM occupations traditionally have lower unemployment rates and greater opportunities. This difference can be seen across the nation and is especially significant for workers seeking STEM-related healthcare positions. Not only are jobs in STEM fields available, an increasing number of STEM-trained workers are finding employment in non-STEM fields.²⁵

STEM occupations, regardless of education level, also offer higher wages that are consistent over time.²⁶ National data shows that STEM occupations can provide average annual wages of \$80,000, nearly twice the annual average for all jobs in the nation. The distribution of earnings within STEM occupations can vary, with engineering and information technology jobs predominantly responsible for increasing wage estimates since these occupations usually have higher base wages. Nevertheless, even the lowest paying STEM occupations provide workers with average annual wages around \$50,000.²⁷

Despite the role that all STEM-trained workers have in the modern economy, descriptions of STEM workers and occupations have focused predominately on those that achieve at least a postsecondary four-year degree. This focus has unintentionally created research and policy that overlooks the impact and importance of middle-skill workers with STEM-related training.²⁸

Overlooking the value of middle-skill STEM occupations has produced several issues. One major concern involves the inconsistent tracking of workforce relevant statistics. National estimates of middle-skill STEM employment range from 1.2 to 7.4 million workers, which illustrates the drastic variance between entities collecting workforce data.²⁹ Considered as a percentage of total national employment, middle-skill STEM workers represent anywhere from less than one percent to six percent of the workforce. This wide variance is startling considering that middle-skill STEM workers make up more than one-third of all national STEM-related workers. Moreover, estimates indicate that of those middle-skill STEM workers, more than 40 percent have an associate's degree.³⁰

More than ever, opportunities to participate in STEM occupations are increasingly available to workers with subbaccalaureate education and training. Of all available STEM jobs, about half are available to workers without a bachelor's degree.³¹ More than 60 percent of middle-skill STEM jobs require six months or less of formal classroom training.³² In many instances, middle-skill STEM workers obtain workforce-related education and training in order to operate in highly specialized environments. Based on educational attainment levels, more middle-skill workers are employed in STEM or STEM-related occupations than workers that have a bachelor's degree.

²¹ Information (30 November 2012); Camarota and Zeigler (May 2014).

²² BLS (May 2014); Vilorio (Spring 2014).

²³ AMT (2015).

²⁴ Educate Texas (28 January 2015).

²⁵ Langdon, et al. (July 2011); Change the Equation (2015); BLS (25 March 2015).

²⁶ Carnevale, et al. (November 2011).

²⁷ Jones (April 2014); Vilorio (Spring 2014).

²⁸ Rothwell (10 June 2013).

²⁹ BLS (May 2014). Estimates calculated from occupational employment statistics based on various classifications of middle-skill STEM jobs.

³⁰ Estimates based on Census employment characteristics of STEM occupations.

³¹ AMT (2015).

³² Carnevale, et al. (September 2012).

Developing a List of Middle-Skill STEM Occupations

As this section illustrated, middle-skill STEM occupations are critical to the workforce system. National estimates indicate significant growth and economic opportunities for workers in many middle-skill STEM occupations. However, these occupations have often been underserved by workforce research in favor of jobs requiring at least a four-year degree. Additionally, national stakeholders have further obscured the subject by offering inconsistent definitions or classification principles. Consistently defining middle-skill STEM occupations is essential to producing accurate information.

The next section examines the initial process for identifying middle-skill STEM occupations. The section begins by briefly describing the method for classifying occupations. In addition, the section explains the process and relevant sources used in this report to identify STEM occupations. Selected sources are organized in order to create a list of STEM occupations for further analysis.

Section 2: Classifying Workers and STEM Occupations

Classifying Workers by Occupational Categories

As the previous section illustrated, estimates of the middle-skill and STEM workforces can differ. One reason for the significant variance is due to the way stakeholders have defined and classified STEM occupations. Accurately classifying STEM occupations is the first step to identifying middle-skill STEM occupations. This section offers relevant background information creating the basis for identifying middle-skill STEM occupations.

Developing the framework begins with a general description of the Standard Occupational Classification (SOC) system. The occupation code standards established by the SOC system form the structure used to compare occupations across various sources. After discussing the SOC system, an annotated description of each STEM occupation classification source is presented. Each organization identifies and determines a different number of jobs as STEM or STEM-related.

Occupational information has long been collected as part of the national census. However, a thorough effort to collect more accurate occupational data did not occur until the SOC system was created in the late 1970s. The SOC system was created to replicate the occupational structure of the nation, and as such, does not include every available individual job title. Instead, SOC organizes jobs and individual titles by designed classification principles. The SOC system organizes and classifies occupations based on similar job duties, skills, education, or training. Thus, while the SOC system includes fewer detailed occupation codes compared to the total number of possible jobs, in general, the system identifies the broadest list of occupations for pay or profit in the national economy.

The SOC system serves as a tool for numerous entities across the nation to efficiently identify, organize, and analyze workforce data. For instance, the U.S. Bureau of Labor Statistics and the U.S. Census Bureau are charged with gathering and publishing information on national employment figures for SOC occupations. The SOC system organizes and codes jobs into 23 major, 97 minor, and 461 broad occupation groups totaling 840 unique and detailed occupations by which workers can be classified. Since its inception, the SOC system has been revised and updated to accurately reflect the economy and workforce system. The 2010 SOC system is currently under revision in preparation for an update in 2018.³³

Classifying STEM Occupations

Using SOC detailed occupation codes to standardize the identification process, this report combines and compares data of 11 sources from nine federal, state, and institutional organizations based on the occupations each recognizes as STEM (see Appendix 1, Step 1, for process details). Based on specific standards, each organization distinguishes a different number of STEM occupations. The number of occupations classified as STEM by each organization ranges from a low of 85 to a high of 184 out of the total 840 SOC detailed occupations. A brief description of the nine organizations and the 11 data sources are presented next.

1. Bureau of Labor Statistics (BLS)/Occupational Employment Statistics (OES)³⁴

As part of the OES publication series, the BLS highlights employment and wage statistics with emphasis on STEM occupations. The report includes a list of occupations used in the OES STEM definition. The OES survey provides employment information on wage and salary jobs in nonfarm industries. Besides typical scientific, engineering, and mathematical occupations, the BLS/OES classification includes several managerial, postsecondary teaching, and sales occupations that are associated with and generally require scientific or technical training. In total, 100 detailed occupations are identified as STEM.

³³ BLS (2015).

³⁴ Watson (August 2014).

2. U.S. Census Bureau (Census)³⁵

The Census methodology for defining STEM occupations follows recommendations from the Standard Occupational Classification Policy Committee. The path between the Census occupation codes and the SOC codes creates a STEM occupation list that distinguishes between STEM, STEM-related, and non-STEM jobs. The Census list of STEM occupations includes computer, mathematical, engineering, and social science groups, while STEM-related jobs are concentrated in healthcare-oriented occupations. Educational teaching occupations at any level are excluded because the Census does not include teaching sectors in its identification of STEM jobs. Occupations that are distinguished as STEM or STEM-related by the Census are combined and broadly cataloged as STEM for this report. In total, 163 detailed occupations are identified as STEM or STEM-related.

3. Center on Education and the Workforce (CEW)³⁶

The CEW provides research on connections between education and training, the workforce, and labor market demands. This report uses two studies conducted by the CEW. The 2010 CEW study examines the relationship between future jobs and the associated educational requirements. The study defines STEM occupations within five occupational groups: computer and mathematics, architects and technicians, engineers and technicians, life and physical sciences, and social sciences.

The 2011 CEW study focuses exclusively on the growth and demand of STEM occupations, along with an examination of trends and STEM competencies. The 2011 study includes most of the STEM occupations from the 2010 study, except it excludes STEM social scientists and middle-skill technical workers. In total, 96 and 85 detailed occupations are identified as STEM in the 2010 and 2011 CEW studies, respectively.

4. U.S. Department of Commerce (Commerce)³⁷

The Commerce report provides a broad overview of the STEM workforce, including employment, wage, and educational data for STEM workers. The report expands on traditional STEM occupations to include professional and technical support jobs in STEM fields. It counts STEM-associated management occupations, but excludes education jobs and social scientists. STEM occupations are analyzed and determined from the SOC system of broad and detailed occupation codes. In total, 85 detailed occupations are identified as STEM.

5. Florida Department of Economic Opportunity (FLDEO)³⁸

As part of the process to improve the state's economy, Florida has increased emphasis on STEM-oriented education and training to fulfill various workforce needs. Florida operates a state-specific list of occupations that identifies STEM jobs. In conjunction with BLS, the FLDEO created a STEM occupation list based on statewide industry priorities, among other things. The list matches SOC codes and occupations to state-specific codes and estimates of education level for entry. As expected, the types of occupations considered STEM by the FLDEO are state specific, including several management, business, media, and production occupations. In total, 156 detailed occupations are identified as STEM.

6. National Science Foundation (NSF)³⁹

The NSF examines the science and engineering (S&E) workforce by highlighting major national and international topics, including, educational, labor force, and employment trends. The NSF considers the broader classification of

³⁵ Census (2015a).

³⁶ Carnevale, et al. (15 June 2010); Carnevale, et al. (20 October 2011).

³⁷ Langdon, et al. (July 2011).

³⁸ FLDEO (2015).

³⁹ NSF (2014).

STEM occupations to include S&E occupations as well as computer, management, and technical jobs. The NSF report distinguishes between occupations that directly or indirectly use STEM skills and knowledge.

Based on SOC major groups, direct STEM jobs include computer and mathematical occupations, architecture and engineering occupations, life, physical, and social science occupations, and postsecondary S&E educators. Indirect STEM jobs encompass certain managers, technicians, and technologists. STEM or STEM-related occupations are analyzed and identified from the NSF's classification of these major occupational groups. In total, 116 detailed occupations are identified as STEM.

