PENNSYLVANIA'S STATE SYSTEM OF HIGHER EDUCATION

West Chester University's

SUPPLY/ DEMAND GAP ANALYSIS

A report for Pennsylvania's State System of Higher Education

2016

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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.[1] 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."[2] 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'[3] and 'Degrees of Value: College Majors and the Pennsylvania State System's Contribution to the Workforce'[4]—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.

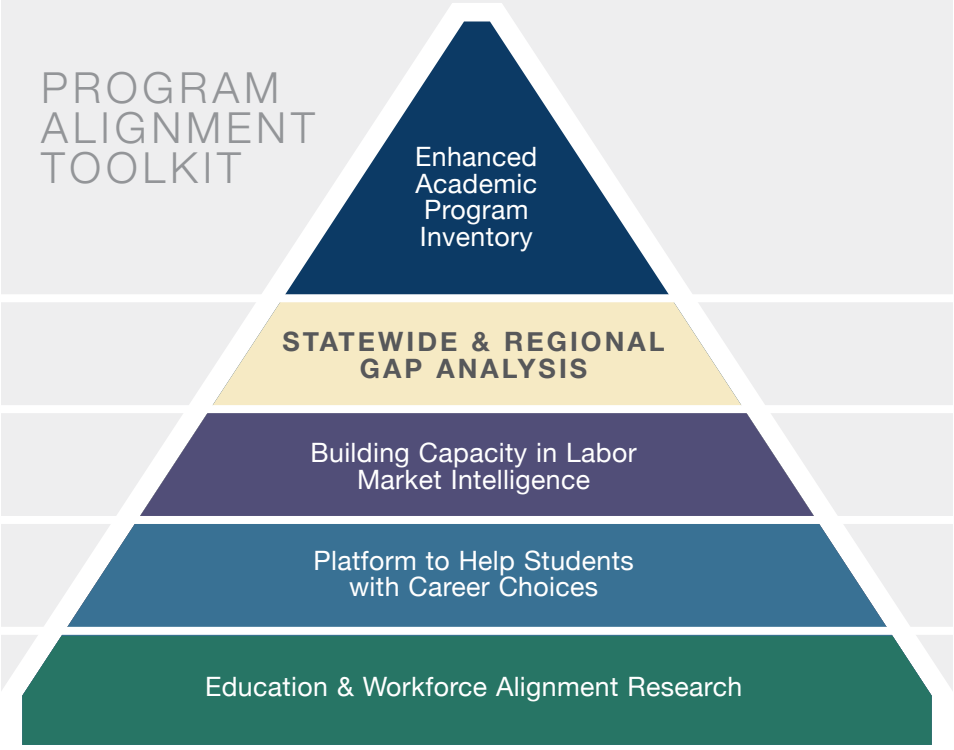
4 *Degrees of Value: College Majors and the Pennsylvania State System's Contribution to the Workforce* is an education and workforce analysis of the Commonwealth with a particular emphasis on the State System's Universities' output produced by Georgetown University's Center on Education and the Workforce.

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.

Fig. 1: Pennsylvania's State System of Higher Education Program Alignment Toolkit Outline



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.

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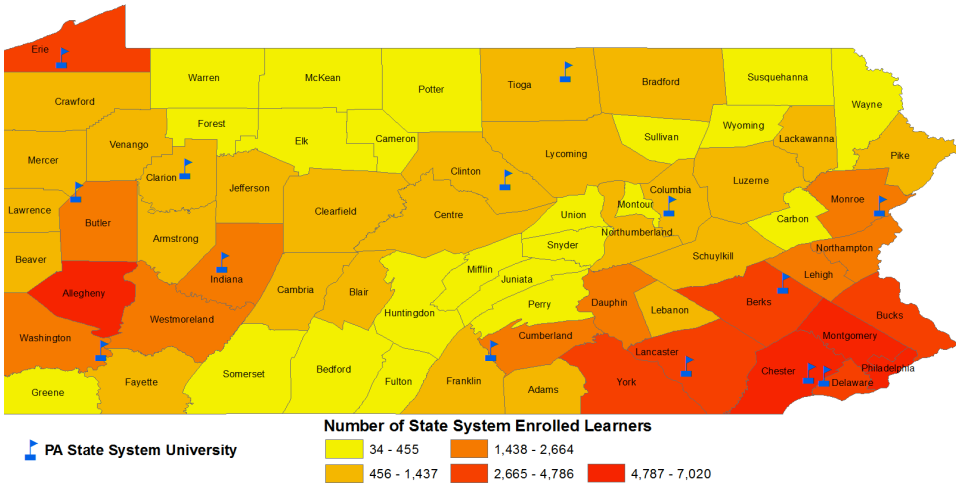
* Pennsylvania's State System of Higher Education – Student Data Fact Center

** 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

1.1 Goal of the Supply/Demand Gap Analysis Report

This Supply/Demand Gap Analysis Report is specific to West Chester University's (WCU) workforce region. It builds on information provided in an earlier State System report entitled West Chester University's Workforce Characteristics Technical Report. In the Workforce Characteristics Report, WCU's workforce region was defined to include the following counties: Bucks, Chester, Delaware, Montgomery, and Philadelphia. 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 WCU'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:

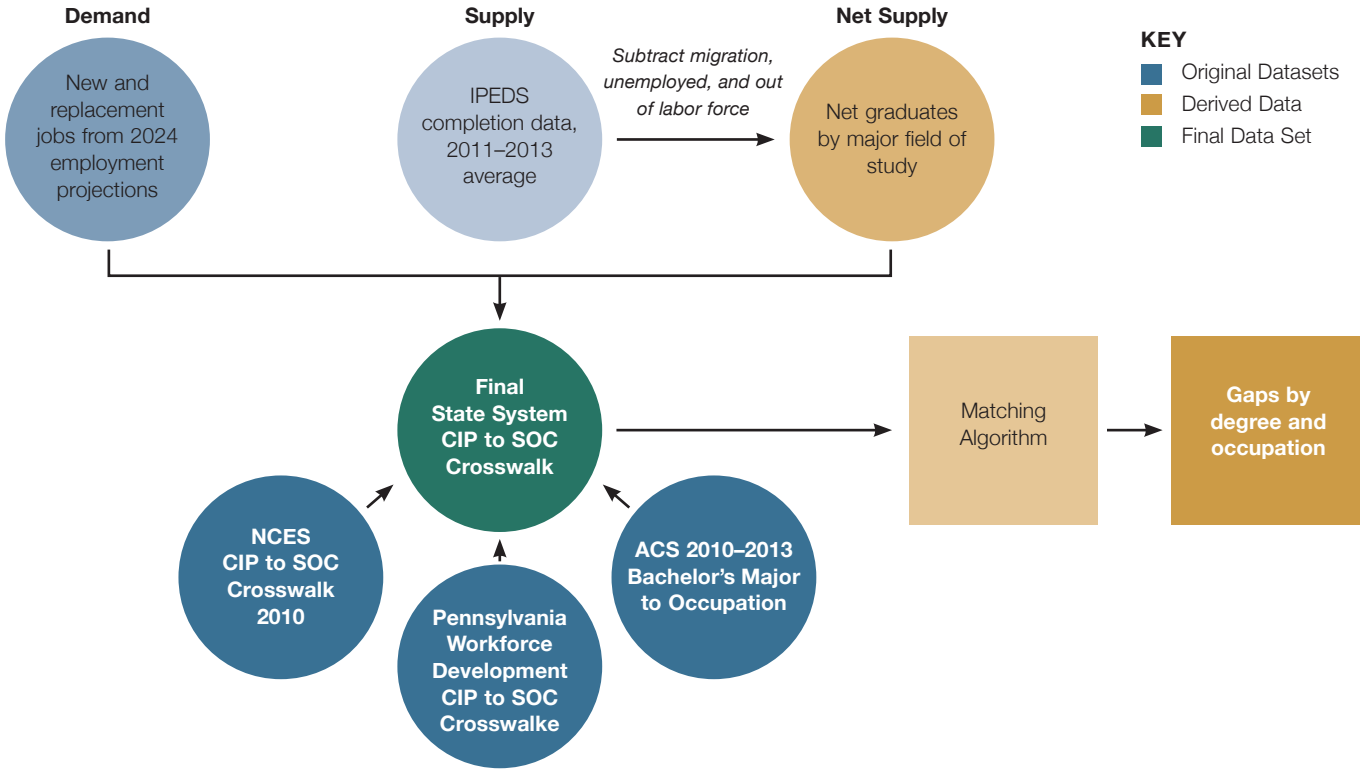
- When considering making adjustments to programs in degree areas related to occupations displaying gaps, further research should be considered to confirm the extent of alignment needed to arrive at equilibrium with the labor market.
- Government data that captures labor market demand lags real-time 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 WCU's workforce region is organized as follows:

Section 1 Introduction and background information.

Section 2 Overview of changes in WCU'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 WCU'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 WCU'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.

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 WEST CHESTER UNIVERSITY'S WORKFORCE REGION

Industry growth is a key driver of demand for occupations and talent. Hence, understanding the structure of WCU'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 WCU'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 WCU's workforce region in 2010 and 2014 as well as projected growth to 2024.

2.1 Major Industry Groups

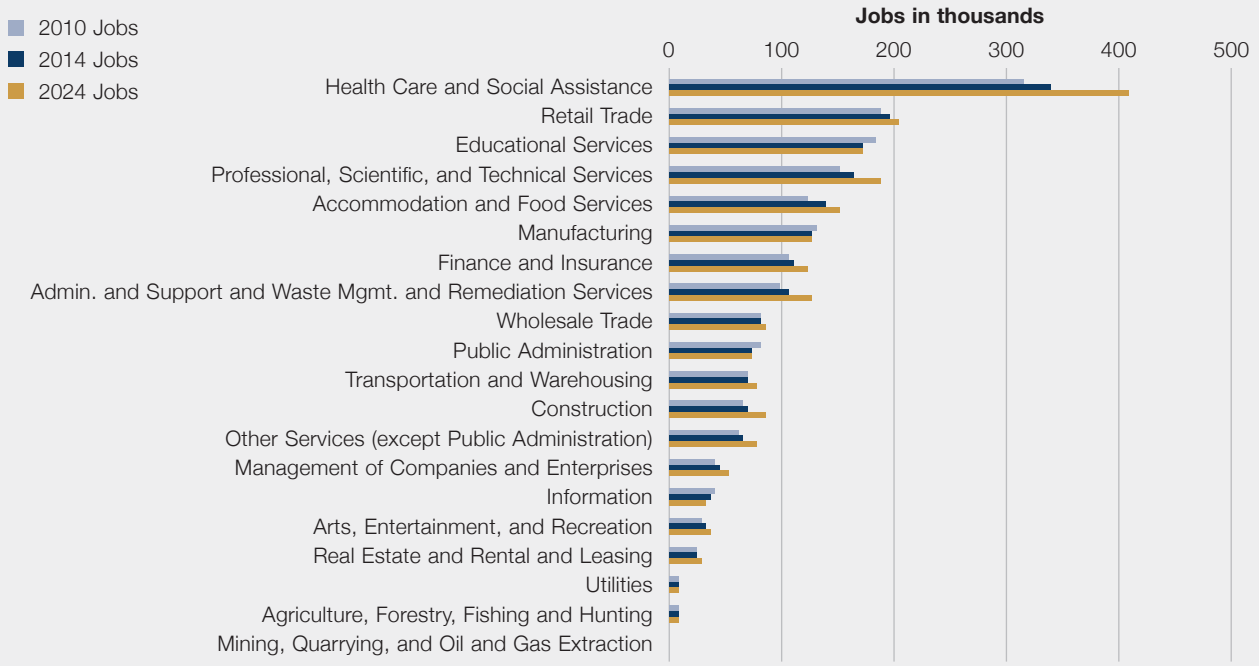
In 2014 the largest 2-digit industries in WCU's workforce region include education and health services, trade, transportation and utilities, and manufacturing. As can be seen in Fig. 4, healthcare and social assistance account for the most jobs (about 341,900 jobs), followed by retail trade, education services, professional, scientific and technical services, and accommodation and food 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 69,700 new jobs in the region between 2014 and 2024 (20% growth). Professional, scientific, and technical services is projected to add 28,100 new jobs (17% 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 WCU'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 WCU's workforce region, the ten largest 4-digit industry classifications employed 31% of total jobs in 2014 (576,900 jobs out of 1.9 million total jobs in the region). The largest industries include restaurants, elementary and secondary schools, and general medical and surgical hospitals. Fig. 5 below displays the region's ten largest 4-digit industry sectors in 2014 and projections to 2024.

