

PENNSYLVANIA'S STATE SYSTEM OF HIGHER EDUCATION



CALU



CLARION  
UNIVERSITY



MANSFIELD  
UNIVERSITY

Millersville  
University



SlipperyRock  
University

WCU  
WEST CHESTER  
UNIVERSITY

# California University's **SUPPLY/ DEMAND GAP ANALYSIS**

A report for Pennsylvania's  
State System of Higher Education

2016



Pennsylvania's  
**STATE SYSTEM**  
of Higher Education

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## GLOSSARY OF TERMS

The following descriptions provide a point of reference to understand terminology as well as the types of data and analysis undertaken in this study, reflecting historic and contemporary narratives.

**Fastest Growing:** A term used to describe the relative growth (percent change) of an industry or occupation in a given time period. Fastest growing industries and occupations in this study are identified by the highest relative change in jobs between 2014 and 2024.

**High Demand:** A term used to describe the demand for workers in a given occupation. High demand occupations are identified as having the highest number of new and replacement jobs projected between 2014 and 2024.

**Industry Change:** A measure of the change in employment within an industry, used to identify whether an industry is growing or declining, as well as the rate of change. Projected changes lay out expectations of growth/decline for specific industries.

**Job Postings:** The number of unique (de-duplicated) online postings for a job in a given occupation.

**Location Quotient:** A comparative statistic used to calculate the relative employment concentration of a given industry or occupation against the average employment of the industry in a larger geography (for example, countrywide). Industries with a higher location quotient (usually greater than 1.2) indicate that the region has a comparative advantage or specialization in the production of that good or service or has a high degree of specialization within its workforce.

**New and Replacement Jobs:** A demand-side estimate of the number of job openings in an occupation that result from new job growth as well as replacement demand. Replacement demand comprises occupation job leavers based on separations, retirement, and death.

**Occupation Jobs:** A measure of employment within an occupation category, used to identify which occupations have been growing or declining, as well as the rate of change. Projected changes lay out expectations of growth/decline for specific occupation categories.

**Sub-regions:** Geographic areas within Pennsylvania defined for more focused workforce and education gap analyses. Sub-regions were determined primarily on Partnerships for Regional Economic Performance (PREP) boundaries. PREP is Pennsylvania's network of business assistance partners, designed to help companies start, grow, and prosper. Please refer to Appendix A for mapping of the Sub-regions and PREP boundaries.

## ACRONYMS USED

**ACS:** American Community Survey

**BLS:** Bureau of Labor Statistics

**CIP:** Classification of Instructional Programs

**DOE:** United States Department of Education

**DOL:** United States Department of Labor

**EMSI:** Economic Modeling Specialists International

**CEW:** Center on Education and the Workforce (Georgetown University)

**IPEDS:** Integrated Postsecondary Education Data System

**LAUS:** Local Area Unemployment Statistics

**LEHD:** Longitudinal Employment and Housing Dynamics

**NAICS:** North American Industry Classification System

**NCES:** National Center for Education Statistics

**OES:** Occupational Employment Statistics

**O\*NET:** Occupational Network

**PUMS:** Public Use Microdata Sample

**QCEW:** Quarterly Census of Employment and Wages

**SOC:** Standard Occupational Classification

# 1. INTRODUCTION

Pennsylvania’s State System of Higher Education (State System) comprises 14 universities, four branch campuses, multiple regional centers and the McKeever Environmental Learning Center.<sup>1</sup> The universities are located in rural, suburban, and small-town settings around Pennsylvania. The State System’s two educational hubs (with locations in Harrisburg—the Dixon University Center, and Philadelphia—State System @ Center City) offer academic programs through a consortium of public and private colleges and universities.

Per Act 188 of 1982, the State System’s mission “is the provision of instruction for undergraduate and graduate students to and beyond the master’s degree in the liberal arts and sciences, and in the applied fields, including the teaching profession.” In doing so, the State System’s purpose is “to provide high quality education at the lowest possible cost to students.”<sup>2</sup> Analysis and understanding of the economy and workforce the State System supports, as well as the alignment between education programs and talent needs, further advances the State System’s mission and philosophy. This is the goal of the State System’s Supply/Demand Gap Analysis Project. It enables effective and targeted strategies and decision-making, grounded in data-driven evidence. Through two earlier reports—‘Pennsylvania’s Workforce Characteristics Report’<sup>3</sup> and ‘Degrees of Value: College Majors and the Pennsylvania State System’s Contribution to the Workforce’<sup>4</sup>—foundation was laid for the State System’s Supply/Demand Gap Analysis Project. This supply/demand gap analysis report establishes the framework to ‘crosswalk’ education programs with relevant occupations. This crosswalk establishes the relationship between the workforce

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1 One of the State System’s entities, System-wide Functions and Services, is primarily located at the Dixon University Center in Harrisburg and includes: System-wide shared administrative services; System leadership functions of the Chancellor and Board of Governors; some System-wide initiatives and grants managed on behalf of the universities; and the academic, student, and facilities support for the multi-university sites in Harrisburg and Philadelphia.

2 The State System’s Economic and Employment Impact on the Commonwealth of Pennsylvania—released April 15, 2015.

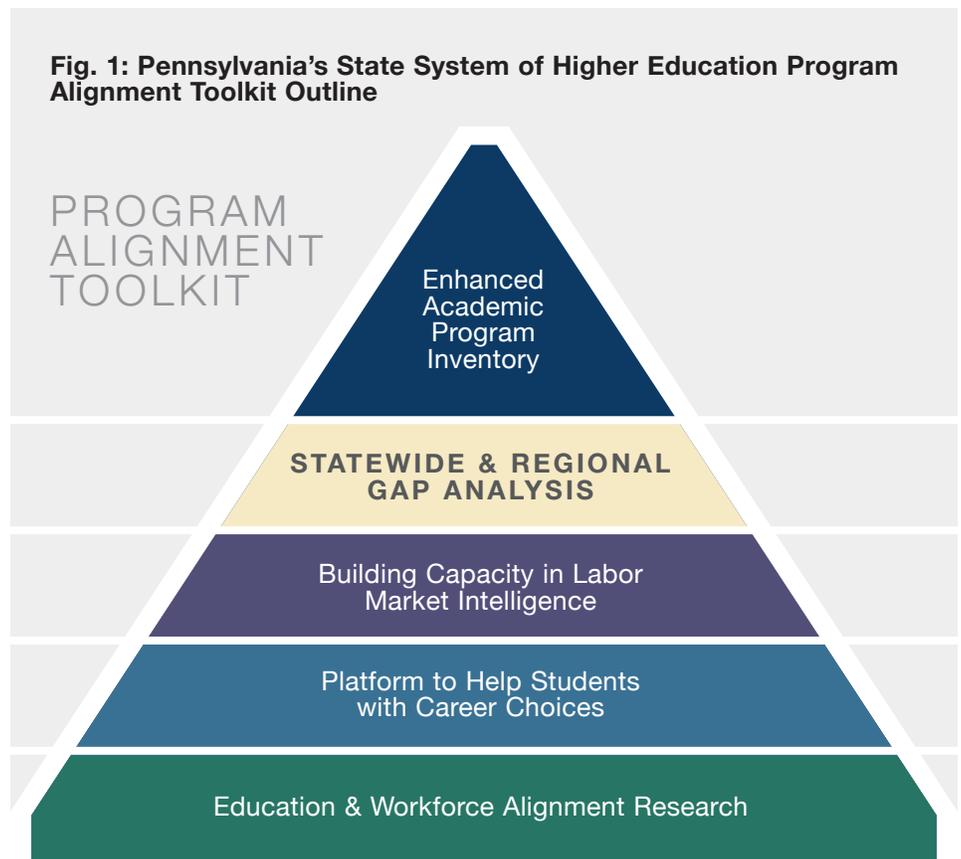
3 Pennsylvania’s Workforce Characteristics Report—a collaboration between the Pennsylvania State System of Higher Education and Oxford Economics with input from Georgetown University’s Center on Education and the Workforce, provides detailed demand-side projections for occupations within Pennsylvania, as well as other labor market intelligence for skilled occupations.

4 *Degrees of Value: College Majors and the Pennsylvania State System’s Contribution to the Workforce* is an education and workforce analysis of the Commonwealth with a particular emphasis on the State System’s Universities’ output produced by Georgetown University’s Center on Education and the Workforce.

employed in specific occupations and the degrees that those workers earned. The goal of this report is to understand this relationship in the context of Pennsylvania’s projected skilled workforce needs and education output.

This study and the broader set of deliverables under the State System’s Supply/Demand Gap Analysis Project will assist universities and education planners by providing an infrastructure of resources for internal planning, as well as external engagement. Understanding key gaps and surpluses within Pennsylvania helps to better align policy and strategic direction in order to continue supporting the talent needs of the Commonwealth.

The results of the State System’s Supply/Demand Gap Analysis project will become part the State System’s Program Alignment Toolkit (see Fig. 1 below)—an infrastructure of resources that are being created to assist the State System’s universities to increase their individual and collective impact on Pennsylvania’s economy. The Program Alignment Toolkit complements the existing Business Intelligence Environment the State System has created to support data driven decision-making. This environment includes forward-thinking, data-rich projects such as the Financial Risk Dashboard, the Data Warehouse project, and the upcoming Student Success Dashboard.



## ABOUT PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION

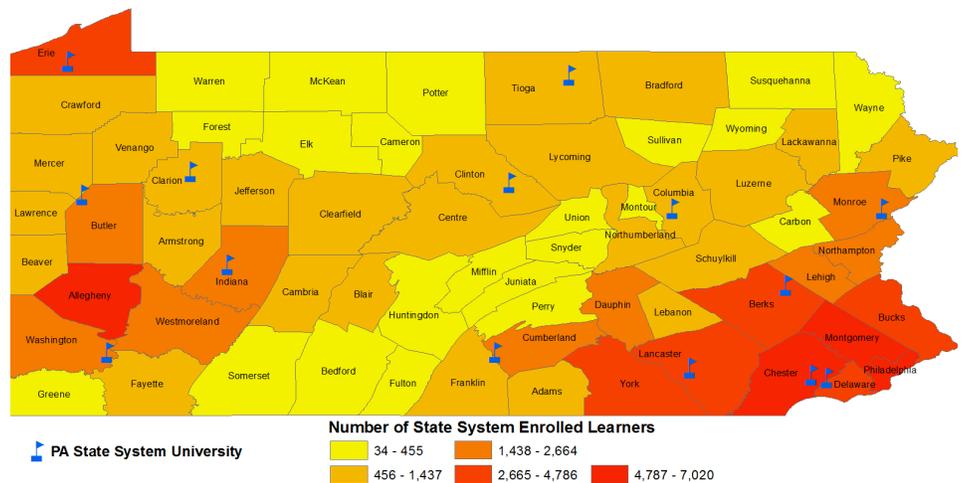
Pennsylvania's State System of Higher Education was established by statute on July 1, 1983, although the 14 universities that comprise the State System have a much longer history dating back to the 19th century.

Today, the State System serves over 110,000 students, with learners coming from every county in Pennsylvania, making it among the largest providers of higher education in Pennsylvania and the United States. It also employs more than 12,000 faculty and staff, making it one of the largest employers in the Commonwealth. Nearly 88% of students enrolled in the State System are from Pennsylvania and the vast majority of students remain after graduation—about 80%.\*

The State System generates more than \$6.7 billion in annual economic activity within Pennsylvania. This economic value in turn supports approximately 62,000 jobs through the State System's direct employment, operational expenditures with vendors and suppliers across Pennsylvania, and spending of those who are employed as a result of the State System's operations.

\* Pennsylvania's State System of Higher Education – Student Data Fact Center  
 \*\* The State System's Economic and Employment Impact on the Commonwealth of Pennsylvania – Released April 15, 2015

**Fig. 2: State System Learner Enrollment by County – Fall 2014**



Source: Pennsylvania State System of Higher Education

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## 1.1 Goal of the Supply/Demand Gap Analysis Report

This Supply/Demand Gap Analysis Report is specific to California University's (Cal U) workforce region. It builds on information provided in an earlier State System report entitled California University's Workforce Characteristics Technical Report. In the Workforce Characteristics Report, Cal U's workforce region was defined to include the following counties: Allegheny, Fayette, Green, Washington, and Westmoreland. The report also contains a set of economic, workforce, demographic, and socio-economic information to contextualize the Supply/Demand Gap Analysis.

The Supply/Demand Gap Analysis Report provides a data-driven perspective of employer demand (growing occupations across the region) and postsecondary education supply (degree production by program and level). The report will assist the State System universities with strategic engagement, program development and evaluation, student engagement, and marketing. The Supply/Demand Gap Analysis Report contains research specific to Cal U's workforce region in the following areas:

- Industry sector and occupation job changes and projections for new and replacement job demand to 2024;
- Size of education production by broad degree category;
- Links between occupations and education programs; and
- Analysis of gaps at the occupational level (presenting a structure to review occupations that have excess employer demand as well as those that have surplus).

While the State System's Gap Analysis project is critical to understanding the connections between education programs and occupations, it is important to note a few caveats to this Supply/Demand Gap Analysis Report:

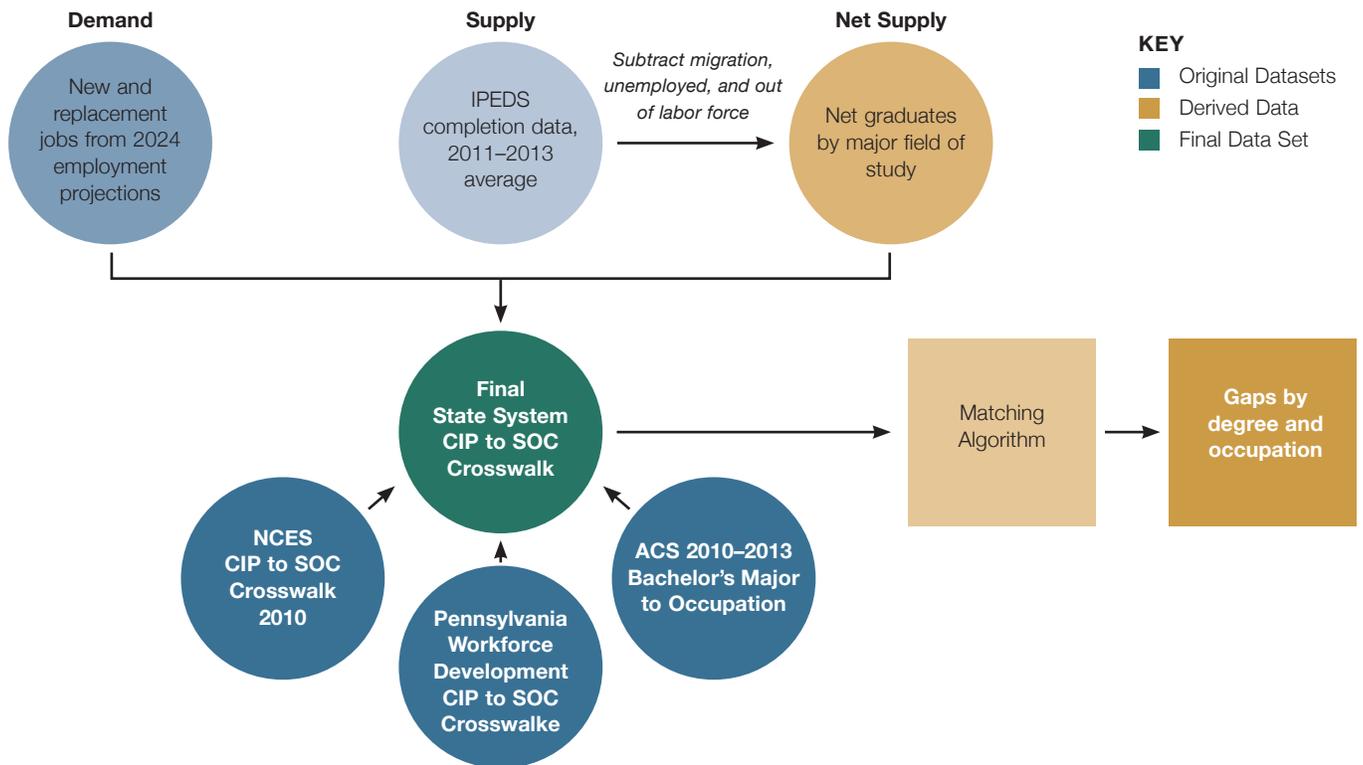
- When considering making adjustments to programs in degree areas related to occupations displaying gaps, further research should be considered to confirm the extent of alignment needed to arrive at equilibrium with the labor market.
- Government data that captures labor market demand lags real-time employer demand as well higher education industry trends. As such, the gap analysis findings may lag these market changes.
- This analysis only focuses on program output as a supply pool (i.e. new graduates). However, regional workforces comprise additional pools of

## ABOUT GAP ANALYSIS

A gap analysis comparing educational supply and occupational demand serves as a critical first step in efforts to align education programs with the workforce needs of Pennsylvania employers. A gap analysis provides a data-driven perspective of demand and supply, which can be connected to a larger process of program evaluation and strategic planning, engagement with employers, and student career guidance. The analysis itself is not the solution, but can lend credible insight to guide decision-making at the strategic level.

Fig. 3 provides a high-level flow chart of the process to calculate gaps/surpluses. A methodological description of the supply/demand gap modeling process can be found in Appendix E.

**Fig. 3: Overview of the gap analysis methodology for the State System**



Source: Oxford Economics

supply—specifically: employed workers, skilled unemployed workers, and skilled underemployed workers. When evaluating gaps, this analysis focuses on new and replacement demand, as opposed to job churn. This helps to mitigate some of the issues involving the employed workforce.

## 1.2 Structure of the Gap Analysis Report

This Supply/Demand Gap Analysis report for Cal U's workforce region is organized as follows:

- Section 1** Introduction and background information.
- Section 2** Overview of changes in Cal U's workforce region industry sectors from a historic and projected point of view, as well as fast growing and most competitive industries.
- Section 3** Overview of changes in Cal U's workforce region occupations including additional detail on skilled occupations as well as high demand occupations, the fastest growing occupations, and occupations that are highly concentrated in Cal U's workforce region.
- Section 4** Evaluation of output of education programs at the associate's, bachelor's, and graduate level, as well as the State System's contribution to the total output of bachelor's degrees.
- Section 5** Comparison of demand for skilled occupations against supply of relevant education program completions.
- Section 6** Conclusion and areas of future research.
- Section 7** Additional information on the Gap Analysis project and contributing organizations.
- Section 8** List of key data sources used in the report.

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While the main body of this report provides a high level summary, the Appendices provide an abundance of information for those seeking additional detail.

**Appendix A** provides a map of the state sub-region boundaries along with economic development and workforce boundaries as defined by PREP and WIA.

**Appendix B** provides a description of O\*NET Job Zone codes.

**Appendix C** provides further detail about strong, limited and weak connections between education programs and occupations.

**Appendix D** provides detailed industry employment and projections to 2024.

**Appendix E** provides a crosswalk and gap analysis methodology.

**Appendix F** provides gap analysis results for over 500 occupations.

**Appendix G** provides the crosswalk of programs to occupations.

## 2. INDUSTRY PROFILE OF CALIFORNIA UNIVERSITY'S WORKFORCE REGION

Industry growth is a key driver of demand for occupations and talent. Hence, understanding the structure of Cal U's workforce region industry sectors offers valuable insights into career opportunities that exist. As the State System implements strategies to increase the economic competitiveness of its workforce and ultimately the economic competitiveness of the state, it is important to understand the connection between occupations and industry jobs. The state's workforce changes and labor demand are presented in multiple ways in this section including:

- Major (2-digit) industries;
- Largest 4-digit industries in 2014;
- Largest growth 4-digit industries from 2014 to 2024;
- Fastest growing 4-digit industries from 2014 to 2024; and
- Industries (4-digit) with high location quotient (or concentration) in 2014.

This section explores the current strengths in the economy of Cal U's workforce region by industry and examines trends that may affect industry structure in the coming years. A table of all 4-digit North American Industrial Classification System (NAICS) sector employment and projections for the region can be found in Appendix D.

The following sub-section begins the analysis by examining major industry groups in Cal U's workforce region in 2010 and 2014 as well as projected growth to 2024.

### 2.1 Major Industry Groups

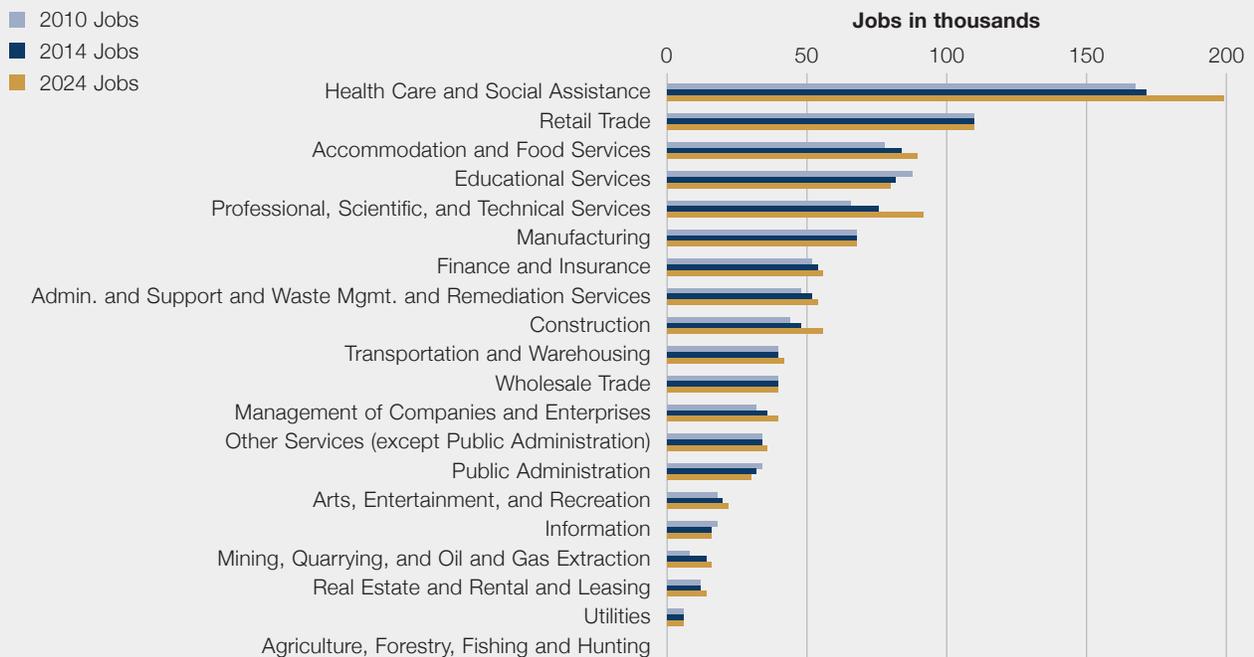
In 2014 the largest 2-digit industries in Cal U's workforce region include education and health services, trade, transportation and utilities, and manufacturing. As can be seen in Fig. 4, healthcare and social assistance account for the most jobs (about 170,900 jobs), followed by retail trade, accommodation and food services, and education services.

Furthermore, each of these industry sectors, except education services, added a significant number of new jobs between 2010 and 2014, reflecting both economic recovery from the recession, as well as continued sector growth. Projections indicate that healthcare and social assistance will add an additional 26,700 new jobs in the region between 2014 and 2024 (16% growth). Professional, scientific, and technical services is projected to add 15,900 new jobs (21% growth)—which will require talent in various disciplines to support this growth.

Substantial economic transformation is taking place across several sectors. While many sectors have experienced moderate or strong growth over the past several years, noted exceptions of job decline include government, education and information. The causes of these reductions may differ. For example, reductions in government employment could reflect changes in legislative priorities and budgets, while reductions in information are largely due to the decline in newspaper and book publishers. This, however, is offset by substantial growth in other sectors discussed earlier.

Fig. 4 below depicts the number of jobs in 2010, 2014 and projections out to 2024 for each of the broad industry sectors.

**Fig. 4: Employment by Major Industry, 2010, 2014, and 2024**



Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

## 2.2 Largest 4-Digit Industries

The largest 4-digit industries in Cal U's workforce region are identified by the volume of 2014 employment. Industry sectors that employ the most workers are critical foundations to a regional economy. In Cal U's workforce region, the ten largest 4-digit industry classifications employed 33% of total jobs in 2014 (326,200 jobs out of 984,600 total jobs in the region). The largest industries include restaurants, general medical and surgical hospitals, and elementary and secondary schools. Fig. 5 below displays the region's ten largest 4-digit industry sectors in 2014 and projections to 2024.