7. Occupational Information Network (O*Net) STEM Career Cluster and STEM Discipline⁴⁰

The O*Net system uses a content-based framework to identify specific characteristics of individual occupations that can be applied across multiple sectors or industries. This framework includes six features: worker characteristics, worker requirements, experience requirements, occupational requirements, workforce characteristics, and occupation-specific information.

O*Net Career Cluster outlines jobs in the same field that require similar skills. It includes jobs that require planning, managing, and providing scientific research and other technical professions. O*Net Career Cluster emphasizes educational planning to obtain required competencies in specific career pathways.

O*Net STEM Discipline organizes occupations by required STEM education and training. While O*Net's category of STEM Discipline includes a wider range of jobs in all major occupational groups, compared to O*Net's STEM Career Cluster, it excludes social science professions. Both O*Net STEM Career Cluster and STEM Discipline exclude nearly all healthcare occupations. In total, 103 and 126 detailed occupations are identified as STEM in the O*Net STEM Career Cluster and STEM Discipline, respectively.

8. Standard Occupational Classification Policy Committee (SOCPC)⁴¹

The STEM acronym was commonly used before any formal definition was created. In 2011, at the request of the Office of Management and Budget, the BLS formally defined STEM through the SOCPC. The workgroup identified existing definitions and developed a STEM framework that includes occupations matched to SOC classification principles to ensure consistency across agencies and organizations.

The SOCPC workgroup created a classification system with two major STEM domains—science, engineering, mathematics, and information technology domain and science- and engineering-related domain—each consisting of two subdomains. This categorization distinguishes between primary and secondary types of STEM occupations. The subdomains for primary STEM jobs are life and physical sciences, engineering, mathematics, and information technology occupations and social science occupations. Secondary STEM jobs distinguish between architecture occupation and health occupation subdomains.

The subdomain categories are applied to every SOC detailed occupation code to distinguish between STEM and non-STEM jobs. Moreover, identified STEM occupations are further organized into five types of occupations within each subdomain—research, development, design, or practitioner occupations; technologist and technician occupations; postsecondary teaching occupations; managerial occupations; and sales occupations. In total, 184 detailed occupations are identified as STEM.

⁴⁰ O*Net (2015).

⁴¹ BLS (2015).

9. Texas Workforce Commission (TWC) Strategic Workforce Assessment Program (SWAP)⁴²

Developed by the TWC as a tool to understand occupational skills and training required for various industry clusters, SWAP provides skill profiles for individual or broad occupations. Among other things, SWAP provides occupational profiles, employment figures, and general education and training requirements. SWAP helps stakeholders identify skills and training by industry cluster or sector based on labor market information. The SWAP program includes a wide range of occupations considered STEM, but excludes social science teachers at any level. In total, 134 detailed occupations are identified as STEM.

Analysis of STEM Occupations Across Nationwide Sources

In all, 11 total sources that identify STEM occupations are collected from nine different organizations. The sources are combined alphabetically to form a comparative list of STEM occupations. Detailed SOC occupation titles and codes are matched to each source to provide a visual overview of jobs classified as STEM (see Appendix 2).

For the most part, occupations considered STEM by each source were already formatted by SOC detailed occupation codes. The Census categorized several STEM occupations in terms of SOC broad groups instead of detailed occupations and the NSF only organized general S&E and S&E-related occupations into categories of STEM or science and technology (S&T).⁴³ Thus, STEM occupations classified by the Census and NSF required further interpretation to match SOC detailed occupation code standards.

After the STEM occupations are organized, the comprehensive list is analyzed. A total of 257 out of 840 possible detailed SOC occupations are identified as STEM by at least one of the sources. Across all sources, 18 of the 23 major occupation groups are represented. Of those 18 major groups, STEM occupations are concentrated around six major groups.⁴⁴ However, only three major groups contain occupations that are considered STEM by all nine organizations, totaling 42 matched STEM occupations (see Appendix 2, matched STEM occupations identified in yellow).⁴⁵ Several organizations classified a greater variety of occupations outside of the SOC major groups most commonly associated with STEM occupations.⁴⁶

The next section details the process for identifying occupations considered middle-skill from the analysis of STEM occupations. Based on the list of identified middle-skill STEM occupations, selected major occupation groups are broadly highlighted and described.

⁴² TWC (2015a).

⁴³ For instance, the Census identifies the entire SOC broad group of software developers and programmers as STEM occupations. The SOC broad group of software developers and programmers encompasses four SOC detailed occupations (computer programmers; software developers, applications; software developers, systems software; and web developers). Using the S&E and S&E-related designations, the NSF groups occupations into general categories (physical scientists, engineers, etc.) and broadly classifies those occupation categories as either STEM or S&T.

⁴⁴ The six major groups are management; computer and mathematics; architecture and engineering; life, physical, and social sciences; education, training, and library; and healthcare practitioners and technical occupations.

⁴⁵ The three major groups are computer and mathematics; architecture and engineering; and life, physical, and social sciences occupations.

⁴⁶ The FLDEO, O*Net STEM Discipline, and TWC SWAP classify additional STEM occupations in the major groups of business and financial operations; art, design, entertainment, sports, and media; and production occupations, among others.

Section 3: Middle-Skill STEM Occupations in the National Workforce

Classifying Middle-Skill STEM Occupations

With the advent of new technologies and processes, more jobs will require STEM or STEM-related skills and knowledge. The analysis of STEM occupations illustrates classification inconsistencies between various sources nationwide. Outside of occupations that are overwhelmingly considered STEM, such as engineering and math related jobs, stakeholders disagree on the total number of STEM occupations in the workforce.

This report constructs a complete list of middle-skill STEM occupations by considering the entire list of STEM occupations (see Appendix 1, Step 2, for process details). With 257 classified jobs, the list of STEM occupations is incorporated with national occupational information regarding typical levels of education required for entry. National data on education and training assignments are obtained from BLS employment projections. Typical entry-level education estimates are based on education and training levels most workers need to enter an occupation. Eight educational categories are identified by the BLS, with half of the categories representing education and training that produces middle-skill workers.⁴⁷ Once education and training levels are applied to the list of STEM occupations, jobs representing middle-skill are identified (see Appendix 3).

Of the 257 occupations considered STEM or STEM-related, 85 occupations are identified as middle-skill STEM occupations. The list of middle-skill STEM occupations represent 14 different major occupational groups. The majority of identified middle-skill STEM jobs are located within three BLS major groups—architecture and engineering; life, physical, and social science; and healthcare practitioners and technical occupations. Based on education and training levels, the majority of middle-skill STEM occupations typically require an associate’s degree for entry. Moreover, only five occupations are identified as middle-skill STEM of the 42 STEM occupations matched across all sources in section two (see Appendix 3, occupations in yellow are matched across all STEM sources).

Analysis of Middle-Skill STEM Occupations by Major Occupation Groups

The following segments describe four major occupation groups that encompass many common middle-skill STEM jobs around the nation.⁴⁸ Each segment briefly describes the overall major occupational group and its associated middle-skill STEM occupations. Collectively, these four major occupation groups encompass over 7.5 million workers—almost 70 percent of the entire middle-skill STEM workforce in America.

Architecture and Engineering Occupations (SOC 17-0000)

The architecture and engineering group includes all occupations associated with these two broad fields, including, surveyors, drafters, and associate technicians. National employment estimates (see Table 1) across the group indicate approximately 2.5 million workers that earn an annual average wage of over \$80,000. Employment in this group is concentrated heavily in service related industries. Top paying occupations are found in industries related to oil and gas extraction, and architecture and engineering information services. Employment is also broadly dispersed throughout the nation, with the highest levels located in California, Texas, Michigan, New York, and Florida.

Middle-skill STEM architecture and engineering occupations constitute almost 30 percent of employment in the group. In terms of employment, aerospace engineering and operations technicians (11,230) and electrical and electronics engineering technicians (137,040) represent the fewest and highest numbers, respectively. The lowest average annual salary belongs to surveying and mapping technicians (\$43,870), while aerospace engineering and

⁴⁷ The four BLS categories of education and training that produce middle-skill workers are high school diploma or equivalent; some college, no degree; postsecondary non-degree award; and associate’s degree.

⁴⁸ The four major groups are architecture and engineering; life, physical, and social science; healthcare practitioners and technical; and installation, maintenance, and repair occupations.

operations technicians earn the highest (\$64,310). Almost every identified middle-skill STEM occupation in this group expects growth either marginal (civil engineering technicians) to faster than average (environmental engineering technicians) over the next decade. Employment as an industrial engineering technician is projected to decline slightly.

Table 1: National Employment for SOC Major Group: Architecture and Engineering (A&E) Occupations

	Employment	Hourly Wage (Mean)	Annual Wage (Mean)
All A&E Occupations	2,418,020	\$39.19	\$81,520
A&E STEM	1,735,080	\$44.36	\$92,350
A&E Middle-Skill STEM	682,960	\$26.73	\$55,610

Life, Physical, and Social Science Occupations (SOC 19-0000)

Similar to the previous major group, the life, physical, and social science group encompasses occupations that require some degree of STEM skills and knowledge. Estimates of employment (see Table 2) indicate over one million workers across the nation. The average annual salary for the entire group is slightly above \$70,000, with workers earning an average of \$30 per hour. Employment in this group is primarily concentrated in scientific research and development services. Industries with the highest earning potential are highly specialized, revolving around securities and commodities, monetary authorities, and oil and gas extraction entities. States with the highest number of workers in this group are in California and Texas.