Fig. 5: West Chester 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	103,342	115,434	12,092	11.7%
Elementary and Secondary Schools	95,030	93,081	-1,949	-2.1%
General Medical and Surgical Hospitals	81,076	87,344	6,268	7.7%
Colleges, Universities, and Professional Schools	59,440	61,522	2,082	3.5%
Management of Companies and Enterprises	46,464	53,879	7,415	16.0%
Individual and Family Services	44,038	60,060	16,022	36.4%
Grocery Stores	43,983	47,241	3,258	7.4%
Computer Systems Design and Related Services	36,459	47,933	11,474	31.5%
Offices of Physicians	34,934	37,785	2,851	8.2%
Insurance Carriers	32,176	34,464	2,288	7.1%
Total, 10 Largest	**576,942**	**638,743**	**61,801**	**10.7%**

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 WCU's workforce region. Projections indicate that the top ten largest growth industries in the region will add nearly 93,400 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 6,300 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 11,500 new jobs between 2014 and 2024.

Industry sectors that are projected to add significant numbers of new jobs to WCU'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: West Chester 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
Individual and Family Services	44,038	60,060	16,023	36.4%
Restaurants and Other Eating Places	103,342	115,434	12,092	11.7%
Computer Systems Design and Related Services	36,459	47,933	11,474	31.5%
Employment Services	31,401	41,597	10,196	32.5%
Home Health Care Services	17,132	27,129	9,997	58.4%
Other Financial Investment Activities	22,048	29,789	7,741	35.1%
Management of Companies and Enterprises	46,464	53,879	7,415	16.0%
Specialty (except Psychiatric and Substance Abuse) Hospitals	17,014	23,939	6,924	40.7%
General Medical and Surgical Hospitals	81,076	87,344	6,268	7.7%
Building Equipment Contractors	22,582	27,857	5,275	23.4%
Total, 10 Largest Growth	**421,556**	**514,961**	**93,405**	**22.2%**

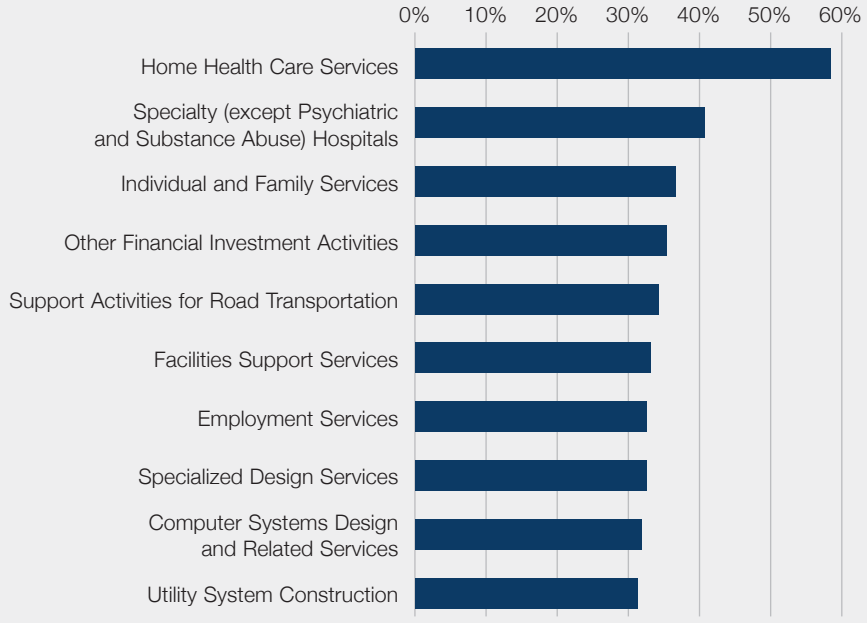
Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

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 WCU'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 WCU's workforce region include: home health care services, specialty hospitals, individual and family services, and other financial investment activities.

Fig. 7 depicts the fastest growing industries in WCU'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: West Chester 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: West Chester 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
Home Health Care Services	17,132	27,129	9,997	58.4%
Specialty (except Psychiatric and Substance Abuse) Hospitals	17,014	23,939	6,925	40.7%
Individual and Family Services	44,038	60,060	16,022	36.4%
Other Financial Investment Activities	22,048	29,789	7,741	35.1%
Support Activities for Road Transportation	1,317	1,765	448	34.0%
Facilities Support Services	2,728	3,622	894	32.8%
Employment Services	31,401	41,597	10,196	32.5%
Specialized Design Services	2,461	3,251	790	32.1%
Computer Systems Design and Related Services	36,459	47,933	11,474	31.5%
Utility System Construction	5,583	7,326	1,743	31.2%
Total, 10 Fastest Growing	**180,181**	**246,411**	**66,230**	**36.8%**

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

2.5 Concentration of Industries

Certain industries in WCU'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.

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 WCU's workforce region include: other investment pools and funds, support activities for water transportation, railroad rolling stock manufacturing, and specialty hospitals.

Fig. 9 displays the most concentrated industries (as measured by LQ) for WCU's workforce region at the 4-digit NAICS level in 2014. The figure reflects the comparative advantage WCU'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.

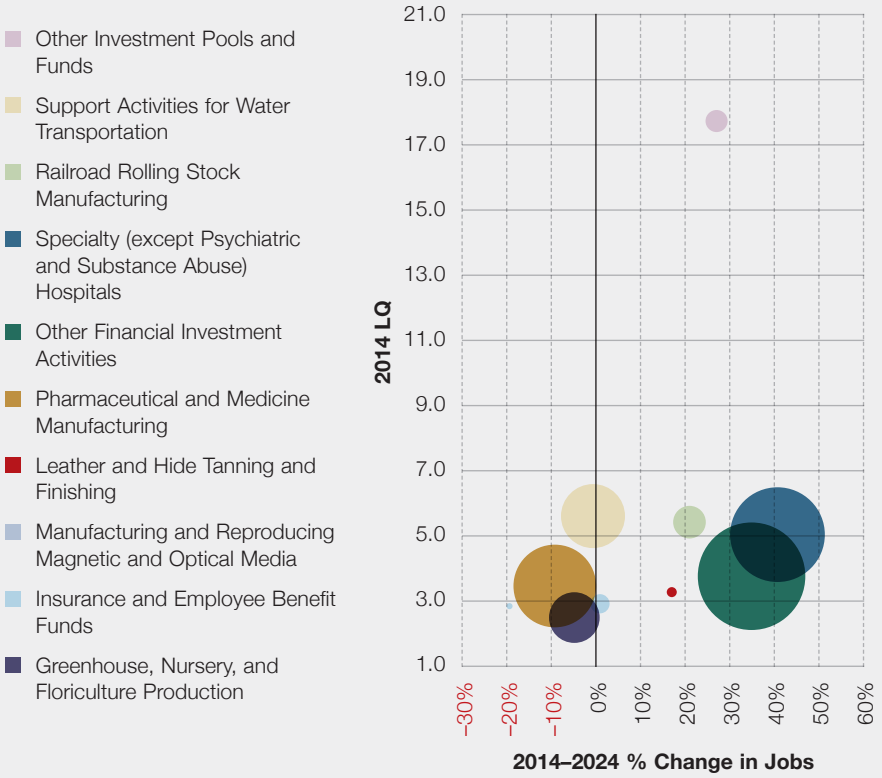
The next section provides information on occupational employment and describes the types of jobs people hold in WCU's workforce region.

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: West Chester 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: West Chester University's Workforce Region Most Concentrated 4-Digit Industries and Projected Growth, 2014-2024

Industry Title	2014 LQ	2014 Jobs	% Change 2014-2024
Other Investment Pools and Funds	17.7	857	27.2%
Support Activities for Water Transportation	5.6	7,777	-0.7%
Railroad Rolling Stock Manufacturing	5.4	2,025	21.1%
Specialty (except Psychiatric and Substance Abuse) Hospitals	5.0	17,014	40.7%
Other Financial Investment Activities	3.7	22,048	35.1%
Pharmaceutical and Medicine Manufacturing	3.4	13,228	-9.1%
Leather and Hide Tanning and Finishing	3.2	199	17.0%
Manufacturing and Reproducing Magnetic and Optical Media	2.9	677	1.2%
Insurance and Employee Benefit Funds	2.8	86	-19.3%
Greenhouse, Nursery, and Floriculture Production	2.5	4,946	-4.7%

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

3. OCCUPATIONAL PROFILE OF WEST CHESTER 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 WCU'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 WCU's workforce region in 2014 and projected growth to 2024.

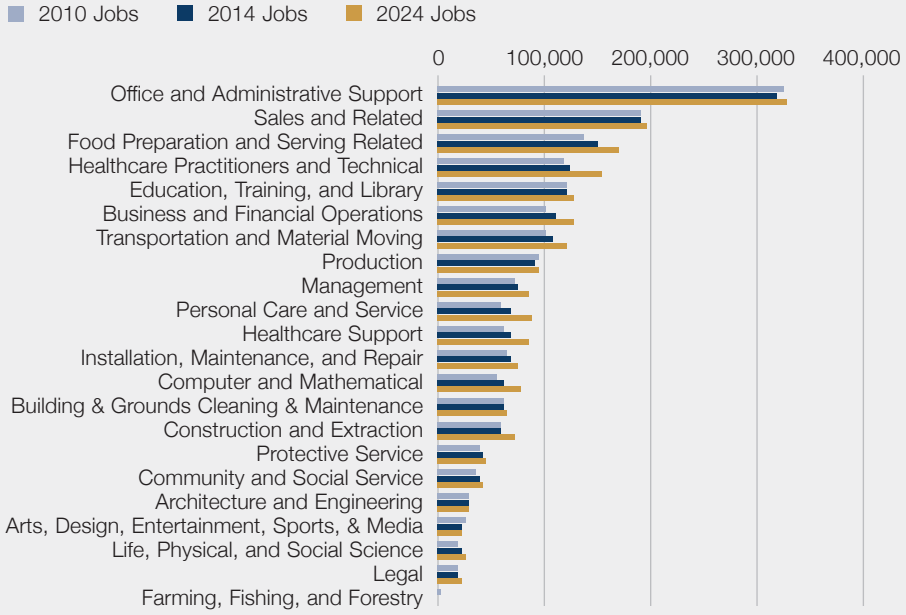
3.1 Major Occupation Groups

In WCU'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.[5] 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 WCU'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 60,600 new jobs between 2014 and 2024 and will account for nearly one third of the total projected occupation job growth in WCU's workforce region.