**Fig. 5: California University's Workforce Region Largest 4-Digit Industries and Projections, 2014-2024**

Industry Title	2014 Jobs	2024 Jobs	New Jobs 2014-2024	% Change 2014-2024
Restaurants and Other Eating Places	64,175	69,000	4,825	7.5%
General Medical and Surgical Hospitals	48,846	52,119	3,273	6.7%
Elementary and Secondary Schools	43,465	41,623	-1,842	-4.2%
Management of Companies and Enterprises	35,368	38,979	3,611	10.2%
Colleges, Universities, and Professional Schools	29,399	30,046	647	2.2%
Depository Credit Intermediation	23,139	21,388	-1,751	-7.6%
Offices of Physicians	23,024	25,016	1,992	8.7%
Executive, Legislative, and Other General Government Support	20,610	19,719	-891	-4.3%
Architectural, Engineering, and Related Services	19,184	21,842	2,658	13.9%
Grocery Stores	19,019	16,708	-2,311	-12.2%
<b>Total, 10 Largest</b>	<b>326,229</b>	<b>336,440</b>	<b>10,211</b>	<b>3.1%</b>

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

## 2.3 Largest Growth 4-Digit Industries

The largest sectors are not necessarily generating the most new jobs in Cal U's workforce region. Projections indicate that the top ten largest growth industries in the region will add almost 37,600 new jobs between 2014 and 2024. Some industries in the top ten largest growth list employ several occupations that require university-level skill specializations. For example,

- **General medical and surgical hospitals** employ a diverse range of health care professionals at multiple levels of educational attainment. This includes professions from surgeons to medical secretaries, as well as a range of nursing professions such as nursing assistants, licensed practical nurses and registered nurses. Projections indicate the industry will add 3,300 new jobs between 2014 and 2024.
- **Computer systems design and related services** employ many skilled occupations such as software developers, computer system analysts, computer programmers and computer user support specialists. Most people employed in these occupations have at least a bachelor's degree. Projections indicate the industry will grow by 6,000 new jobs between 2014 and 2024.

Industry sectors that are projected to add significant numbers of new jobs to Cal U's workforce region over the next ten years will provide opportunities to establish stronger business collaboration and course alignment to these sectors. Furthermore, State System universities currently offer a range of degree programs in business and health fields that align well to opportunities within these high-growth sectors. Fig. 6 below displays the ten largest growth industries projected to 2024.

**Fig. 6: California University's Workforce Region Top 10 Largest Growth Sectors and Projections, 2014-2024**

Industry Title	2014 Jobs	2024 Jobs	New Jobs 2014-2024	% Change 2014-2024
Computer Systems Design and Related Services	13,355	19,366	6,012	45.0%
Individual and Family Services	17,715	23,013	5,298	29.9%
Restaurants and Other Eating Places	64,175	69,000	4,825	7.5%
Home Health Care Services	9,141	13,490	4,349	47.6%
Management of Companies and Enterprises	35,368	38,979	3,612	10.2%
General Medical and Surgical Hospitals	48,846	52,119	3,273	6.7%
Offices of Other Health Practitioners	9,242	12,176	2,934	31.7%
Architectural, Engineering, and Related Services	19,184	21,842	2,658	13.9%
Other Financial Investment Activities	4,678	7,182	2,504	53.5%
Scientific Research and Development Services	6,909	8,980	2,070	30.0%
<b>Total, 10 Largest Growth</b>	<b>228,613</b>	<b>266,147</b>	<b>37,535</b>	<b>16.4%</b>

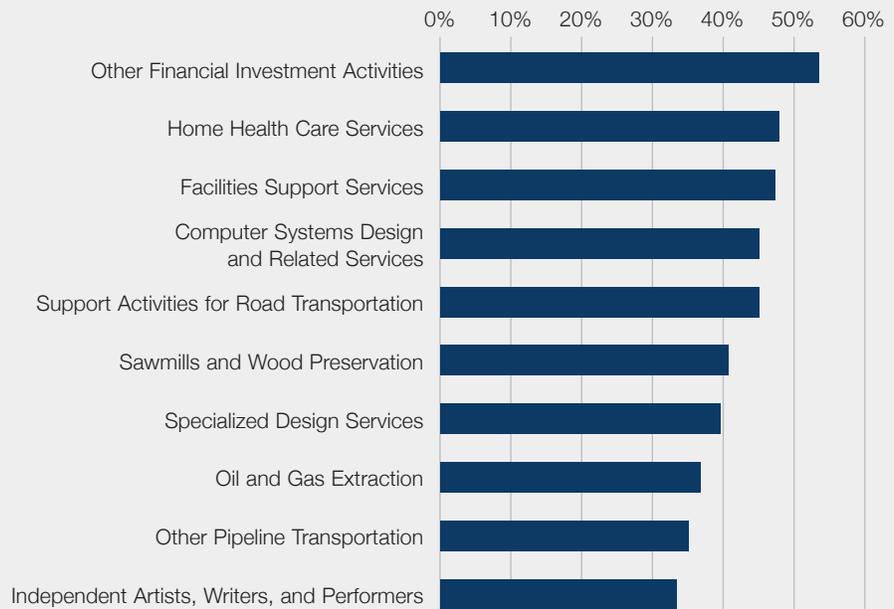
Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

## 2.4 Fastest Growing 4-Digit Industries

The fastest growing 4-digit industries are identified by the highest relative change (percent change) projected to occur between 2014 and 2024. The fastest growing industries represent emerging sectors within Cal U's workforce region that may present opportunities for collaboration and support from postsecondary education and training institutions. Given the aging population in the U.S. and Pennsylvania, the health care sector is driving demand for workers. The fastest growing industries in Cal U's workforce region include other financial investment activities, home health care services, facilities support services, and computer systems design and related services.

Fig. 7 depicts the fastest growing industries in Cal U's workforce region and the projected growth from 2014 to 2024 and Fig. 8 displays the employment in the fastest growing industries, projected job growth, and 10-year new jobs.

**Fig. 7: California University's Workforce Region Fastest Growing 4-Digit Industries and Projections, 2014-2024**



Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

**Fig. 8: California University’s Workforce Region Fastest Growing 4-Digit Industries and Projections, 2014-2024**

Industry Title	2014 Jobs	2024 Jobs	New Jobs 2014-2024	% Change 2014-2024
Other Financial Investment Activities	4,678	7,182	2,504	53.5%
Home Health Care Services	9,141	13,490	4,349	47.6%
Facilities Support Services	759	1,117	358	47.2%
Computer Systems Design and Related Services	13,355	19,366	6,011	45.0%
Support Activities for Road Transportation	1,040	1,508	468	45.0%
Sawmills and Wood Preservation	302	425	123	40.7%
Specialized Design Services	895	1,248	353	39.4%
Oil and Gas Extraction	3,303	4,513	1,210	36.6%
Other Pipeline Transportation	69	93	24	34.8%
Independent Artists, Writers, and Performers	108	144	36	33.3%
<b>Total, 10 Fastest Growing</b>	<b>33,650</b>	<b>49,086</b>	<b>15,436</b>	<b>45.9%</b>

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

## 2.5 Concentration of Industries

Certain industries in Cal U’s workforce region have a greater concentration within the region as compared to the nation. A location quotient (LQ) for an industry provides perspective on statewide concentration in industry classifications. When evaluated jointly with the industry employment data, one gains a sense of the industry sectors that might benefit from efforts to align educational opportunities with economic development (i.e. industries that State System universities may consider engaging in larger conversations about aligning employer and educational needs).

Location quotients equal to 1 indicate that the area’s industry concentration is equal to the national concentration of the same industry. Industries with higher location quotients (usually greater than 1.2) indicate that a region has a concentration in the production of that good or service, relative to the rest of the nation. A value of 1.5 indicates that industry employment within the region is 1.5 times more concentrated than the U.S. average. A location quotient below 1 indicates that industry employment within the region is less concentrated compared to the U.S. average. Note: High employment industries do not necessarily result in large location quotients, as this is a relative statistic.

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The location quotient chart provides three key pieces of information. The vertical axis indicates the location quotient value. The horizontal axis indicates whether the industry sector is projected to grow or decline over the next 10 years. The size of the bubble indicates the size of employment in the industry.

Industries with high LQ's that are adding new jobs suggest that the comparative regional advantage may be creating further job growth. When viewed together, large employment industries (large bubbles) that have high concentrations (high LQs) and add new jobs (high growth), are significant driving forces for regional growth and advancement.

Industry sectors that are highly concentrated in Cal U's workforce region include: coal mining, iron and steel mills and ferroalloy manufacturing, railroad rolling stock manufacturing, and charter bus industry.

Fig. 9 displays the most concentrated industries (as measured by LQ) for Cal U's workforce region at the 4-digit NAICS level in 2014. The figure reflects the comparative advantage Cal U's workforce region enjoys in various manufacturing sectors (both advanced and non-advanced). Warehousing and storage also shows high levels of concentration, highlighting those sectors that support the strong manufacturing base.

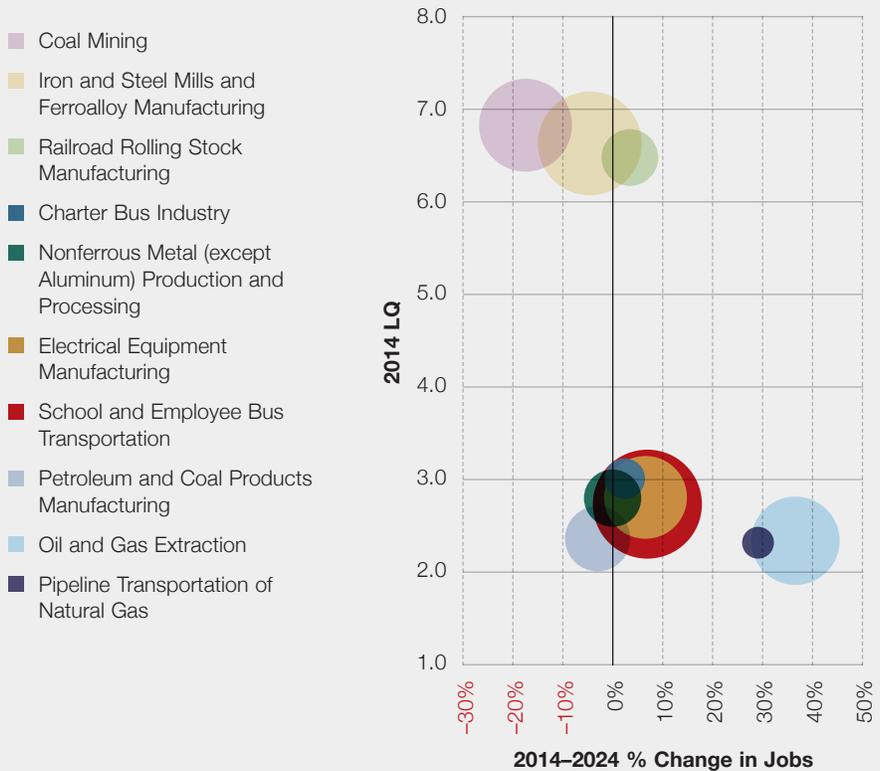
The next section provides information on occupational employment and describes the types of jobs people hold in Cal U's workforce region.

**How to read a Location Quotient chart**

The location quotient (LQ) bubble chart provides three key sources of information: level of concentration, as indicated by the LQ value, the % change in the variable measured—industries and occupations in this report—and the number of jobs employed. The LQ value is located on the vertical chart. As described above, values above the 1 on the vertical axis indicate higher levels of concentration compared to the national average. Bubbles that are situated above zero on the horizontal axis indicate positive job growth. Finally, larger bubbles indicate that the employment within the measured indicate larger levels of employment.

If one were to divide the bubble chart into sections, bubbles with LQ's greater than 1 located in the upper right hand section indicate highly concentrated industries that are projected to grow, whereas bubbles with LQ's greater than 1 in the left side indicate highly concentrated industries that are projected to decline. Similarly, LQ's less than one but on the right side, indicate job growth, but with a low concentration of employment, relative to the US average. Finally, LQ's less than one and on the left side indicate a low level of employment concentration with projected job loss.

**Fig. 9: California University’s Workforce Region Most Concentrated 4-Digit Industries and Projected Growth, 2014-2024**



Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

**Fig. 10: California University’s Workforce Region Most Concentrated 4-Digit Industries and Projected Growth, 2014-2024**

Industry Title	2014 LQ	2014 Jobs	% Change 2014-2024
Coal Mining	6.8	3,549	-17.5%
Iron and Steel Mills and Ferroalloy Manufacturing	6.6	4,375	-4.7%
Railroad Rolling Stock Manufacturing	6.5	1,275	3.5%
Charter Bus Industry	3.0	646	2.2%
Nonferrous Metal (except Aluminum) Production and Processing	2.8	1,263	0.4%
Electrical Equipment Manufacturing	2.8	2,905	6.2%
School and Employee Bus Transportation	2.7	4,871	7.0%
Petroleum and Coal Products Manufacturing	2.4	1,876	-3.0%
Oil and Gas Extraction	2.3	3,303	36.6%
Pipeline Transportation of Natural Gas	2.3	487	29.3%

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

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### 3. OCCUPATIONAL PROFILE OF CALIFORNIA UNIVERSITY'S WORKFORCE REGION

Examining occupational employment data reveals the importance of skills, experience and knowledge of workers. It showcases the types of jobs in which Cal U's workforce region workforce is currently employed and projected to be employed by 2024. When evaluating occupation employment and demand, it is important to note that an occupation can be found in many different industry sectors. For example, every major industry sector employs accountants and auditors to maintain books, payroll, and ensure reporting compliance. This analysis compiles occupational employment across all industry sectors and reports the total number of jobs, median annual wages, and demand (10-year new and replacement jobs) for each occupation classification. The analysis also considers the educational attainment level that is typically required to gain employment in an occupation.

The region's workforce changes and labor demand are presented in multiple ways in this section including:

- Major occupation groups (2-digit SOC);
- Skilled occupations;
- Largest detailed occupations (6-digit SOC) in 2014;
- Occupations (6-digit SOC) with high location quotient (or concentration) in 2014; and
- Occupations aligning to educational attainment at the associate degree level as well as the bachelor's and graduate degree level, specifically:
  - Top high demand occupations (6-digit SOC) from 2014 to 2024, and
  - Fastest growing occupations (6-digit SOC) from 2014 to 2024.

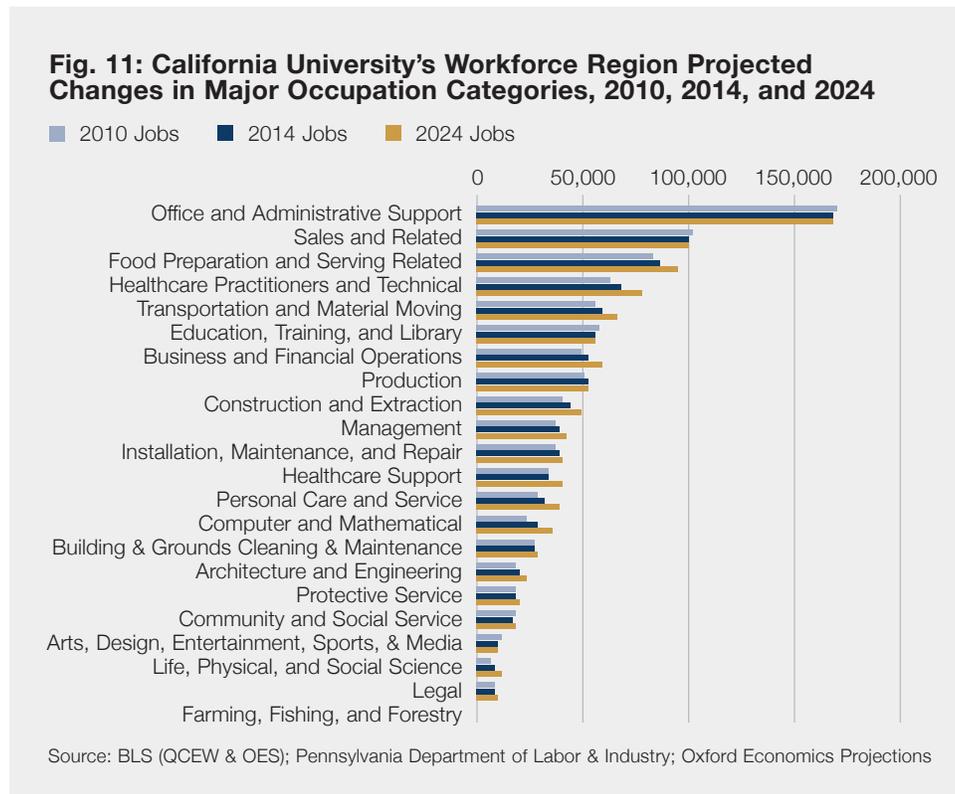
The following sub-section begins the analysis by examining major occupation groups in Cal U's workforce region in 2014 and projected growth to 2024.

### 3.1 Major Occupation Groups

In Cal U’s workforce region, several occupation categories are projected to grow over the next 10 years, from 2014 to 2024, as well as require a significant level of replacement labor.<sup>5</sup> Certain major occupation categories—at the 2-digit Standard Occupation Classification (SOC) level—have experienced substantial growth in recent years and are expected to continue to lead the pack to 2024. Between 2010 and 2014 Cal U’s workforce region experienced growth in several occupation categories, which are typically aligned with postsecondary education. These include:

- Healthcare practitioners and technical occupations;
- Business and financial operations occupations; and
- Computer and mathematical occupations.

Furthermore, these three occupation categories are projected to add 25,800 new jobs between 2014 and 2024 and will account for over one third of the total projected occupation job growth in Cal U’s workforce region.



5 This estimate accounts for the need to replace workers who leave an occupation permanently due to retirement, death, or a change in occupation.

## Identifying Skilled Occupations

For this analysis a “skilled” occupation is defined as an occupation in O\*NET Job Zones\* Three, Four or Five. The O\*NET program is the nation’s primary source of occupational information. Central to the project is the O\*NET database, containing information on hundreds of standardized and occupation-specific descriptors. The database, which is available to the public at no cost, is continually updated by surveying a broad range of workers from each occupation.\*\* Most occupations in Job Zone Three require training in vocational schools, related on-the-job experience, or an associate’s degree. Most occupations in Job Zone Four require a four-year bachelor’s degree, but some do not. Most occupations in Job Zone Five require graduate school. For example, they may require a master’s degree, and some require a Ph.D., M.D., or J.D. (law degree).

For a more detailed description of O\*NET Job Zones and training requirements see Appendix B.

\* <https://www.onetonline.org/help/online/zones>  
 \*\* <http://www.onetcenter.org/overview.html>

## 3.2 Skilled Occupations Overview

Cal U’s workforce region had 984,600 jobs in 2014, a number which is projected to grow to 1,056,500 in 2024—an increase of about 72,000 jobs or a 7.3 percent change. It is important to note that the share of Cal U’s workforce region jobs that will require some postsecondary education will increase from 2014 to 2024, showing the employer demand for skilled workers will continue to grow. The growth in jobs that require some level of postsecondary education in 2024 is projected to be 10.0 percent as compared to 4.5 percent for those that do not require postsecondary education. These are defined as skilled jobs or skilled occupations in the State System’s Gap Analysis Project using terminology from the O\*NET program.

Fig. 12 shows the number of jobs in Cal U’s workforce region by skilled occupations (Job Zones 3-5) and low skilled occupations (Job Zones 1-2) in 2014 as well as projected growth to 2024 for each set of occupations.

**Fig. 12: California University’s Workforce Region Projected Job Growth by Job Zone, 2014-2024**

	2014	2024	% Change 2014-2024	Share 2014	Share 2024
<b>Cal U workforce region, Total Jobs</b>	<b>984,555</b>	<b>1,056,526</b>	<b>7.3%</b>	<b>100%</b>	<b>100%</b>
Job Zones 1-2 (Low Skilled)	481,369	502,990	4.5%	49%	48%
Job Zones 3-5 (Skilled)	503,186	553,536	10.0%	51%	52%

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry, O\*NET; Oxford Economics Projections

## 3.3 Largest Occupations

Top occupations in the state are driven by industry composition. Medical centers employ a cadre of health professionals, while enterprise management companies employ a range of business professionals. Given the dominating presence of health care and social assistance, accommodation and food services, retail trade and manufacturing establishments in Cal U’s workforce region, top occupations include: retail salespersons, food preparation and serving workers, registered nurses, and cashiers. Fig. 13 highlights the top occupations in the state, 10-year job growth projections, and new and replacement jobs.<sup>6</sup> The Job Zone is also included to indicate skill level for each occupation.<sup>7</sup>

6 New and replacement job change takes into account demand for occupations based on: industry growth (new jobs), occupation productivity, workforce ageing (retirements and deaths), migration and other factors that would contribute to new and replacement job openings.  
 7 Job Zone One and Two represent low-skilled occupations and Job Zone Three, Four and Five represent skilled occupations.

**Fig. 13: Largest Occupations in California University’s Workforce Region and Projected Growth, 2014-2024**

Occupation Title	Job Zone	2014	2024	% Change 2014-2024	10-year New and Replacement Jobs
Retail Salespersons	2	34,530	36,465	5.6%	14,470
Combined Food Preparation and Serving Workers, Including Fast Food	1	24,753	27,882	12.6%	13,763
Registered Nurses	3	23,838	27,569	15.7%	8,558
Cashiers	1	23,790	21,258	-10.6%	8,655
Office Clerks, General	2	22,949	21,567	-6.0%	3,902
Customer Service Representatives	2	20,464	22,026	7.6%	7,745
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	3	19,424	21,607	11.2%	4,706
Waiters and Waitresses	1	18,043	19,737	9.4%	11,243
Laborers and Freight, Stock, and Material Movers, Hand	2	15,026	17,584	17.0%	7,972
Janitors and Cleaners, Except Maids and Housekeeping Cleaners	2	14,339	14,173	-1.2%	3,122
Nursing Assistants	2	12,662	14,354	13.4%	4,249
Stock Clerks and Order Fillers	2	12,348	11,565	-6.3%	3,531
Bookkeeping, Accounting, and Auditing Clerks	3	12,175	12,993	6.7%	2,022
General and Operations Managers	4	11,546	13,299	15.2%	3,808
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	4	10,899	9,992	-8.3%	1,624

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

### 3.4 Concentration of Occupations

Growth in areas of comparative advantage provides career opportunities that reflect statewide workforce concentration. Just as industry location quotient analysis is used to determine industry concentration, occupation location quotient analysis is used to evaluate specializations that exist within Cal U’s workforce, which may indicate the presence of key occupation clusters. A classic example of one such cluster would be Silicon Valley’s large concentration of IT and computer programming occupations. The presence of occupation concentration (especially skilled occupations) indicates areas of opportunity for postsecondary institutions to support workforce needs for occupations that have strong employment advantages within the region.

Location quotients equal to 1 indicate that the area’s occupation concentration is equal to the national concentration of the same occupation. Occupations

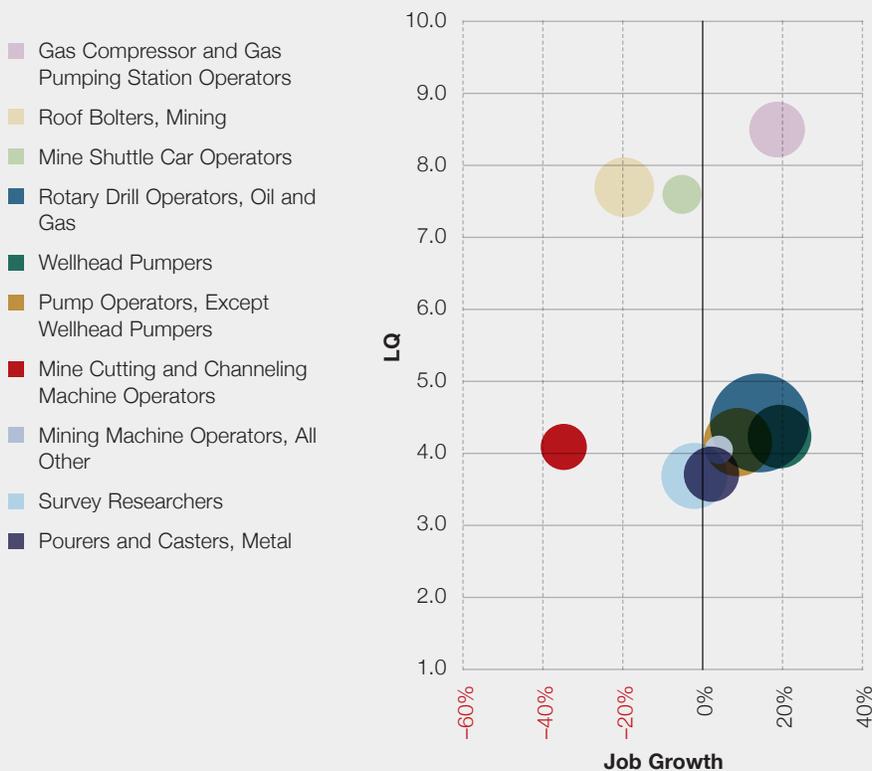
with higher location quotients (usually greater than 1.2) indicate that a region has a concentration or comparative advantage in the occupation, relative to the rest of the nation. A value of 1.5 indicates that occupation employment within the region is 1.5 times more concentrated compared to the U.S. average. A location quotient below 1 indicates that occupation employment within the region is less concentrated compared to the U.S. average. Note: High employment occupations do not necessarily result in large location quotients, as this is a comparative statistic.