Middle-skill STEM workers in this group make up more than 20 percent of the workforce. Nuclear technicians (6,380) have the smallest employment figures, but have the highest average annual earnings (\$75,960). Representing the most workers, life, physical, and social science technicians (67,140) are primarily employed at colleges, universities, and professional schools. Technicians across several specializations employ the most workers and have average annual salaries over \$45,000. The majority of middle-skill STEM occupations in this group are projected to grow at a faster than average pace over the next decade (i.e. chemical, environmental science and protection, geological and petroleum, and nuclear technicians). Conversely, forest and conservation technician employment is expected to decline.

Table 2: National Employment for SOC Major Group: Life, Physical, and Social Science (LPS) Occupations

	Employment	Hourly Wage (Mean)	Annual Wage (Mean)
All LPS Occupations	1,144,440	\$33.69	\$70,070
LPS STEM	878,670	\$38.06	\$79,162
LPS Middle-Skill STEM	265,790	\$23.68	\$49,251

Healthcare Practitioners and Technical Occupations (29-0000)

Healthcare practitioners and technical workers encompass a wide variety of occupations—from medical records technicians to physicians and surgeons. Relative to every major occupational group, healthcare practitioners and technicians have the seventh highest employment number, representing nearly eight million workers (see Table 3). Additionally, this group has the fifth highest average annual wage estimate at over \$75,000. Industries with the most employment and highest wage earners are concentrated in independent physician offices and general medical and surgical hospitals. Workers in this group are primarily concentrated around major metropolitan areas across the nation, especially in California, Texas, New York, and Florida.

Within this group, middle-skill STEM workers represent over 70 percent of the workforce. Registered nurses represent nearly half of all middle-skill STEM healthcare workers (2,687,310), earning an average of nearly \$70,000 annually. Hearing aid specialists employ the fewest number of workers (5,570) and radiation therapists earn the

highest annual average (\$83,710). The job outlook for every middle-skill STEM occupation in this group is projected to grow over the next decade—increasing by nearly 1.5 million workers. Growth for most of these middle-skill STEM jobs are expected to increase much faster than average. Specifically, employment for registered nurses are projected to grow by more than half a million workers.

Table 3: National Employment for SOC Major Group: Healthcare Practitioners and Technical (HP&T) Occupations

	Employment	Hourly Wage (Mean)	Annual Wage (Mean)
All HP&T Occupations	7,854,380	\$36.54	\$76,010
HP&T STEM	2,310,820	\$59.62	\$121,881
HP&T Middle-Skill STEM	5,543,540	\$24.08	\$50,093

Installation, Maintenance, and Repair Occupations (49-0000)

The installation, maintenance, and repair group includes over 50 different detailed occupations. Workers in the group are found in nearly every industry, from automotive and avionics to medical and information technology services. Nationally, there are more than five million workers employed in this group (see Table 4). Annual wages are slightly above the national average, with workers earning just over \$45,000. Employment across industries in this group is primarily located in automotive, building equipment, and local government. Texas employs the greatest number of workers in this group, representing approximately 42 jobs for every 1,000 jobs in the state.

Middle-skill STEM workers make up about 20 percent of the workforce within the group. Automotive service technicians and mechanics represent the largest portion of middle-skill STEM workers with over 600,000 employed around the nation. Aircraft mechanics and service technicians earn the highest annual average salary (\$58, 850), while electronic home entertainment equipment workers earn the least (\$38,140). Although they represent the smallest number of workers (3,710), wind turbine service technicians earn well over the annual national average. Additionally, as demand for wind energy increases, employment is projected to rise much faster than the average for all occupations. Automotive service and medical equipment repairers are also expected to see increased and improved job growth.

Table 4: National Employment for SOC Major Group: Installation, Maintenance, and Repair (IM&R) Occupations

	Employment	Hourly Wage (Mean)	Annual Wage (Mean)
All IM&R Occupations	5,244,670	\$21.74	\$45,220
IM&R STEM	1,068,540	\$23.62	\$49,122
IM&R Middle-Skill STEM	1,068,540	\$23.62	\$49,122

While not detailed in this section, three other occupation groups—computer and mathematical, healthcare support, and construction and extraction—are worth mentioning based on their impact on employment. While only 10 detailed occupations are identified as middle-skill STEM, about three million workers are employed in jobs across the three groups. Chief among those jobs are electricians, dental assistants, and medical-related assistants. The next section utilizes the identified list of middle-skill STEM occupations to analyze the Texas workforce system. Several additional jobs are identified and combined with the list of middle-skill STEM occupations. These additional jobs represent other middle-skill STEM occupations important to the Texas economy. Statewide employment and wage information are then matched to each middle-skill STEM occupation for further evaluation.

Section 4: Middle-Skill STEM Occupations in the Texas Economy

Identifying Middle-Skill STEM Occupations in Texas

Relative to other states, the economic health of Texas remained strong during and after the Great Recession. In 2011, Texas surpassed its pre-recession employment peak of 10.6 million jobs. Over the next four years the state added an additional 1.2 million jobs.⁴⁹ Despite a slight decrease in the demand for middle-skill workers over the last decade, middle-skill jobs still represent the greatest share of statewide employment by skill level. Many major Texas metropolitan areas are also consistently among the top areas in the nation for middle-skill job growth.⁵⁰ Moreover, estimates of future job openings in the state indicate that demand for middle-skill jobs will remain strong.⁵¹

Overall, the demand and opportunity for STEM talent has remained strong in Texas. The economic and workforce environment has fostered significant growth and development in STEM fields. Texas has been recognized as the largest tech-exporting state in the nation. Additionally, the state was ranked in the top 10 for STEM job growth and technology-related entrepreneurship.⁵² In terms of employment opportunities, there are roughly 2.5 STEM-related jobs for every unemployed worker, compared to only one non-STEM job for every 3.3 unemployed workers in the state. Employment in STEM jobs will only increase over the next decade—nearly 25 percent—with significant opportunities in computing, engineering, and advanced manufacturing fields. Potential earnings for STEM occupations are also nearly double that of all other jobs in Texas.⁵³ The demand for STEM education has also seen a meteoric rise in the state. Over the last decade, the number of STEM bachelor's, associate's, and certifications (BACs) awarded in Texas has increased steadily. In 2014, the state awarded over 21,500 STEM BACs—an 80.2 percent increase in awards since 2000.⁵⁴

Not surprisingly, the direction of the Texas economy and workforce has fostered a greater need for middle-skill STEM workers, especially in occupations such as manufacturing, construction, and energy. However, like most states, the challenge for many industries has been finding enough qualified talent to fill available middle-skill STEM positions. The emphasis on traditional four-year degrees usually overshadows the fact that middle-skill jobs, especially those that require STEM training, are capable of providing high wages for workers. In Texas, the average first-year earnings for a worker with a two-year technical degree is roughly \$50,000—over \$10,000 more than the average graduate with a four-year degree.⁵⁵

This final analysis step generates a middle-skill STEM occupation list for Texas. The final list of occupations for Texas combines additional statewide jobs with the 85 identified middle-skill STEM occupations (see Appendix 1, Step 3, for process details). An additional 12 middle-skill STEM occupations were identified based on relevance and importance to the Texas economy.⁵⁶ Thus, a total of 97 middle-skill occupations are identified as STEM or STEM-related. Statewide employment information are matched to each occupation to present a broad view of middle-skill STEM jobs in Texas (see Appendix 4, occupations in blue are the additional 12).

This section presents an overview of Texas middle-skill STEM occupations described in the context of four major occupational groups. Next, selected high-growth middle-skill STEM occupations are analyzed in order to highlight employment and wage data and the regions that foster these occupations.

⁴⁹ Texas Comptroller (1 July 2015).

⁵⁰ Kotkin (24 October 2013); Webster (September 2014).

⁵¹ NSC (August 2011); NSC (2014).

⁵² USCCF (June 2014).

⁵³ Carnevale, et al. (26 June 2013); Change the Equation (2015).

⁵⁴ THECB (June 2015).

⁵⁵ College Measures (2015).

⁵⁶ The 12 additional STEM occupations include healthcare support; construction and extraction; installation, maintenance, and repair; and production occupations.

Analysis of Texas Middle-Skill STEM Occupations by Major Occupation Groups

Current middle-skill STEM employment in Texas is estimated near 1.2 million workers—about 10.5 percent of total state employment.⁵⁷ Based on available employment information, nearly every identified middle-skill STEM occupation will see growth through 2022.⁵⁸ Overall, the entire Texas middle-skill STEM workforce is projected to increase by 24 percent to nearly 1.5 million workers. This rise represents a cumulative growth of almost 300,000 middle-skill STEM jobs. The current median annual income for the middle-skill STEM workforce in Texas is about \$46,000. Comparatively, the middle-skill STEM median income estimate is almost twice the amount of the federal poverty threshold for a family of four and just slightly less than the middle-skill STEM national median income.⁵⁹

The following segments provide further detail on four important major occupation groups in Texas based on estimates of employment growth and income potential. These major occupation groups are briefly described in broad terms to include all occupations within the group. The descriptions are then narrowed to illustrate middle-skill STEM occupations within each major group.

Healthcare Practitioners and Technical Occupations (SOC 29-0000)

As illustrated by the national description of this occupational group, healthcare practitioners and technical occupations offer some of the highest paying jobs among all groups. Representing over 600,000 workers in Texas, this group is projected to increase dramatically over the next decade. Additionally, this group is projected to represent 6.5 percent of Texas' total employment by 2022.

Middle-skill STEM workers in this group are expected to increase by well over 100,000 workers by 2022. The most common jobs in this group are those considered middle-skill STEM, such as, registered nurses (45 percent), licensed practical and vocational nurses (17 percent), and pharmacy technicians (7 percent). Additionally, diagnostic sonographers (57.5 percent), cardiovascular technicians (44.3 percent), and surgical technologists (39.3 percent) are projected to have the largest change in growth for all middle-skill STEM occupations in the group.