Fig. 11: West Chester University's Workforce Region Projected Changes in Major Occupation Categories, 2010, 2014, and 2024



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

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

WCU's workforce region had 1.9 million jobs in 2014, a number which is projected to grow to 2.1 million in 2024—an increase of about 194,500 jobs or a 10.3 percent change. It is important to note that the share of WCU'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 12.0 percent as compared to 8.5 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 WCU'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: West Chester University's Workforce Region Projected Job Growth by Job Zone, 2014-2024

	2014	2024	% Change 2014-2024	Share 2014	Share 2024
WCU workforce region, Total Jobs	**1,879,500**	**2,074,019**	**10.3%**	**100%**	**100%**
Job Zones 1-2 (Low Skilled)	882,316	957,351	8.5%	47%	46%
Job Zones 3-5 (Skilled)	997,184	1,116,668	12.0%	53%	54%

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 finance and insurance establishments in WCU's workforce region, top occupations include: retail salespersons, office clerks, cashiers, registered nurses, and food preparation and serving workers. Fig. 13 highlights the top occupations in the state, 10-year job growth projections, and new and replacement jobs.[6] The Job Zone is also included to indicate skill level for each occupation.[7]

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 West Chester 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	61,999	65,065	4.9%	25,574
Registered Nurses	3	45,264	55,303	22.2%	19,205
Office Clerks, General	2	44,406	43,585	-1.8%	9,404
Cashiers	1	42,945	42,671	-0.6%	19,921
Combined Food Preparation and Serving Workers, Including Fast Food	1	42,198	48,975	16.1%	24,904
Customer Service Representatives	2	38,790	43,488	12.1%	16,418
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	3	38,586	43,972	14.0%	10,399
Laborers and Freight, Stock, and Material Movers, Hand	2	32,784	38,143	16.3%	17,172
Janitors and Cleaners, Except Maids and Housekeeping Cleaners	2	31,819	33,706	5.9%	9,184
Waiters and Waitresses	1	30,238	34,598	14.4%	20,362
Nursing Assistants	2	25,186	30,072	19.4%	9,972
Stock Clerks and Order Fillers	2	24,507	24,927	1.7%	8,982
Bookkeeping, Accounting, and Auditing Clerks	3	22,402	24,503	9.4%	4,317
Personal Care Aides	2	22,243	32,986	48.3%	13,712
General and Operations Managers	4	22,219	26,140	17.6%	7,877

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 WCU'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

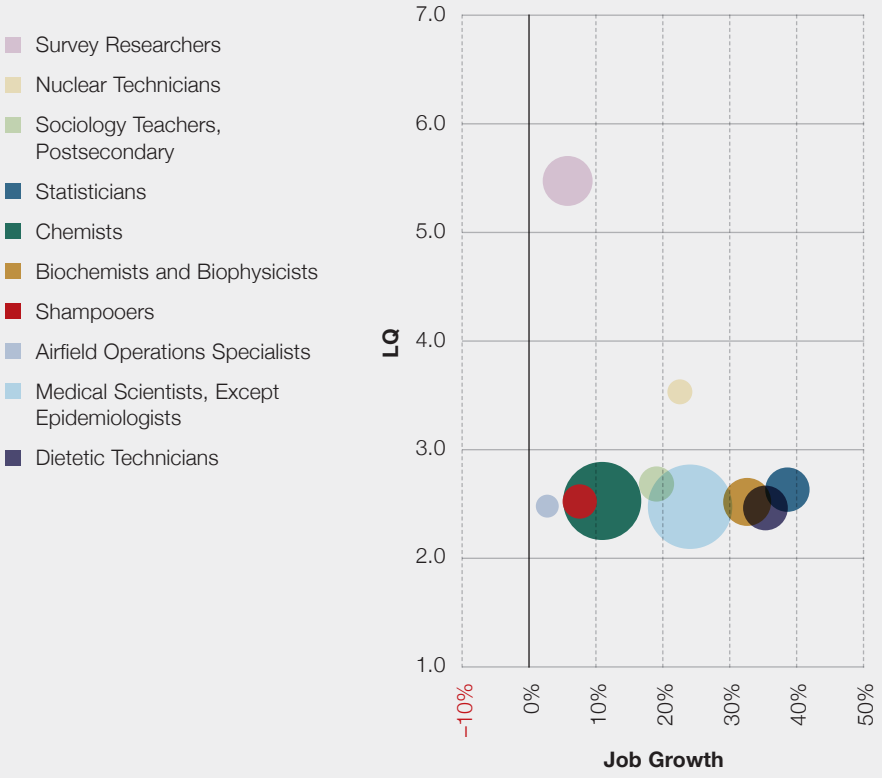
has a concentration or comparative advantage in the occupation, relative to the rest of the nation. A value of 1.5 indicates that occupation employment within the region is 1.5 times more concentrated compared to the U.S. average. A location quotient below 1 indicates that occupation employment within 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 WCU's workforce region include: survey researchers, nuclear technicians, postsecondary sociology teachers, and statisticians.

Fig. 14 illustrates the LQ, projected job change and employment size of the top 10 most concentrated occupations (as measured by LQ) in WCU'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: West Chester 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: West Chester University's Workforce Region Most Concentrated Occupations and Projected Growth, 2014-2024

Occupation Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
Survey Researchers	5.5	1,171	1,241	6.0%
Nuclear Technicians	3.5	313	383	22.4%
Sociology Teachers, Postsecondary	2.7	628	747	19.0%
Statisticians	2.6	984	1,361	38.3%
Chemists	2.5	3,009	3,340	11.0%
Biochemists and Biophysicists	2.5	1,094	1,448	32.3%
Shampooers	2.5	577	622	7.8%
Airfield Operations Specialists	2.5	242	249	2.9%
Medical Scientists, Except Epidemiologists	2.5	3,448	4,280	24.1%
Dietetic Technicians	2.4	977	1,319	35.1%

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

3.5 Occupations Aligning to Associate's Degrees

WCU'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.

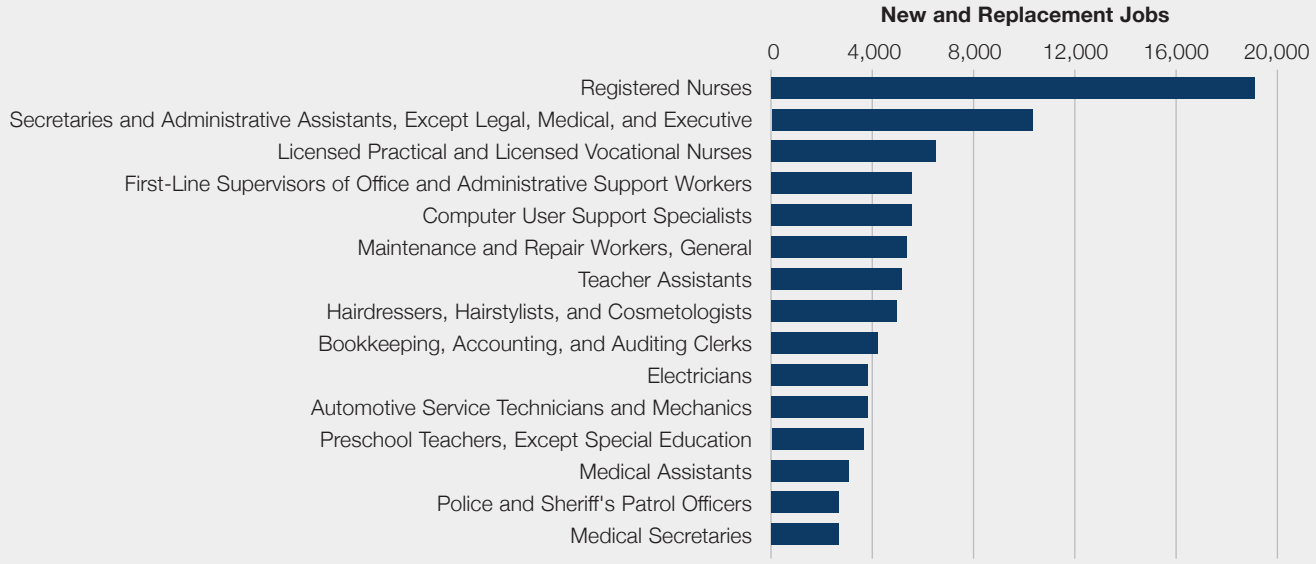
There are over 200 Job Zone Three occupations. Looking ahead, many Job Zone Three occupations show significant growth and demand. In WCU's workforce region, projections indicate 12.4 percent growth in Job Zone Three jobs between 2014 and 2024. Job demand is further emphasized through both new job growth 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 169,700 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, licensed practical and licensed vocational nurses, and secretaries and administrative assistants. Fig. 16 and Fig. 17 highlight WCU'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 West Chester 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 West Chester University's Workforce Region, 2014-2024

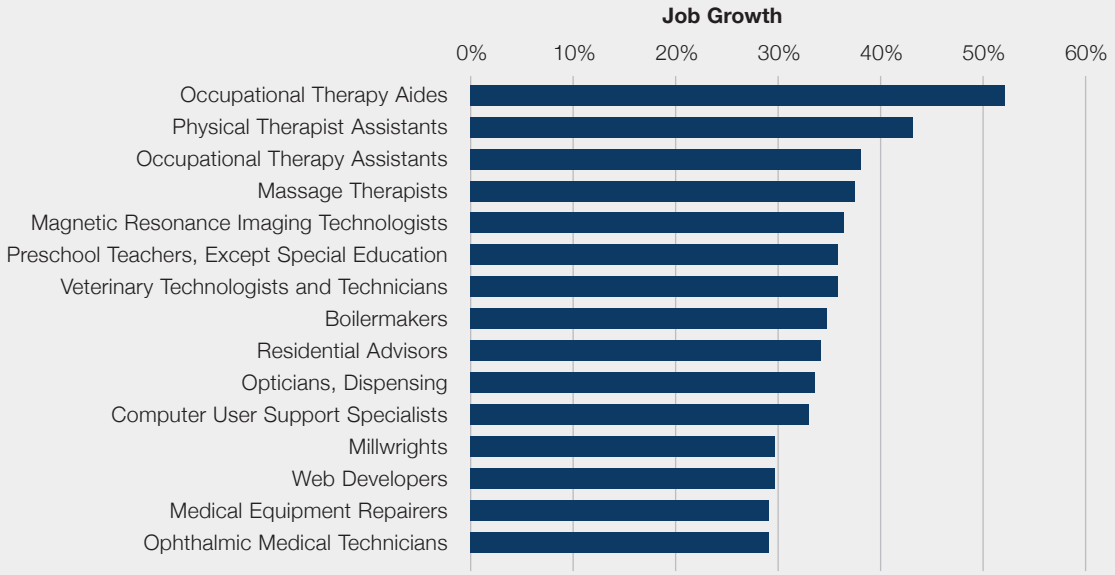
Occupation Title	2014 Jobs	2024 Jobs	% Change 2014-2024	10-year New and Replacement Jobs
Registered Nurses	45,264	55,303	22.2%	19,205
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	38,586	43,972	14.0%	10,399
Licensed Practical and Licensed Vocational Nurses	12,325	15,574	26.4%	6,504
First-Line Supervisors of Office and Administrative Support Workers	18,840	19,925	5.8%	5,596
Computer User Support Specialists	10,833	14,378	32.7%	5,484
Maintenance and Repair Workers, General	19,457	20,584	5.8%	5,414
Teacher Assistants	15,864	17,041	7.4%	5,120
Hairdressers, Hairstylists, and Cosmetologists	9,844	12,143	23.4%	5,083
Bookkeeping, Accounting, and Auditing Clerks	22,402	24,503	9.4%	4,317
Electricians	7,038	9,027	28.3%	3,906
Automotive Service Technicians and Mechanics	9,585	10,672	11.3%	3,873
Preschool Teachers, Except Special Education	5,821	7,878	35.3%	3,728
Medical Assistants	7,703	9,150	18.8%	2,993
Police and Sheriff's Patrol Officers	8,963	8,489	-5.3%	2,742
Medical Secretaries	7,037	8,954	27.2%	2,738