The location quotient chart provides three key pieces of information. The vertical axis indicates the location quotient value. A value of 1.5 indicates that employment within the region is 1.5 times more concentrated compared to the average region in the U.S. The horizontal axis indicates whether the occupation is projected to grow or decline over the next 10 years. Occupations with high LQ's that are adding new jobs suggest that the comparative regional advantage may be creating further employment opportunities. The size of the bubble indicates the number of jobs within the occupations. When viewed together skilled occupations with large employment (large bubbles) that have comparative advantages (high LQs) and are adding new jobs (high growth), are likely critical areas of regional workforce needs and warrant closer evaluation of program availability and completion to support statewide workforce demand.

Occupations that are highly concentrated in Cal U's workforce region include: gas compressor and gas pumping station operators; roof bolters, mining; mine shuttle car operators; and rotary drills operators, oil and gas.

Fig. 14 illustrates the LQ, projected job change and employment size of the top 10 most concentrated occupations (as measured by LQ) in Cal U's workforce region in 2014. Fig. 15 below provides detailed data on the occupations, including LQ, 2014 jobs, projected 2024 jobs and projected percent change in jobs.

**Fig. 14: California University's Workforce Region Most Concentrated Occupations and Projected Growth, 2014-2024**



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

**Fig. 15: California University's Workforce Region Most Concentrated Occupations and Projected Growth, 2014-2024**

Occupation Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
Gas Compressor and Gas Pumping Station Operators	8.5	291	344	18.3%
Roof Bolters, Mining	7.7	320	256	-19.9%
Mine Shuttle Car Operators	7.6	146	137	-5.6%
Rotary Drill Operators, Oil and Gas	4.4	858	976	13.8%
Wellhead Pumpers	4.2	389	460	18.3%
Pump Operators, Except Wellhead Pumpers	4.1	367	402	9.7%
Mine Cutting and Channeling Machine Operators	4.1	207	135	-34.9%
Mining Machine Operators, All Other	4.0	73	75	3.7%
Survey Researchers	3.7	413	405	-2.1%
Pourers and Casters, Metal	3.7	259	264	1.9%

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

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### **3.5 Occupations Aligning to Associate's Degrees**

Cal U's workforce region employment projections to 2024 conducted by the State System's Gap Analysis project indicate significant growth in many occupations that align with postsecondary education. Occupations that generally align to associate's degree programs are categorized as Job Zone Three.

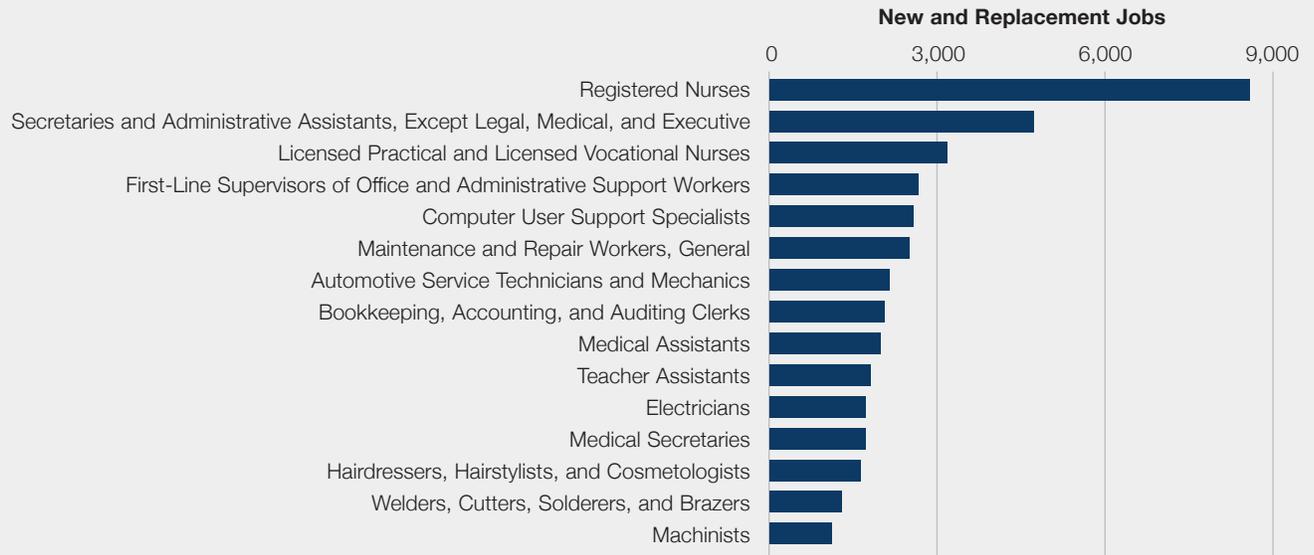
There are over 200 Job Zone Three occupations. Looking ahead, many Job Zone Three occupations show significant growth and demand. In Cal U's workforce region, projections indicate 9.1 percent growth in Job Zone Three jobs between 2014 and 2024. Job demand is further emphasized through both new job growth and replacement job openings as workers in the profession retire, relocate, or change jobs. The projected new and replacement demand for Job Zone Three occupations is 80,800 between 2014 and 2024.

#### **3.5.1 Top High Demand Occupations Aligning to Associate's Degrees**

High demand occupations are identified as having the largest projected new and replacement demand between 2014 and 2024. The top high demand occupations in the region are largely driven by industry demand for skilled workers and typically the largest occupations in the region. However, career changes and the demographic characteristics of those who are currently employed—specifically age—also influence replacement demand. Occupations that employ an older demographic, specifically those aged 55 and older, will face increasing pressure to replace workers as older workers approach retirement age.

High demand occupations aligned to associate's degrees include: registered nurses, secretaries and administrative assistants, and licensed practical and licensed vocational nurses. Fig. 16 and Fig. 17 highlight Cal U's workforce region top high demand occupations aligning to associate's degrees, projected job growth, and 10-year new and replacement jobs.

**Fig. 16: Top High Demand Occupations Aligning to Associate's Degrees in California University's Workforce Region, 2014-2024**



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

**Fig. 17: Employment Projections for Top High Demand Occupations Aligning to Associate's Degrees in California University's Workforce Region, 2014-2024**

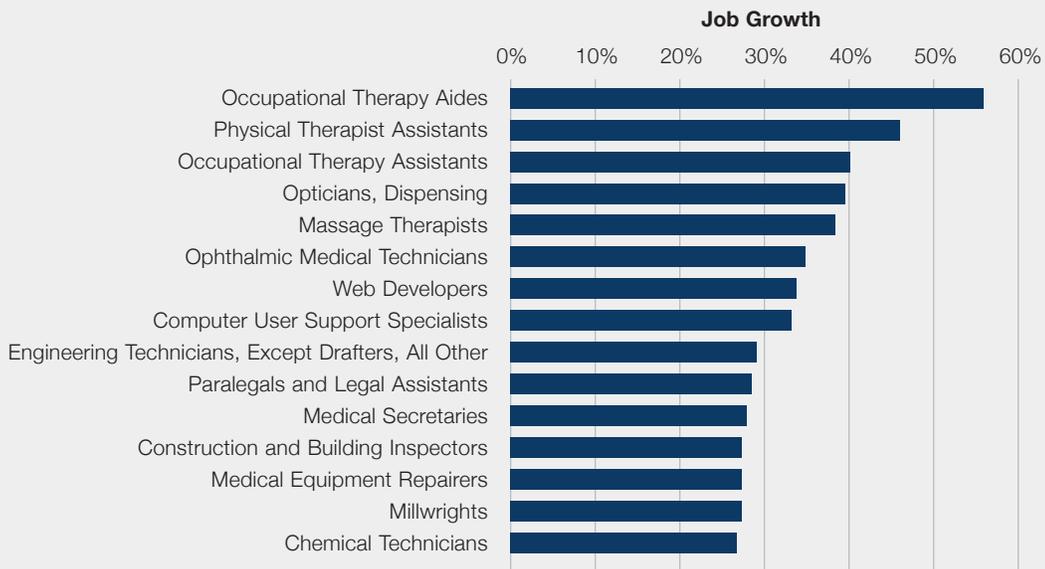
Occupation Title	2014 Jobs	2024 Jobs	% Change 2014-2024	10-year New and Replacement Jobs
Registered Nurses	23,838	27,569	15.7%	8,558
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	19,424	21,607	11.2%	4,706
Licensed Practical and Licensed Vocational Nurses	6,221	7,756	24.7%	3,178
First-Line Supervisors of Office and Administrative Support Workers	10,605	10,710	1.0%	2,644
Computer User Support Specialists	4,955	6,608	33.4%	2,540
Maintenance and Repair Workers, General	10,449	10,621	1.6%	2,474
Automotive Service Technicians and Mechanics	5,738	6,217	8.3%	2,148
Bookkeeping, Accounting, and Auditing Clerks	12,175	12,993	6.7%	2,022
Medical Assistants	4,786	5,794	21.1%	1,969
Teacher Assistants	6,716	6,845	1.9%	1,798
Electricians	4,069	4,662	14.6%	1,701
Medical Secretaries	4,239	5,441	28.4%	1,697
Hairdressers, Hairstylists, and Cosmetologists	4,380	4,789	9.3%	1,648
Welders, Cutters, Solderers, and Brazers	2,684	3,085	14.9%	1,274
Machinists	3,251	3,452	6.2%	1,159

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

### 3.5.2 Fastest Growing Occupations Aligning to Associate's Degrees

The fastest growing occupations are identified by the highest relative change (percent change) projected to occur between 2014 and 2024. In Cal U's workforce region, the fastest growing occupations are largely driven by industry growth and demand. Growing industries reflect the needs of the broader economy. Given the aging population in the U.S. and Pennsylvania, the health care sector is driving demand for workers. The fastest growing occupations aligning to associate's degrees include: occupational therapy aides, physical therapy assistants, occupational therapy assistants, and opticians, dispensing. Fig. 18 and Fig. 19 highlight the fastest growing occupations in the region that align to associate's degrees, projected job growth, and 10-year new and replacement jobs.

**Fig. 18: Fastest Growing Occupations Aligning to Associate's Degrees in California University's Workforce Region, 2014-2024**



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

**Fig. 19: Employment Projections for Fastest Growing Occupations Aligning to Associate's Degrees in California University's Workforce Region, 2014-2024**

<b>Occupation Title</b>	<b>2014</b>	<b>2024</b>	<b>% Change 2014-2024</b>	<b>10-year New and Replacement Jobs</b>
Occupational Therapy Aides	112	175	56.3%	95
Physical Therapist Assistants	942	1,378	46.3%	691
Occupational Therapy Assistants	486	682	40.3%	346
Opticians, Dispensing	636	891	40.1%	472
Massage Therapists	439	609	38.7%	214
Ophthalmic Medical Technicians	237	321	35.4%	114
Web Developers	799	1,074	34.4%	406
Computer User Support Specialists	4,955	6,608	33.4%	2,540
Engineering Technicians, Except Drafters, All Other	507	656	29.4%	276
Paralegals and Legal Assistants	2,114	2,719	28.6%	963
Medical Secretaries	4,239	5,441	28.4%	1,697
Construction and Building Inspectors	1,396	1,786	27.9%	775
Medical Equipment Repairers	513	656	27.9%	322
Millwrights	237	303	27.8%	124
Chemical Technicians	888	1,128	27.0%	522

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

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## **3.6 Occupations Aligning to Bachelor's and Graduate Degrees**

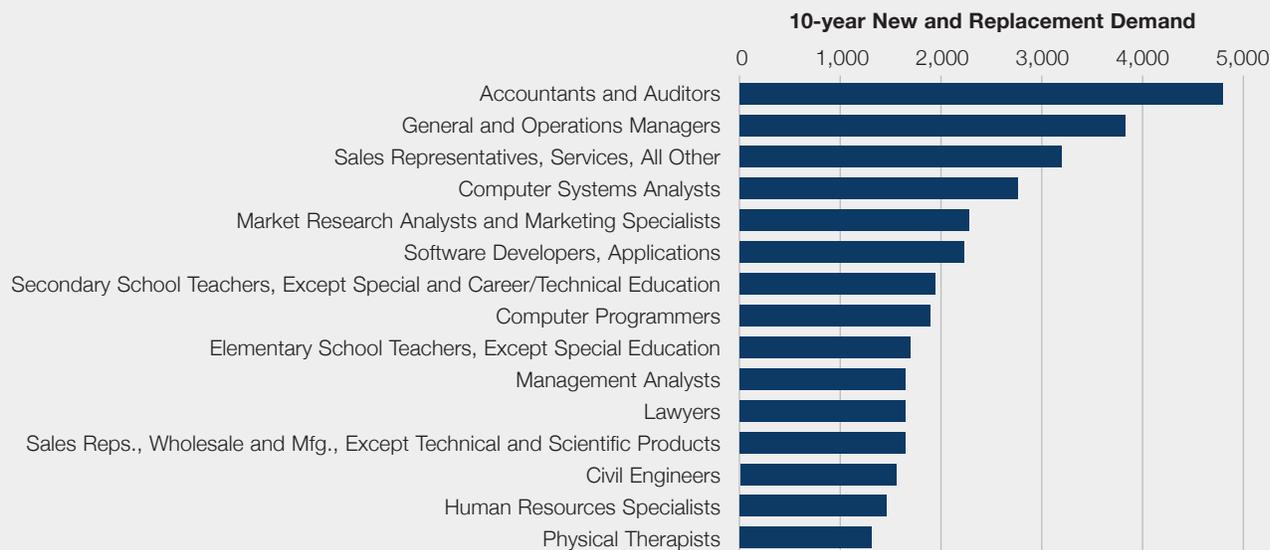
Job Zones Four and Five describe occupations that typically require a bachelor's degree or graduate degree. There are over 250 Job Zone Four and Five occupation classifications. In Cal U's workforce region, the employment projections indicate that occupations typically requiring a bachelor's degree or higher will grow 10.9 percent between 2014 and 2024. This growth will result in total demand for new and replacement job openings of nearly 87,900 over the same time period.

### **3.6.1 Top High Demand Occupations Aligning to Bachelor's and Graduate Degrees**

High demand occupations are identified as having the largest projected new and replacement demand between 2014 and 2024. The top high demand occupations in the region are largely driven by industry demand for skilled workers and typically the largest occupations in the region. However, career changes and the demographic characteristics of those who are currently employed—specifically age—also influence replacement demand. Occupations that employ an older demographic, specifically those aged 55 and older, will face increasing pressure to replace workers as older workers approach retirement age.

High demand occupations aligning to bachelor's and graduate degree level education include: accountants and auditors, general and operations managers, sales representatives, services, and computer systems analysts. Fig. 20 and Fig. 21 highlight the top high demand occupations in the region aligning to bachelor's and graduate degrees, projected job growth, and 10-year new and replacement jobs.

**Fig. 20: Top High Demand Occupations Aligning to Bachelor’s and Graduate Degrees in California University’s Workforce Region, 2014-2024**



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

**Fig. 21: Employment Projections for Top High Demand Occupations Aligning to Bachelor’s and Graduate Degrees in California University’s Workforce Region, 2014-2024**

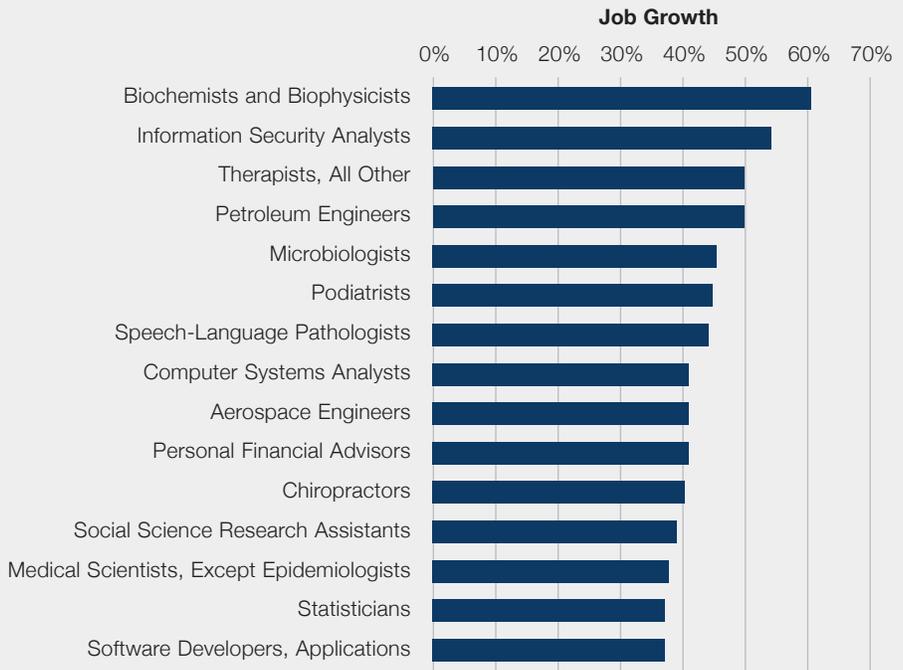
Occupation Title	2014 Jobs	2024 Jobs	% Change 2014-2024	10-year New and Replacement Jobs
Accountants and Auditors	10,817	11,945	10.4%	4,729
General and Operations Managers	11,546	13,299	15.2%	3,808
Sales Representatives, Services, All Other	5,906	7,382	25.0%	3,170
Computer Systems Analysts	4,697	6,620	40.9%	2,754
Market Research Analysts and Marketing Specialists	4,528	6,036	33.3%	2,233
Software Developers, Applications	4,342	5,931	36.6%	2,209
Secondary School Teachers, Except Special and Career/Technical Education	7,548	6,887	-8.8%	1,910
Computer Programmers	2,873	3,821	33.0%	1,888
Elementary School Teachers, Except Special Education	8,197	7,832	-4.5%	1,697
Management Analysts	4,077	5,027	23.3%	1,628
Lawyers	5,163	5,906	14.4%	1,625
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	10,899	9,992	-8.3%	1,624
Civil Engineers	3,438	4,015	16.8%	1,514
Human Resources Specialists	3,563	4,249	19.3%	1,446
Physical Therapists	2,111	2,798	32.5%	1,285

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

### 3.6.2 Fastest Growing Occupations Aligning to Bachelor's and Graduate Degrees

The fastest growing occupations are identified by the highest relative change (percent change) projected to occur between 2014 and 2024. In Cal U's workforce region, the fastest growing occupations aligning to bachelor's and graduate degrees include: biochemists and biophysicists, information security analysts, petroleum engineers, and therapists, all other. Fig. 22 and Fig. 23 highlight Cal U's workforce region fastest growing occupations aligning to bachelor's and graduate degrees, projected job growth, and 10-year new and replacement jobs.

**Fig. 22: Fastest Growing Occupations Aligning to Bachelor's and Graduate Degrees in California University's Workforce Region, 2014-2024**



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

The next section provides a high-level overview of Cal U's workforce region education program output by broad degree category.

**Fig. 23: Employment Projections for Fastest Growing Occupations Aligning to Bachelor's and Graduate Degrees California University's Workforce Region, 2014-2024**

<b>Occupation Title</b>	<b>2014</b>	<b>2024</b>	<b>% Change 2014-2024</b>	<b>10-year New and Replacement Jobs</b>
Biochemists and Biophysicists	438	702	60.3%	398
Information Security Analysts	499	766	53.5%	344
Therapists, All Other	75	112	49.3%	45
Petroleum Engineers	373	557	49.3%	317
Microbiologists	261	379	45.2%	206
Podiatrists	110	159	44.5%	93
Speech-Language Pathologists	841	1,210	43.9%	494
Computer Systems Analysts	4,697	6,620	40.9%	2,754
Aerospace Engineers	323	455	40.9%	215
Personal Financial Advisors	1,459	2,052	40.6%	865
Chiropractors	290	406	40.0%	181
Social Science Research Assistants	152	211	38.8%	129
Medical Scientists, Except Epidemiologists	1,060	1,459	37.6%	654
Statisticians	376	514	36.7%	268
Software Developers, Applications	4,342	5,931	36.6%	2,209

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

## 4. POSTSECONDARY PROGRAM COMPLETIONS IN CALIFORNIA UNIVERSITY'S WORKFORCE REGION

California University's workforce region is home to many different postsecondary institutions, offering a range of degree programs. As reported by the National Center for Education Statistics (NCES), there are approximately 60 higher education institutions in the region that awarded an associate's degree or higher between 2011 and 2013.<sup>8</sup> These institutions graduated, on average, 29,900 students annually from 2011 to 2013 with an associate's degree or higher.<sup>9</sup> The top major fields of study include education; health professions and related programs; and business, management, marketing, and related support services. Pennsylvania's State System of Higher Education is a large contributor to bachelor's and graduate degree completions. California University produces approximately 10% of the total bachelor's degrees and above in the region.<sup>10</sup>

### 4.1 Associate's Degree Completions

Cal U's workforce region is home to approximately 36 different institutions that offer a range of associate's degree programs.<sup>11</sup> From 2011 to 2013, these institutions in Cal U's workforce region awarded, on average, 6,200 associate's degrees annually. The top three program areas in the region's associate degree production include:

- Health professions and related programs,
- Business, management, marketing, and related support services, and
- Engineering technologies and engineering-related fields.

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8 This number includes the location of a physical campus/structure with learner enrolment as reported to NCES. Institutions with extension campuses that report enrollment at their main campus may not be captured within this list.

9 This number is the 3-year average completions from 2011 to 2013 as reported to NCES.

10 This number is based on the 3-year average completions from 2011 to 2013 as reported to NCES.

11 This number includes the location of a physical campus/structure as reported to NCES. Institutions with extension campuses that report to their main campus may not be captured within this list.

Of the 6,200 average annual completions of associate's degrees, these three program areas accounted for 52% of completions in the region.

#### 4.1.1 California University's Associate's Degree Completions

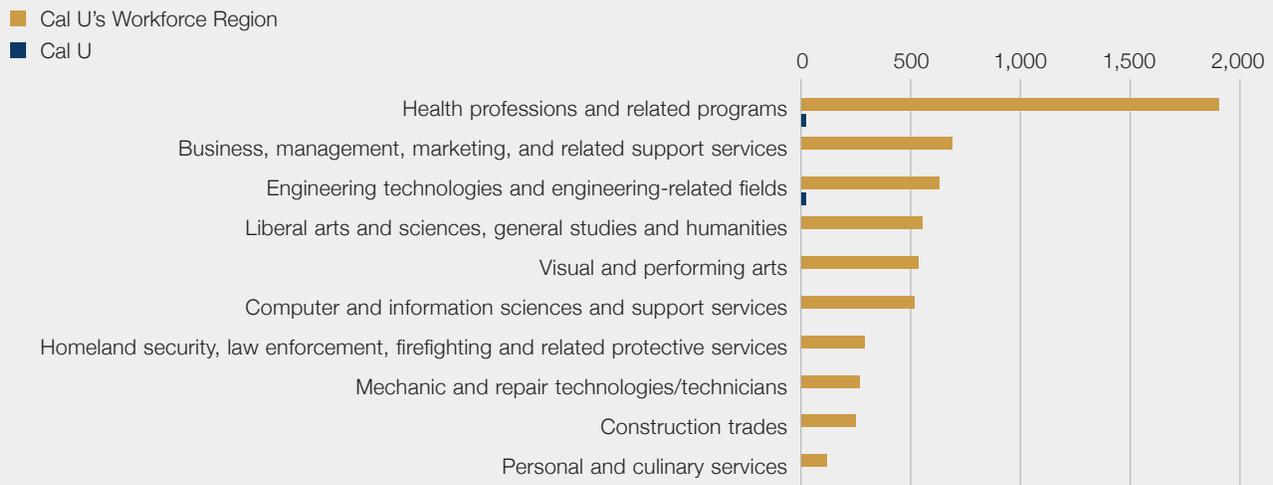
From 2011 to 2013, California University awarded, on average, 50 associate's degrees annually. The top program areas for associate's degrees from California University include:

- Health professions and related programs,
- Engineering technologies and engineering-related fields, and
- Liberal arts and sciences, general studies and humanities.

Of the 50 average annual completions of associate's degrees from California University, these three program areas accounted for 94% of associate's degree completions.

Fig. 24 highlights the top 10 program areas for associate's completions in Cal U's workforce region along with the corresponding associate's completions from California University.