Healthcare Support Occupations (SOC 31-0000)

While healthcare support occupations are related to healthcare practitioners and technical occupations, workers in this group generally assist and are supervised by workers from the latter group. Nevertheless, this group represents approximately 300,000 workers in Texas. This occupational group is about three percent of current total employment in the state.

Depending on the occupation, middle-skill STEM workers in this group can earn annual wages upwards of \$70,000 (occupational therapy assistants). About 25,000 middle-skill STEM workers are expected to be added to the workforce by 2022, with the majority of workers employed as medical and dental assistants. Occupational (44.1 percent) and physical (38 percent) therapy assistants represent the highest changing middle-skill STEM occupations.

Construction and Extraction Occupations (SOC 47-0000)

Construction and extraction occupations consist of numerous trade, skilled, and manual workers. Workers in this group are primarily found in contracting industries. With more than 600,000 workers, Texas has the highest number of individuals employed in this group in the nation. Construction and extraction occupations make up 5.5 percent of total employment in the state, but 11.7 percent of all construction and extraction jobs in the nation.

⁵⁷ TWC (2015b).

⁵⁸ Employment in four middle-skill STEM occupations are projected to decline: farmers, ranchers, and other agricultural managers; animal breeders; fallers; and prepress technicians and workers.

⁵⁹ Census (2015b); HHS (3 September 2015).

Overall, Texas workers in this occupation group can earn an average annual salary near \$40,000, and even upwards of \$67,000.

Several occupations in this group are expected to grow significantly over the next decade in Texas, with several middle-skill STEM occupations leading the way. Specifically, electricians (10,700) and operating engineers and construction operators (8,500) are projected to have the largest total increase in employment among middle-skill STEM occupations in the group. By 2022, middle-skill STEM occupations are expected to make up approximately 15 percent of the entire group in the state.

Production Occupations (SOC 51-0000)

There are over 100 occupations identified within this major group, from assemblers and fabricators to machine and chemical plant operators. Production occupations represent nearly 700,000 workers in Texas, with more than 60 jobs for every 1,000 jobs. The majority of production occupation workers are employed in various manufacturing industries. Employment is estimated to increase by 14 percent in the state by 2022, adding more than 100,000 workers. On average, workers in this group can earn more than \$65,000 per year.

Middle-skill STEM production occupations are expected to increase by nearly 20 percent by 2022. Average annual earnings for middle-skill STEM production workers reach nearly \$46,000. Overall, the middle-skill STEM production occupations are projected to add more than 20,000 workers to the group, totaling almost 130,000 workers by 2022. Chemical equipment and gas plant operators earn well over the state average, reaching nearly \$66,000.

Critical Middle-Skill STEM Occupations in Texas

Utilizing the list of middle-skill STEM occupations, a more detailed regional analysis of Texas can be developed. Workforce information for statewide development boards are matched with specific middle-skill STEM occupations and highlighted below based on projected employment and wage information. Based on occupational growth and wage data, the top middle-skill STEM occupations come from six different major occupation groups.⁶⁰ Overall, projections indicate that each occupation will increase in employment across the state, with significant growth concentrated near major metropolitan areas.

Computer User Support Specialists (SOC 15-1151)

As the state's technology industry continues to grow, computer user support specialists will see increased employment opportunities. Support specialists provide technical assistance to a variety of computer users, from hardware to installation related information. By 2022, almost 60,000 computer user support specialists will be employed across the state. That figure represents a 15 percent increase from 2012. Overall, average annual earnings are around \$45,000, with workers in the Gulf Coast region earning nearly \$60,000. Along with the Gulf Coast region, the Alamo, Capital Area, Greater Dallas, and North Central regions will account for almost 80 percent of total employment growth across the state.

Registered Nurses (SOC 29-1141)

Of all the identified middle-skill STEM occupations in Texas, registered nurses are projected to increase the greatest number by 2022. Currently, nearly 200,000 workers are employed as registered nurses in Texas, second only to California. However, by 2022, the number of registered nurses in Texas will increase by more than 20 percent, adding more than 50,000 workers. The Alamo, Greater Dallas, and Gulf Coast regions will account for almost half of the total growth in the state. Registered nurses in Texas can earn an average of \$65,000, with

⁶⁰ Computer and mathematical occupations (15-0000); healthcare practitioners and technical occupations (29-0000); healthcare support occupations (31-0000); construction and extraction occupations (47-0000); installation, maintenance, and repair occupations (49-0000); and production occupations (51-0000).

workers in the Middle Rio Grande region earning upwards of \$90,000. Registered nurses in the North East Texas region earn an average greater than \$55,000.

Licensed Practical and Licensed Vocational Nurses (SOC 29-2061)

Compared to other states, Texas employs the highest number of licensed practical and vocational nurses in the nation. Of the top jobs in the state, this occupation is expected to increase dramatically over the next several years. With nearly 20,000 new workers, representing a 27 percent increase, licensed practical and vocational nurses will reach almost 100,000 total workers by 2022. While statewide annual averages for this occupation are near \$45,000, workers in the Middle Rio Grande (\$35,267) earned the lowest and those in Greater Dallas (\$49,709) earned the highest. The majority of workers in this occupation are employed at nursing care facilities and home healthcare services. Much of the growth in this occupation is concentrated around three major areas of the state. Nearly 6,000 jobs will be added to the North Central Texas, Tarrant County, and Greater Dallas areas, while the Alamo area will increase by 2,000 workers. The most significant increase will be seen in the Gulf Coast region (4,300), an area consisting of Harris and Galveston County.

Medical Assistants (SOC 31-9092)

Similar to nursing occupations, medical assistants are heavily involved in the healthcare industry. Generally, medical assistants perform a variety of administrative and clinical duties under the direction of a physician. With the nation's second highest employment total, medical assistants in Texas are expected to grow by more than 30 percent. By 2022, Texas will have nearly 70,000 workers employed as medical assistants. The majority of these workers will be employed at hospitals and physician offices around the state. Generally, medical assistants in Texas can earn an average of \$28,000, with the Lower Rio Grande Valley (\$21,310) and the Greater Dallas (\$31,850) areas earning the lowest and highest, respectively. Not surprisingly, growth in the medical assistance profession follows growth in other major healthcare industries. The North Central Texas, Tarrant County, and Greater Dallas regions will add an additional 5,200 workers, while the Gulf Coast region is projected to increase the most, with over 4,000 new workers.

Electricians (SOC 47-2111)

As a vital workforce occupation, demand for electricians will continue to grow in Texas. Texas has the highest number of employed electricians in the nation, with over 50,000 workers. Over the next several years this occupation is projected to increase employment by over 20 percent, adding 11,000 workers to the Texas workforce. Generally, electricians can earn upwards of \$45,000 each year working as building equipment contractors or in other construction services. Electricians in Cameron, the southernmost area of the state, take home an average of \$30,000, while those in Southeast Texas can earn as much as \$52,440 per year. Significant employment growth for electricians will occur in the Gulf Coast (3,660) and Greater Dallas (1,470) regions. Additionally, the Alamo and Capital Area are projecting growth rates of 18.3 and 25.7 percent, respectively. Both of these areas offer an average hourly wage of \$22.

Automotive Service Technicians and Mechanics (SOC 49-3023)

As the national population continues to grow, new estimates indicate that drivers can spend an average of 84 hours a year in gridlock. Predictably, the largest metropolitan areas are the most impacted by growth in these occupations.⁶¹ As the number of vehicles increases so does the need for automotive service technicians and mechanics. Currently, Texas has the second highest employment level for this occupation in the nation—about 50,000 workers. In the upcoming years this occupation projects to increase by over 17 percent, adding almost 10,000 workers. The majority of these workers are employed at repair and maintenance stores or automotive dealerships, earning an average annual salary of \$39,000. Workers in the Cameron (\$29,565) and Lower Rio Grande Valley (\$32,087) generally earn less than workers in the Southeast (\$42,713) and North Central (\$43,724)

⁶¹ INRIX (26 August 2015).

Texas regions. Growth in this occupation will primarily be located around the Gulf Coast, Greater Dallas, and North Central Texas areas.

Welders, Cutters, Solderers, and Brazers (SOC 51-4121)

Workers in this occupation predominantly work with fabricated metal products in a variety of environments. Nationally, Texas has the most workers employed in this occupation, more than double the number of similar workers in California. With employment growth projected at over 20 percent, this occupation expects to add nearly 10,000 workers by 2022. Workers can earn an average of \$41,000 per year in many manufacturing and construction industries across Texas. Depending on the region, the distribution of wages can be significant, with workers in the Cameron area earning an estimated \$26,000 and those in Greater Dallas earning \$56,000. Moreover, growth in this occupation is expected to occur around major population areas in North (North Central, Tarrant County, Greater Dallas), West (Permian Basin), and Southeast (Gulf Coast) Texas.

Section 5: Concluding Comments

While traditional STEM workers with four-year degrees are important to the economy, middle-skill STEM occupations represent many of the fastest growing and most needed jobs around the nation. Contrary to many reports, middle-skill workers—individuals with education and training beyond high school but less than a four-year degree—will continue to represent the largest segment of the workforce population for the foreseeable future. At the same time, many jobs once considered non-STEM now need STEM-related knowledge.

However, evaluations of STEM occupations have been hindered by different definitions of STEM. In order to improve economic and workforce assessments, a more accurate list of occupations must be developed. Various sources that define STEM jobs were identified to create a more comprehensive list of middle-skill STEM occupations. These occupations were combined with employment and wage data to understand their impact on the Texas economy. Not only do middle-skill STEM workers earn above average wages, findings suggest that these workers will continue to have significant employment opportunities in the future. Most importantly, they make up a critical segment of the workforce population integral to the development and sustained health of the state.