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 WCU'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, massage therapists, and occupational therapy assistants. 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 West Chester 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 West Chester University's Workforce Region, 2014-2024

Occupation Title	2014	2024	% Change 2014-2024	10-year New and Replacement Jobs
Occupational Therapy Aides	230	349	51.7%	184
Physical Therapist Assistants	1,493	2,131	42.7%	1,041
Occupational Therapy Assistants	813	1,120	37.8%	558
Massage Therapists	801	1,100	37.3%	380
Magnetic Resonance Imaging Technologists	484	658	36.0%	251
Preschool Teachers, Except Special Education	5,821	7,878	35.3%	3,728
Veterinary Technologists and Technicians	1,792	2,424	35.3%	822
Boilermakers	222	298	34.2%	193
Residential Advisors	2,629	3,523	34.0%	2,213
Opticians, Dispensing	967	1,287	33.1%	650
Computer User Support Specialists	10,833	14,378	32.7%	5,484
Millwrights	337	437	29.7%	183
Web Developers	1,733	2,242	29.4%	793
Medical Equipment Repairers	924	1,193	29.1%	592
Ophthalmic Medical Technicians	338	436	29.0%	140

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

3.6 Occupations Aligning to Bachelor's and Graduate Degrees

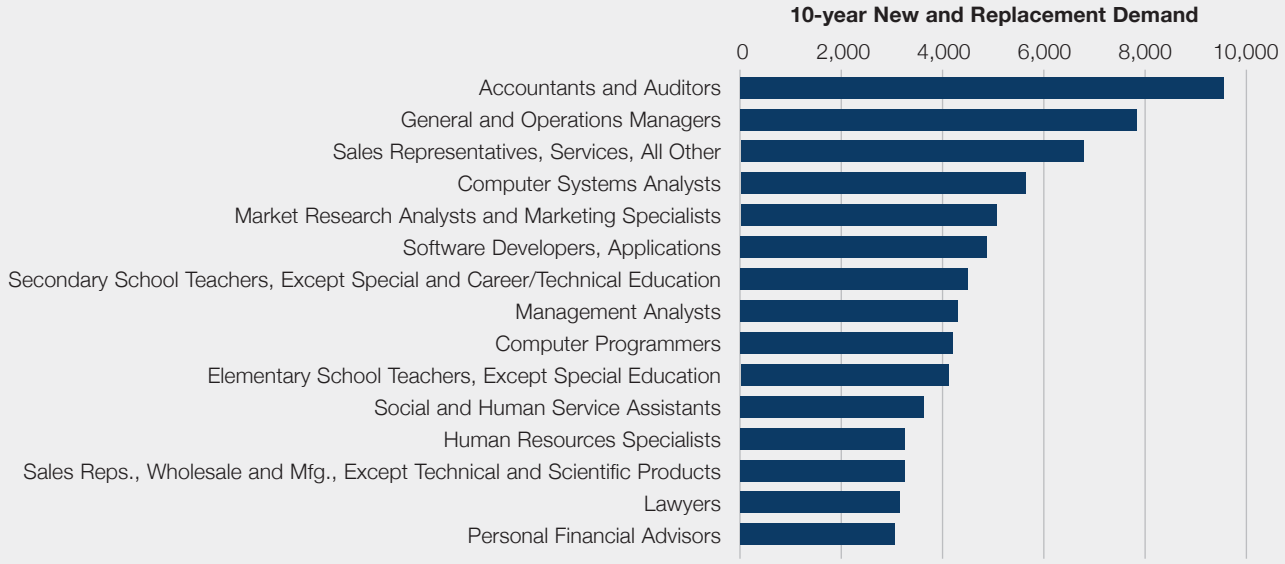
Job Zones Four and Five describe occupations that typically require a bachelor's degree or graduate degree. There are over 250 Job Zone Four and Five occupation classifications. In WCU's workforce region, the employment projections indicate that occupations typically requiring a bachelor's degree or higher will grow 11.6 percent between 2014 and 2024. This growth will result in total demand for new and replacement job openings of nearly 184,100 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 West Chester 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 West Chester University's Workforce Region, 2014-2024

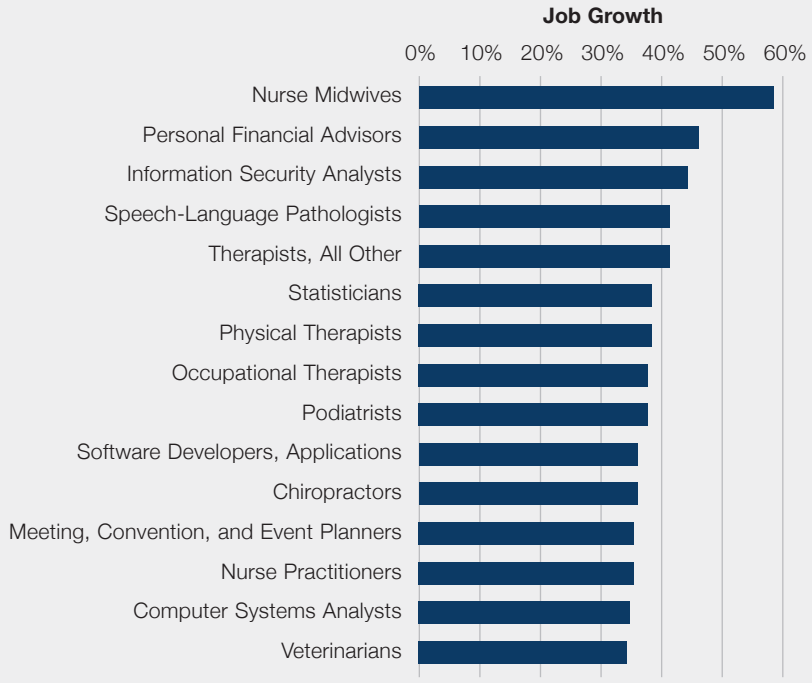
Occupation Title	2014 Jobs	2024 Jobs	% Change 2014-2024	10-year New and Replacement Jobs
Accountants and Auditors	21,470	23,947	11.5%	9,624
General and Operations Managers	22,219	26,140	17.6%	7,877
Sales Representatives, Services, All Other	12,322	15,646	27.0%	6,859
Computer Systems Analysts	10,756	14,513	34.9%	5,659
Market Research Analysts and Marketing Specialists	10,132	13,552	33.8%	5,043
Software Developers, Applications	9,730	13,232	36.0%	4,888
Secondary School Teachers, Except Special and Career/Technical Education	16,427	15,366	-6.5%	4,534
Management Analysts	10,385	12,939	24.6%	4,282
Computer Programmers	6,962	8,948	28.5%	4,266
Elementary School Teachers, Except Special Education	17,851	17,443	-2.3%	4,083
Social and Human Service Assistants	8,099	9,353	15.5%	3,671
Human Resources Specialists	6,999	8,736	24.8%	3,231
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	21,790	19,958	-8.4%	3,230
Lawyers	12,017	13,118	9.2%	3,153
Personal Financial Advisors	4,833	7,038	45.6%	3,105

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 WCU's workforce region, the fastest growing occupations aligning to bachelor's and graduate degrees include: nurse midwives, personal financial advisors, information security analysts, and speech-language pathologists. Fig. 22 and Fig. 23 highlight WCU'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 West Chester 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 WCU'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 West Chester University's Workforce Region, 2014-2024

Occupation Title	2014	2024	% Change 2014-2024	10-year New and Replacement Jobs
Nurse Midwives	48	76	58.3%	37
Personal Financial Advisors	4,833	7,038	45.6%	3,105
Information Security Analysts	1,094	1,579	44.3%	653
Speech-Language Pathologists	1,690	2,390	41.4%	950
Therapists, All Other	117	165	41.0%	62
Statisticians	984	1,361	38.3%	717
Physical Therapists	3,600	4,979	38.3%	2,398
Occupational Therapists	2,226	3,065	37.7%	1,188
Podiatrists	138	190	37.7%	108
Software Developers, Applications	9,730	13,232	36.0%	4,888
Chiropractors	348	472	35.6%	202
Meeting, Convention, and Event Planners	1,202	1,629	35.5%	611
Nurse Practitioners	1,345	1,822	35.5%	722
Computer Systems Analysts	10,756	14,513	34.9%	5,659
Veterinarians	1,142	1,532	34.2%	798

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

4. POSTSECONDARY PROGRAM COMPLETIONS IN WEST CHESTER UNIVERSITY'S WORKFORCE REGION

West Chester 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 100 higher education institutions in the region that awarded an associate's degree or higher between 2011 and 2013.[8] These institutions graduated, on average, 58,900 students annually from 2011 to 2013 with an associate's degree or higher.[9] 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. West Chester University produces approximately 7% of the total bachelor's degrees and above in the region.[10]

4.1 Associate's Degree Completions

WCU's workforce region is home to approximately 54 different institutions that offer a range of associate's degree programs.[11] From 2011 to 2013, these institutions in WCU's workforce region awarded, on average, 8,000 associate's degrees annually. The top three program areas in the region's associate degree production include:

- Liberal arts and sciences, general studies and humanities,
- Health professions and related programs, and
- Business, management, marketing, and related support services.

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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.

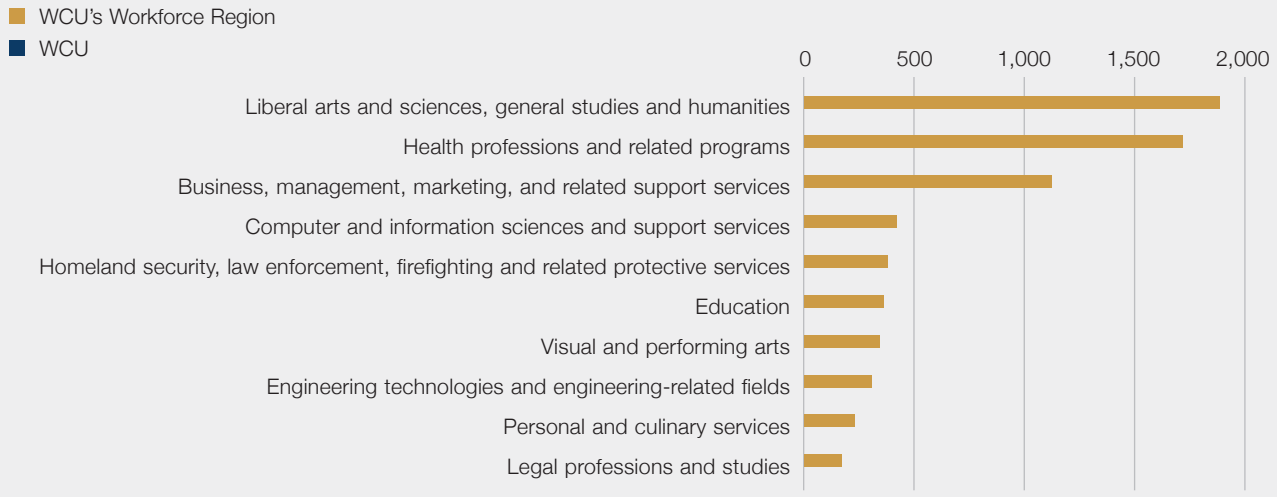
Of the 8,000 average annual completions of associate's degrees, these three program areas accounted for 59% of completions in the region.

4.1.1 West Chester University's Associate's Degree Completions

From 2011 to 2013, West Chester University did not award an associate's degree.

Fig. 24 highlights the top 10 program areas for associate's completions in WCU's workforce region.