**Fig. 24: Associate's Degree Program Completions from California University and Cal U's Workforce Region, 2011-2013 Annual Average**



Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

Fig. 25 below provides the total number of associate's degrees awarded in Cal U's workforce region by major field of study as well as the total number of associate's degrees awarded by California University.

**Fig. 25: Associate's Degree Total Program Completions from California University and Cal U's Workforce Region, 2011-2013 Annual Average**

Major Category	Cal U's Workforce Region 3-year Average Associate Completions	Share of Total Cal U's Workforce Region Associate Degrees	Cal U 3-year Average Associate Completions	Share of Total Cal U Associate Degrees
<b>Total</b>	<b>6,193</b>	<b>100.0%</b>	<b>47</b>	<b>100.0%</b>
Health professions and related programs	1,892	30.5%	26	56.4%
Business, management, marketing, and related support services	692	11.2%	2	3.6%
Engineering technologies and engineering-related fields	618	10.0%	12	25.0%
Liberal arts and sciences, general studies and humanities	552	8.9%	6	12.1%
Visual and performing arts	538	8.7%	0	0.7%
Computer and information sciences and support services	518	8.4%	0	0.7%
Homeland security, law enforcement, firefighting and related protective services	277	4.5%	0	0.7%
Mechanic and repair technologies/technicians	271	4.4%	0	0.0%
Construction trades	243	3.9%	0	0.0%
Personal and culinary services	120	1.9%	0	0.0%
Legal professions and studies	89	1.4%	0	0.0%
Family and consumer sciences/human sciences	77	1.2%	0	0.0%
Precision production	76	1.2%	0	0.0%
Education	72	1.2%	0	0.7%
Public administration and social service professions	34	0.5%	0	0.0%
Mathematics and statistics	23	0.4%	0	0.0%
Science technologies/technicians	18	0.3%	0	0.0%
Psychology	17	0.3%	0	0.0%
Biological and biomedical sciences	15	0.2%	0	0.0%
Communications technologies/technicians and support services	12	0.2%	0	0.0%
Social sciences	10	0.2%	0	0.0%
Agriculture, agriculture operations, and related sciences	10	0.2%	0	0.0%
Multi/interdisciplinary studies	6	0.1%	0	0.0%
Physical sciences	3	0.1%	0	0.0%
Engineering	3	0.0%	0	0.0%
Parks, recreation, leisure, and fitness studies	2	0.0%	0	0.0%
Transportation and materials moving	2	0.0%	0	0.0%
Foreign languages, literatures, and linguistics	2	0.0%	0	0.0%

Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

## 4.2 Bachelor's Degree Completions

California University's workforce region is home to approximately 20 different institutions that offer a range of bachelor's degree programs.<sup>12</sup> From 2011 to 2013, these institutions in Cal U's workforce region awarded, on average, 13,100 bachelor's degrees annually. The top three program areas in the region's bachelor degree production include:

- Business, management, marketing, and related support services,
- Health professions and related programs, and
- Visual and performing arts.

Of the 13,100 average annual completions of bachelor's degrees, these three program areas accounted for 38% of completions in the region.

### 4.2.1 California University's Bachelor's Degree Completions

From 2011 to 2013, California University awarded, on average, 1,400 bachelor's degrees annually. The top program areas for bachelor degrees from California University include:

- Business, management, marketing, and related support services,
- Parks, recreation, leisure, and fitness studies, and
- Education.

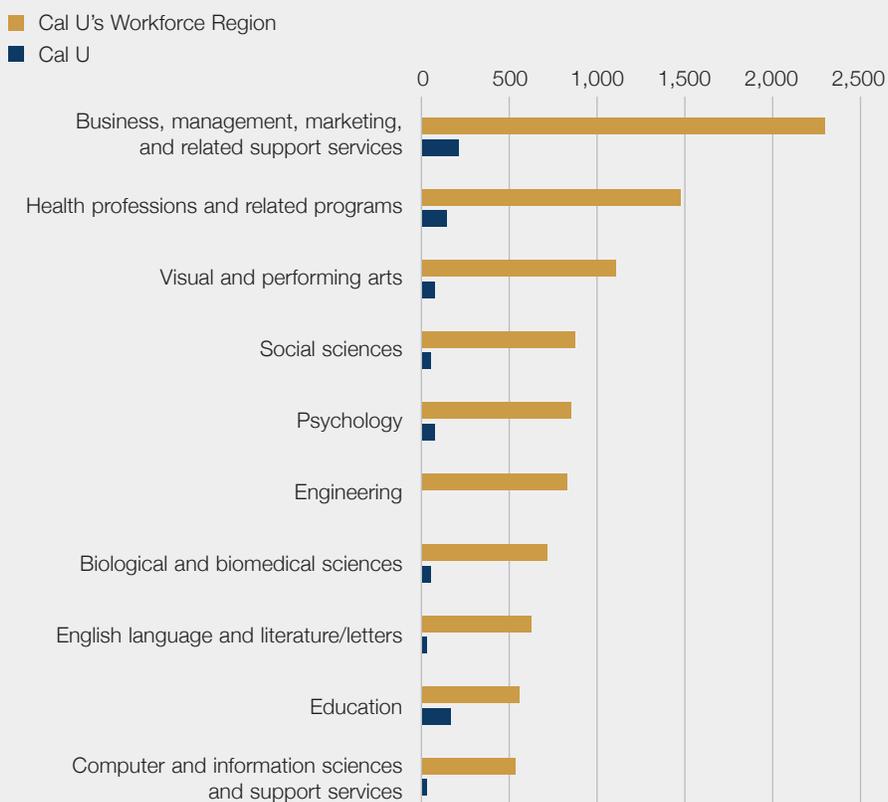
Of the 1,400 average annual completions of bachelor's degrees from California University, these three program areas accounted for 37% of bachelor's degree completions.

Fig. 26 highlights the top program areas for bachelor's completions in Cal U's workforce region, along with the corresponding bachelor's completions from California University.

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<sup>12</sup> This number includes the location of a physical campus/structure as reported to NCES. Institutions with extension campuses that report to their main campus may not be captured within this list.

**Fig. 26: Bachelor's Degree Program Completions from California University and Cal U's Workforce Region, 2011-2013 Annual Average**



Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

Fig. 27 on the next page provides the total number of bachelor's degrees awarded in Cal U's workforce region by major field of study as well as the total number of bachelor's degrees awarded by California University.

**Fig. 27: Bachelor's Degree Total Program Completions from California University and Cal U's Workforce Region, 2011-2013 Annual Average**

<b>Major Category</b>	<b>Cal U's Workforce Region 3-year Average Bachelor Completions</b>	<b>Share of Total Cal U's Workforce Region Bachelor Degrees</b>	<b>Cal U 3-year Average Bachelor Completions</b>	<b>Share of Total Cal U Bachelor Degrees</b>
<b>Total</b>	<b>13,110</b>	<b>100.0%</b>	<b>1,416</b>	<b>100.0%</b>
Business, management, marketing, and related support services	2,324	17.7%	204	14.4%
Health professions and related programs	1,480	11.3%	140	9.9%
Visual and performing arts	1,123	8.6%	61	4.3%
Social sciences	871	6.6%	55	3.9%
Psychology	863	6.6%	58	4.1%
Engineering	838	6.4%	0	0.0%
Biological and biomedical sciences	714	5.4%	41	2.9%
English language and literature/letters	626	4.8%	29	2.0%
Education	550	4.2%	157	11.1%
Computer and information sciences and support services	531	4.0%	26	1.9%
Communication, journalism, and related programs	458	3.5%	42	3.0%
Physical sciences	387	2.9%	77	5.5%
Homeland security, law enforcement, firefighting and related protective services	347	2.6%	102	7.2%
History	302	2.3%	26	1.9%
Mathematics and statistics	261	2.0%	20	1.4%
Multi/interdisciplinary studies	230	1.8%	11	0.8%
Liberal arts and sciences, general studies and humanities	223	1.7%	75	5.3%
Parks, recreation, leisure, and fitness studies	208	1.6%	162	11.5%
Foreign languages, literatures, and linguistics	182	1.4%	6	0.4%
Public administration and social service professions	146	1.1%	30	2.1%
Engineering technologies and engineering-related fields	86	0.7%	61	4.3%
Philosophy and religious studies	74	0.6%	2	0.2%
Architecture and related services	70	0.5%	0	0.0%
Personal and culinary services	66	0.5%	0	0.0%
Natural resources and conservation	50	0.4%	22	1.6%
Legal professions and studies	25	0.2%	6	0.4%
Communications technologies/technicians and support services	19	0.1%	0	0.0%
Family and consumer sciences/human sciences	19	0.1%	0	0.0%
Area, ethnic, cultural, gender, and group studies	18	0.1%	0	0.0%
Theology and religious vocations	18	0.1%	0	0.0%

Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

## 4.3 Graduate Degree Completions

California University's workforce region is home to approximately 17 different institutions that offer a range of graduate degree programs.<sup>13</sup> From 2011 to 2013, these institutions in Cal U's workforce region awarded, on average, 10,600 graduate degrees annually. The top three program areas in the region's graduate degree production include:

- Health professions and related programs,
- Business, management, marketing, and related support services, and
- Education.

Of the 10,600 average annual completions of graduate degrees in Cal U's workforce region, these three program areas accounted for 47% of graduate completions.

### 4.3.1 California University Graduate Degree Completions

From 2011 to 2013, California University awarded, on average, 990 graduate degrees annually. The top program areas for graduate degrees from California University include:

- Parks, recreation, leisure, and fitness studies
- Education, and
- Health professions and related programs.

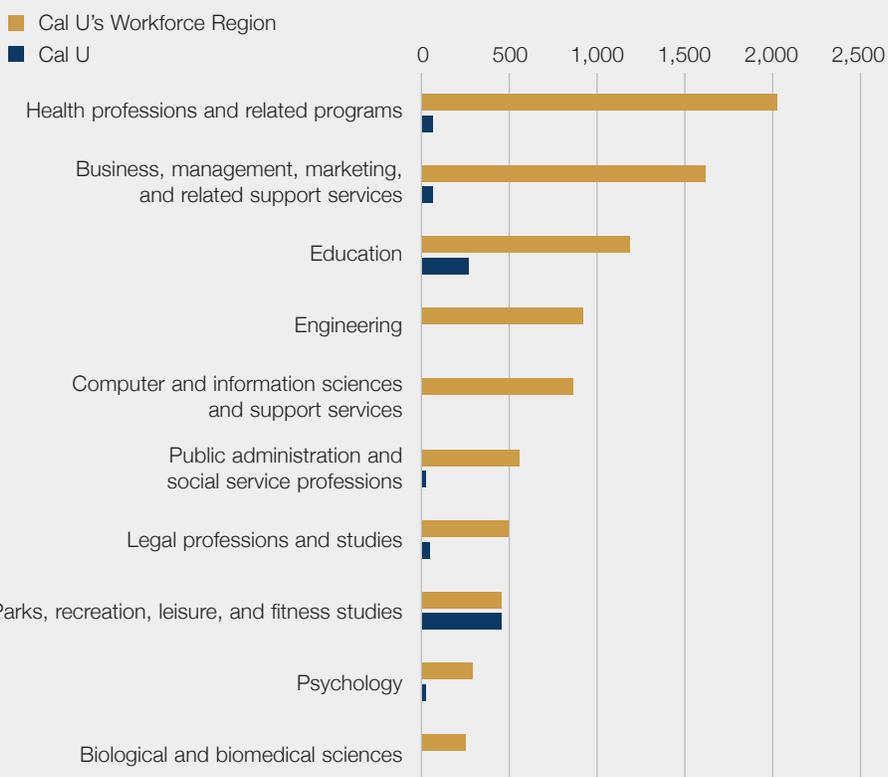
Of the 990 average annual completions of graduate degrees from California University, these three program areas accounted for 81% of graduate degree completions.

Fig. 28 highlights the top program areas for graduate completions in Cal U's workforce region, along with the corresponding graduate completions from California University.

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<sup>13</sup> This number includes the location of a physical campus/structure as reported to NCES. Institutions with extension campuses that report to their main campus may not be captured within this list.

**Fig. 28: Graduate Degree Program Completions from California University and Cal U's Workforce Region, 2011-2013 Annual Average**



Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

Fig. 29 on the next page provides the total number of graduate degrees awarded in Cal U's workforce region by major category as well as the total number of graduate degrees awarded by California University.

The next section evaluates the combination of completions by degree type (education supply) against the demand for skilled labor by occupation to determine whether potential gaps (excess demand or supply surplus) exist within the region's postsecondary education system.

**Fig. 29: Graduate Degree Total Program Completions from California University and Cal U's Workforce Region, 2011-2013 Annual Average**

Major Category	Cal U's Workforce Region 3-year Average Graduate Completions	Share of Total Cal U's Workforce Region Graduate Completions	Cal U 3-year Average Graduate Completions	Share of Total Cal U Graduate Completions
<b>Total</b>	<b>10,621</b>	<b>100.0%</b>	<b>990</b>	<b>100.0%</b>
Health professions and related programs	2,071	19.5%	66	6.7%
Business, management, marketing, and related support services	1,669	15.7%	57	5.8%
Education	1,214	11.4%	278	28.1%
Engineering	940	8.8%	0	0.0%
Computer and information sciences and support services	888	8.4%	0	0.0%
Public administration and social service professions	565	5.3%	31	3.1%
Legal professions and studies	510	4.8%	45	4.5%
Parks, recreation, leisure, and fitness studies	459	4.3%	459	46.4%
Psychology	285	2.7%	12	1.2%
Biological and biomedical sciences	253	2.4%	0	0.0%
English language and literature/letters	228	2.1%	3	0.3%
Library science	209	2.0%	0	0.0%
Visual and performing arts	209	2.0%	1	0.1%
Physical sciences	167	1.6%	2	0.2%
Theology and religious vocations	162	1.5%	0	0.0%
Social sciences	156	1.5%	3	0.3%
Liberal arts and sciences, general studies and humanities	145	1.4%	0	0.0%
Mathematics and statistics	88	0.8%	0	0.0%
Engineering technologies and engineering-related fields	88	0.8%	32	3.2%
Architecture and related services	51	0.5%	0	0.0%
Communication, journalism, and related programs	50	0.5%	2	0.2%
Homeland security, law enforcement, firefighting and related protective services	49	0.5%	0	0.0%
Philosophy and religious studies	45	0.4%	0	0.0%
History	42	0.4%	0	0.0%
Foreign languages, literatures, and linguistics	32	0.3%	0	0.0%
Natural resources and conservation	20	0.2%	0	0.0%
Multi/interdisciplinary studies	14	0.1%	0	0.0%
Family and consumer sciences/human sciences	6	0.1%	0	0.0%
Area, ethnic, cultural, gender, and group studies	3	0.0%	0	0.0%
Agriculture, agriculture operations, and related sciences	3	0.0%	0	0.0%

Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

## 5. OVERVIEW OF GAP ANALYSIS

A gap analysis comparing educational supply and occupational demand serves as a critical first step in efforts to align education programs with the workforce needs of Pennsylvania employers. It provides a data-driven perspective of employer demand (growing occupations across the state) and postsecondary education supply (degree production by program and level). This section focuses on the demand gaps and supply surpluses for skilled occupations in Cal U's workforce region.<sup>14</sup>

To make the connection between employer demand and education supply a crosswalk between the taxonomy of occupation codes (Standard Occupation Codes, or SOC) and major programs (Classification of Instructional Program or CIP) is required. The State System's Gap Analysis project conducted original research to enhance the traditional taxonomy of major program to occupation crosswalk using American Community Survey data that demonstrate a broader spectrum of connections between education programs and occupations.<sup>15</sup> This hybrid crosswalk connected the CIP and SOC using both the NCES and Pennsylvania standard crosswalks and the additional real-world connections using the American Community Survey.

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<sup>14</sup> Skilled occupations are occupations in Job Zones 3, 4, and 5.

<sup>15</sup> The existing crosswalks available include a national NCES crosswalk and a state crosswalk specific to Pennsylvania. Additional connections were made using data available in the ACS.

## EDUCATION TO OCCUPATION CROSSWALKS AND WHAT SETS THIS GAP ANALYSIS APART FROM PREVIOUS STUDIES

Typical gap analysis will use one of two approaches when building a crosswalk: The Department of Education (DOE) crosswalk or the American Community Survey (ACS) crosswalk.

The DOE crosswalk, completed through collaboration with the Bureau of Labor Statistics and the National Center for Education Statistics (NCES), attempts to link occupation classifications (SOC code) to their related educational programs (CIP code). The drawback is that there is often not a one-to-one connection between education programs and occupations and in even some extreme cases, education programs related to occupations do not match the reality of careers people enter. Another drawback is that occupations often employ a range of degree and non-degree completers, which reflects the reality of the labor market. For example a customer representative for a technology company may have a bachelor's degree in computer programming, whereas a customer service representative for a retail company may only have a high school diploma.

The ACS crosswalk is built on a large survey sample consisting of 160 education program codes and 261 occupation classifications (note: these are not as detailed as CIP and SOC codes), reflecting the careers individuals take after they complete their education programs. Whereas DOE's crosswalk seeks to state what should be, the ACS crosswalk states what is. This approach is very practical when dealing with education programs that don't match closely to a specific occupation (e.g. liberal arts degrees, history degrees, etc.). Additionally, ACS data provide a measure that estimates the demand for workers with various levels of postsecondary education in a given occupation. For example if 21% of customer service representatives have a bachelor's degree, then only 21% of the annual demand for customer service representatives will be counted against the supply of matching education programs.

The methodology developed for this gap analysis bridges the two approaches above. Occupations that

are linked through DOE are not discounted, even if ACS suggests that there are relatively few degree completions entering the occupation field. Additionally, the use of ACS more closely captures the reality of where degree holders have found employment in Pennsylvania and surrounding states—note the geography for measuring gaps was restricted to Pennsylvania only, however occupation to education linkages were built on a multi-state region. While there are certainly exceptions to the rule, which were ultimately reviewed on a case-by-case basis as described in detail in Appendix E, the approach does capture the vast majority of relevant and compelling connections between education programs and occupations. Lastly, the methodology takes into account the labor market behavior of both employers and employees in the following ways:

- It provides a measure of education distribution by degree level demonstrating that a range of skill levels can exist within occupation classification.
- It captures the demand and range for bachelor's degree field of study within an occupation classification.\*
- It provides a reality-driven process to connect bachelor's degree field of study to occupations, especially in the liberal arts programs.
- It provides a regionalized crosswalk that better reflects the competition for jobs in Pennsylvania and the surrounding region.

By modeling these features, this gap analysis accounts for issues that were not accounted for in previous gap analysis studies.

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\* The ACS reports two separate pieces of information: highest level of educational attainment for an individual and major field of study for an individual's bachelor degree. The major field of study is not reported for associate's degrees or graduate degrees.

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## 5.1 How to use the Gap Analysis

The gap analysis results are presented as two main sets of findings: demand gaps (excess employer demand) and supply surpluses. Each outcome has a different set of implications for area stakeholders, postsecondary education institutions, and learners. These outcomes are summarized briefly below and then described further in each relevant section.

The uses of a gap analysis are many and varied and include:

- **Strategic engagement:** Increased collaboration and alignment between regional employers and education programs helps ensure a competitive, vibrant regional economy. The gap analysis enables this process by helping postsecondary institutions identify areas of employer need. The analysis provides a data-driven starting point to begin conversations with employers on how postsecondary institutions can help meet education/training needs in the regional economy.
- **Enhanced program development/evaluation:** The gap analysis serves as an additional tool for decision-making in academic program planning by addressing one aspect of the external eco-system—alignment of academic programs to the regional labor market.
- **Student engagement/career guidance:** The analysis provides information that can be used for career guidance and job search. The gap analysis results can inform learners about the alignment of education programs to careers, as well as the market demand for jobs.
- **Marketing:** By highlighting information about high demand occupations that are linked to education programs, postsecondary education institutions can demonstrate how learners will succeed after program completion. Where compelling information exists, this can be used in student recruitment efforts.

While the State System's Gap Analysis project is critical to understanding the connections between education programs and occupations, it is important to recall the caveats of this Gap Analysis report:

- When considering making adjustments to programs in degree areas related to occupations displaying gaps, further research should be considered to confirm the extent of alignment needed to arrive at equilibrium with the labor market.
- Government data that capture labor market demand lag real-time employer demand as well as higher education industry trends. As such, the gap analysis findings may lag these market changes.

- This analysis only focuses on program output as a supply pool (i.e. new graduates). However, regional workforces comprise additional pools of supply—specifically: employed workers, skilled unemployed workers, and skilled underemployed workers. When evaluating gaps, this analysis focuses on new and replacement demand, as opposed to job churn.<sup>16</sup> This helps to mitigate some of the issues involving the employed workforce.

### Excess Employer Demand (Demand Gap)

A demand gap exists where the regional supply of talent is insufficient to support the workforce needs of businesses located there. Where such gaps exist businesses will likely seek talent from outside the area, which can become costly from an HR perspective. This especially affects small and medium sized businesses that usually do not have well-developed HR functions. Additionally,

## ABSOLUTE DEMAND GAP VS. RELATIVE DEMAND GAP

Results for demand gaps in this analysis are calculated in two different ways. An absolute demand gap is a nominal comparison, wherein the supply of program completions which align to an occupation is subtracted from the demand for those aligned occupations. This produces a “headcount” of the additional number of program completions needed to meet the demand within an occupation.

A relative demand gap is a ratio of program supply to occupation demand, which is expressed as a percentage. A percentage below 100% indicates excess employer demand relatively (e.g. the number of program completers is less than the occupation demand), whereas a value over 100% indicates that there are more program completions relative to occupation demand.

This analysis factors in both the absolute measure and relative measure to enable a broader perspective for interpretation. For example, an occupation that may indicate an average annual demand for 40 jobs per year with 30 annual completers would require 25% more completions to bridge the gap ( $30 / 40 = 0.75$ ). However, this absolute gap would suggest that the increased amount of program output—10 additional completers—is relatively small. Therefore for program planning purposes, both perspectives are helpful to set the context of the demand gap.

<sup>16</sup> Replacement jobs include retirements, deaths, and other workers who permanently leave an occupation. Job churn occurs when a worker leaves one job for another, but continues working in the same occupation.

employers—especially those in more rural areas—may face higher costs as they attempt to draw in workers from more populated areas.

This creates an opportunity to expand output or develop programs. For education institutions, gaps present an opportunity for program expansion (where current programs align, but are not creating enough output). The strategy for increasing output may differ—whether capacity or learner recruitment is a constraining factors. If a program does not exist, a gap may present an opportunity for new program development.

Learners may gain a competitive employment edge when excess employer demand exists. For learners, when demand exceeds supply, graduates in relevant disciplines usually benefit—providing opportunities for career progression and higher earnings in both the short and long term.

### **Supply Surplus (Supply Gap)**

A supply surplus for an occupation exists when the number of program completions within a region exceeds the employer demand. This presents some key implications to consider.

## **ABSOLUTE SUPPLY SURPLUS VS. RELATIVE SUPPLY SURPLUS**

Results for supply surpluses are calculated in two different ways. An absolute supply surplus is a nominal comparison, wherein the supply of program completions which align to an occupation is subtracted from the demand for those aligned occupations. This produces a “headcount” of the number of program completions that exceed the projected demand for a given occupation.

A relative supply surplus is a ratio of program supply to occupation demand, which is expressed as a percentage. A percent above 100% indicates a relative supply surplus (e.g. the number of program completers is more than the occupation demand).

This analysis factors both ways to enable a broader perspective for interpretation. For example, an occupation that may indicate an average annual demand for 40 jobs per year with 50 annual completers would suggest that there are about 25% more completions than the workforce demands for occupations that tie to that program ( $50 / 40 = 1.25$ ). However, this absolute gap would suggest that the increased amount of program output—10 additional completers—is relatively small. Furthermore, this may indeed fall within “tolerable levels” of program supply surplus. Therefore for programming planning and evaluation purposes, both perspectives are helpful to set the context of the supply surplus.

If employer demand is less than education production in relevant occupations, learners are likely to leave the region after graduation causing learner attrition and out-migration. Surpluses in talent supply can also suppress wages for graduates in certain careers. Classic labor market economic theory suggests that increased competition for jobs will put downward pressure on wages—i.e. the more people competing for the same job gives an employer a better bargaining position for wage/salary. While a college degree in and of itself has a measured wage premium, specific programs areas may have a range of wage premiums based on the supply of new talent competing for jobs and the conditions of the labor market.

## **5.2 Excess Demand Gaps for Skilled Occupations**

Excess demand gaps exist for many skilled occupations (occupations in Job Zones Three, Four and Five) within Cal U's workforce region. The degree programs that align to these occupations span associate's degrees through graduate degrees. Recall that a demand gap exists where the regional supply of talent is insufficient to support the workforce needs of businesses located there. The top excess demand gaps are identified by the size of the annual gap.