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Appendix 1: Process for Developing a Middle-Skill STEM Occupations List

This section describes the process used to develop and classify the list of middle-skill STEM occupations in the report. The process involves three separate steps:

1. Identifying and Comparing STEM Occupation Sources
2. Classifying Middle-Skill STEM Occupations
3. Creating a List of Middle-Skill STEM Occupations Critical to the Texas Economy

Each step in the process is described in further detail below.

1. Identifying and Comparing STEM Occupation Sources
(See Appendix 2: Analysis of STEM Occupations by Source)

The first step in developing a list of middle-skill STEM occupations is to identify national organizations that classify occupations as STEM. After examining various federal, state, and independent organizations, nine different organizations were identified for analysis. Each organization identifies a different number of occupations as STEM based on varying definitions and classification procedures. Cumulatively, the nine organizations generate 11 different lists of occupations considered STEM. For consistency and coding purposes this report follows SOC detailed occupation code principles. A total of 257 SOC detailed occupations are identified as STEM by at least one of the 11 STEM occupation source lists.

After identifying the occupations classified as STEM from each of the 11 sources, a detailed spreadsheet cataloging each organization was developed. Corresponding SOC detailed occupation codes and titles were then matched to each of the 11 sources. Occupations identified as STEM by each source are indicated by a “✓” mark. The numbers in parentheses indicate total occupations classified as STEM by each source. The U.S. Census Bureau is the only source that distinguishes between STEM and STEM-related occupations. Occupations classified as STEM-related by the U.S. Census Bureau are indicated by an “X” mark. A total of 63 occupations are classified as STEM-related by the U.S. Census Bureau, primarily from the SOC major group of healthcare practitioners and technical occupations (61).

The STEM occupation list was then analyzed to determine classification similarities. Across all organizations, 18 of the 23 major occupation groups are represented. Of the 18 major groups, STEM occupations are concentrated around six SOC major groups. Identified in yellow, only 42 detailed occupations classified as STEM were matched across all sources. These occupations are found within the SOC major groups of computer and mathematical occupations; architecture and engineering occupations; and life, physical, and social science occupations. Most of the 42 detailed occupations matched across all sources require a four-year degree or higher.

2. Classifying Middle-Skill STEM Occupations
(See Appendix 3: Middle-Skill STEM Occupations List)

After developing the list of STEM occupations, the next step in the process reduced the list down to only those occupations considered middle-skill STEM. The first objective was to determine the most comprehensive number of STEM occupations to be used for analysis. In all, 257 detailed occupations are considered STEM by at least one of the 11 sources.

The complete list of 257 identified STEM occupations are matched with BLS detailed occupation education and training assignments. The BLS education and training assignment identifies typical education levels needed for entry into every SOC occupation. As described in the report, middle-skill occupations are those that require more than a high school diploma but less than a postsecondary four-year degree. Of the original 257 occupations considered STEM by at least one of the 11 sources, 85 are classified as middle-skill. These 85

occupations represent the complete list of middle-skill STEM occupations classified in this report. These middle-skill STEM occupations are found in 14 of the 23 SOC major groups.

Additionally, of the 42 STEM occupations matched across all sources in Step 1, only five are considered middle-skill STEM occupations. These five middle-skill STEM occupations are identified in yellow and found in only two major SOC groups.

3. Creating a List of Middle-Skill STEM Occupations Critical to the Texas Economy
(See Appendix 4: Texas Middle-Skill STEM Occupations, Wages, and Employment Projections)

The final step in this process builds upon the list of 85 classified middle-skill STEM occupations derived in Step 2. This step analyzes the Texas economy to identify middle-skill STEM jobs important to the state to create the final list of Texas middle-skill STEM occupations.

Using BLS education and training assignments, every middle-skill occupation not included in the 85 middle-skill STEM occupations list was evaluated to locate possible STEM occupations critical to Texas based on job growth and salary data. Upon examination, 12 additional middle-skill classified occupations were identified (highlighted in blue). While the 12 additional middle-skill occupations are not considered STEM by any of the 11 sources, they require significant STEM-related skills and knowledge. Thus, a total of 97 middle-skill STEM occupations are identified for the Texas economy.

Lastly, state wage and employment information is added to the list of Texas middle-skill STEM occupations. This information is obtained from TWC's Labor Market and Career Information portal where users can find various workforce related data. Employment estimates for 2012 to 2022 and average annual wages are included for each identified Texas middle-skill STEM occupation. Moreover, absolute employment change (#Δ) and percentage change (%Δ) are included with employment figures.

Appendix 2: Analysis of STEM Occupations by Source

Detail SOC Code	SOC Occupation Title	BLS/OES (100)	Census (163)	CEW 2010 (96)	CEW 2011 (85)	Commerce (85)	FL DEO (156)	NSF (116)	O*Net Career Cluster (103)	O*Net STEM Discipline (126)	SOCPC (184)	TWC SWAP (134)
11-0000	Management Occupations											
11-3021	Computer and Information Systems Manager	✓	✓			✓	✓	✓		✓	✓	✓
11-3031	Financial Managers						✓	✓				✓
11-3051	Industrial Production Managers						✓	✓	✓	✓		
11-9013	Farmers, Ranchers, and Other Agricultural Managers						✓			✓		
11-9021	Construction Managers									✓		
11-9041	Architectural and Engineering Managers	✓	✓			✓	✓	✓	✓	✓	✓	✓
11-9111	Medical and Health Services Managers		X					✓			✓	✓
11-9121	Natural Sciences Managers	✓	✓			✓	✓	✓	✓	✓	✓	✓
11-9199	Managers, All Other									✓		

13-0000	Business and Financial Operations Occupations											
13-1041	Compliance Officers									✓		
13-1051	Cost Estimators						✓		✓	✓		
13-1081	Logisticians						✓		✓			
13-1161	Market Research Analysts and Marketing Specialists								✓			
13-1199	Business Operations Specialists, All Other									✓		
13-2011	Accountants and Auditors						✓			✓		✓
13-2021	Appraisers and Assessors of Real Estate						✓					
13-2031	Budget Analysts						✓					✓
13-2051	Financial Analysts						✓					✓
13-2061	Financial Examiners											✓
13-2081	Tax Examiners and Collectors, and Revenue Agents											✓
13-2099	Financial Specialists, All Other									✓		✓

15-0000	Computer and Mathematical Occupations											
15-1111	Computer and Information Research Scientists	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
15-1121	Computer Systems Analysts	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
15-1122	Information Security Analysts	✓	✓	✓	✓	✓	✓	✓		✓	✓	
15-1131	Computer Programmers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
15-1132	Software Developers, Applications	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
15-1133	Software Developers, Systems Software	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
15-1134	Web Developers	✓	✓	✓	✓	✓	✓	✓			✓	
15-1141	Database Administrators	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
15-1142	Network and Computer Systems Administrators	✓	✓	✓	✓	✓	✓	✓			✓	✓
15-1143	Computer Network Architects	✓	✓	✓	✓	✓	✓	✓		✓	✓	

Detail SOC Code	SOC Occupation Title	BLS/OES (100)	Census (163)	CEW 2010 (96)	CEW 2011 (85)	Commerce (85)	FL DEO (156)	NSF (116)	O*Net Career Cluster (103)	O*Net STEM Discipline (126)	SOCPC (184)	TWC SWAP (134)
15-1151	Computer User Support Specialists	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
15-1152	Computer Network Support Specialists	✓	✓	✓	✓	✓	✓	✓		✓	✓	
15-1199	Computer Occupations, All Other	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
15-2011	Actuaries	✓	✓	✓	✓		✓	✓		✓	✓	✓
15-2021	Mathematicians	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
15-2031	Operations Research Analysts	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
15-2041	Statisticians	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
15-2091	Mathematical Technicians	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
15-2099	Mathematical Science Occupations, All Other	✓	✓	✓	✓	✓		✓	✓		✓	

17-0000	Architecture and Engineering Occupations											
17-1011	Architects, Except Landscape and Naval	✓	X	✓	✓		✓			✓	✓	✓
17-1012	Landscape Architects	✓	✓	✓	✓						✓	✓
17-1021	Cartographers and Photogrammetrists	✓	✓	✓	✓	✓	✓		✓		✓	✓
17-1022	Surveyors	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
17-2011	Aerospace Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2021	Agricultural Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2031	Biomedical Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2041	Chemical Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2051	Civil Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2061	Computer Hardware Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2071	Electrical Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2072	Electronics Engineers, Except Computer	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2081	Environmental Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2112	Industrial Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2121	Marine Engineers and Naval Architects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2131	Materials Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2141	Mechanical Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2151	Mining and Geological Engineers, Including Mining Safety Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2161	Nuclear Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2171	Petroleum Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-2199	Engineers, All Other	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-3011	Architectural and Civil Drafters	✓	✓		✓	✓	✓		✓	✓	✓	
17-3012	Electrical and Electronics Drafters	✓	✓	✓	✓	✓	✓		✓		✓	
17-3013	Mechanical Drafters	✓	✓	✓	✓	✓	✓				✓	
17-3019	Drafters, All Other	✓	✓	✓	✓	✓			✓		✓	

Detail SOC Code	SOC Occupation Title	BLS/OES (100)	Census (163)	CEW 2010 (96)	CEW 2011 (85)	Commerce (85)	FL DEO (156)	NSF (116)	O*Net Career Cluster (103)	O*Net STEM Discipline (126)	SOCPC (184)	TWC SWAP (134)
17-3021	Aerospace Engineering and Operation Technicians	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
17-3022	Civil Engineering Technicians	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
17-3023	Electrical and Electronics Engineering Technicians	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-3024	Electro-Mechanical Technicians	✓	✓	✓	✓	✓	✓	✓	✓		✓	
17-3025	Environmental Engineering Technicians	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
17-3026	Industrial Engineering Technicians	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-3027	Mechanical Engineering Technicians	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-3029	Engineering Technicians, Except Drafters, All Other	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17-3031	Surveying and Mapping Technicians	✓	✓	✓	✓	✓	✓	✓	✓		✓	