Fig. 24: Associate's Degree Program Completions from West Chester University and WCU's Workforce Region, 2011-2013 Annual Average



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

Fig. 25 on the next page provides the total number of associate's degrees awarded in WCU's workforce region by major field of study as well as the total number of associate's degrees awarded by West Chester University.

Fig. 25: Associate's Degree Total Program Completions from West Chester University and WCU's Workforce Region, 2011-2013 Annual Average

Major Category	WCU's workforce Region 3-year Average Associate Completions	Share of Total WCU's workforce Region Associate Degrees	WCU 3-year Average Associate Completions	Share of Total WCU Associate Degrees
Total	**7,986**	**100.0%**	**0**	**NA**
Liberal arts and sciences, general studies and humanities	1,879	23.5%	0	NA
Health professions and related programs	1,716	21.5%	0	NA
Business, management, marketing, and related support services	1,128	14.1%	0	NA
Computer and information sciences and support services	413	5.2%	0	NA
Homeland security, law enforcement, firefighting and related protective services	371	4.6%	0	NA
Education	353	4.4%	0	NA
Visual and performing arts	344	4.3%	0	NA
Engineering technologies and engineering-related fields	299	3.7%	0	NA
Personal and culinary services	227	2.8%	0	NA
Legal professions and studies	179	2.2%	0	NA
Mechanic and repair technologies/technicians	177	2.2%	0	NA
Family and consumer sciences/human sciences	153	1.9%	0	NA
Psychology	137	1.7%	0	NA
Public administration and social service professions	105	1.3%	0	NA
Communication, journalism, and related programs	87	1.1%	0	NA
Multi/interdisciplinary studies	78	1.0%	0	NA
Social sciences	59	0.7%	0	NA
Physical sciences	57	0.7%	0	NA
Engineering	50	0.6%	0	NA
Science technologies/technicians	46	0.6%	0	NA
Communications technologies/technicians and support services	17	0.2%	0	NA
Construction trades	17	0.2%	0	NA
Precision production	16	0.2%	0	NA
English language and literature/letters	15	0.2%	0	NA
Parks, recreation, leisure, and fitness studies	15	0.2%	0	NA
Mathematics and statistics	12	0.2%	0	NA
Agriculture, agriculture operations, and related sciences	11	0.1%	0	NA
Theology and religious vocations	5	0.1%	0	NA
Biological and biomedical sciences	5	0.1%	0	NA
Area, ethnic, cultural, gender, and group studies	4	0.1%	0	NA
Natural resources and conservation	4	0.1%	0	NA
Foreign languages, literatures, and linguistics	4	0.1%	0	NA

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

4.2 Bachelor's Degree Completions

West Chester University's workforce region is home to approximately 46 different institutions that offer a range of bachelor's degree programs.[12] From 2011 to 2013, these institutions in WCU's workforce region awarded, on average, 29,100 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 29,100 average annual completions of bachelor's degrees, these three program areas accounted for 43% of completions in the region.

4.2.1 West Chester University's Bachelor's Degree Completions

From 2011 to 2013, West Chester University awarded, on average, 2,700 bachelor's degrees annually. The top program areas for bachelor degrees from West Chester University include:

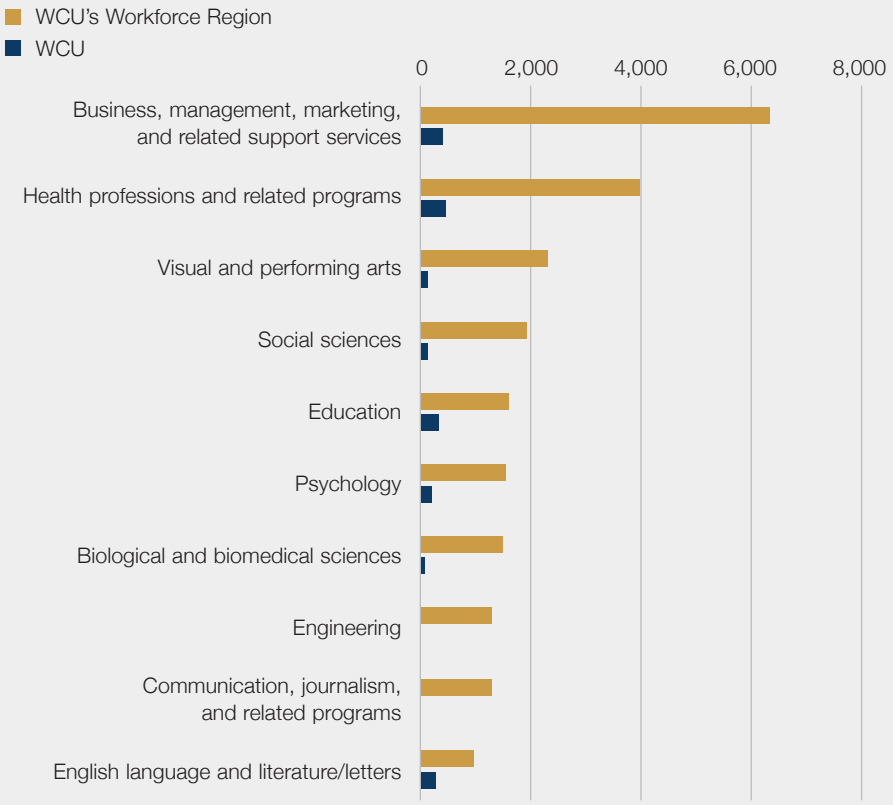
- Health professions and related programs,
- Business, management, marketing, and related support services, and
- Education.

Of the 2,700 average annual completions of bachelor's degrees from West Chester University, these three program areas accounted for 42% of bachelor's degree completions.

Fig. 26 highlights the top program areas for bachelor's completions in WCU's workforce region, along with the corresponding bachelor's completions from West Chester University.

12 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 West Chester University and WCU'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 WCU's workforce region by major field of study as well as the total number of bachelor's degrees awarded by West Chester University.

Fig. 27: Bachelor's Degree Total Program Completions from West Chester University and WCU's Workforce Region, 2011-2013 Annual Average

Major Category	WCU's Workforce Region 3-year Average Bachelor Completions	Share of Total WCU's Workforce Region Bachelor Degrees	WCU 3-year Average Bachelor Completions	Share of Total WCU Bachelor Degrees
Total	**29,087**	**100.0%**	**2,668**	**100.0%**
Business, management, marketing, and related support services	6,339	21.8%	402	15.1%
Health professions and related programs	3,938	13.5%	417	15.6%
Visual and performing arts	2,297	7.9%	142	5.3%
Social sciences	1,944	6.7%	111	4.2%
Education	1,607	5.5%	312	11.7%
Psychology	1,540	5.3%	162	6.1%
Biological and biomedical sciences	1,483	5.1%	85	3.2%
Engineering	1,298	4.5%	0	0.0%
Communication, journalism, and related programs	1,298	4.5%	0	0.0%
English language and literature/letters	937	3.2%	241	9.0%
Computer and information sciences and support services	720	2.5%	22	0.8%
Homeland security, law enforcement, firefighting and related protective services	640	2.2%	93	3.5%
History	596	2.1%	103	3.8%
Parks, recreation, leisure, and fitness studies	585	2.0%	152	5.7%
Liberal arts and sciences, general studies and humanities	562	1.9%	252	9.4%
Philosophy and religious studies	488	1.7%	11	0.4%
Physical sciences	430	1.5%	42	1.6%
Public administration and social service professions	344	1.2%	44	1.7%
Multi/interdisciplinary studies	294	1.0%	0	0.0%
Foreign languages, literatures, and linguistics	291	1.0%	34	1.3%
Mathematics and statistics	279	1.0%	34	1.3%
Architecture and related services	271	0.9%	0	0.0%
Agriculture, agriculture operations, and related sciences	171	0.6%	0	0.0%
Natural resources and conservation	165	0.6%	0	0.0%
Theology and religious vocations	139	0.5%	0	0.0%
Area, ethnic, cultural, gender, and group studies	122	0.4%	9	0.3%
Legal professions and studies	120	0.4%	0	0.0%
Engineering technologies and engineering-related fields	68	0.2%	0	0.0%
Personal and culinary services	59	0.2%	0	0.0%
Family and consumer sciences/human sciences	48	0.2%	0	0.0%
Communications technologies/technicians and support services	16	0.1%	0	0.0%

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

4.3 Graduate Degree Completions

West Chester University's workforce region is home to approximately 48 different institutions that offer a range of graduate degree programs.[13] From 2011 to 2013, these institutions in WCU's workforce region awarded, on average, 21,800 graduate degrees annually. The top three program areas in the region's graduate degree production include:

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

Of the 21,800 average annual completions of graduate degrees in WCU's workforce region, these three program areas accounted for 62% of graduate completions.

4.3.1 West Chester University Graduate Degree Completions

From 2011 to 2013, West Chester University awarded, on average, 670 graduate degrees annually. The top program areas for graduate degrees from West Chester University include:

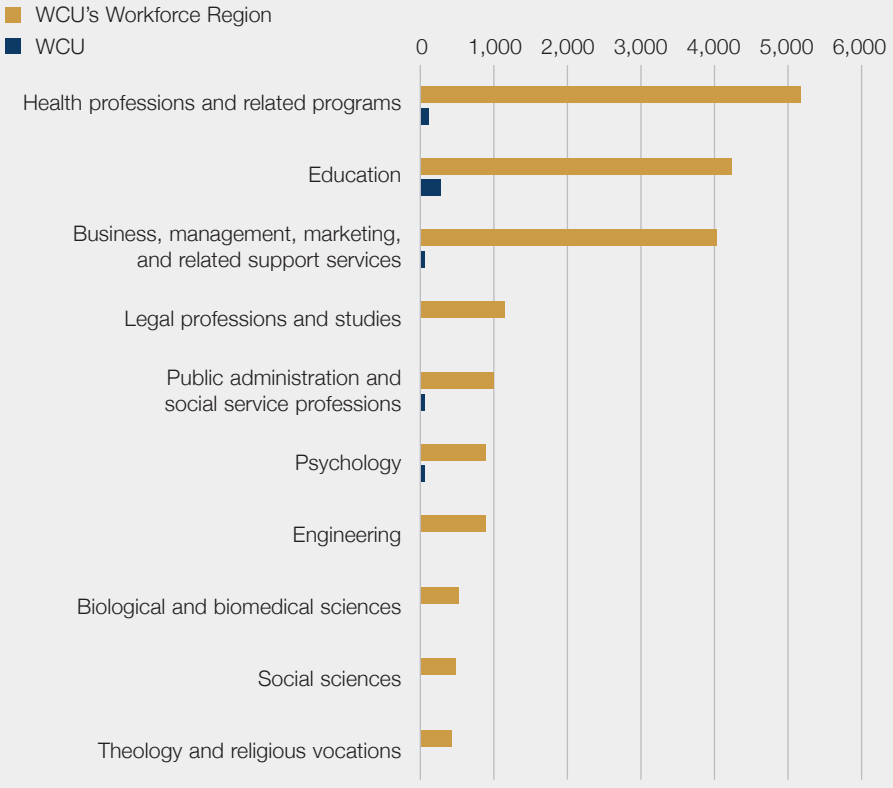
- Education,
- Health professions and related programs, and
- Multi/interdisciplinary studies.

Of the 670 average annual completions of graduate degrees from West Chester University, these three program areas accounted for 59% of graduate degree completions.

Fig. 28 highlights the top program areas for graduate completions in WCU's workforce region, along with the corresponding graduate completions from West Chester University.