In Cal U's workforce region, growth in the finance and insurance sector has increased demand for business and sales occupations. Thirteen out of the top twenty demand gaps are occupations related to sales and business occupations, combining for an average annual demand gap of 736. The largest demand gap exists for accountants and auditors with an average annual gap of 220.

Additionally, growth in the health care and social assistance industry has increased demand for healthcare practitioners and technical occupations. These occupations represent three out of the top twenty demand gaps and combine for an average annual demand gap of 126.

Fig. 30 and Fig. 31 provide further detail about the top occupation gaps that reveal excess employer demand. The table includes the occupation title, occupation job zone, projected annual employer demand (for associate's degrees and higher), the annual supply of program completions (allocated to the occupation), the average annual gap, and a ratio of supply to demand (S/D Ratio).

**Fig. 30: Top Demand Gaps for Skilled Occupations in California University's Workforce Region**



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

**Fig. 31: Top Demand Gaps for Skilled Occupations in California University's Workforce Region**

Occupation Title	Job Zone	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio
Accountants and Auditors	4	473	253	220	0.53
Secretaries and Admin. Assistants, Except Legal, Medical, and Executive	3	235	110	125	0.47
Market Research Analysts and Marketing Specialists	4	223	108	115	0.48
Sales Representatives, Services, All Other	4	211	152	59	0.72
Financial Analysts	4	112	57	55	0.51
Dental Hygienists	3	72	21	51	0.29
Personal Financial Advisors	4	89	47	42	0.53
Physicians and Surgeons, All Other	5	104	62	42	0.60
Claims Adjusters, Examiners, and Investigators	4	64	28	36	0.44
Insurance Sales Agents	4	59	25	34	0.42
Cost Estimators	4	56	23	33	0.41
Registered Nurses	3	853	820	33	0.96
Loan Officers	3	62	30	32	0.48
Securities, Commodities, and Financial Services Sales Agents	4	61	32	29	0.52
Human Resources Specialists	4	113	85	28	0.75
Compliance Officers	4	47	20	27	0.43
Teacher Assistants	3	69	43	26	0.62
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	4	98	72	26	0.73
Production, Planning, and Expediting Clerks	3	45	19	26	0.42
Legal Secretaries	3	47	22	25	0.47

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

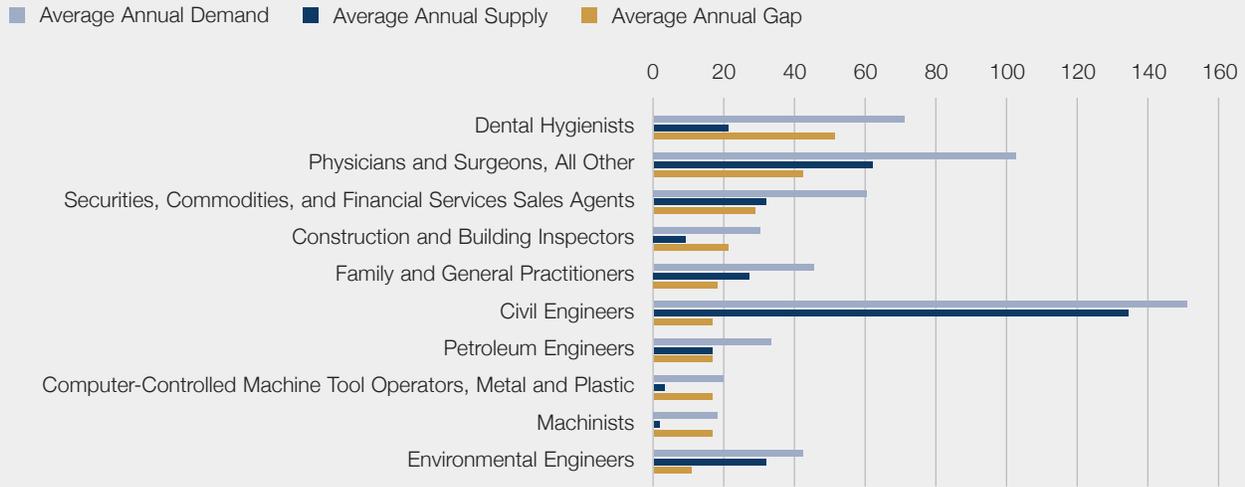
### **5.3 Excess Demand Gaps for Occupations Without a California University Match**

The breadth of programs offered at California University indicates a number of strong linkages to occupations. However, many occupations within Cal U's workforce region show excess demand for which California University did not produce completers in a matching program area. Furthermore, analysis indicates continued demand for these occupations over the next decade. Recall that a demand gap exists where the regional supply of talent is insufficient to support the workforce needs of businesses located there.

Fig. 32 displays the top excess demand gaps for occupations that did not have matching program completers at California University. Dental hygienists show the largest excess annual demand gap at 51. This is followed by: physicians and surgeons, all other; securities, commodities, and financial services sales agents; construction and building inspectors; and family and general practitioners.

Fig. 33 provides detailed information for each occupation the occupation title, occupation job zone, projected annual employer demand (for associate's degrees and higher), the annual supply of program completions (allocated to the occupation), the average annual gap, and a ratio of supply to demand (S/D Ratio).

**Fig. 32: Top Demand Gaps for Skilled Occupations in Cal U's Workforce Region Without a California University Match**



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

**Fig. 33: Top Demand Gaps for Skilled Occupations in California University's Workforce Region Without a Cal U Match**

Occupation Title	Job Zone	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio
Dental Hygienists	3	72	21	51	0.29
Physicians and Surgeons, All Other	5	104	62	42	0.60
Securities, Commodities, and Financial Services Sales Agents	4	61	32	29	0.52
Construction and Building Inspectors	3	31	9	22	0.29
Family and General Practitioners	5	46	28	18	0.61
Civil Engineers	4	152	136	16	0.89
Petroleum Engineers	4	33	17	16	0.52
Computer-Controlled Machine Tool Operators, Metal and Plastic	3	19	3	16	0.16
Machinists	3	18	2	16	0.11
Environmental Engineers	5	43	32	11	0.74
Directors, Religious Activities and Education	4	16	5	11	0.31
Real Estate Sales Agents	3	22	11	11	0.50
Surgeons	5	24	14	10	0.58
Physical Therapists	5	129	121	8	0.94
Sales Engineers	4	13	6	7	0.46
Brokerage Clerks	3	13	6	7	0.46
Tour Guides and Escorts	3	10	4	6	0.40
Architects, Except Landscape and Naval	4	50	45	5	0.90
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	4	10	5	5	0.50
Industrial Engineers	4	53	48	5	0.91

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

## 5.4 Supply Surplus Gaps

Supply surplus gaps for skilled occupations cover occupations in Job Zones Three, Four and Five. The degree programs that align to these occupations span associate's degrees through graduate degrees. Recall that a supply surplus for an occupation exists where the number of program completions within a region exceeds the employer demand. The top supply surplus gaps are identified by the size of the annual gap.

The top supply surpluses within Cal U's workforce region cover a broad range of both technical and non-technical occupations. When considering program changes in degree areas related to occupations displaying a supply surplus, further research should be considered to confirm the extent of alignment needed to arrive at equilibrium with the labor market.

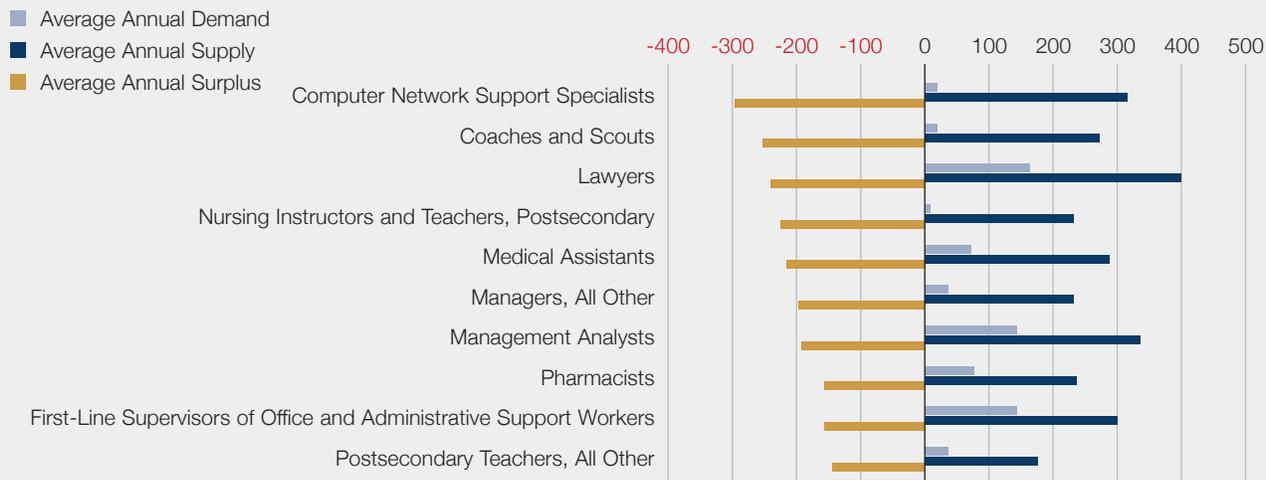
In Cal U's workforce region, the data reveal the number of graduates that are aligned to education, training, and library occupations greatly exceed the annual demand for workers by a combined annual average of 944 completions. Other occupations that indicate a supply surplus in Cal U's workforce region are concentrated in arts, design, entertainment, sports, and media occupations. Coaches and scouts and graphic designers combine for an average annual supply surplus of 393.

The largest supply surplus gap in the region exists for computer network support specialists with an average annual surplus gap of 294. Program completers in the top supply surplus occupations may face increased competition for occupations related to their field of study within the region.

Fig. 34 illustrates the top supply surpluses for skilled occupations in Cal U's workforce region. Fig. 35 provides the occupation title, occupation job zone, projected annual employer demand (for associate's degrees and higher), the annual supply of program completions (allocated to the occupation), the average annual gap, and a ratio of supply to demand (S/D Ratio).

This section provided an overview of gaps from the perspective of excess demand and supply surpluses. It is intended to set the data-driven foundation for understanding current alignment of education production in Cal U's workforce region compared to the region's employer demand for graduates in specific program areas. Results for the gaps are largely driven by industry employment growth. As market conditions change, the resulting demand for skilled workers will also change. Therefore, results of this analysis should be taken in the context of changing industry sector employment and occupational demand.

**Fig. 34: Top Supply Surplus Gaps for Skilled Occupations in California University's Workforce Region**



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

**Fig. 35: Top Supply Surplus Gaps for Skilled Occupations in California University's Workforce Region**

Occupation Title	Job Zone	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio
Computer Network Support Specialists	4	20	314	-294	15.70
Coaches and Scouts	4	18	270	-252	15.00
Lawyers	5	163	401	-238	2.46
Nursing Instructors and Teachers, Postsecondary	5	9	233	-224	25.89
Medical Assistants	3	72	287	-215	3.99
Managers, All Other	4	36	230	-194	6.39
Management Analysts	4	144	334	-190	2.32
Pharmacists	5	77	234	-157	3.04
First-Line Supervisors of Office and Administrative Support Workers	3	142	298	-156	2.10
Postsecondary Teachers, All Other	5	35	177	-142	5.06
Graphic Designers	4	60	201	-141	3.35
Librarians	5	29	162	-133	5.59
Clinical, Counseling, and School Psychologists	5	30	160	-130	5.33
Secondary School Teachers, Except Special and Career/Technical Education	4	193	315	-122	1.63
Recreation and Fitness Studies Teachers, Postsecondary	5	3	123	-120	41.00
Veterinary Technologists and Technicians	3	5	119	-114	23.80
Police and Sheriff's Patrol Officers	3	65	175	-110	2.69
Art, Drama, and Music Teachers, Postsecondary	5	40	143	-103	3.58
Business Teachers, Postsecondary	5	33	133	-100	4.03
Education Administrators, Elementary and Secondary School	5	28	127	-99	4.54

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

## 6. CONCLUSION

The State System Gap Analysis report provides a data-driven foundation for program planning and alignment in order to drive economic value and career success within the state and its regions. The analysis itself is not the solution, but can lend credible insight to guide decision-making at the strategic level. The content is designed to be a starting point and resource for program evaluation and planning.

It is important to remember that the results for the gaps are largely driven by industry employment growth. As labor market conditions change, the resulting demand for skilled workers will also change. Therefore, the results of this analysis should be taken in a context of changing industry sector employment and occupational demand.

Additionally, areas of future research should be considered when considering program evaluation and planning. These areas include (but are not limited to):

- Strong vs. weak occupation to education alignment,
- Wage trend research and supply/demand effects on wages,
- Career pathways, outcomes, and lifetime earnings,
- Issues of mal-employment<sup>17</sup> and underemployment,<sup>18</sup> and
- Program alignment best practices.

As more insights into the connections between education programs and labor market outcomes are gained, students, universities, workers, and employers will all benefit significantly.

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17 Mal-employment is a specific type of underemployment that exists in the labor market. This occurs when college-educated workers choose to work in occupations that do not utilize the skills and abilities gained in college. An example of this would include a person who has a bachelor's degree in political science but works as bartender. For more on mal-employment see Harrington and Fogg (2011) "Rising Mal-Employment and the Great Recession: The Growing Disconnection between Recent College Graduates and the College Labor Market."

18 Underemployment occurs in the labor market when workers' skills, experience, and willingness to work are not fully utilized. An example of this would include a person who is employed part-time but wants to work full-time.

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## 7. ABOUT THE STATE SYSTEM'S GAP ANALYSIS PROJECT

The gap analysis methodology and report was produced through a multi-organization collaboration that consisted of Pennsylvania's State System of Higher Education Office of the Chancellor and Oxford Economics USA Inc. —the team. Throughout the project and research process, the team sought feedback and insight from senior administration and representatives from each of the 14 State System Universities. The team also drew on insight and feedback from Georgetown University's Center on Education and the Workforce as well as subject matter experts involved in labor market intelligence and education program alignment.

The modeling and results presented here are based on information provided by third parties, upon which Oxford Economics has relied in producing its report and forecasts in good faith. Any subsequent revision or update of those data will affect the assessments and projections shown.

Oxford Economics is a key adviser to corporate, financial, government and education decision-makers and thought leaders. Oxford Economics' worldwide client base now comprises over 1000 international organizations, including leading multinational companies and financial institutions; key government bodies and trade associations; and top universities, consultancies, and think tanks.

This report is confidential to stakeholders of Pennsylvania's State System of Higher Education and may not be published or distributed without their prior written permission. Contact information for such request is provided below:

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## 8. DATA SOURCES KEY

Bureau of Labor Statistics (BLS):

- QCEW - Quarterly Census of Employment & Wages - <http://www.bls.gov/cew/>
- OES – Occupational Employment Statistics - <http://www.bls.gov/oes/>
- LAUS – Local Area Unemployment Statistics - <http://www.bls.gov/lau/>

U.S. Census Bureau (Census):

- LEHD – Longitudinal Employer-Household Dynamics - <http://lehd.census.gov/>
- ACS – American Community Survey - <http://www.census.gov/acs/www/>
- SAIPe – Small Area Income and Poverty Estimates - <http://www.census.gov/did/www/saipe/>

National Center for Education Statistics (NCES):

- IPEDS – Integrated Postsecondary Education Data System (National Center for Education Statistics) - <https://nces.ed.gov/ipeds/>

Pennsylvania Department of Labor and Industry (PADLI):

- [www.paworkstats.pa.gov](http://www.paworkstats.pa.gov)

O\*NET Resource Center (O\*NET)

- Job Zones [www.onetonline.org/help/online/zones](http://www.onetonline.org/help/online/zones)

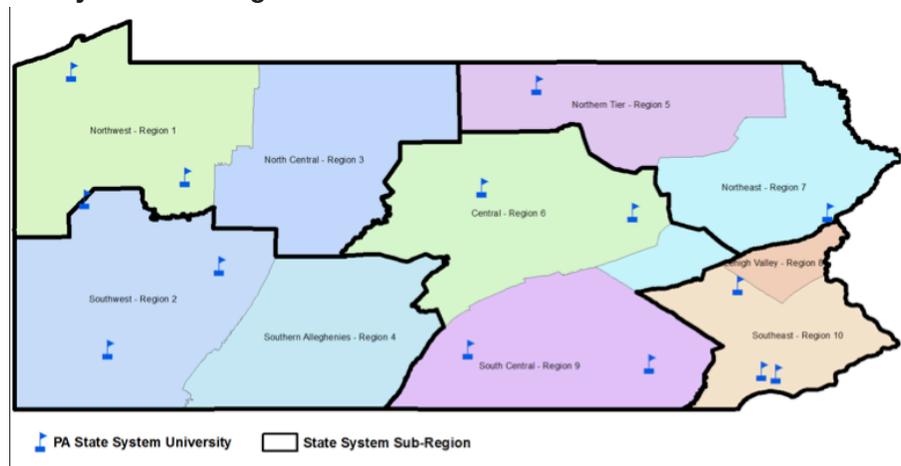
Economic Modeling Specialists International (EMSI)

# APPENDIX A: STATE SYSTEM SUB-REGIONS WITH PREP REGIONS AND WIA REGIONS

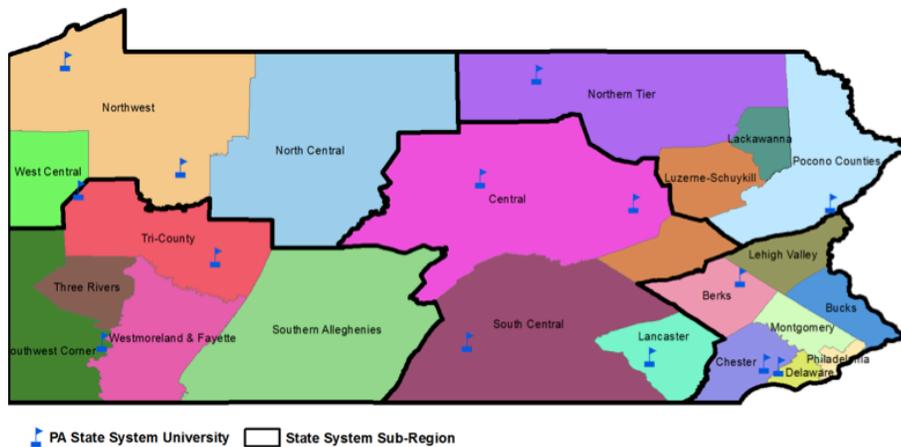
Partnerships for Regional Economic Performance (PREP) regions provide geographic context of how the Pennsylvania Department of Community & Economic Development divides resources and services to support business development, start-ups, investment and other economic development initiatives. To define sub-regions for this project, PREP regions served as the starting point. The following figures outline the sub-regions in relation to PREP regions.

An additional map of Pennsylvania's Workforce Investment Act (WIA) regional boundaries is also provided.

**State System Sub-regions and PREP Boundaries**



**State System Sub-regions and WIA Boundaries**



# APPENDIX B: O\*NET JOB ZONE CODES

The O\*NET program is the nation's primary source of occupational information. Central to the project is the O\*NET database, containing information on hundreds of standardized and occupation-specific descriptors. The database, which is available to the public at no cost, is continually updated by surveying a broad range of workers from each occupation.<sup>19</sup>

## **JOB ZONE ONE: Little or No Preparation Needed**

- *Education* – Some of these occupations may require a high school diploma or GED certificate.
- *Related Experience* – Little or no previous work-related skill, knowledge, or experience is needed for these occupations. For example, a person can become a waiter or waitress even if he/she has never worked before.
- *Job Training* – Employees in these occupations need anywhere from a few days to a few months of training. Usually, an experienced worker could show you how to do the job.
- *Job Zone Examples* – These occupations involve following instructions and helping others. Examples include taxi drivers, amusement and recreation attendants, counter and rental clerks, nonfarm animal caretakers, continuous mining machine operators, and waiters/waitresses.

## **JOB ZONE TWO: Some Preparation Needed**

- *Education* – These occupations usually require a high school diploma.
- *Related Experience* – Some previous work-related skill, knowledge, or experience is usually needed. For example, a teller would benefit from experience working directly with the public.
- *Job Training* – Employees in these occupations need anywhere from a few months to one year of working with experienced employees. A recognized apprenticeship program may be associated with these occupations.

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<sup>19</sup> <http://www.onetcenter.org/overview.html>

- *Job Zone Examples* – These occupations often involve using your knowledge and skills to help others. Examples include sheet metal workers, forest fire fighters, customer service representatives, physical therapist aides, salespersons (retail), and tellers.

### **JOB ZONE THREE: Medium Preparation Needed**

- *Education* – Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree.
- *Related Experience* – Previous work-related skill, knowledge, or experience is required for these occupations. For example, an electrician must have completed three or four years of apprenticeship or several years of vocational training, and often must have passed a licensing exam, in order to perform the job.
- *Job Training* – Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. A recognized apprenticeship program may be associated with these occupations.
- *Job Zone Examples* – These occupations usually involve using communication and organizational skills to coordinate, supervise, manage, or train others to accomplish goals. Examples include food service managers, electricians, agricultural technicians, legal secretaries, occupational therapy assistants, and medical assistants.

### **JOB ZONE FOUR: Considerable Preparation Needed**

- *Education* – Most of these occupations require a four-year bachelor's degree, but some do not.
- *Related Experience* – A considerable amount of work-related skill, knowledge, or experience is needed for these occupations. For example, an accountant must complete four years of college and work for several years in accounting to be considered qualified.
- *Job Training* – Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.
- *Job Zone Examples* – Many of these occupations involve coordinating, supervising, managing, or training others. Examples include accountants, sales managers, database administrators, teachers, chemists, art directors, and cost estimators.

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## **JOB ZONE FIVE: Extensive Preparation Needed**

- *Education* – Most of these occupations require graduate school. For example, they may require a master’s degree, and some require a Ph.D., M.D., or J.D. (law degree).
- *Related Experience* – Extensive skill, knowledge, and experience are needed for these occupations. Many require more than five years of experience. For example, surgeons must complete four years of college and an additional five to seven years of specialized medical training to be able to do their job.
- *Job Training* – Employees may need some on-the-job training, but most of these occupations assume that the person will already have the required skills, knowledge, work-related experience, and/or training.
- *Job Zone Examples* – These occupations often involve coordinating, training, supervising, or managing the activities of others to accomplish goals. Very advanced communication and organizational skills are required. Examples include librarians, lawyers, sports medicine physicians, wildlife biologists, school psychologists, surgeons, treasurers, and controllers.

# APPENDIX C: STRONG, LIMITED AND WEAK EDUCATION PROGRAM TO OCCUPATION CONNECTIONS<sup>20</sup>

	Direct Connection	Limited Connection	Weak Connection
Surplus	Definitive surplus of graduates to projected demand; indicates strong market relationship between CIP and SOC(s) suggesting limited need for additional investments in program.	Apparent surplus of graduates in most related occupations. Likely intense competition for limited job opportunities. Moderate occupation ties require identification of special market links prior to added program investments.	Data indicates surplus of graduates likely, however the weak connection of the education program to specific occupations does not conform to traditional supply/demand data analysis.
Balanced	Balanced supply of graduates relative to demand. Job competition for newly minted graduates will be competitive, but opportunities in related occupations exist.	Apparent balanced supply of graduates relative to job demand in most related occupations. Data may be indeterminate relative to labor surplus or shortage situation. Added program review required to determine if greater labor market opportunities are present due to emerging or evolving occupations.	Data indicates balanced supply of graduates likely, but the weak connection to specific occupations does not conform to traditional supply/demand data analysis. Review occupational connections in CIP to SOC crosswalk to determine possible job market opportunities.
Gap	Definitive gap of completers relative to occupation demand. Data indicates likely shortages. Program is a strong candidate for additional resources and targeted recruitment efforts increase supply.	Apparent gap of graduates relative to job demand in at least one closely related occupation. Job opportunities may exist in at least one other related occupation. More research worthwhile to determine possible added occupation connections.	Data indicates gap of graduates likely, but weak connection to specific occupations does not conform to traditional supply/demand data analysis. Related jobs may exist but are not directly connected to the program. Review crosswalk for possible occupation links.

<sup>20</sup> The relationship matrix is drawn from: Labor Supply/Demand Analysis: Approaches and Concerns (2010) by Richard Froeschle formerly of the Texas Workforce Commission's Labor Market and Career Information (LMCI). While this context is important to know, Oxford Economics' methodology sought to minimize these issues by developing a crosswalk that uses real world education program to occupation matches through U.S. Census ACS data to more closely reflect the careers program completers actually enter into after graduation.