19-0000	Life, Physical, and Social Science Occupations											
19-1011	Animal Scientists	✓	✓	✓	✓	✓	✓	✓		✓	✓	
19-1012	Food Scientists and Technologists	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
19-1013	Soil and Plant Scientists	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
19-1021	Biochemists and Biophysicists	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19-1022	Microbiologists	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19-1023	Zoologists and Wildlife Biologists	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19-1029	Biological Scientists, All Other	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
19-1031	Conservation Scientists	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19-1032	Foresters	✓	✓	✓	✓	✓		✓		✓	✓	✓
19-1041	Epidemiologists	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19-1042	Medical Scientists, Except Epidemiologists	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19-1099	Life Scientists, All Other	✓	✓	✓	✓			✓	✓		✓	
19-2011	Astronomers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
19-2012	Physicists	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19-2021	Atmospheric and Space Scientists	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19-2031	Chemists	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19-2032	Materials Scientists	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19-2041	Environmental Scientists and Specialists, Including Health	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19-2042	Geoscientists, Except Hydrologists and Geographers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19-2043	Hydrologists	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19-2099	Physical Scientists, All Other	✓	✓	✓	✓	✓	✓	✓	✓		✓	
19-3011	Economists		✓	✓			✓	✓	✓		✓	✓
19-3022	Survey Researchers		✓	✓			✓	✓	✓		✓	✓
19-3031	Clinical, Counseling, and School Psychologists		✓	✓				✓		✓	✓	✓
19-3032	Industrial-Organizational Psychologists		✓	✓			✓	✓		✓	✓	
19-3039	Psychologists, All Other		✓	✓				✓	✓	✓	✓	
19-3041	Sociologists		✓	✓				✓	✓		✓	

Detail SOC Code	SOC Occupation Title	BLS/OES (100)	Census (163)	CEW 2010 (96)	CEW 2011 (85)	Commerce (85)	FL DEO (156)	NSF (116)	O*Net Career Cluster (103)	O*Net STEM Discipline (126)	SOCPC (184)	TWC SWAP (134)
19-3051	Urban and Regional Planners		✓	✓				✓			✓	
19-3091	Anthropologists and Archeologists		✓	✓				✓	✓		✓	
19-3092	Geographers		✓	✓			✓	✓	✓		✓	
19-3093	Historians		✓	✓				✓	✓			
19-3094	Political Scientists		✓	✓				✓	✓		✓	
19-3099	Social Science and Related Workers, All Other		✓	✓				✓	✓	✓	✓	
19-4011	Agricultural and Food Science Technicians	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
19-4021	Biological Technicians	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19-4031	Chemical Technicians	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19-4041	Geological and Petroleum Technicians	✓	✓	✓	✓	✓	✓	✓			✓	✓
19-4051	Nuclear Technicians	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
19-4061	Social Science Research Assistants		✓	✓	✓	✓		✓	✓		✓	
19-4091	Environmental Science and Protection Technicians, Including Health	✓	✓	✓	✓	✓		✓		✓	✓	✓
19-4092	Forensic Science Technicians	✓	✓	✓	✓	✓		✓			✓	✓
19-4093	Forest and Conservation Technicians	✓	✓	✓	✓	✓		✓		✓	✓	
19-4099	Life, Physical, and Social Science Technicians, All Other	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓

21-0000	Community and Social Service Occupations											
21-1091	Health Educators											✓
21-1099	Community and Social Service Specialists, All Other								✓			

25-0000	Education, Training, and Library Occupations											
25-1011	Business Teachers, Postsecondary									✓		
25-1021	Computer Science Teachers, Postsecondary	✓					✓	✓		✓	✓	✓
25-1022	Mathematical Science Teachers, Postsecondary	✓					✓	✓	✓	✓	✓	✓
25-1031	Architecture Teachers, Postsecondary	✓					✓	✓	✓	✓	✓	✓
25-1032	Engineering Teachers, Postsecondary	✓					✓	✓	✓	✓	✓	✓
25-1041	Agricultural Sciences Teachers, Postsecondary	✓					✓	✓		✓	✓	✓
25-1042	Biological Science Teachers, Postsecondary	✓					✓	✓	✓	✓	✓	✓
25-1043	Forestry and Conservation Science Teachers, Postsecondary	✓					✓	✓			✓	
25-1051	Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary	✓					✓	✓	✓	✓	✓	✓
25-1052	Chemistry Teachers, Postsecondary	✓					✓	✓	✓	✓	✓	✓
25-1053	Environmental Science Teachers, Postsecondary	✓					✓	✓		✓	✓	
25-1054	Physics Teachers, Postsecondary	✓					✓	✓	✓	✓	✓	✓
25-1061	Anthropology and Archeology Teachers, Postsecondary							✓	✓		✓	

Detail SOC Code	SOC Occupation Title	BLS/OES (100)	Census (163)	CEW 2010 (96)	CEW 2011 (85)	Commerce (85)	FL DEO (156)	NSF (116)	O*Net Career Cluster (103)	O*Net STEM Discipline (126)	SOCPC (184)	TWC SWAP (134)
25-1062	Area, Ethnic, and Cultural Studies Teachers, Postsecondary							✓	✓		✓	
25-1063	Economics Teachers, Postsecondary						✓	✓	✓		✓	✓
25-1064	Geography Teachers, Postsecondary							✓	✓		✓	
25-1065	Political Science Teachers, Postsecondary							✓	✓		✓	
25-1066	Psychology Teachers, Postsecondary							✓		✓	✓	✓
25-1067	Sociology Teachers, Postsecondary							✓			✓	
25-1069	Social Science Teachers, Postsecondary, All Other							✓	✓		✓	
25-1071	Health Specialties Teachers, Postsecondary						✓	✓	✓	✓	✓	✓
25-1072	Nursing Instructors and Teachers, Postsecondary						✓	✓			✓	✓
25-1125	History Teachers, Postsecondary								✓			
25-1126	Philosophy and Religion Teachers, Postsecondary								✓			
25-1192	Home Economics Teachers, Postsecondary									✓		
25-1194	Vocational Education Teachers, Postsecondary								✓			
25-4011	Archivists								✓			
25-4012	Curators								✓			
25-4013	Museum Technicians and Conservators								✓			
25-9021	Farm and Home Management Advisors									✓		
25-9099	Education, Training, and Library Workers, All Other								✓			

27-0000	Art, Design, Entertainment, Sports, and Media Occupations											
27-1014	Multimedia Artists and Animators											✓
27-1021	Commercial and Industrial Designers						✓					
27-1024	Graphic Designers									✓		
27-3042	Technical Writers								✓			
27-4012	Broadcast Technicians						✓					
27-4014	Sound Engineering Technicians						✓					
27-4031	Camera Operators, Television, Video, and Motion Picture						✓					
27-4032	Film and Video Editors						✓					

29-0000	Healthcare Practitioners and Technical Occupations											
29-1011	Chiropractors		X								✓	✓
29-1021	Dentists, General		X				✓				✓	✓
29-1022	Oral and Maxillofacial Surgeons		X				✓				✓	
29-1023	Orthodontists		X				✓				✓	✓
29-1024	Prosthodontists		X				✓				✓	
29-1029	Dentists, All Other Specialists		X								✓	
29-1031	Dietitians and Nutritionists		X				✓		✓	✓	✓	✓

Detail SOC Code	SOC Occupation Title	BLS/OES (100)	Census (163)	CEW 2010 (96)	CEW 2011 (85)		FL DEO (156)	NSF (116)	O*Net Career Cluster (103)	O*Net STEM Discipline (126)	SOCPC (184)	TWC SWAP (134)
29-1041	Optometrists		X				✓				✓	✓
29-1051	Pharmacists		X				✓				✓	✓
29-1061	Anesthesiologists		X				✓				✓	✓
29-1062	Family and General Practitioners		X				✓		✓		✓	✓
29-1063	Internists, General		X				✓				✓	✓
29-1064	Obstetricians and Gynecologists		X				✓				✓	✓
29-1065	Pediatricians, General		X				✓				✓	✓
29-1066	Psychiatrists		X				✓				✓	✓
29-1067	Surgeons		X				✓				✓	✓
29-1069	Physicians and Surgeons, All Other		X				✓				✓	✓
29-1071	Physician Assistants		X				✓				✓	✓
29-1081	Podiatrists		X				✓				✓	✓
29-1122	Occupational Therapists		X								✓	✓
29-1123	Physical Therapists		X								✓	✓
29-1124	Radiation Therapists		X								✓	✓
29-1125	Recreational Therapists		X								✓	✓
29-1126	Respiratory Therapists		X				✓				✓	✓
29-1127	Speech-Language Pathologists		X								✓	✓
29-1128	Exercise Physiologists		X				✓				✓	✓
29-1129	Therapists, All Other		X								✓	
29-1131	Veterinarians		X				✓				✓	✓
29-1141	Registered Nurses		X				✓				✓	
29-1151	Nurse Anesthetists		X				✓				✓	
29-1161	Nurse Midwives		X				✓				✓	
29-1171	Nurse Practitioners		X				✓				✓	
29-1181	Audiologists		X								✓	✓
29-1199	Health Diagnosing and Treating Practitioners, All Other		X				✓				✓	✓
29-2011	Medical and Clinical Laboratory Technologists		X				✓				✓	✓
29-2012	Medical and Clinical Laboratory Technicians		X				✓				✓	✓
29-2021	Dental Hygienists		X				✓				✓	✓
29-2031	Cardiovascular Technologists and Technicians		X				✓				✓	✓
29-2032	Diagnostic Medical Sonographers		X								✓	✓
29-2033	Nuclear Medicine Technologists		X							✓	✓	✓
29-2034	Radiologic Technologists		X								✓	
29-2035	Magnetic Resonance Imaging Technologists		X								✓	
29-2041	Emergency Medical Technicians and Paramedics		X				✓				✓	
29-2051	Dietetic Technicians		X						✓	✓	✓	
29-2052	Pharmacy Technicians		X								✓	