13 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 West Chester University and WCU'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 WCU's workforce region by major category as well as the total number of graduate degrees awarded by West Chester 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 West Chester University and WCU's Workforce Region, 2011-2013 Annual Average

Major Category	WCU's Workforce Region 3-year Average Graduate Completions	Share of Total WCU's Workforce Region Graduate Completions	WCU 3-year Average Graduate Completions	Share of Total WCU Graduate Completions
Total	**21,845**	**100.0%**	**674**	**100.0%**
Health professions and related programs	5,209	23.8%	105	15.5%
Education	4,238	19.4%	247	36.6%
Business, management, marketing, and related support services	4,074	18.6%	27	4.1%
Legal professions and studies	1,159	5.3%	0	0.0%
Public administration and social service professions	975	4.5%	42	6.2%
Psychology	908	4.2%	32	4.7%
Engineering	889	4.1%	0	0.0%
Biological and biomedical sciences	526	2.4%	9	1.4%
Social sciences	457	2.1%	10	1.4%
Theology and religious vocations	423	1.9%	0	0.0%
Computer and information sciences and support services	416	1.9%	7	1.0%
Visual and performing arts	399	1.8%	26	3.9%
Architecture and related services	285	1.3%	0	0.0%
Library science	260	1.2%	0	0.0%
Multi/interdisciplinary studies	202	0.9%	44	6.5%
Physical sciences	191	0.9%	8	1.2%
Communication, journalism, and related programs	184	0.8%	0	0.0%
English language and literature/letters	170	0.8%	33	4.9%
Liberal arts and sciences, general studies and humanities	124	0.6%	0	0.0%
Homeland security, law enforcement, firefighting and related protective services	120	0.5%	21	3.1%
Mathematics and statistics	115	0.5%	28	4.1%
Foreign languages, literatures, and linguistics	109	0.5%	10	1.5%
History	94	0.4%	7	1.0%
Parks, recreation, leisure, and fitness studies	87	0.4%	9	1.4%
Philosophy and religious studies	74	0.3%	10	1.4%
Engineering technologies and engineering-related fields	73	0.3%	0	0.0%
Natural resources and conservation	39	0.2%	0	0.0%
Area, ethnic, cultural, gender, and group studies	28	0.1%	0	0.0%
Agriculture, agriculture operations, and related sciences	16	0.1%	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 WCU's workforce region.[14]

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.[15] 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.

14 Skilled occupations are occupations in Job Zones 3, 4, and 5.

15 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.

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 leaners 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.[16] 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.

16 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.

Leaners 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 WCU'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.

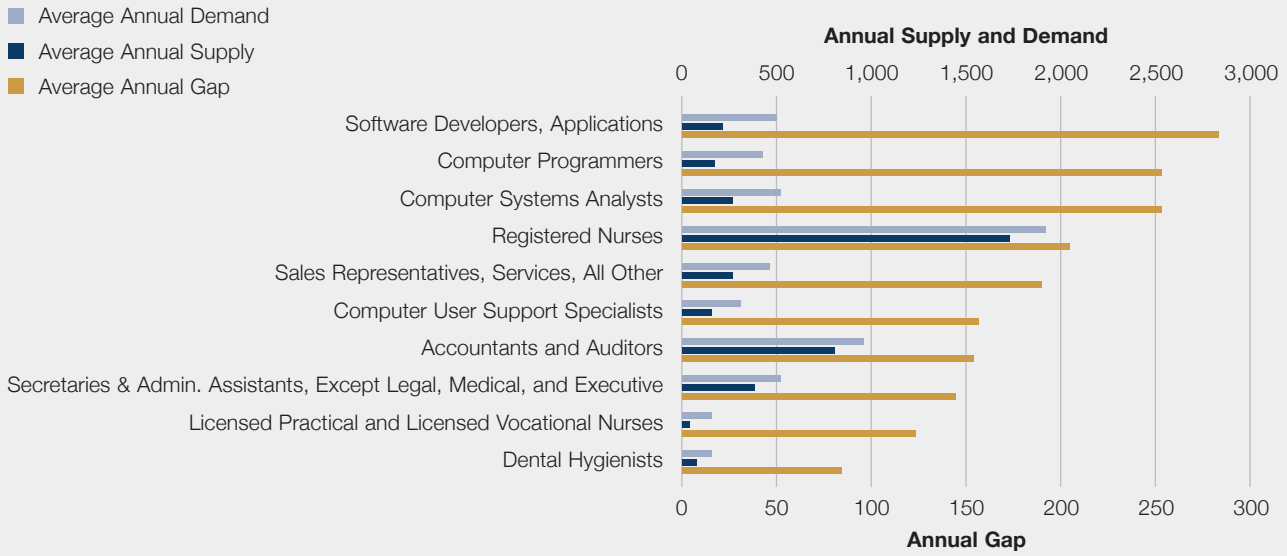
In WCU's workforce region, growth in the health care and social assistance industry has increased demand for healthcare practitioners and technical occupations. Seven out of the top twenty demand gaps are occupations related to health care and community and social service and combine for an average annual demand gap of 648.

Additionally, growth in professional, technical and scientific services has driven significant demand for computer occupations, which, in-turn, has driven the demand for STEM majors.[17] These occupations represent four out of the top ten excess demand gaps in the region and combine for an average annual demand gap of 945. The largest excess demand gap exists for software developers, applications with an average annual gap of 283.

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).

17 STEM majors include programs in the fields of Science, Technology, Engineering, and Mathematics.

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

Occupation Title	Job Zone	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio
Software Developers, Applications	4	499	216	283	0.43
Computer Programmers	4	433	180	253	0.42
Computer Systems Analysts	4	515	263	252	0.51
Registered Nurses	3	1,932	1,729	203	0.89
Sales Representatives, Services, All Other	4	461	271	190	0.59
Computer User Support Specialists	3	310	153	157	0.49
Accountants and Auditors	4	959	806	153	0.84
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	3	522	377	145	0.72
Licensed Practical and Licensed Vocational Nurses	3	155	33	122	0.21
Dental Hygienists	3	155	71	84	0.46
Personal Financial Advisors	4	316	236	80	0.75
Hairdressers, Hairstylists, and Cosmetologists	3	85	6	79	0.07
Claims Adjusters, Examiners, and Investigators	4	162	84	78	0.52
Insurance Sales Agents	4	152	79	73	0.52
Medical and Clinical Laboratory Technologists	4	102	32	70	0.31
Medical and Clinical Laboratory Technicians	3	96	37	59	0.39
Emergency Medical Technicians and Paramedics	3	82	24	58	0.29
Physical Therapist Assistants	3	87	33	54	0.38
Securities, Commodities, and Financial Services Sales Agents	4	208	155	53	0.75
Pharmacy Technicians	3	64	12	52	0.19

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

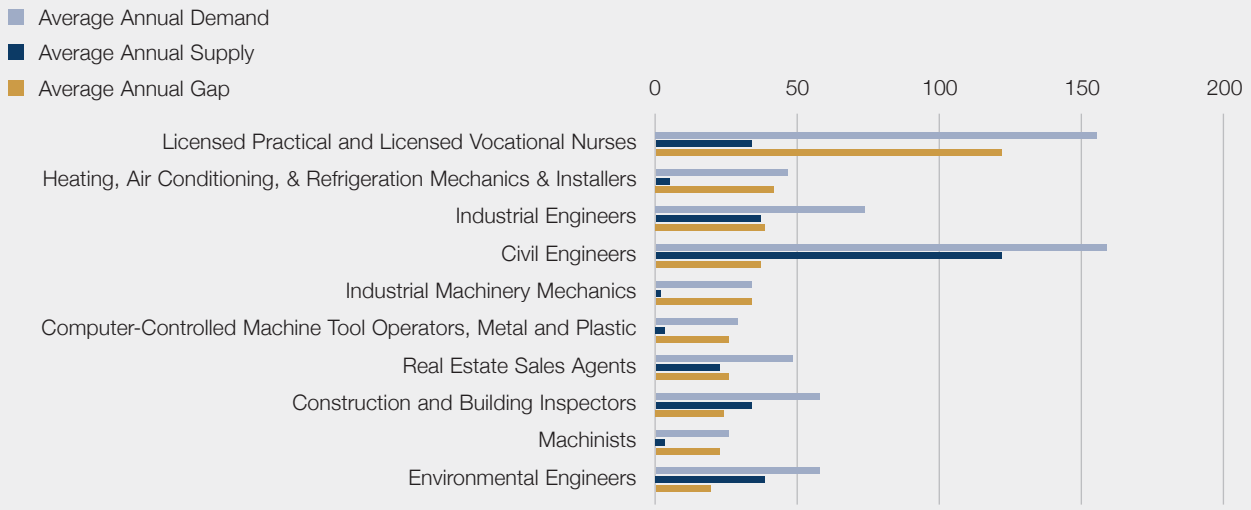
5.3 Excess Demand Gaps for Occupations Without a West Chester University Match

The breadth of programs offered at West Chester University indicates a number of strong linkages to occupations. However, many occupations within WCU's workforce region show excess demand for which West Chester 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 West Chester University. Licensed practical and licensed vocational nurses show the largest excess annual demand gap at 122. This is followed by: HVAC and refrigeration mechanics, industrial engineers, civil engineers, and industrial machinery mechanics.

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 West Chester University's Workforce Region Without a State System Program



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 West Chester University's Workforce Region Without a State System Program

Occupation Title	Job Zone	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio
Licensed Practical and Licensed Vocational Nurses	3	155	33	122	0.21
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	3	46	4	42	0.09
Industrial Engineers	4	74	36	38	0.49
Civil Engineers	4	159	122	37	0.77
Industrial Machinery Mechanics	3	34	1	33	0.03
Computer-Controlled Machine Tool Operators, Metal and Plastic	3	29	3	26	0.10
Real Estate Sales Agents	3	48	23	25	0.48
Construction and Building Inspectors	3	58	34	24	0.59
Machinists	3	26	3	23	0.12
Environmental Engineers	5	57	38	19	0.67
Nuclear Engineers	4	28	9	19	0.32
Travel Agents	3	34	19	15	0.56
Printing Press Operators	3	13	1	12	0.08
Social Science Research Assistants	4	22	11	11	0.50
Structural Metal Fabricators and Fitters	3	12	1	11	0.08
Maintenance Workers, Machinery	3	9	0	9	0.00
Medical Equipment Repairers	3	11	2	9	0.18
Stationary Engineers and Boiler Operators	3	13	5	8	0.38
Water and Wastewater Treatment Plant and System Operators	3	9	1	8	0.11
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	4	13	7	6	0.54

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 WCU'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.

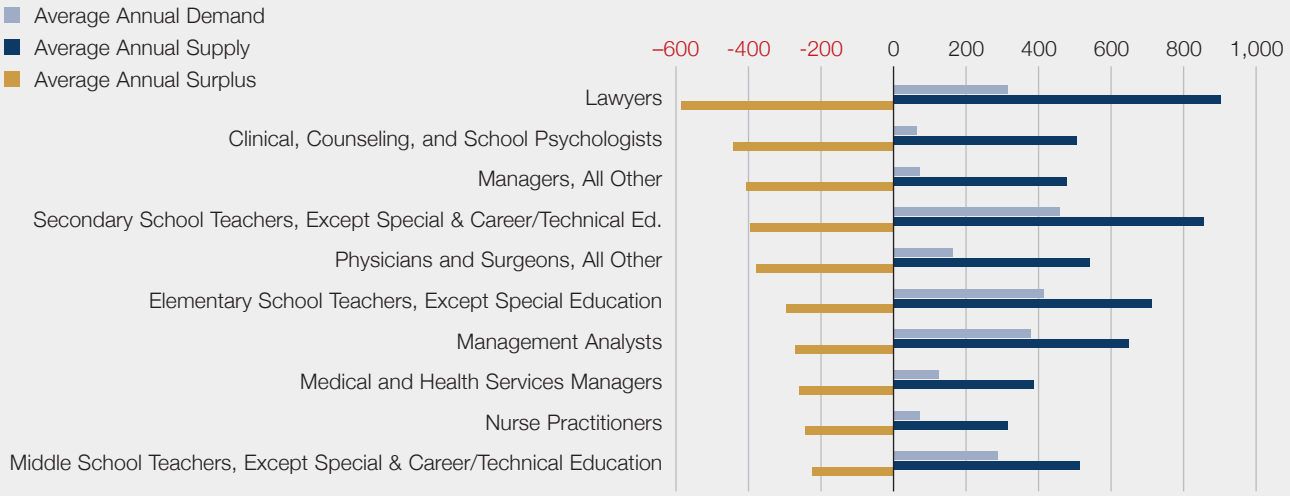
In WCU's workforce region, the data reveal the number of graduates that are aligned to education, training, and library occupations greatly exceed the annual demand for workers by a combined annual average of 1,108 completions. Other occupations that indicate a supply surplus in WCU's workforce region are concentrated in healthcare practitioner and technical occupations. Physicians and surgeons, nurse practitioners, and pharmacists combine for an average annual supply surplus of 807.