# APPENDIX D: 4-DIGIT INDUSTRY EMPLOYMENT PROJECTIONS

The table below displays the employment numbers for industries at the four-digit NAICS level in Cal U's workforce region in 2010, 2014, and 2024. It also provides the detailed NAICS code, industry title, 2014 industry LQ, and projected job growth to 2024.

NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
<b>Total</b>	<b>All Industries</b>	<b>1.0</b>	<b>984,555</b>	<b>1,056,526</b>	<b>7.3%</b>
1111	Oilseed and Grain Farming	0.0	13	16	23.1%
1112	Vegetable and Melon Farming	0.1	105	104	-1.0%
1113	Fruit and Tree Nut Farming	0.0	35	42	20.0%
1114	Greenhouse, Nursery, and Floriculture Production	0.1	100	85	-15.0%
1119	Other Crop Farming	0.0	11	11	0.0%
1121	Cattle Ranching and Farming	0.1	60	69	15.0%
1122	Hog and Pig Farming	0.0	2	2	0.0%
1123	Poultry and Egg Production	0.2	52	57	9.6%
1124	Sheep and Goat Farming	1.4	15	18	20.0%
1129	Other Animal Production	0.2	29	23	-20.7%
1131	Timber Tract Operations	0.2	12	15	25.0%
1132	Forest Nurseries and Gathering of Forest Products	0.1	2	3	50.0%
1133	Logging	0.0	7	9	28.6%
1142	Hunting and Trapping	0.5	7	9	28.6%
1151	Support Activities for Crop Production	0.0	92	104	13.0%
1152	Support Activities for Animal Production	0.4	90	82	-8.9%
1153	Support Activities for Forestry	0.2	22	27	22.7%
2111	Oil and Gas Extraction	2.3	3,303	4,513	36.6%
2121	Coal Mining	6.8	3,549	2,928	-17.5%
2122	Metal Ore Mining	0.0	0	0	0.0%
2123	Nonmetallic Mineral Mining and Quarrying	0.9	585	586	0.2%
2131	Support Activities for Mining	1.9	6,070	6,875	13.3%
2211	Electric Power Generation, Transmission and Distribution	0.5	1,669	1,553	-7.0%
2212	Natural Gas Distribution	1.7	1,481	1,508	1.8%

NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
2213	Water, Sewage and Other Systems	1.9	2,923	3,159	8.1%
2361	Residential Building Construction	1.0	4,614	5,856	26.9%
2362	Nonresidential Building Construction	1.3	6,330	7,319	15.6%
2371	Utility System Construction	1.3	4,291	4,907	14.4%
2372	Land Subdivision	1.5	452	542	19.9%
2373	Highway, Street, and Bridge Construction	1.2	3,479	4,226	21.5%
2379	Other Heavy and Civil Engineering Construction	1.2	893	1,093	22.4%
2381	Foundation, Structure, and Building Exterior Contractors	0.9	4,852	5,039	3.9%
2382	Building Equipment Contractors	0.9	12,455	13,826	11.0%
2383	Building Finishing Contractors	0.9	4,617	4,849	5.0%
2389	Other Specialty Trade Contractors	1.5	6,205	7,573	22.0%
3111	Animal Food Manufacturing	0.1	31	35	12.9%
3112	Grain and Oilseed Milling	0.2	96	70	-27.1%
3113	Sugar and Confectionery Product Manufacturing	1.5	734	756	3.0%
3114	Fruit and Vegetable Preserving and Specialty Food Manufacturing	0.9	1,049	1,166	11.2%
3115	Dairy Product Manufacturing	0.4	414	386	-6.8%
3116	Animal Slaughtering and Processing	0.1	344	331	-3.8%
3118	Bakeries and Tortilla Manufacturing	0.8	1,756	1,751	-0.3%
3119	Other Food Manufacturing	0.2	282	295	4.6%
3121	Beverage Manufacturing	0.5	759	801	5.5%
3122	Tobacco Manufacturing	1.0	93	109	17.2%
3131	Fiber, Yarn, and Thread Mills	0.2	36	41	13.9%
3132	Fabric Mills	0.6	228	195	-14.5%
3133	Textile and Fabric Finishing and Fabric Coating Mills	0.2	55	63	14.5%
3141	Textile Furnishings Mills	0.3	102	112	9.8%
3149	Other Textile Product Mills	0.9	420	426	1.4%
3152	Cut and Sew Apparel Manufacturing	0.1	67	63	-6.0%
3159	Apparel Accessories and Other Apparel Manufacturing	1.1	95	72	-24.2%
3161	Leather and Hide Tanning and Finishing	0.0	0	0	0.0%
3162	Footwear Manufacturing	0.1	11	9	-18.2%
3169	Other Leather and Allied Product Manufacturing	0.0	0	0	0.0%
3211	Sawmills and Wood Preservation	0.5	302	425	40.7%
3212	Veneer, Plywood, and Engineered Wood Product Manufacturing	0.2	116	130	12.1%
3219	Other Wood Product Manufacturing	0.6	892	1,129	26.6%
3222	Converted Paper Product Manufacturing	0.7	1,289	1,162	-9.9%
3231	Printing and Related Support Activities	0.8	2,681	2,153	-19.7%
3241	Petroleum and Coal Products Manufacturing	2.4	1,876	1,821	-2.9%
3251	Basic Chemical Manufacturing	0.8	833	848	1.8%

NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	0.8	561	500	-10.9%
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	0.1	20	15	-25.0%
3254	Pharmaceutical and Medicine Manufacturing	0.1	257	210	-18.3%
3255	Paint, Coating, and Adhesive Manufacturing	1.5	632	546	-13.6%
3256	Soap, Cleaning Compound, and Toilet Preparation Manufacturing	0.4	267	263	-1.5%
3259	Other Chemical Product and Preparation Manufacturing	1.6	946	917	-3.1%
3261	Plastics Product Manufacturing	0.6	2,349	2,302	-2.0%
3262	Rubber Product Manufacturing	0.6	538	546	1.5%
3271	Clay Product and Refractory Manufacturing	1.9	543	519	-4.4%
3272	Glass and Glass Product Manufacturing	1.9	1,145	1,211	5.8%
3273	Cement and Concrete Product Manufacturing	0.7	858	909	5.9%
3274	Lime and Gypsum Product Manufacturing	0.2	21	17	-19.0%
3279	Other Nonmetallic Mineral Product Manufacturing	0.5	254	309	21.7%
3311	Iron and Steel Mills and Ferroalloy Manufacturing	6.6	4,375	4,169	-4.7%
3312	Steel Product Manufacturing from Purchased Steel	1.2	534	452	-15.4%
3313	Alumina and Aluminum Production and Processing	0.7	306	350	14.4%
3314	Nonferrous Metal (except Aluminum) Production and Processing	2.8	1,263	1,269	0.5%
3315	Foundries	2.0	1,787	1,901	6.4%
3321	Forging and Stamping	1.3	946	945	-0.1%
3322	Cutlery and Handtool Manufacturing	1.7	468	441	-5.8%
3323	Architectural and Structural Metals Manufacturing	1.1	2,742	3,018	10.1%
3324	Boiler, Tank, and Shipping Container Manufacturing	1.2	875	928	6.1%
3325	Hardware Manufacturing	0.5	94	94	0.0%
3326	Spring and Wire Product Manufacturing	1.2	371	382	3.0%
3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	1.5	4,067	4,211	3.5%
3328	Coating, Engraving, Heat Treating, and Allied Activities	0.9	914	988	8.1%
3329	Other Fabricated Metal Product Manufacturing	0.5	936	903	-3.5%
3331	Agriculture, Construction, and Mining Machinery Manufacturing	0.4	764	805	5.4%
3332	Industrial Machinery Manufacturing	0.7	546	566	3.7%
3333	Commercial and Service Industry Machinery Manufacturing	1.0	633	500	-21.0%
3334	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	0.3	281	264	-6.0%
3335	Metalworking Machinery Manufacturing	2.0	2,655	2,405	-9.4%
3336	Engine, Turbine, and Power Transmission Equipment Manufacturing	0.7	520	515	-1.0%
3339	Other General Purpose Machinery Manufacturing	1.6	3,003	3,270	8.9%
3341	Computer and Peripheral Equipment Manufacturing	0.4	435	404	-7.1%
3342	Communications Equipment Manufacturing	1.9	1,276	907	-28.9%
3343	Audio and Video Equipment Manufacturing	0.0	0	0	0.0%

NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
3344	Semiconductor and Other Electronic Component Manufacturing	0.3	772	624	-19.2%
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	1.4	3,957	4,262	7.7%
3346	Manufacturing and Reproducing Magnetic and Optical Media	0.1	8	5	-37.5%
3351	Electric Lighting Equipment Manufacturing	0.6	194	200	3.1%
3352	Household Appliance Manufacturing	0.0	0	0	0.0%
3353	Electrical Equipment Manufacturing	2.8	2,905	3,084	6.2%
3359	Other Electrical Equipment and Component Manufacturing	1.3	1,167	1,267	8.6%
3361	Motor Vehicle Manufacturing	0.0	0	0	0.0%
3362	Motor Vehicle Body and Trailer Manufacturing	0.2	178	190	6.7%
3363	Motor Vehicle Parts Manufacturing	0.1	274	268	-2.2%
3364	Aerospace Product and Parts Manufacturing	0.1	220	191	-13.2%
3365	Railroad Rolling Stock Manufacturing	6.5	1,275	1,320	3.5%
3366	Ship and Boat Building	0.1	146	119	-18.5%
3369	Other Transportation Equipment Manufacturing	0.7	163	198	21.5%
3371	Household and Institutional Furniture and Kitchen Cabinet Manufacturing	0.2	357	352	-1.4%
3372	Office Furniture (including Fixtures) Manufacturing	0.4	326	347	6.4%
3379	Other Furniture Related Product Manufacturing	0.1	13	13	0.0%
3391	Medical Equipment and Supplies Manufacturing	0.8	1,805	1,552	-14.0%
3399	Other Miscellaneous Manufacturing	0.6	1,115	1,172	5.1%
4231	Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers	1.0	2,475	2,863	15.7%
4232	Furniture and Home Furnishing Merchant Wholesalers	0.7	511	555	8.6%
4233	Lumber and Other Construction Materials Merchant Wholesalers	1.2	1,759	1,813	3.1%
4234	Professional and Commercial Equipment and Supplies Merchant Wholesalers	0.9	4,147	4,222	1.8%
4235	Metal and Mineral (except Petroleum) Merchant Wholesalers	1.1	1,047	1,136	8.5%
4236	Household Appliances and Electrical and Electronic Goods Merchant Wholesalers	0.7	1,702	1,566	-8.0%
4237	Hardware, and Plumbing and Heating Equipment and Supplies Merchant Wholesalers	0.9	1,590	1,846	16.1%
4238	Machinery, Equipment, and Supplies Merchant Wholesalers	1.1	5,250	5,517	5.1%
4239	Miscellaneous Durable Goods Merchant Wholesalers	1.2	2,553	2,866	12.3%
4241	Paper and Paper Product Merchant Wholesalers	0.6	551	516	-6.4%
4242	Drugs and Druggists' Sundries Merchant Wholesalers	0.2	281	235	-16.4%
4243	Apparel, Piece Goods, and Notions Merchant Wholesalers	0.2	190	212	11.6%
4244	Grocery and Related Product Merchant Wholesalers	0.7	3,477	3,705	6.6%
4245	Farm Product Raw Material Merchant Wholesalers	0.0	19	16	-15.8%
4246	Chemical and Allied Products Merchant Wholesalers	1.1	1,031	1,039	0.8%
4247	Petroleum and Petroleum Products Merchant Wholesalers	1.1	798	898	12.5%
4248	Beer, Wine, and Distilled Alcoholic Beverage Merchant Wholesalers	0.7	866	1,085	25.3%

NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
4249	Miscellaneous Nondurable Goods Merchant Wholesalers	0.6	1,326	1,225	-7.6%
4251	Wholesale Electronic Markets and Agents and Brokers	1.5	9,390	9,141	-2.7%
4411	Automobile Dealers	1.2	10,146	11,322	11.6%
4412	Other Motor Vehicle Dealers	0.5	501	513	2.4%
4413	Automotive Parts, Accessories, and Tire Stores	0.8	3,109	3,083	-0.8%
4421	Furniture Stores	0.9	1,433	1,500	4.7%
4422	Home Furnishings Stores	0.8	1,435	1,415	-1.4%
4431	Electronics and Appliance Stores	0.8	2,810	2,516	-10.5%
4441	Building Material and Supplies Dealers	0.8	6,503	6,733	3.5%
4442	Lawn and Garden Equipment and Supplies Stores	0.8	839	860	2.5%
4451	Grocery Stores	1.0	19,019	16,708	-12.2%
4452	Specialty Food Stores	0.7	1,171	1,026	-12.4%
4453	Beer, Wine, and Liquor Stores	1.0	1,171	1,309	11.8%
4461	Health and Personal Care Stores	1.1	8,293	8,287	-0.1%
4471	Gasoline Stations	0.9	5,772	5,964	3.3%
4481	Clothing Stores	1.1	8,311	8,019	-3.5%
4482	Shoe Stores	0.9	1,308	1,343	2.7%
4483	Jewelry, Luggage, and Leather Goods Stores	1.0	1,017	966	-5.0%
4511	Sporting Goods, Hobby, and Musical Instrument Stores	1.0	3,883	4,208	8.4%
4512	Book Stores and News Dealers	0.9	599	562	-6.2%
4521	Department Stores	1.0	9,564	8,839	-7.6%
4529	Other General Merchandise Stores	0.8	9,965	10,526	5.6%
4531	Florists	1.5	662	462	-30.2%
4532	Office Supplies, Stationery, and Gift Stores	0.9	1,905	1,705	-10.5%
4533	Used Merchandise Stores	1.2	1,443	1,842	27.7%
4539	Other Miscellaneous Store Retailers	1.0	2,198	2,125	-3.3%
4541	Electronic Shopping and Mail-Order Houses	1.7	4,023	5,129	27.5%
4542	Vending Machine Operators	1.3	353	331	-6.2%
4543	Direct Selling Establishments	0.5	446	430	-3.6%
4811	Scheduled Air Transportation	0.7	2,199	2,326	5.8%
4812	Nonscheduled Air Transportation	1.1	295	332	12.5%
4832	Inland Water Transportation	1.1	228	203	-11.0%
4841	General Freight Trucking	0.7	5,032	5,695	13.2%
4842	Specialized Freight Trucking	1.0	3,305	3,910	18.3%
4851	Urban Transit Systems	1.3	2,255	2,463	9.2%
4852	Interurban and Rural Bus Transportation	0.9	151	143	-5.3%
4853	Taxi and Limousine Service	0.6	356	367	3.1%
4854	School and Employee Bus Transportation	2.7	4,871	5,214	7.0%

NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
4855	Charter Bus Industry	3.0	646	660	2.2%
4859	Other Transit and Ground Passenger Transportation	1.1	781	908	16.3%
4862	Pipeline Transportation of Natural Gas	2.3	487	630	29.4%
4869	Other Pipeline Transportation	1.2	69	93	34.8%
4871	Scenic and Sightseeing Transportation, Land	2.0	198	252	27.3%
4872	Scenic and Sightseeing Transportation, Water	0.8	82	71	-13.4%
4879	Scenic and Sightseeing Transportation, Other	0.1	2	2	0.0%
4881	Support Activities for Air Transportation	0.6	1,030	1,066	3.5%
4882	Support Activities for Rail Transportation	1.6	365	450	23.3%
4883	Support Activities for Water Transportation	0.2	118	100	-15.3%
4884	Support Activities for Road Transportation	1.3	1,040	1,508	45.0%
4885	Freight Transportation Arrangement	0.6	800	972	21.5%
4889	Other Support Activities for Transportation	1.0	229	286	24.9%
4911	Postal Service	1.2	5,333	3,438	-35.5%
4921	Couriers and Express Delivery Services	1.3	4,895	5,462	11.6%
4922	Local Messengers and Local Delivery	0.4	160	138	-13.8%
4931	Warehousing and Storage	0.9	4,738	5,532	16.8%
5111	Newspaper, Periodical, Book, and Directory Publishers	1.0	2,841	2,363	-16.8%
5112	Software Publishers	0.7	1,480	1,778	20.1%
5121	Motion Picture and Video Industries	0.6	1,702	1,732	1.8%
5122	Sound Recording Industries	0.5	57	52	-8.8%
5151	Radio and Television Broadcasting	1.0	1,561	1,820	16.6%
5152	Cable and Other Subscription Programming	0.1	33	26	-21.2%
5171	Wired Telecommunications Carriers	1.1	4,797	4,175	-13.0%
5172	Wireless Telecommunications Carriers (except Satellite)	0.4	458	301	-34.3%
5174	Satellite Telecommunications	0.3	17	15	-11.8%
5179	Other Telecommunications	0.5	286	212	-25.9%
5182	Data Processing, Hosting, and Related Services	0.4	802	630	-21.4%
5191	Other Information Services	0.9	2,282	2,890	26.6%
5211	Monetary Authorities-Central Bank	0.0	5	4	-20.0%
5221	Depository Credit Intermediation	1.9	23,139	21,388	-7.6%
5222	Nondepository Credit Intermediation	0.5	2,202	1,781	-19.1%
5223	Activities Related to Credit Intermediation	0.5	937	732	-21.9%
5231	Securities and Commodity Contracts Intermediation and Brokerage	0.5	1,619	1,711	5.7%
5232	Securities and Commodity Exchanges	0.1	4	6	50.0%
5239	Other Financial Investment Activities	1.5	4,678	7,182	53.5%
5241	Insurance Carriers	1.6	13,726	14,625	6.5%
5242	Agencies, Brokerages, and Other Insurance Related Activities	1.1	7,650	8,819	15.3%

NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
5251	Insurance and Employee Benefit Funds	0.3	6	5	-16.7%
5259	Other Investment Pools and Funds	0.0	0	0	0.0%
5311	Lessors of Real Estate	0.9	4,010	4,302	7.3%
5312	Offices of Real Estate Agents and Brokers	0.6	1,272	1,270	-0.2%
5313	Activities Related to Real Estate	0.6	2,800	2,772	-1.0%
5321	Automotive Equipment Rental and Leasing	0.9	1,292	1,502	16.3%
5322	Consumer Goods Rental	0.8	941	1,017	8.1%
5323	General Rental Centers	0.4	124	131	5.6%
5324	Commercial and Industrial Machinery and Equipment Rental and Leasing	2.2	2,255	2,683	19.0%
5331	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	0.5	84	80	-4.8%
5411	Legal Services	1.3	10,767	12,008	11.5%
5412	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	1.1	7,674	8,439	10.0%
5413	Architectural, Engineering, and Related Services	1.9	19,184	21,842	13.9%
5414	Specialized Design Services	1.0	895	1,248	39.4%
5415	Computer Systems Design and Related Services	1.0	13,355	19,366	45.0%
5416	Management, Scientific, and Technical Consulting Services	1.0	8,988	11,023	22.6%
5417	Scientific Research and Development Services	1.5	6,909	8,980	30.0%
5418	Advertising, Public Relations, and Related Services	0.8	2,812	3,055	8.6%
5419	Other Professional, Scientific, and Technical Services	0.9	3,964	4,536	14.4%
5511	Management of Companies and Enterprises	2.3	35,368	38,979	10.2%
5611	Office Administrative Services	0.2	734	614	-16.3%
5612	Facilities Support Services	0.8	759	1,117	47.2%
5613	Employment Services	0.7	16,164	18,192	12.5%
5614	Business Support Services	1.1	7,088	6,654	-6.1%
5615	Travel Arrangement and Reservation Services	0.6	887	790	-10.9%
5616	Investigation and Security Services	1.2	7,704	7,737	0.4%
5617	Services to Buildings and Dwellings	0.9	12,343	12,519	1.4%
5619	Other Support Services	1.0	2,251	2,861	27.1%
5621	Waste Collection	1.1	1,329	1,745	31.3%
5622	Waste Treatment and Disposal	0.6	544	657	20.8%
5629	Remediation and Other Waste Management Services	1.1	1,097	1,191	8.6%
6111	Elementary and Secondary Schools	0.8	43,465	41,623	-4.2%
6112	Junior Colleges	0.9	4,390	4,096	-6.7%
6113	Colleges, Universities, and Professional Schools	1.4	29,399	30,046	2.2%
6114	Business Schools and Computer and Management Training	0.3	172	197	14.5%
6115	Technical and Trade Schools	0.8	884	982	11.1%
6116	Other Schools and Instruction	0.7	1,818	1,934	6.4%
6117	Educational Support Services	0.4	464	536	15.5%

NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
6211	Offices of Physicians	1.3	23,024	25,016	8.7%
6212	Offices of Dentists	0.9	5,513	6,033	9.4%
6213	Offices of Other Health Practitioners	1.6	9,242	12,176	31.7%
6214	Outpatient Care Centers	1.1	5,819	7,623	31.0%
6215	Medical and Diagnostic Laboratories	1.2	2,133	2,297	7.7%
6216	Home Health Care Services	1.0	9,141	13,490	47.6%
6219	Other Ambulatory Health Care Services	2.0	4,345	4,643	6.9%
6221	General Medical and Surgical Hospitals	1.2	48,846	52,119	6.7%
6222	Psychiatric and Substance Abuse Hospitals	1.3	2,150	2,203	2.5%
6223	Specialty (except Psychiatric and Substance Abuse) Hospitals	2.3	4,034	5,129	27.1%
6231	Nursing Care Facilities (Skilled Nursing Facilities)	1.2	14,542	16,420	12.9%
6232	Residential Intellectual and Developmental Disability, Mental Health, and Substance Abuse Facilities	1.4	7,382	7,424	0.6%
6233	Continuing Care Retirement Communities and Assisted Living Facilities for the Elderly	1.2	7,361	8,880	20.6%
6239	Other Residential Care Facilities	0.9	1,140	1,383	21.3%
6241	Individual and Family Services	1.1	17,715	23,013	29.9%
6242	Community Food and Housing, and Emergency and Other Relief Services	0.9	999	1,090	9.1%
6243	Vocational Rehabilitation Services	0.7	1,677	1,952	16.4%
6244	Child Day Care Services	1.0	5,820	6,654	14.3%
7111	Performing Arts Companies	1.0	865	902	4.3%
7112	Spectator Sports	1.6	1,625	1,819	11.9%
7113	Promoters of Performing Arts, Sports, and Similar Events	2.0	1,797	1,983	10.4%
7114	Agents and Managers for Artists, Athletes, Entertainers, and Other Public Figures	0.4	64	76	18.8%
7115	Independent Artists, Writers, and Performers	0.3	108	144	33.3%
7121	Museums, Historical Sites, and Similar Institutions	1.3	2,173	2,504	15.2%
7131	Amusement Parks and Arcades	1.7	2,334	2,933	25.7%
7132	Gambling Industries	1.0	1,856	1,673	-9.9%
7139	Other Amusement and Recreation Industries	0.9	8,505	9,404	10.6%
7211	Traveler Accommodation	0.6	7,682	7,956	3.6%
7212	RV (Recreational Vehicle) Parks and Recreational Camps	0.3	143	157	9.8%
7213	Rooming and Boarding Houses	0.4	44	53	20.5%
7223	Special Food Services	1.5	6,682	7,662	14.7%
7224	Drinking Places (Alcoholic Beverages)	1.3	3,366	3,467	3.0%
7225	Restaurants and Other Eating Places	0.9	64,175	69,000	7.5%
8111	Automotive Repair and Maintenance	0.9	5,855	6,295	7.5%
8112	Electronic and Precision Equipment Repair and Maintenance	1.1	791	815	3.0%
8113	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	1.1	1,637	1,794	9.6%
8114	Personal and Household Goods Repair and Maintenance	0.9	458	495	8.1%