Detail SOC Code	SOC Occupation Title	BLS/OES (100)	Census (163)	CEW 2010 (96)	CEW 2011 (85)		FL DEO (156)	NSF (116)	O*Net Career Cluster (103)	O*Net STEM Discipline (126)	SOCPC (184)	TWC SWAP (134)
29-2053	Psychiatric Technicians		X								✓	
29-2054	Respiratory Therapy Technicians		X				✓				✓	✓
29-2055	Surgical Technologists		X								✓	
29-2056	Veterinary Technologists and Technicians		X								✓	✓
29-2057	Ophthalmic Medical Technicians		X								✓	
29-2061	Licensed Practical and Licensed Vocational Nurses		X								✓	
29-2071	Medical Records and Health Information Technicians		X								✓	✓
29-2081	Opticians, Dispensing		X								✓	
29-2091	Orthotists and Prosthetists		X								✓	✓
29-2092	Hearing Aid Specialists		X				✓				✓	
29-2099	Health Technologists and Technicians, All Other		X								✓	
29-9011	Occupational Health and Safety Specialists		X								✓	
29-9012	Occupational Health and Safety Technicians		X								✓	
29-9091	Athletic Trainers		X								✓	
29-9092	Genetic Counselors		X				✓				✓	
29-9099	Healthcare Practitioners and Technical Workers, All Other		X				✓				✓	

31-0000	Healthcare Support Occupations											
31-2011	Occupational Therapy Assistants											✓
31-2021	Physical Therapist Assistants											✓

33-0000	Protective Service Occupations											
33-3031	Fish and Game Wardens									✓		

35-0000	Food Preparation and Serving Related Occupations											
35-1012	First-Line Supervisors of Food Preparation and Serving Workers									✓		
35-2012	Cooks, Institution and Cafeteria									✓		

41-0000	Sales and Related Occupations											
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	✓									✓	
41-9031	Sales Engineers	✓	✓			✓	✓				✓	

43-0000	Office and Administrative Support Occupations											
43-9111	Statistical Assistants						✓		✓	✓		✓

45-0000	Farming, Fishing, and Forestry Occupations											
45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers									✓		

Detail SOC Code	SOC Occupation Title	BLS/OES (100)	Census (163)	CEW 2010 (96)	CEW 2011 (85)	Commerce (85)	FL DEO (156)	NSF (116)	O*Net Career Cluster (103)	O*Net STEM Discipline (126)	SOCPC (184)	TWC SWAP (134)
45-2021	Animal Breeders									✓		
45-3011	Fishers and Related Fishing Workers									✓		
45-4011	Forest and Conservation Workers									✓		
45-4021	Fallers									✓		
45-4022	Logging Equipment Operators									✓		
45-4023	Log Graders and Scalers									✓		

49-0000	Installation, Maintenance, and Repair Occupations											
49-2011	Computer, Automated Teller, and Office Machine Repairers						✓					
49-2021	Radio, Cellular, and Tower Equipment Installers and Repairs						✓					
49-2091	Avionics Technicians									✓		
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment						✓					
49-2097	Electronic Home Entertainment Equipment Installers and Repairers						✓					
49-3011	Aircraft Mechanics and Service Technicians									✓		
49-3023	Automotive Service Technicians and Mechanics									✓		
49-9044	Millwrights						✓					
49-9062	Medical Equipment Repairers						✓					
49-9081	Wind Turbine Service Technicians									✓		

51-0000	Production Occupations											
51-2023	Electromechanical Equipment Assemblers									✓		
51-3092	Food Batchmakers									✓		
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic											✓
51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic						✓			✓		✓
51-4111	Tool and Die Makers						✓					
51-5111	Prepress Technicians and Workers						✓					
51-8011	Nuclear Power Reactor Operators						✓					
51-8091	Chemical Plant and System Operators									✓		
51-9011	Chemical Equipment Operators and Tenders									✓		

53-0000	Transportation and Material Moving Occupations											
53-2011	Airline Pilots, Copilots, and Flight Engineers											✓
53-6041	Traffic Technicians						✓					
53-6051	Transportation Inspectors									✓		

Appendix 3: Middle-Skill STEM Occupations List

Detailed SOC Code	SOC Occupation Title
11-0000	Management Occupations
11-9013	Farmers, Ranchers, and Other Agricultural Managers
11-9199	Managers, All Other

13-0000	Business and Financial Operations Occupations
13-1199	Business Operations Specialists, All Other

15-0000	Computer and Mathematical Occupations
15-1134	Web Developers
15-1151	Computer User Support Specialists
15-1152	Computer Network Support Specialists

17-0000	Architecture and Engineering Occupations
17-3011	Architectural and Civil Drafters
17-3012	Electrical and Electronics Drafters
17-3013	Mechanical Drafters
17-3019	Drafters, All Other
17-3021	Aerospace Engineering and Operations Technicians
17-3022	Civil Engineering Technicians
17-3023	Electrical and Electronics Engineering Technicians
17-3024	Electro-Mechanical Technicians
17-3025	Environmental Engineering Technicians
17-3026	Industrial Engineering Technicians
17-3027	Mechanical Engineering Technicians
17-3029	Engineering Technicians, Except Drafters, All Other
17-3031	Surveying and Mapping Technicians

19-0000	Life, Physical, and Social Science Occupations
19-4011	Agricultural and Food Science Technicians
19-4031	Chemical Technicians
19-4041	Geological and Petroleum Technicians
19-4051	Nuclear Technicians
19-4061	Social Science Research Assistants
19-4091	Environmental Science and Protection Technicians, Including Health
19-4093	Forest and Conservation Technicians
19-4099	Life, Physical, and Social Science Technicians, All Other

Detailed SOC Code	SOC Occupation Title
27-0000	Arts, Design, Entertainment, Sports, and Media Occupations
27-4012	Broadcast Technicians
27-4014	Sound Engineering Technicians

29-0000	Healthcare Practitioners and Technical Occupations
29-1124	Radiation Therapists
29-1126	Respiratory Therapists
29-1141	Registered Nurses
29-2012	Medical and Clinical Laboratory Technicians
29-2021	Dental Hygienists
29-2031	Cardiovascular Technologists and Technicians
29-2032	Diagnostic Medical Sonographers
29-2033	Nuclear Medicine Technologists
29-2034	Radiologic Technologists
29-2035	Magnetic Resonance Imaging Technologists
29-2041	Emergency Medical Technicians and Paramedics
29-2051	Dietetic Technicians
29-2052	Pharmacy Technicians
29-2053	Psychiatric Technicians
29-2054	Respiratory Therapy Technicians
29-2055	Surgical Technologists
29-2056	Veterinary Technologists and Technicians
29-2057	Ophthalmic Medical Technicians
29-2061	Licensed Practical and Licensed Vocational Nurses
29-2071	Medical Records and Health Information Technicians
29-2081	Opticians, Dispensing
29-2092	Hearing Aid Specialists
29-2099	Health Technologists and Technicians, All Other
29-9012	Occupational Health and Safety Technicians
29-9099	Healthcare Practitioners and Technical Workers, All Other

31-0000	Healthcare Support Occupations
31-2011	Occupational Therapy Assistants
31-2021	Physical Therapist Assistants

33-0000	Protective Service Occupations
33-3031	Fish and Game Wardens

35-0000	Food Preparation and Serving Related Occupations
35-1012	First-Line Supervisors of Food Preparation and Serving Workers

Detailed SOC Code	SOC Occupation Title
45-0000	Farming, Fishing, and Forestry Occupations
45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers
45-2021	Animal Breeders
45-4011	Forest and Conservation Workers
45-4021	Fallers
45-4022	Logging Equipment Operators
45-4023	Log Graders and Scalers
49-0000	Installation, Maintenance, and Repair Occupations
49-2011	Computer, Automated Teller, and Office Machine Repairers
49-2021	Radio, Cellular, and Tower Equipment Installers and Repairs
49-2091	Avionics Technicians
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment
49-2097	Electronic Home Entertainment Equipment Installers and Repairers
49-3011	Aircraft Mechanics and Service Technicians
49-3023	Automotive Service Technicians and Mechanics
49-9044	Millwrights
49-9062	Medical Equipment Repairers
49-9081	Wind Turbine Service Technicians
51-0000	Production Occupations
51-2023	Electromechanical Equipment Assemblers
51-3092	Food Batchmakers
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic
51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic
51-4111	Tool and Die Makers
51-5111	Prepress Technicians and Workers
51-8011	Nuclear Power Reactor Operators
51-8091	Chemical Plant and System Operators
51-9011	Chemical Equipment Operators and Tenders
53-0000	Transportation and Material Moving Occupations
53-6041	Traffic Technicians
53-6051	Transportation Inspectors

Appendix 4: Texas Middle-Skill STEM Occupations, Wages, and Employment Projections

Detailed SOC Code	SOC Occupation Title	Total Employ (2012)	Total Employ (2022)	#Δ	%Δ	\$ Mean (2014)
11-0000	Management Occupations					
11-9013	Farmers, Ranchers, and Other Agricultural Managers	20,390	18,040	-2,350	-11.50%	67,170
11-9199	Managers, All Other	39,460	46,540	7,080	17.90%	122,010

13-0000	Business and Financial Operations Occupations					
13-1199	Business Operations Specialists, All Other	65,010	77,950	12,940	19.90%	80,830