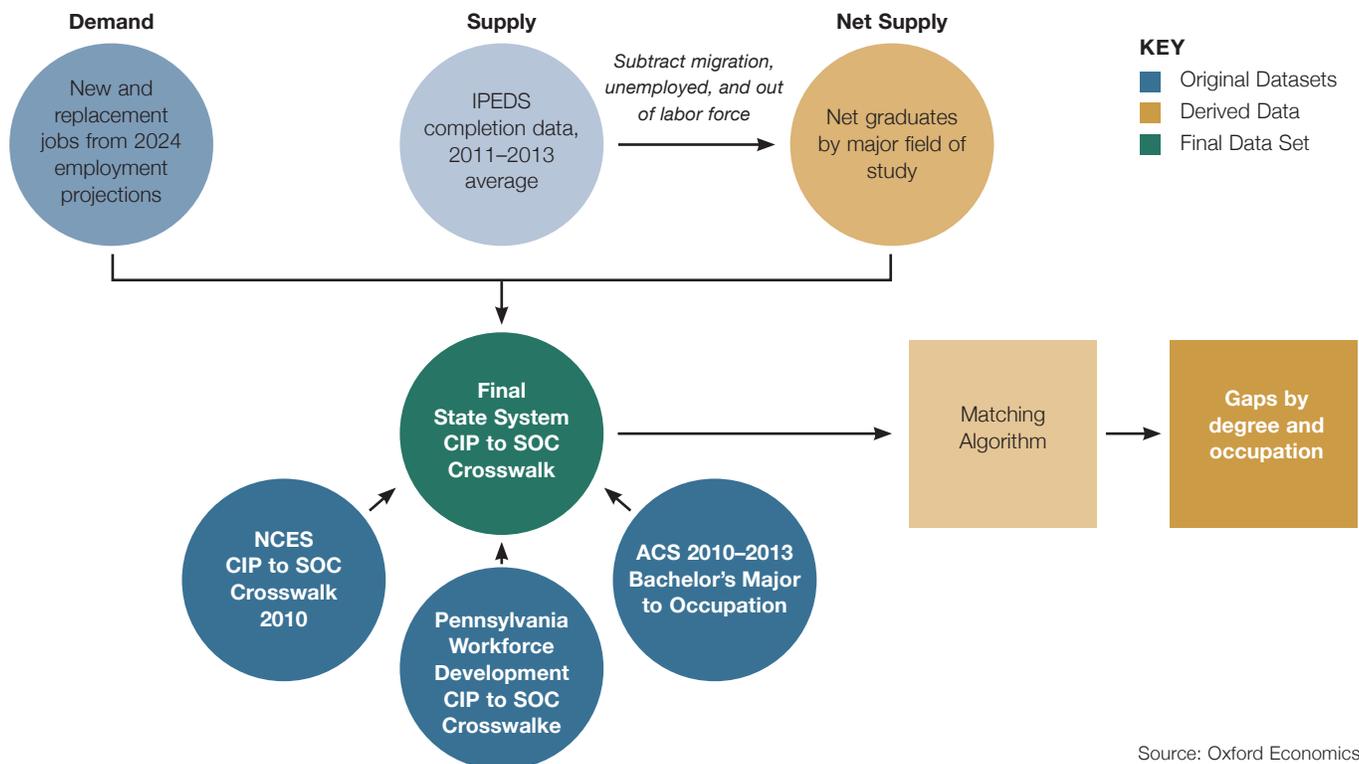
NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
8121	Personal Care Services	1.4	6,590	7,207	9.4%
8122	Death Care Services	1.6	1,612	1,616	0.2%
8123	Drycleaning and Laundry Services	1.0	2,220	2,119	-4.5%
8129	Other Personal Services	1.0	2,076	2,464	18.7%
8131	Religious Organizations	1.1	1,443	1,444	0.1%
8132	Grantmaking and Giving Services	1.1	1,075	1,031	-4.1%
8133	Social Advocacy Organizations	0.9	1,376	1,391	1.1%
8134	Civic and Social Organizations	1.7	4,941	5,154	4.3%
8139	Business, Professional, Labor, Political, and Similar Organizations	1.1	3,476	3,578	2.9%
8141	Private Households	0.4	815	681	-16.4%
9211	Executive, Legislative, and Other General Government Support	1.0	20,610	19,719	-4.3%
9221	Justice, Public Order, and Safety Activities	0.4	4,860	4,570	-6.0%
9231	Administration of Human Resource Programs	0.2	1,141	1,063	-6.8%
9241	Administration of Environmental Quality Programs	0.3	795	747	-6.0%
9251	Administration of Housing Programs, Urban Planning, and Community Development	1.6	947	861	-9.1%
9261	Administration of Economic Programs	0.4	1,686	1,570	-6.9%
9281	National Security and International Affairs	0.2	824	769	-6.7%

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

# APPENDIX E: METHODOLOGY

The data-driven process involved in developing this gap analysis required multiple steps including compiling education output and forecasting occupation demand. Broadly speaking, supply-side educational completion data were assembled at the program level for State System Universities as well as other institutions within Pennsylvania. A three-year average was used to mitigate year-to-year variability in completions. A mapping analysis, known as a crosswalk, was developed looking at education programs and occupations and using a combination of the National Center for Education Statistics' (NCES) and US Census American Community Survey (ACS) data. The crosswalk was applied to occupation demand projections, which were produced by Oxford Economics and updated to 2014-2024, to calculate both new and replacement jobs. Linking annual program completions (supply) and annual occupation

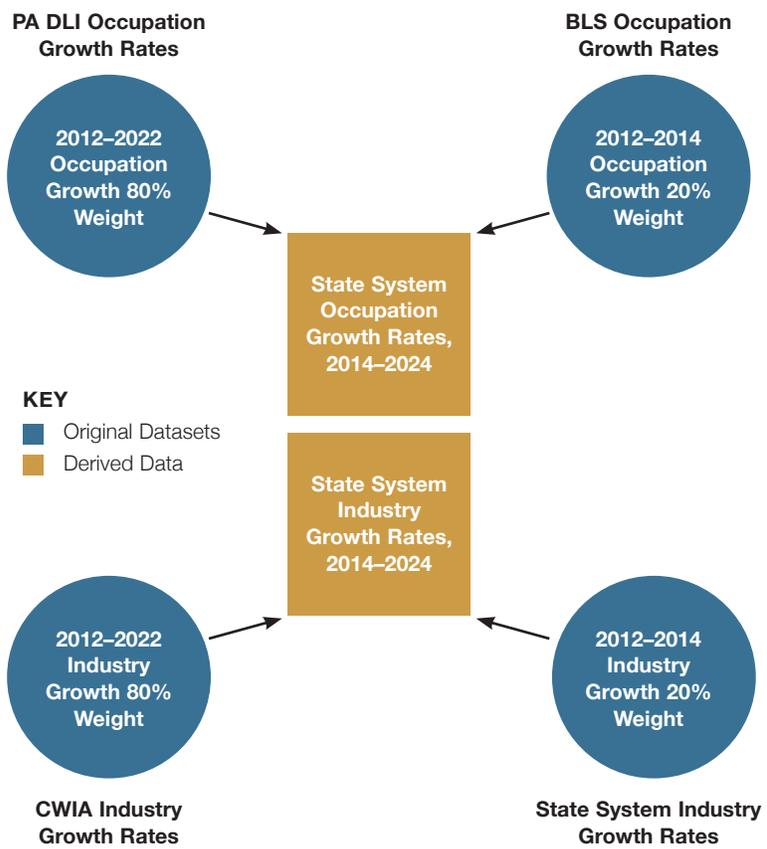
**Fig. 36: Summary of Gap Analysis Methodology**



projections (demand) enabled the calculation of the difference between the two, providing an insight into potential workforce gaps and surpluses for educational institutions to consider. Fig. 36 provides a high-level flow chart of the process to calculate gaps/surpluses.

A primary goal of the research was to produce updated forecasts for industries and occupations at the county level for Pennsylvania. Fig. 37 provides a summary of the growth rate calculations used in the forecasts.

**Fig. 37: Summary of Growth Rate Calculations**



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# APPENDIX F: GAP ANALYSIS RESULTS

The following table provides the results of the gap analysis for all detailed occupations in Cal U's workforce region. The following information is provided in the table below:

- A description of the occupation – SOC Code and occupation title.
- A description of the level of the occupation – Job Zone.
- Gap indicator with the following color codes:
  - Green = Projected excess employer demand
  - Purple = Projected excess demand at specific degree level
  - Yellow = Projected balance
  - Blue = Projected supply surplus
- Average annual supply, demand, and gap number for each occupation and the detailed degree level supply, demand, and gap number for each occupation.
- The ratio of average annual supply to average annual demand (S/D Ratio).

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
11-1011	Chief Executives	5		31	98	-67	3.16	0	0	0	26	13	13	5	85	-80
11-1021	General and Operations Managers	4		259	357	-98	1.38	0	0	0	197	88	109	63	268	-205
11-2011	Advertising and Promotions Managers	4		2	2	0	1.00	0	0	0	2	2	0	0	0	0
11-2021	Marketing Managers	4		32	49	-17	1.53	0	0	0	28	30	-2	4	19	-15
11-2022	Sales Managers	4		35	53	-18	1.51	0	0	0	30	32	-2	5	21	-16
11-2031	Public Relations and Fundraising Managers	4		5	13	-8	2.60	0	0	0	3	4	-1	2	8	-6
11-3011	Administrative Services Managers	3		10	4	6	0.40	0	0	0	10	4	6	0	0	0
11-3021	Computer and Information Systems Managers	4		92	165	-73	1.79	0	0	0	56	22	34	36	142	-106
11-3031	Financial Managers	4		39	74	-35	1.90	0	0	0	25	13	12	14	61	-47
11-3051	Industrial Production Managers	4		18	20	-2	1.11	0	0	0	15	7	8	3	13	-10
11-3061	Purchasing Managers	4		4	2	2	0.50	0	0	0	4	2	2	0	0	0
11-3071	Transportation, Storage, and Distribution Managers	4		8	4	4	0.50	0	0	0	8	4	4	0	0	0
11-3111	Compensation and Benefits Managers	4		2	1	1	0.50	0	0	0	2	1	1	0	0	0
11-3121	Human Resources Managers	4		24	55	-31	2.29	0	0	0	12	5	7	12	50	-38
11-3131	Training and Development Managers	4		7	14	-7	2.00	0	0	0	4	2	2	3	12	-9
11-9021	Construction Managers	4		30	11	19	0.37	0	0	0	30	11	19	0	0	0
11-9031	Education Administrators, Preschool and Childcare Center/Program	4		9	31	-22	3.44	0	0	0	3	1	2	7	29	-22
11-9032	Education Administrators, Elementary and Secondary School	5		28	127	-99	4.54	0	0	0	0	0	0	28	127	-99
11-9033	Education Administrators, Postsecondary	5		24	106	-82	4.42	0	0	0	0	0	0	24	106	-82
11-9039	Education Administrators, All Other	5		6	26	-20	4.33	0	0	0	2	1	1	4	25	-21
11-9041	Architectural and Engineering Managers	5		45	114	-69	2.53	0	0	0	25	18	7	20	96	-76
11-9051	Food Service Managers	3		13	75	-62	5.77	4	52	-48	9	23	-14	0	0	0
11-9061	Funeral Service Managers	3		2	1	1	0.50	0	0	0	2	1	1	0	0	0
11-9081	Lodging Managers	3		4	9	-5	2.25	0	0	0	4	9	-5	0	0	0
11-9111	Medical and Health Services Managers	5		59	146	-87	2.47	0	0	0	36	25	11	23	121	-98

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
11-9121	Natural Sciences Managers	5		17	26	-9	1.53	0	0	0	5	5	0	12	21	-9
11-9141	Property, Real Estate, and Community Association Managers	4		15	6	9	0.40	0	0	0	15	6	9	0	0	0
11-9151	Social and Community Service Managers	4		27	77	-50	2.85	0	0	0	15	23	-8	13	54	-41
11-9199	Managers, All Other	4		36	230	-194	6.39	0	0	0	28	138	-110	8	93	-85
13-1011	Agents and Business Managers of Artists, Performers, and Athletes	4		1	2	-1	2.00	0	0	0	1	2	-1	0	0	0
13-1022	Wholesale and Retail Buyers, Except Farm Products	3		12	9	3	0.75	0	0	0	12	9	3	0	0	0
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	4		35	15	20	0.43	0	0	0	35	15	20	0	0	0
13-1031	Claims Adjusters, Examiners, and Investigators	4		64	28	36	0.44	0	0	0	64	28	36	0	0	0
13-1032	Insurance Appraisers, Auto Damage	3		6	2	4	0.33	0	0	0	6	2	4	0	0	0
13-1041	Compliance Officers	4		47	20	27	0.43	0	0	0	47	20	27	0	0	0
13-1051	Cost Estimators	4		56	23	33	0.41	0	0	0	56	23	33	0	0	0
13-1071	Human Resources Specialists	4		113	85	28	0.75	0	0	0	80	33	47	33	52	-19
13-1075	Labor Relations Specialists	4		2	1	1	0.50	0	0	0	2	1	1	0	0	0
13-1081	Logisticians	4		24	22	2	0.92	0	0	0	20	10	10	4	12	-8
13-1111	Management Analysts	4		144	334	-190	2.32	0	0	0	74	32	42	70	302	-232
13-1121	Meeting, Convention, and Event Planners	4		22	32	-10	1.45	0	0	0	18	30	-12	4	2	2
13-1131	Fundraisers	4		23	10	13	0.43	0	0	0	11	7	4	11	4	7
13-1141	Compensation, Benefits, and Job Analysis Specialists	4		9	5	4	0.56	0	0	0	7	3	4	1	2	-1
13-1151	Training and Development Specialists	4		52	36	16	0.69	0	0	0	38	16	22	14	20	-6
13-1161	Market Research Analysts and Marketing Specialists	4		223	108	115	0.48	0	0	0	128	98	30	95	9	86
13-1199	Business Operations Specialists, All Other	4		36	21	15	0.58	0	0	0	25	13	12	11	8	3
13-2011	Accountants and Auditors	4		473	253	220	0.53	0	0	0	379	203	176	94	50	44
13-2021	Appraisers and Assessors of Real Estate	4		1	0	1	0.00	0	0	0	1	0	1	0	0	0
13-2031	Budget Analysts	4		16	8	8	0.50	0	0	0	9	5	4	6	3	3

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
13-2041	Credit Analysts	4		21	11	10	0.52	0	0	0	14	7	7	8	4	4
13-2051	Financial Analysts	4		112	57	55	0.51	0	0	0	80	40	40	32	17	15
13-2052	Personal Financial Advisors	4		89	47	42	0.53	0	0	0	76	40	36	12	7	5
13-2053	Insurance Underwriters	4		38	19	19	0.50	0	0	0	38	19	19	0	0	0
13-2061	Financial Examiners	4		13	7	6	0.54	0	0	0	8	4	4	5	3	2
13-2071	Credit Counselors	4		11	5	6	0.45	0	0	0	9	4	5	2	1	1
13-2072	Loan Officers	3		62	30	32	0.48	0	0	0	62	30	32	0	0	0
13-2081	Tax Examiners and Collectors, and Revenue Agents	3		7	4	3	0.57	0	0	0	7	4	3	0	0	0
13-2082	Tax Preparers	3		5	6	-1	1.20	1	4	-3	4	2	2	0	0	0
13-2099	Financial Specialists, All Other	4		5	2	3	0.40	0	0	0	3	2	1	1	1	0
15-1121	Computer Systems Analysts	4		248	283	-35	1.14	0	0	0	188	72	116	60	211	-151
15-1122	Information Security Analysts	4		27	38	-11	1.41	0	0	0	19	8	11	8	30	-22
15-1131	Computer Programmers	4		190	193	-3	1.02	0	0	0	146	56	90	44	137	-93
15-1132	Software Developers, Applications	4		223	301	-78	1.35	0	0	0	157	72	85	66	229	-163
15-1133	Software Developers, Systems Software	4		17	24	-7	1.41	0	0	0	12	6	6	5	18	-13
15-1134	Web Developers	3		30	11	19	0.37	0	0	0	30	11	19	0	0	0
15-1141	Database Administrators	4		49	62	-13	1.27	0	0	0	35	13	22	14	49	-35
15-1142	Network and Computer Systems Administrators	4		26	30	-4	1.15	0	0	0	20	8	12	6	22	-16
15-1143	Computer Network Architects	4		20	26	-6	1.30	0	0	0	14	6	8	6	21	-15
15-1151	Computer User Support Specialists	3		142	182	-40	1.28	38	142	-104	104	41	63	0	0	0
15-1152	Computer Network Support Specialists	4		20	314	-294	15.70	4	296	-292	12	5	7	4	13	-9
15-1199	Computer Occupations, All Other	4		38	43	-5	1.13	0	0	0	29	11	18	8	32	-24
15-2011	Actuaries	4		19	42	-23	2.21	0	0	0	11	13	-2	8	29	-21
15-2031	Operations Research Analysts	5		21	22	-1	1.05	0	0	0	15	7	8	6	16	-10
15-2041	Statisticians	5		27	57	-30	2.11	0	0	0	0	0	0	27	57	-30
17-1011	Architects, Except Landscape and Naval	4		50	45	5	0.90	0	0	0	29	17	12	21	28	-7
17-1012	Landscape Architects	4		15	14	1	0.93	0	0	0	9	5	4	6	9	-3
17-1021	Cartographers and Photogrammetrists	4		1	0	1	0.00	0	0	0	1	0	1	0	0	0

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual		S/D Ratio	Associate		Bachelor		Graduate				
				Demand	Supply		Demand	Supply	Demand	Supply	Demand	Supply	Gap	Supply	Gap
17-1022	Surveyors	4		13	5	0.38	0	0	13	5	8	0	0	0	0
17-2011	Aerospace Engineers	4		21	45	2.14	0	0	14	7	7	8	39	-31	
17-2031	Biomedical Engineers	4		5	11	2.20	0	0	4	3	1	2	9	-7	
17-2041	Chemical Engineers	4		8	17	2.13	0	0	6	5	1	2	12	-10	
17-2051	Civil Engineers	4		152	136	0.89	0	0	99	31	68	53	105	-52	
17-2071	Electrical Engineers	4		68	167	2.46	0	0	38	19	19	30	148	-118	
17-2072	Electronics Engineers, Except Computer	4		5	12	2.40	0	0	3	1	2	2	11	-9	
17-2081	Environmental Engineers	5		43	32	0.74	0	0	27	22	5	16	10	6	
17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	4		10	5	0.50	0	0	8	3	5	2	2	0	
17-2112	Industrial Engineers	4		53	48	0.91	0	0	40	18	22	13	30	-17	
17-2131	Materials Engineers	4		21	35	1.67	0	0	16	7	9	6	28	-22	
17-2141	Mechanical Engineers	4		86	108	1.26	0	0	70	31	39	15	77	-62	
17-2151	Mining and Geological Engineers, Including Mining Safety Engineers	4		2	1	0.50	0	0	1	0	1	1	1	0	
17-2161	Nuclear Engineers	4		7	4	0.57	0	0	0	0	0	7	4	3	
17-2171	Petroleum Engineers	4		33	17	0.52	0	0	15	7	8	17	10	7	
17-2199	Engineers, All Other	4		34	71	2.09	0	0	19	10	9	14	61	-47	
17-3011	Architectural and Civil Drafters	4		33	123	3.73	16	113	16	10	6	0	0	0	
17-3013	Mechanical Drafters	3		5	29	5.80	3	28	3	1	2	0	0	0	
17-3019	Drafters, All Other	3		2	8	4.00	1	7	1	1	0	0	0	0	
17-3022	Civil Engineering Technicians	3		14	16	1.14	7	10	7	6	1	0	0	0	
17-3023	Electrical and Electronics Engineering Technicians	3		1	3	3.00	0	0	1	3	-2	0	0	0	
17-3025	Environmental Engineering Technicians	4		5	4	0.80	0	0	5	4	1	0	0	0	
17-3026	Industrial Engineering Technicians	3		3	9	3.00	2	7	2	2	0	0	0	0	
17-3027	Mechanical Engineering Technicians	3		8	20	2.50	4	17	4	4	0	0	0	0	
17-3029	Engineering Technicians, Except Drafters, All Other	3		13	37	2.85	6	29	7	8	-1	0	0	0	
19-1013	Soil and Plant Scientists	5		1	1	1.00	0	0	1	1	0	0	0	0	
19-1021	Biochemists and Biophysicists	5		40	56	1.40	0	0	0	0	0	40	56	-16	
19-1022	Microbiologists	5		21	25	1.19	0	0	9	8	1	11	17	-6	

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual		S/D Ratio	Associate		Bachelor		Graduate		
				Demand	Supply		Demand	Supply	Demand	Supply	Demand	Supply	Gap
19-1029	Biological Scientists, All Other	5		3	14	4.67	0	0	1	10	1	4	-3
19-1042	Medical Scientists, Except Epidemiologists	5		66	110	1.67	0	0	0	0	66	110	-44
19-2031	Chemists	4		63	68	1.08	0	0	33	28	5	30	-10
19-2032	Materials Scientists	5		4	11	2.75	0	0	2	2	0	2	-7
19-2041	Environmental Scientists and Specialists, Including Health	4		45	45	1.00	0	0	26	26	0	18	-1
19-2042	Geoscientists, Except Hydrologists and Geographers	4		21	18	0.86	0	0	12	12	0	9	3
19-3011	Economists	5		6	9	1.50	0	0	0	0	0	6	-3
19-3022	Survey Researchers	5		13	23	1.77	0	0	0	0	13	23	-10
19-3031	Clinical, Counseling, and School Psychologists	5		30	160	5.33	0	0	0	0	0	30	-130
19-3039	Psychologists, All Other	5		3	17	5.67	0	0	0	0	0	3	-14
19-3041	Sociologists	5		1	2	2.00	0	0	0	0	1	2	-1
19-3051	Urban and Regional Planners	5		16	3	0.19	0	0	0	0	16	3	13
19-4021	Biological Technicians	4		47	38	0.81	0	0	47	38	9	0	0
19-4031	Chemical Technicians	3		37	21	0.57	0	0	37	21	16	0	0
19-4061	Social Science Research Assistants	4		11	10	0.91	0	0	9	10	-1	2	2
19-4091	Environmental Science and Protection Technicians, Including Health	4		25	23	0.92	0	0	20	17	3	5	0
19-4093	Forest and Conservation Technicians	3		2	2	1.00	0	0	2	2	0	0	0
19-4099	Life, Physical, and Social Science Technicians, All Other	3		12	10	0.83	0	0	12	10	2	0	0
21-1011	Substance Abuse and Behavioral Disorder Counselors	5		18	26	1.44	0	0	7	11	-4	11	-5
21-1012	Educational, Guidance, School, and Vocational Counselors	5		33	54	1.64	0	0	0	0	0	33	-21
21-1013	Marriage and Family Therapists	5		7	22	3.14	0	0	0	0	0	7	-15
21-1014	Mental Health Counselors	5		41	55	1.34	0	0	0	0	0	41	-14
21-1015	Rehabilitation Counselors	5		48	95	1.98	0	0	0	0	0	48	-47
21-1019	Counselors, All Other	5		2	5	2.50	0	0	0	0	0	2	-3
21-1021	Child, Family, and School Social Workers	4		73	107	1.47	0	0	48	75	-27	24	-9

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual		S/D Ratio	Associate		Bachelor		Graduate		Average Annual Gap
				Demand	Supply		Demand	Supply	Demand	Supply	Demand	Supply	
21-1022	Healthcare Social Workers	5		56	76	1.36	0	0	0	0	0	56	-20
21-1023	Mental Health and Substance Abuse Social Workers	5		57	84	1.47	0	0	38	58	19	26	-7
21-1029	Social Workers, All Other	5		2	2	1.00	0	0	2	2	0	0	0
21-1091	Health Educators	4		12	31	2.58	0	0	8	11	4	19	-15
21-1092	Probation Officers and Correctional Treatment Specialists	4		14	23	1.64	0	0	9	17	4	6	-2
21-1093	Social and Human Service Assistants	4		59	91	1.54	12	19	47	73	0	0	0
21-1094	Community Health Workers	4		4	11	2.75	0	0	3	4	1	7	-6
21-1099	Community and Social Service Specialists, All Other	4		5	15	3.00	0	0	0	0	5	15	-10
21-2011	Clergy	5		12	87	7.25	0	0	5	15	7	73	-66
21-2021	Directors, Religious Activities and Education	4		16	5	0.31	0	0	12	2	5	3	2
23-1011	Lawyers	5		163	401	2.46	0	0	0	0	163	401	-238
23-1012	Judicial Law Clerks	5		4	10	2.50	0	0	0	0	4	10	-6
23-1022	Arbitrators, Mediators, and Conciliators	5		3	6	2.00	0	0	0	0	3	6	-3
23-2011	Paralegals and Legal Assistants	3		69	102	1.48	10	51	59	52	7	0	0
23-2091	Court Reporters	3		2	2	1.00	0	0	2	2	0	0	0
23-2093	Title Examiners, Abstractors, and Searchers	3		11	18	1.64	2	10	9	8	1	0	0
25-1011	Business Teachers, Postsecondary	5		33	133	4.03	0	0	0	0	33	133	-100
25-1021	Computer Science Teachers, Postsecondary	5		16	59	3.69	0	0	0	0	16	59	-43
25-1022	Mathematical Science Teachers, Postsecondary	5		14	25	1.79	0	0	0	0	14	25	-11
25-1031	Architecture Teachers, Postsecondary	5		4	6	1.50	0	0	0	0	4	6	-2
25-1032	Engineering Teachers, Postsecondary	5		23	108	4.70	0	0	0	0	23	108	-85
25-1042	Biological Science Teachers, Postsecondary	5		16	27	1.69	0	0	0	0	16	27	-11
25-1051	Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary	5		5	8	1.60	0	0	0	0	5	8	-3

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
25-1052	Chemistry Teachers, Postsecondary	5		10	14	-4	1.40	0	0	0	0	0	0	10	14	-4
25-1054	Physics Teachers, Postsecondary	5		8	13	-5	1.63	0	0	0	0	0	0	8	13	-5
25-1062	Area, Ethnic, and Cultural Studies Teachers, Postsecondary	5		3	4	-1	1.33	0	0	0	0	0	0	3	4	-1
25-1063	Economics Teachers, Postsecondary	5		8	12	-4	1.50	0	0	0	0	0	0	8	12	-4
25-1064	Geography Teachers, Postsecondary	5		2	4	-2	2.00	0	0	0	0	0	0	2	4	-2
25-1065	Political Science Teachers, Postsecondary	5		6	101	-95	16.83	0	0	0	0	0	0	6	101	-95
25-1066	Psychology Teachers, Postsecondary	5		12	63	-51	5.25	0	0	0	0	0	0	12	63	-51
25-1067	Sociology Teachers, Postsecondary	5		14	23	-9	1.64	0	0	0	0	0	0	14	23	-9
25-1069	Social Sciences Teachers, Postsecondary, All Other	5		4	6	-2	1.50	0	0	0	0	0	0	4	6	-2
25-1071	Health Specialties Teachers, Postsecondary	5		23	67	-44	2.91	0	0	0	0	0	0	23	67	-44
25-1072	Nursing Instructors and Teachers, Postsecondary	5		9	233	-224	25.89	0	0	0	0	0	0	9	233	-224
25-1081	Education Teachers, Postsecondary	5		12	18	-6	1.50	0	0	0	0	0	0	12	18	-6
25-1082	Library Science Teachers, Postsecondary	5		3	14	-11	4.67	0	0	0	0	0	0	3	14	-11
25-1111	Criminal Justice and Law Enforcement Teachers, Postsecondary	5		2	16	-14	8.00	0	0	0	0	0	0	2	16	-14
25-1112	Law Teachers, Postsecondary	5		3	8	-5	2.67	0	0	0	0	0	0	3	8	-5
25-1113	Social Work Teachers, Postsecondary	5		1	2	-1	2.00	0	0	0	0	0	0	1	2	-1
25-1121	Art, Drama, and Music Teachers, Postsecondary	5		40	143	-103	3.58	0	0	0	0	0	0	40	143	-103
25-1122	Communications Teachers, Postsecondary	5		10	28	-18	2.80	0	0	0	0	0	0	10	28	-18
25-1123	English Language and Literature Teachers, Postsecondary	5		15	72	-57	4.80	0	0	0	0	0	0	15	72	-57
25-1124	Foreign Language and Literature Teachers, Postsecondary	5		12	25	-13	2.08	0	0	0	0	0	0	12	25	-13
25-1125	History Teachers, Postsecondary	5		8	13	-5	1.63	0	0	0	0	0	0	8	13	-5
25-1126	Philosophy and Religion Teachers, Postsecondary	5		8	87	-79	10.88	0	0	0	0	0	0	8	87	-79

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
25-1191	Graduate Teaching Assistants	5		11	12	-1	1.09	0	0	0	4	2	2	6	10	-4
25-1193	Recreation and Fitness Studies Teachers, Postsecondary	5		3	123	-120	41.00	0	0	0	0	0	0	3	123	-120
25-1194	Vocational Education Teachers, Postsecondary	3		3	1	2	0.33	0	0	0	3	1	2	0	0	0
25-1199	Postsecondary Teachers, All Other	5		35	177	-142	5.06	0	0	0	0	0	0	35	177	-142
25-2011	Preschool Teachers, Except Special Education	3		57	103	-46	1.81	13	71	-58	44	31	13	0	0	0
25-2012	Kindergarten Teachers, Except Special Education	4		15	18	-3	1.20	0	0	0	11	8	3	4	10	-6
25-2021	Elementary School Teachers, Except Special Education	4		172	226	-54	1.31	0	0	0	56	63	-7	116	164	-48
25-2022	Middle School Teachers, Except Special and Career/Technical Education	4		122	171	-49	1.40	0	0	0	40	45	-5	82	127	-45
25-2023	Career/Technical Education Teachers, Middle School	4		4	5	-1	1.25	0	0	0	1	2	-1	3	3	0
25-2031	Secondary School Teachers, Except Special and Career/Technical Education	4		193	315	-122	1.63	0	0	0	64	101	-37	128	214	-86
25-2032	Career/Technical Education Teachers, Secondary School	4		15	18	-3	1.20	0	0	0	5	6	-1	10	12	-2
25-2051	Special Education Teachers, Preschool	4		3	4	-1	1.33	0	0	0	0	0	0	3	4	-1
25-2052	Special Education Teachers, Kindergarten and Elementary School	4		39	58	-19	1.49	0	0	0	10	8	2	28	50	-22
25-2053	Special Education Teachers, Middle School	4		12	16	-4	1.33	0	0	0	3	1	2	9	15	-6
25-2054	Special Education Teachers, Secondary School	4		28	40	-12	1.43	0	0	0	7	3	4	21	37	-16
25-3021	Self-Enrichment Education Teachers	3		9	7	2	0.78	0	0	0	9	7	2	0	0	0
25-3097	Teachers and Instructors, All Other, Except Substitute Teachers	3		12	10	2	0.83	0	0	0	12	10	2	0	0	0
25-3098	Substitute Teachers	3		12	75	-63	6.25	0	0	0	8	7	1	4	68	-64
25-4011	Archivists	5		3	5	-2	1.67	0	0	0	0	0	0	3	5	-2
25-4012	Curators	5		6	8	-2	1.33	0	0	0	0	0	0	6	8	-2
25-4013	Museum Technicians and Conservators	4		7	11	-4	1.57	0	0	0	1	4	-3	6	7	-1

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual		S/D Ratio	Associate		Bachelor		Graduate		
				Demand	Supply		Demand	Supply	Demand	Supply	Demand	Supply	Gap
25-4021	Librarians	5		29	162	5.59	0	0	0	0	29	162	-133
25-4031	Library Technicians	4		14	23	1.64	0	0	14	23	0	0	0
25-9031	Instructional Coordinators	5		5	90	18.00	0	0	0	0	5	90	-85
25-9041	Teacher Assistants	3		69	43	0.62	19	5	50	38	12	0	0
27-1011	Art Directors	4		8	31	3.88	0	0	7	23	2	8	-6
27-1014	Multimedia Artists and Animators	4		3	11	3.67	0	0	3	11	0	0	0
27-1024	Graphic Designers	4		60	201	3.35	0	0	60	201	0	0	0
27-1025	Interior Designers	4		19	66	3.47	0	0	19	66	0	0	0
27-1026	Merchandise Displayers and Window Trimmers	3		21	77	3.67	0	0	21	77	0	0	0
27-1027	Set and Exhibit Designers	5		3	9	3.00	0	0	3	9	0	0	0
27-2012	Producers and Directors	4		31	113	3.65	0	0	31	113	0	0	0
27-2022	Coaches and Scouts	4		18	270	15.00	0	0	11	10	1	7	260
27-2032	Choreographers	4		1	4	4.00	0	0	1	4	0	0	0
27-2042	Musicians and Singers	3		2	2	1.00	0	0	2	2	0	0	0
27-3011	Radio and Television Announcers	3		7	13	1.86	0	0	7	13	0	0	0
27-3022	Reporters and Correspondents	4		7	16	2.29	0	0	5	9	2	6	-4
27-3031	Public Relations Specialists	4		18	36	2.00	0	0	16	28	3	8	-5
27-3041	Editors	4		12	105	8.75	0	0	10	95	2	10	-8
27-3042	Technical Writers	4		7	16	2.29	0	0	5	7	2	10	-8
27-3043	Writers and Authors	4		7	55	7.86	0	0	5	44	2	11	-9
27-4011	Audio and Video Equipment Technicians	3		7	16	2.29	1	6	6	10	0	0	0
27-4012	Broadcast Technicians	3		3	5	1.67	0	0	3	5	0	0	0
27-4021	Photographers	3		2	10	5.00	0	0	2	10	0	0	0
29-1021	Dentists, General	5		23	63	2.74	0	0	0	0	23	63	-40
29-1031	Dietitians and Nutritionists	5		8	25	3.13	0	0	4	6	4	18	-14
29-1051	Pharmacists	5		77	234	3.04	0	0	0	0	77	234	-157
29-1061	Anesthesiologists	5		10	6	0.60	0	0	0	0	10	6	4
29-1062	Family and General Practitioners	5		46	28	0.61	0	0	0	0	46	28	18
29-1063	Internists, General	5		4	2	0.50	0	0	0	0	4	2	2
29-1064	Obstetricians and Gynecologists	5		4	2	0.50	0	0	0	0	4	2	2
29-1065	Pediatricians, General	5		4	2	0.50	0	0	0	0	4	2	2

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
29-1066	Psychiatrists	5		3	2	1	0.67	0	0	0	0	0	0	3	2	1
29-1067	Surgeons	5		24	14	10	0.58	0	0	0	0	0	0	24	14	10
29-1069	Physicians and Surgeons, All Other	5		104	62	42	0.60	0	0	0	0	0	0	104	62	42
29-1071	Physician Assistants	5		31	105	-74	3.39	0	0	0	0	0	0	31	105	-74
29-1081	Podiatrists	5		9	6	3	0.67	0	0	0	0	0	0	9	6	3
29-1122	Occupational Therapists	5		61	115	-54	1.89	0	0	0	0	0	0	61	115	-54
29-1123	Physical Therapists	5		129	121	8	0.94	0	0	0	0	0	0	129	121	8
29-1124	Radiation Therapists	3		1	1	0	1.00	0	0	0	1	1	0	0	0	0
29-1125	Recreational Therapists	4		5	7	-2	1.40	0	0	0	5	7	-2	0	0	0
29-1126	Respiratory Therapists	3		27	40	-13	1.48	20	31	-11	7	9	-2	0	0	0
29-1127	Speech-Language Pathologists	5		49	78	-29	1.59	0	0	0	0	0	0	49	78	-29
29-1128	Exercise Physiologists	5		2	3	-1	1.50	0	0	0	0	0	0	2	3	-1
29-1129	Therapists, All Other	4		4	13	-9	3.25	0	0	0	1	2	-1	3	11	-8
29-1141	Registered Nurses	3		853	820	33	0.96	380	471	-91	473	350	123	0	0	0
29-1151	Nurse Anesthetists	5		13	65	-52	5.00	0	0	0	0	0	0	13	65	-52
29-1171	Nurse Practitioners	5		33	126	-93	3.82	0	0	0	0	0	0	33	126	-93
29-1181	Audiologists	5		6	9	-3	1.50	0	0	0	0	0	0	6	9	-3
29-2012	Medical and Clinical Laboratory Technicians	3		13	15	-2	1.15	13	15	-2	0	0	0	0	0	0
29-2021	Dental Hygienists	3		72	21	51	0.29	52	15	37	19	6	13	0	0	0
29-2032	Diagnostic Medical Sonographers	3		8	47	-39	5.88	8	47	-39	0	0	0	0	0	0
29-2033	Nuclear Medicine Technologists	3		2	9	-7	4.50	2	9	-7	0	0	0	0	0	0
29-2034	Radiologic Technologists	3		38	100	-62	2.63	25	87	-62	13	13	0	0	0	0
29-2041	Emergency Medical Technicians and Paramedics	3		28	47	-19	1.68	14	38	-24	15	10	5	0	0	0
29-2052	Pharmacy Technicians	3		13	31	-18	2.38	13	31	-18	0	0	0	0	0	0
29-2055	Surgical Technologists	3		6	70	-64	11.67	6	70	-64	0	0	0	0	0	0
29-2056	Veterinary Technologists and Technicians	3		5	119	-114	23.80	5	119	-114	0	0	0	0	0	0
29-2071	Medical Records and Health Information Technicians	3		22	33	-11	1.50	8	24	-16	14	9	5	0	0	0
29-2099	Health Technologists and Technicians, All Other	3		3	3	0	1.00	0	0	0	3	3	0	0	0	0

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual		S/D Ratio	Associate		Bachelor		Graduate Supply	Graduate Demand	Graduate Gap	
				Demand	Supply		Demand	Supply	Demand	Supply				Demand
29-9011	Occupational Health and Safety Specialists	4		5	25	5.00	0	0	0	0	0	5	25	-20
29-9012	Occupational Health and Safety Technicians	3		3	4	1.33	0	0	3	4	4	0	0	0
29-9091	Athletic Trainers	5		14	39	2.79	0	0	10	23	23	4	16	-12
31-2011	Occupational Therapy Assistants	3		35	54	1.54	24	45	11	9	9	2	0	0
31-2012	Occupational Therapy Aides	3		9	14	1.56	7	12	3	2	2	1	0	0
31-2021	Physical Therapist Assistants	3		58	72	1.24	32	36	26	36	36	0	0	0
31-9011	Massage Therapists	3		5	15	3.00	5	15	0	0	0	0	0	0
31-9091	Dental Assistants	3		11	29	2.64	11	29	0	0	0	0	0	0
31-9092	Medical Assistants	3		72	287	3.99	72	287	0	0	0	0	0	0
31-9094	Medical Transcriptionists	3		3	1	0.33	0	0	3	1	2	0	0	0
31-9096	Veterinary Assistants and Laboratory Animal Caretakers	3		3	44	14.67	2	44	1	1	1	0	0	0
31-9097	Phlebotomists	3		13	27	2.08	13	27	0	0	0	0	0	0
33-1011	First-Line Supervisors of Correctional Officers	3		3	8	2.67	1	5	1	2	2	0	0	0
33-1012	First-Line Supervisors of Police and Detectives	3		12	33	2.75	4	19	7	13	13	0	0	0
33-1021	First-Line Supervisors of Fire Fighting and Prevention Workers	3		3	6	2.00	1	4	1	2	2	0	0	0
33-1099	First-Line Supervisors of Protective Service Workers, All Other	3		13	33	2.54	4	17	9	16	16	0	0	0
33-2011	Firefighters	3		8	17	2.13	3	8	5	9	9	0	0	0
33-3012	Correctional Officers and Jailers	3		16	46	2.88	8	32	8	15	15	0	0	0
33-3021	Detectives and Criminal Investigators	3		6	20	3.33	0	0	5	9	9	1	11	-10
33-3051	Police and Sheriff's Patrol Officers	3		65	175	2.69	23	99	42	76	76	0	0	0
33-9021	Private Detectives and Investigators	3		3	6	2.00	0	0	3	6	6	0	0	0
35-1011	Chefs and Head Cooks	3		8	69	8.63	4	58	4	11	11	0	0	0
35-9099	Food Preparation and Serving Related Workers, All Other	1		18	0	0.00	0	0	0	0	0	18	0	18
39-1021	First-Line Supervisors of Personal Service Workers	3		21	9	0.43	0	0	21	9	9	12	0	0

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual		S/D Ratio	Associate		Bachelor		Graduate		
				Demand	Supply		Demand	Supply	Demand	Supply		Demand	Supply
39-4031	Morticians, Undertakers, and Funeral Directors	3		14	36	2.57	5	30	10	6	4	0	0
39-5012	Hairdressers, Hairstylists, and Cosmetologists	3		28	7	0.25	28	7	0	0	0	0	0
39-7011	Tour Guides and Escorts	3		10	4	0.40	0	0	10	4	6	0	0
39-9011	Childcare Workers	3		18	14	0.78	0	0	18	14	4	0	0
39-9031	Fitness Trainers and Aerobics Instructors	3		41	35	0.85	0	0	41	35	6	0	0
39-9032	Recreation Workers	4		46	39	0.85	0	0	46	39	7	0	0
39-9041	Residential Advisors	3		25	39	1.56	0	0	25	39	-14	0	0
41-1012	First-Line Supervisors of Non-Retail Sales Workers	4		5	14	2.80	1	12	4	2	2	0	0
41-3011	Advertising Sales Agents	3		28	41	1.46	0	0	28	41	-13	0	0
41-3021	Insurance Sales Agents	4		59	25	0.42	0	0	59	25	34	0	0
41-3031	Securities, Commodities, and Financial Services Sales Agents	4		61	32	0.52	0	0	52	27	25	9	4
41-3041	Travel Agents	3		7	10	1.43	3	9	4	2	2	0	0
41-3099	Sales Representatives, Services, All Other	4		211	152	0.72	37	42	138	98	40	37	12
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	4		8	6	0.75	0	0	8	6	2	0	0
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	4		98	72	0.73	0	0	98	72	26	0	0
41-9022	Real Estate Sales Agents	3		22	11	0.50	4	3	18	8	10	0	0
41-9031	Sales Engineers	4		13	6	0.46	0	0	13	6	7	0	0
43-1011	First-Line Supervisors of Office and Administrative Support Workers	3		142	298	2.10	37	252	105	45	60	0	0
43-3031	Bookkeeping, Accounting, and Auditing Clerks	3		92	129	1.40	29	96	63	33	30	0	0
43-3061	Procurement Clerks	3		5	2	0.40	2	1	4	2	2	0	0
43-4011	Brokerage Clerks	3		13	6	0.46	0	0	13	6	7	0	0
43-4031	Court, Municipal, and License Clerks	3		4	5	1.25	1	0	3	4	-1	0	0
43-4061	Eligibility Interviewers, Government Programs	3		12	18	1.50	0	0	12	18	-6	0	0
43-4131	Loan Interviewers and Clerks	3		21	12	0.57	8	6	13	5	8	0	0

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual		S/D Ratio	Associate		Bachelor		Graduate Gap			
				Demand	Supply		Demand	Supply	Demand	Supply				
43-4161	Human Resources Assistants, Except Payroll and Timekeeping	3		12	28	2.33	2	24	9	4	5	0	0	0
43-5061	Production, Planning, and Expediting Clerks	3		45	19	0.42	9	4	5	36	15	21	0	0
43-6011	Executive Secretaries and Executive Administrative Assistants	3		16	16	1.00	5	11	11	5	6	0	0	0
43-6012	Legal Secretaries	3		47	22	0.47	14	7	7	33	15	18	0	0
43-6013	Medical Secretaries	3		85	85	1.00	25	58	-33	59	27	32	0	0
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	3		235	110	0.47	71	33	38	164	76	88	0	0
43-9011	Computer Operators	3		5	2	0.40	2	1	1	3	1	2	0	0
43-9031	Desktop Publishers	3		2	5	2.50	0	0	0	2	5	-3	0	0
43-9041	Insurance Claims and Policy Processing Clerks	3		45	20	0.44	15	6	9	30	13	17	0	0
43-9111	Statistical Assistants	4		4	5	1.25	0	0	0	2	1	1	1	-3
43-9199	Office and Administrative Support Workers, All Other	3		29	12	0.41	6	3	3	23	10	13	0	0
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	3		26	11	0.42	0	0	0	26	11	15	0	0
47-2111	Electricians	3		44	140	3.18	44	140	-96	0	0	0	0	0
47-4011	Construction and Building Inspectors	3		31	9	0.29	0	0	0	31	9	22	0	0
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	3		33	14	0.42	0	0	0	33	14	19	0	0
49-2011	Computer, Automated Teller, and Office Machine Repairers	3		8	7	0.88	8	7	1	0	0	0	0	0
49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers	3		8	5	0.63	4	4	0	4	2	2	0	0
49-2092	Electric Motor, Power Tool, and Related Repairers	3		1	1	1.00	1	1	0	0	0	0	0	0
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	3		4	3	0.75	2	2	0	1	1	0	0	0
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	3		2	2	1.00	2	2	0	0	0	0	0	0
49-2098	Security and Fire Alarm Systems Installers	3		4	13	3.25	4	13	-9	0	0	0	0	0

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual		S/D Ratio	Associate		Bachelor		Graduate	
				Demand	Supply		Demand	Supply	Demand	Supply	Demand	Supply
49-3023	Automotive Service Technicians and Mechanics	3		38	74	1.95	38	74	0	0	0	0
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	3		16	31	1.94	16	31	0	0	0	0
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	3		20	85	4.25	20	85	0	0	0	0
49-9044	Millwrights	3		4	0	0.00	4	0	0	0	0	0
49-9062	Medical Equipment Repairers	3		11	9	0.82	11	9	0	0	0	0
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	3		19	3	0.16	19	3	0	0	0	0
51-4041	Machinists	3		18	2	0.11	18	2	0	0	0	0
51-4111	Tool and Die Makers	3		4	0	0.00	4	0	0	0	0	0
51-5112	Printing Press Operators	3		2	3	1.50	2	3	0	0	0	0
51-6052	Tailors, Dressmakers, and Custom Sewers	3		2	8	4.00	0	0	2	8	-6	0

# APPENDIX G: CROSSWALK OF PROGRAMS TO OCCUPATIONS

(Full List Available Upon Request)

Occupation Code	Occupation Title	Degree Code	Degree Title	NCES	PA	ACS
11-1021	General and Operations Managers	44.0401	Public Administration	•		•
		50.1001	Arts, Entertainment, and Media Management, General		•	
		50.1002	Fine and Studio Arts Management		•	
		50.1003	Music Management		•	
		50.1004	Theatre/Theatre Arts Management		•	
		52.0101	Business/Commerce, General	•		•
		52.0201	Business Administration and Management, General	•	•	•
		52.0204	Office Management and Supervision	•		
		52.0205	Operations Management and Supervision	•		
		52.0206	Non-Profit/Public/Organizational Management	•		
		52.0213	Organizational Leadership	•		
		52.0299	Business Administration, Management and Operations, Other	•		
		52.0501	Business/Corporate Communications		•	
		52.0701	Entrepreneurship/Entrepreneurial Studies	•		•
		52.0703	Small Business Administration/Management	•		
		52.0799	Entrepreneurial and Small Business Operations, Other	•		
		52.0801	Finance, General			•
		52.1101	International Business/Trade/Commerce	•		•
		52.1201	Management Information Systems, General		•	
		52.1206	Information Resources Management		•	
		52.1207	Knowledge Management		•	
		52.1299	Management Information Systems and Services, Other		•	
		52.1301	Management Science			•

Occupation Code	Occupation Title	Degree Code	Degree Title	NCES	PA	ACS
13-1161	Market Research Analysts and Marketing Specialists	45.0101	Social Sciences, General	•		
		45.0602	Applied Economics			•
		45.9999	Social Sciences, Other	•		
		52.0101	Business/Commerce, General	•		
		52.0601	Business/Managerial Economics	•		
		52.1401	Marketing/Marketing Management, General	•	•	•
		52.1402	Marketing Research	•	•	•
		52.1403	International Marketing	•	•	•
		52.1499	Marketing, Other	•	•	
		13-2011	Accountants and Auditors	43.0117	Financial Forensics and Fraud Investigation	•
45.0601	Economics, General				•	
45.0603	Econometrics and Quantitative Economics				•	
45.0605	International Economics				•	
45.0699	Economics, Other				•	
52.0101	Business/Commerce, General			•		
52.0301	Accounting			•	•	•
52.0303	Auditing			•	•	•
52.0304	Accounting and Finance			•	•	•
52.0305	Accounting and Business/Management			•	•	•
52.0399	Accounting and Related Services, Other			•	•	
52.0601	Business/Managerial Economics				•	
52.0801	Finance, General			•	•	
52.0804	Financial Planning and Services				•	
52.0807	Investments and Securities				•	
52.0899	Finance and Financial Management Services, Other			•	•	
52.1304	Actuarial Science				•	
52.1601	Taxation			•		•
15-1121	Computer Systems Analysts	11.0101	Computer and Information Sciences, General	•		•
		11.0103	Information Technology	•		•
		11.0501	Computer Systems Analysis/Analyst	•	•	•
		11.0701	Computer Science		•	
		11.0801	Web Page, Digital/Multimedia and Information Resources Design	•	•	
		11.0803	Computer Graphics		•	
		11.0804	Modeling, Virtual Environments and Simulation		•	

Occupation Code	Occupation Title	Degree Code	Degree Title	NCES	PA	ACS
		11.0899	Computer Software and Media Applications, Other		•	
		11.0901	Computer Systems Networking and Telecommunications			•
		52.1201	Management Information Systems, General	•		
		52.1207	Knowledge Management	•		
		52.1299	Management Information Systems and Services, Other	•		
29-1141	Registered Nurses	51.0000	Health Services/Allied Health/Health Sciences, General	•	•	
		51.0704	Health Unit Manager/Ward Supervisor	•	•	
		51.3801	Registered Nursing/Registered Nurse	•	•	•
		51.3803	Adult Health Nurse/Nursing	•	•	•
		51.3805	Family Practice Nurse/Nursing	•	•	•
		51.3808	Nursing Science	•	•	•
		51.3818	Nursing Practice	•	•	•
		51.3899	Registered Nursing, Nursing Administration, Nursing Research and Clinical Nursing, Other	•	•	•