15-0000	Computer and Mathematical Occupations					
15-1134	Web Developers	10,420	13,080	2,660	25.50%	66,997
15-1151	Computer User Support Specialists	47,460	60,550	13,090	22.79%	50,168
15-1152	Computer Network Support Specialists	17,760	20,180	2,420	13.60%	68,068

17-0000	Architecture and Engineering Occupations					
17-3011	Architectural and Civil Drafters	10,680	11,320	640	6.00%	54,601
17-3012	Electrical and Electronics Drafters	4,020	4,890	870	21.60%	73,035
17-3013	Mechanical Drafters	4,670	5,100	430	9.20%	63,508
17-3019	Drafters, All Other	1,510	1,860	350	23.20%	64,241
17-3021	Aerospace Engineering and Operations Technicians	760	830	70	9.20%	61,250
17-3022	Civil Engineering Technicians	11,030	11,530	500	4.50%	45,084
17-3023	Electrical and Electronics Engineering Technicians	14,570	17,130	2,560	17.60%	62,550
17-3024	Electro-Mechanical Technicians	1,550	1,940	390	25.20%	58,887
17-3025	Environmental Engineering Technicians	1,070	1,360	290	27.10%	57,878
17-3026	Industrial Engineering Technicians	4,450	5,060	610	13.70%	65,430
17-3027	Mechanical Engineering Technicians	4,410	5,350	940	21.30%	57,671
17-3029	Engineering Technicians, Except Drafters, All Other	9,100	10,920	1,820	20.00%	64,705
17-3031	Surveying and Mapping Technicians	8,020	9,940	1,920	23.90%	40,729

19-0000	Life, Physical, and Social Science Occupations					
19-4011	Agricultural and Food Science Technicians	1,600	1,780	180	11.30%	32,554
19-4031	Chemical Technicians	5,700	6,960	1,260	22.10%	51,556
19-4041	Geological and Petroleum Technicians	6,490	8,380	1,890	29.10%	60,673
19-4051	Nuclear Technicians	20	30	10	50.00%	76,740
19-4061	Social Science Research Assistants	890	1,050	160	18.00%	38,344
19-4091	Enviro. Science & Protection Techs, Including Health	2,940	3,630	690	23.50%	45,676
19-4093	Forest and Conservation Technicians	380	430	50	9.50%	39,920
19-4099	Life, Physical, and Social Science Technicians, All Other	5,780	6,960	1,180	20.40%	49,071

Detailed SOC Code	SOC Occupation Title	Total Employ (2012)	Total Employ (2022)	#Δ	%Δ	\$ Mean (2014)
27-0000	Art, Design, Entertainment, Sports, and Media Occupations					
27-4012	Broadcast Technicians	2,250	2,440	190	8.40%	34,050
27-4014	Sound Engineering Technicians	490	560	70	14.30%	51,140

29-0000	Healthcare Practitioners and Technical Occupations					
29-1124	Radiation Therapists	810	1,050	240	29.60%	79,800
29-1126	Respiratory Therapists	10,010	12,940	2,930	29.30%	55,213
29-1141	Registered Nurses	186,390	239,590	53,200	27.45%	68,584
29-2012	Medical and Clinical Laboratory Technicians	11,300	15,530	4,230	37.40%	37,975
29-2021	Dental Hygienists	12,390	16,030	3,640	29.40%	71,977
29-2031	Cardiovascular Technologists and Technicians	3,950	5,700	1,750	44.30%	54,583
29-2032	Diagnostic Medical Sonographers	4,380	6,900	2,520	57.50%	65,720
29-2033	Nuclear Medicine Technologists	1,230	1,610	380	30.90%	71,039
29-2034	Radiologic Technologists	13,350	17,410	4,060	30.40%	54,245
29-2035	Magnetic Resonance Imaging Technologists	2,530	3,320	790	31.20%	66,578
29-2041	Emergency Medical Technicians and Paramedics	14,820	19,080	4,260	28.70%	35,015
29-2051	Dietetic Technicians	1,060	1,340	280	26.40%	28,249
29-2052	Pharmacy Technicians	27,630	35,290	7,660	27.70%	31,830
29-2053	Psychiatric Technicians	3,090	3,770	680	22.00%	28,256
29-2054	Respiratory Therapy Technicians	1,350	1,740	390	28.90%	50,711
29-2055	Surgical Technologists	9,090	12,660	3,570	39.30%	44,050
29-2056	Veterinary Technologists and Technicians	9,020	11,510	2,490	27.60%	28,528
29-2057	Ophthalmic Medical Technicians	3,410	4,540	1,130	33.10%	34,306
29-2061	Licensed Practical and Licensed Vocational Nurses	71,890	91,740	19,850	27.60%	44,882
29-2071	Medical Records and Health Information Technicians	16,460	21,330	4,870	29.60%	37,562
29-2081	Opticians, Dispensing	5,620	6,760	1,140	20.30%	30,812
29-2092	Hearing Aid Specialists	720	950	230	31.90%	41,732
29-2099	Health Technologists and Technicians, All Other	3,160	4,110	950	30.10%	42,921
29-9012	Occupational Health and Safety Technicians	2,900	3,570	670	23.10%	50,113
29-9099	Healthcare Practitioners and Technical Workers, All Other	1,350	1,670	320	23.70%	52,958

31-0000	Healthcare Support Occupations					
31-2011	Occupational Therapy Assistants	2,700	3,890	1,190	44.10%	70,606
31-2021	Physical Therapist Assistants	5,180	7,150	1,970	38.00%	69,368
31-9091	Dental Assistants	23,130	28,090	4,960	21.40%	34,192
31-9092	Medical Assistants	51,560	67,960	16,400	31.80%	28,550

33-0000	Protective Service Occupations					
33-3031	Fish and Game Wardens	450	500	50	11.10%	58,590

Detailed SOC Code	SOC Occupation Title	Total Employ (2012)	Total Employ (2022)	#Δ	%Δ	\$ Mean (2014)
35-0000	Food Preparation and Serving Related Occupations					
35-1012	First-Line Supervisors of Food Preparation and Serving Workers	76,260	99,620	23,360	30.60%	33,560

45-0000	Farming, Fishing, and Forestry Occupations					
45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers	4,120	4,400	280	6.80%	44,340
45-2021	Animal Breeders	250	200	-50	-20.00%	32,410
45-4011	Forest and Conservation Workers	200	220	20	10.00%	34,460
45-4021	Fallers	440	280	-160	-36.40%	38,360
45-4022	Logging Equipment Operators	750	840	90	12.00%	38,260
45-4023	Log Graders and Scalers	N/A	N/A	N/A	N/A	29,270

47-0000	Construction and Extraction Occupations					
47-2073	Operating Engineers and Other Construction Equipment Operators	36,250	44,750	8,500	23.40%	38,730
47-2111	Electricians	50,220	60,920	10,700	21.30%	45,130
47-4041	Hazardous Materials Removal Workers	3,470	4,100	630	18.20%	34,820

49-0000	Installation, Maintenance, and Repair Occupations					
49-2011	Computer, Automated Teller, and Office Machine Repairers	13,890	15,470	1,580	11.40%	34,120
49-2021	Radio, Cellular, and Tower Equipment Installers and Repairers	1,830	2,190	360	19.70%	42,950
49-2091	Avionics Technicians	1,490	1,720	230	15.40%	51,048
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	7,390	9,120	1,730	23.40%	57,380
49-2097	Electronic Home Entertainment Equipment Installers and Repairers	2,290	2,300	10	0.40%	33,530
49-3011	Aircraft Mechanics and Service Technicians	13,020	15,190	2,170	16.70%	56,383
49-3023	Automotive Service Technicians and Mechanics	51,540	60,680	9,140	17.70%	39,217
49-9044	Millwrights	3,470	4,390	920	26.50%	45,410
49-9062	Medical Equipment Repairers	2,980	4,160	1,180	39.60%	44,746
49-9081	Wind Turbine Service Technicians	1,250	1,790	540	43.20%	51,728

51-0000	Production Occupations					
51-2023	Electromechanical Equipment Assemblers	4,350	5,020	670	15.40%	33,330
51-3092	Food Batchmakers	7,860	8,900	1,040	13.20%	23,750
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	9,930	13,710	3,780	38.10%	38,293
51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	1,740	2,700	960	55.20%	54,608
51-4111	Tool and Die Makers	1,990	2,390	400	20.10%	44,920
51-4121	Welders, Cutters, Solderers, and Brazers	47,830	57,610	9,780	20.40%	40,895
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	3,810	5,460	1,650	43.30%	36,801
51-5111	Prepress Technicians and Workers	2,180	2,010	-170	-7.80%	39,690
51-8011	Nuclear Power Reactor Operators	N/A	N/A	N/A	N/A	N/A
51-8013	Power Plant Operators	3,370	3,630	260	7.70%	66,125

Detailed SOC Code	SOC Occupation Title	Total Employ (2012)	Total Employ (2022)	#Δ	%Δ	\$ Mean (2014)
51-8091	Chemical Plant and System Operators	6,130	6,950	820	13.40%	65,433
51-8092	Gas Plant Operators	1,820	2,110	290	15.90%	62,320
51-9011	Chemical Equipment Operators and Tenders	9,520	10,770	1,250	13.10%	54,840
51-9081	Dental Laboratory Technicians	2,300	2,640	340	14.80%	38,552
51-9082	Medical Appliance Technicians	1,130	1,360	230	20.40%	46,430
51-9083	Ophthalmic Laboratory Technicians	2,670	3,120	450	16.90%	26,903

53-0000	Transportation and Material Moving Occupations					
53-6041	Traffic Technicians	680	790	110	16.20%	39,840
53-6051	Transportation Inspectors	2,690	3,460	770	28.60%	71,170

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