The largest supply surplus gap in the region exists for lawyers with an average annual supply surplus of 581. 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 WCU'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 WCU'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 West Chester 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 West Chester University's Workforce Region

Occupation Title	Job Zone	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio
Lawyers	5	318	899	-581	2.83
Clinical, Counseling, and School Psychologists	5	62	501	-439	8.08
Managers, All Other	4	71	476	-405	6.70
Secondary School Teachers, Except Special and Career/Technical Ed.	4	456	851	-395	1.87
Physicians and Surgeons, All Other	5	166	544	-378	3.28
Elementary School Teachers, Except Special Education	4	412	711	-299	1.73
Management Analysts	4	376	644	-268	1.71
Medical and Health Services Managers	5	125	389	-264	3.11
Nurse Practitioners	5	72	311	-239	4.32
Middle School Teachers, Except Special and Career/Technical Education	4	286	514	-228	1.80
Producers and Directors	4	53	269	-216	5.08
Computer Network Support Specialists	4	38	253	-215	6.66
Clergy	5	28	241	-213	8.61
Graphic Designers	4	127	338	-211	2.66
First-Line Supervisors of Office and Administrative Support Workers	3	300	499	-199	1.66
Education Administrators, Elementary and Secondary School	5	66	263	-197	3.98
Pharmacists	5	170	360	-190	2.12
Health Specialties Teachers, Postsecondary	5	59	245	-186	4.15
Education Administrators, Postsecondary	5	52	237	-185	4.56
Police and Sheriff's Patrol Officers	3	159	339	-180	2.13

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[18] and underemployment,[19] 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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18 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."

19 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.

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:

Dr. Sue Mukherjee
Executive Director for Program Alignment and Policy Development
Phone: (717) 720-4201
Email: SMukherjee@passhe.edu

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.ces.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

O*NET Resource Center (O*NET)

- Job Zones – www.onetonline.org/help/online/zones

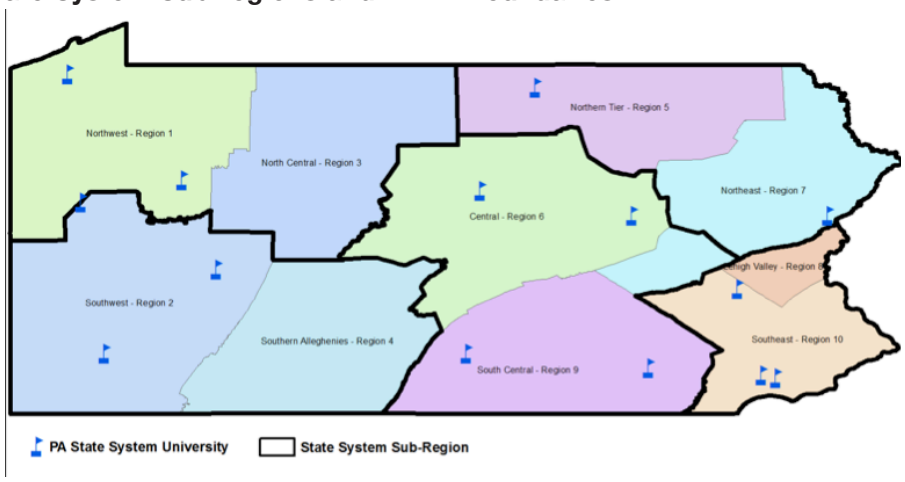
Economic Modeling Specialists International (EMSI)

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

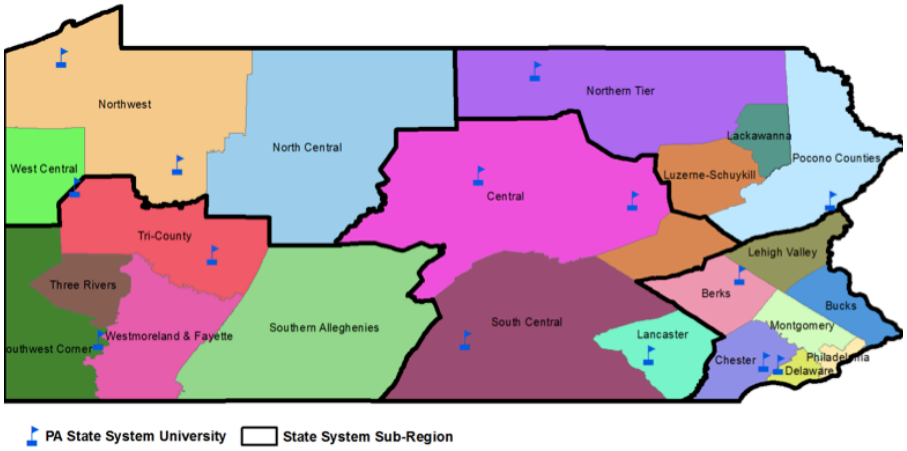
Partnerships for Regional Economic Performance (PREP) regions provide geographic context of how the Pennsylvania Department of Community & Economic Development divides resources and services to support business development, start-ups, investment and other economic development initiatives. To define sub-regions 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.[20]

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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20 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.

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[21]

	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 traditionalsupply/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.

21 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 WCU'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
Total	**All Industries**	**1.0**	**1,879,500**	**2,074,019**	**10.3%**
1111	Oilseed and Grain Farming	0.1	66	71	7.6%
1112	Vegetable and Melon Farming	0.1	133	132	-0.8%
1113	Fruit and Tree Nut Farming	0.0	115	128	11.3%
1114	Greenhouse, Nursery, and Floriculture Production	2.5	4,946	4,716	-4.7%
1119	Other Crop Farming	0.1	63	71	12.7%
1121	Cattle Ranching and Farming	0.1	156	177	13.5%
1122	Hog and Pig Farming	0.0	6	7	16.7%
1123	Poultry and Egg Production	0.1	71	84	18.3%
1124	Sheep and Goat Farming	0.4	9	10	11.1%
1125	Aquaculture	0.2	16	15	-6.3%
1129	Other Animal Production	0.6	156	171	9.6%
1132	Forest Nurseries and Gathering of Forest Products	0.2	6	6	0.0%
1133	Logging	0.0	0	0	0.0%
1142	Hunting and Trapping	0.2	6	6	0.0%
1151	Support Activities for Crop Production	0.2	811	1,012	24.8%
1152	Support Activities for Animal Production	0.5	185	182	-1.6%
1153	Support Activities for Forestry	0.0	0	0	0.0%
2111	Oil and Gas Extraction	0.0	78	91	16.7%
2121	Coal Mining	0.0	0	0	0.0%
2123	Nonmetallic Mineral Mining and Quarrying	0.4	471	467	-0.8%
2131	Support Activities for Mining	0.0	56	71	26.8%
2211	Electric Power Generation, Transmission and Distribution	0.6	4,148	4,049	-2.4%
2212	Natural Gas Distribution	0.8	1,227	1,248	1.7%
2213	Water, Sewage and Other Systems	0.8	2,390	2,396	0.3%

NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
2361	Residential Building Construction	0.9	7,933	10,241	29.1%
2362	Nonresidential Building Construction	0.7	6,706	8,131	21.2%
2371	Utility System Construction	0.9	5,583	7,326	31.2%
2372	Land Subdivision	0.5	288	317	10.1%
2373	Highway, Street, and Bridge Construction	1.1	5,733	6,869	19.8%
2379	Other Heavy and Civil Engineering Construction	0.3	508	619	21.9%
2381	Foundation, Structure, and Building Exterior Contractors	0.7	7,200	8,536	18.6%
2382	Building Equipment Contractors	0.9	22,582	27,857	23.4%
2383	Building Finishing Contractors	0.8	7,973	9,214	15.6%
2389	Other Specialty Trade Contractors	0.9	6,883	8,497	23.4%
3111	Animal Food Manufacturing	0.3	188	198	5.3%
3112	Grain and Oilseed Milling	0.1	56	49	-12.5%
3113	Sugar and Confectionery Product Manufacturing	1.1	1,080	1,121	3.8%
3114	Fruit and Vegetable Preserving and Specialty Food Manufacturing	0.3	611	541	-11.5%
3115	Dairy Product Manufacturing	0.5	911	939	3.1%
3116	Animal Slaughtering and Processing	0.8	5,120	5,594	9.3%
3117	Seafood Product Preparation and Packaging	0.2	86	98	14.0%
3118	Bakeries and Tortilla Manufacturing	1.1	4,291	3,875	-9.7%
3119	Other Food Manufacturing	0.5	1,400	1,472	5.1%
3121	Beverage Manufacturing	0.5	1,446	1,551	7.3%
3122	Tobacco Manufacturing	2.0	372	340	-8.6%
3131	Fiber, Yarn, and Thread Mills	0.3	112	86	-23.2%
3132	Fabric Mills	0.9	679	481	-29.2%
3133	Textile and Fabric Finishing and Fabric Coating Mills	0.8	357	235	-34.2%
3141	Textile Furnishings Mills	0.4	264	227	-14.0%
3149	Other Textile Product Mills	0.8	732	684	-6.6%
3151	Apparel Knitting Mills	0.3	59	59	0.0%
3152	Cut and Sew Apparel Manufacturing	0.7	1,125	1,017	-9.6%
3159	Apparel Accessories and Other Apparel Manufacturing	0.5	79	84	6.3%
3161	Leather and Hide Tanning and Finishing	3.2	199	233	17.1%
3162	Footwear Manufacturing	0.1	15	18	20.0%
3169	Other Leather and Allied Product Manufacturing	0.1	17	19	11.8%
3211	Sawmills and Wood Preservation	0.0	44	54	22.7%
3212	Veneer, Plywood, and Engineered Wood Product Manufacturing	0.2	183	203	10.9%
3219	Other Wood Product Manufacturing	0.4	1,018	1,129	10.9%
3221	Pulp, Paper, and Paperboard Mills	0.7	1,016	1,021	0.5%
3222	Converted Paper Product Manufacturing	1.3	4,683	4,532	-3.2%
3231	Printing and Related Support Activities	1.2	7,565	7,099	-6.2%

NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
3241	Petroleum and Coal Products Manufacturing	1.1	1,639	1,506	-8.1%
3251	Basic Chemical Manufacturing	1.0	2,037	1,935	-5.0%
3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	0.9	1,172	1,201	2.5%
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	0.4	213	200	-6.1%
3254	Pharmaceutical and Medicine Manufacturing	3.4	13,228	12,021	-9.1%
3255	Paint, Coating, and Adhesive Manufacturing	0.8	692	781	12.9%
3256	Soap, Cleaning Compound, and Toilet Preparation Manufacturing	2.2	3,179	3,052	-4.0%
3259	Other Chemical Product and Preparation Manufacturing	1.2	1,382	1,394	0.9%
3261	Plastics Product Manufacturing	0.5	4,071	4,535	11.4%
3262	Rubber Product Manufacturing	0.3	571	627	9.8%
3271	Clay Product and Refractory Manufacturing	0.1	80	78	-2.5%
3272	Glass and Glass Product Manufacturing	0.5	546	583	6.8%
3273	Cement and Concrete Product Manufacturing	0.6	1,395	1,523	9.2%
3274	Lime and Gypsum Product Manufacturing	0.2	36	44	22.2%
3279	Other Nonmetallic Mineral Product Manufacturing	0.5	526	567	7.8%
3311	Iron and Steel Mills and Ferroalloy Manufacturing	0.5	660	732	10.9%
3312	Steel Product Manufacturing from Purchased Steel	2.0	1,656	1,641	-0.9%
3313	Alumina and Aluminum Production and Processing	0.4	283	354	25.1%
3314	Nonferrous Metal (except Aluminum) Production and Processing	0.5	418	453	8.4%
3315	Foundries	0.1	245	260	6.1%
3321	Forging and Stamping	0.3	383	419	9.4%
3322	Cutlery and Handtool Manufacturing	0.6	312	319	2.2%
3323	Architectural and Structural Metals Manufacturing	0.8	3,838	4,510	17.5%
3324	Boiler, Tank, and Shipping Container Manufacturing	0.4	502	444	-11.6%
3325	Hardware Manufacturing	0.3	102	104	2.0%
3326	Spring and Wire Product Manufacturing	0.8	458	530	15.7%
3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	1.1	5,502	5,621	2.2%
3328	Coating, Engraving, Heat Treating, and Allied Activities	0.6	1,054	1,138	8.0%
3329	Other Fabricated Metal Product Manufacturing	0.7	2,624	2,852	8.7%
3331	Agriculture, Construction, and Mining Machinery Manufacturing	0.1	422	394	-6.6%
3332	Industrial Machinery Manufacturing	0.8	1,176	1,232	4.8%
3333	Commercial and Service Industry Machinery Manufacturing	0.9	1,091	942	-13.7%
3334	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	0.5	854	868	1.6%
3335	Metalworking Machinery Manufacturing	0.4	979	890	-9.1%
3336	Engine, Turbine, and Power Transmission Equipment Manufacturing	0.2	229	208	-9.2%
3339	Other General Purpose Machinery Manufacturing	0.8	2,880	2,749	-4.5%
3341	Computer and Peripheral Equipment Manufacturing	0.3	655	574	-12.4%

NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
3342	Communications Equipment Manufacturing	1.0	1,252	1,164	-7.0%
3343	Audio and Video Equipment Manufacturing	0.5	147	110	-25.2%
3344	Semiconductor and Other Electronic Component Manufacturing	0.5	2,483	2,458	-1.0%
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	0.9	4,611	4,387	-4.9%
3346	Manufacturing and Reproducing Magnetic and Optical Media	2.9	677	686	1.3%
3351	Electric Lighting Equipment Manufacturing	1.2	759	675	-11.1%
3352	Household Appliance Manufacturing	0.5	393	419	6.6%
3353	Electrical Equipment Manufacturing	0.4	806	920	14.1%
3359	Other Electrical Equipment and Component Manufacturing	0.6	965	983	1.9%
3361	Motor Vehicle Manufacturing	0.0	122	149	22.1%
3362	Motor Vehicle Body and Trailer Manufacturing	0.2	414	510	23.2%
3363	Motor Vehicle Parts Manufacturing	0.4	3,332	3,115	-6.5%
3364	Aerospace Product and Parts Manufacturing	0.9	6,255	5,247	-16.1%
3365	Railroad Rolling Stock Manufacturing	5.4	2,025	2,452	21.1%
3366	Ship and Boat Building	0.3	699	771	10.3%
3369	Other Transportation Equipment Manufacturing	1.7	770	928	20.5%
3371	Household and Institutional Furniture and Kitchen Cabinet Manufacturing	0.4	1,268	1,459	15.1%
3372	Office Furniture (including Fixtures) Manufacturing	1.5	2,136	2,321	8.7%
3379	Other Furniture Related Product Manufacturing	0.3	147	133	-9.5%
3391	Medical Equipment and Supplies Manufacturing	0.9	3,611	3,617	0.2%
3399	Other Miscellaneous Manufacturing	1.0	3,773	3,361	-10.9%
4231	Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers	1.1	5,063	5,271	4.1%
4232	Furniture and Home Furnishing Merchant Wholesalers	0.9	1,252	1,260	0.6%
4233	Lumber and Other Construction Materials Merchant Wholesalers	0.8	2,235	2,313	3.5%
4234	Professional and Commercial Equipment and Supplies Merchant Wholesalers	1.2	10,028	9,736	-2.9%
4235	Metal and Mineral (except Petroleum) Merchant Wholesalers	0.9	1,595	1,704	6.8%
4236	Household Appliances and Electrical and Electronic Goods Merchant Wholesalers	0.9	3,923	3,659	-6.7%
4237	Hardware, and Plumbing and Heating Equipment and Supplies Merchant Wholesalers	1.0	3,346	3,744	11.9%
4238	Machinery, Equipment, and Supplies Merchant Wholesalers	0.7	6,293	6,974	10.8%
4239	Miscellaneous Durable Goods Merchant Wholesalers	0.7	3,079	3,948	28.2%
4241	Paper and Paper Product Merchant Wholesalers	1.3	2,209	2,276	3.0%
4242	Drugs and Druggists' Sundries Merchant Wholesalers	2.0	5,349	5,048	-5.6%
4243	Apparel, Piece Goods, and Notions Merchant Wholesalers	1.1	2,126	2,176	2.4%
4244	Grocery and Related Product Merchant Wholesalers	0.7	7,327	7,728	5.5%
4245	Farm Product Raw Material Merchant Wholesalers	0.1	114	116	1.8%
4246	Chemical and Allied Products Merchant Wholesalers	0.9	1,608	1,757	9.3%

NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
4247	Petroleum and Petroleum Products Merchant Wholesalers	0.4	482	505	4.8%
4248	Beer, Wine, and Distilled Alcoholic Beverage Merchant Wholesalers	0.5	1,372	1,485	8.2%
4249	Miscellaneous Nondurable Goods Merchant Wholesalers	0.6	2,537	2,405	-5.2%
4251	Wholesale Electronic Markets and Agents and Brokers	1.9	23,062	23,482	1.8%
4411	Automobile Dealers	0.9	14,860	17,044	14.7%
4412	Other Motor Vehicle Dealers	0.4	802	859	7.1%
4413	Automotive Parts, Accessories, and Tire Stores	0.6	4,090	4,559	11.5%
4421	Furniture Stores	0.9	2,742	2,802	2.2%
4422	Home Furnishings Stores	0.8	2,757	2,837	2.9%
4431	Electronics and Appliance Stores	0.9	5,976	5,824	-2.5%
4441	Building Material and Supplies Dealers	0.7	10,581	11,139	5.3%
4442	Lawn and Garden Equipment and Supplies Stores	0.7	1,475	1,468	-0.5%
4451	Grocery Stores	1.2	43,983	47,241	7.4%
4452	Specialty Food Stores	1.3	4,219	4,306	2.1%
4453	Beer, Wine, and Liquor Stores	0.8	1,648	1,895	15.0%
4461	Health and Personal Care Stores	1.2	16,195	17,017	5.1%
4471	Gasoline Stations	0.5	6,628	7,400	11.6%
4481	Clothing Stores	1.1	16,251	15,445	-5.0%
4482	Shoe Stores	1.2	3,404	3,405	0.0%
4483	Jewelry, Luggage, and Leather Goods Stores	1.0	1,968	1,890	-4.0%
4511	Sporting Goods, Hobby, and Musical Instrument Stores	0.9	6,271	6,523	4.0%
4512	Book Stores and News Dealers	1.1	1,320	1,230	-6.8%
4521	Department Stores	0.9	17,871	15,462	-13.5%
4529	Other General Merchandise Stores	0.5	11,210	13,585	21.2%
4531	Florists	1.3	1,100	843	-23.4%
4532	Office Supplies, Stationery, and Gift Stores	0.9	3,810	3,423	-10.2%
4533	Used Merchandise Stores	0.7	1,674	1,815	8.4%
4539	Other Miscellaneous Store Retailers	1.0	4,366	4,896	12.1%
4541	Electronic Shopping and Mail-Order Houses	1.6	7,078	8,409	18.8%
4542	Vending Machine Operators	1.0	506	405	-20.0%
4543	Direct Selling Establishments	1.5	2,755	2,810	2.0%
4811	Scheduled Air Transportation	1.6	8,867	9,503	7.2%
4812	Nonscheduled Air Transportation	0.1	67	82	22.4%
4831	Deep Sea, Coastal, and Great Lakes Water Transportation	0.4	220	199	-9.5%
4832	Inland Water Transportation	0.1	28	35	25.0%
4841	General Freight Trucking	0.4	5,384	6,730	25.0%
4842	Specialized Freight Trucking	0.5	3,151	3,946	25.2%
4851	Urban Transit Systems	0.4	1,131	1,169	3.4%

NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
4852	Interurban and Rural Bus Transportation	0.7	230	240	4.3%
4853	Taxi and Limousine Service	1.1	1,199	1,239	3.3%
4854	School and Employee Bus Transportation	2.3	7,713	8,846	14.7%
4855	Charter Bus Industry	1.1	438	493	12.6%
4859	Other Transit and Ground Passenger Transportation	1.6	2,098	2,239	6.7%
4861	Pipeline Transportation of Crude Oil	0.0	0	0	0.0%
4862	Pipeline Transportation of Natural Gas	0.3	113	137	21.2%
4869	Other Pipeline Transportation	2.0	220	246	11.8%
4871	Scenic and Sightseeing Transportation, Land	1.2	231	192	-16.9%
4872	Scenic and Sightseeing Transportation, Water	0.7	139	168	20.9%
4879	Scenic and Sightseeing Transportation, Other	0.0	0	0	0.0%
4881	Support Activities for Air Transportation	0.7	2,193	2,733	24.6%
4882	Support Activities for Rail Transportation	0.8	340	381	12.1%
4883	Support Activities for Water Transportation	5.6	7,777	7,720	-0.7%
4884	Support Activities for Road Transportation	0.9	1,317	1,765	34.0%
4885	Freight Transportation Arrangement	0.7	1,910	2,067	8.2%
4889	Other Support Activities for Transportation	0.5	226	234	3.5%
4911	Postal Service	1.1	9,216	6,654	-27.8%
4921	Couriers and Express Delivery Services	1.3	9,271	10,720	15.6%
4922	Local Messengers and Local Delivery	0.7	535	603	12.7%
4931	Warehousing and Storage	0.7	7,601	8,548	12.5%
5111	Newspaper, Periodical, Book, and Directory Publishers	1.3	7,404	5,771	-22.1%
5112	Software Publishers	0.5	2,126	2,297	8.0%
5121	Motion Picture and Video Industries	0.5	2,601	2,621	0.8%
5122	Sound Recording Industries	0.7	160	151	-5.6%
5151	Radio and Television Broadcasting	1.0	3,010	3,090	2.7%
5152	Cable and Other Subscription Programming	0.1	88	86	-2.3%
5171	Wired Telecommunications Carriers	1.2	10,202	8,853	-13.2%
5172	Wireless Telecommunications Carriers (except Satellite)	0.5	1,002	809	-19.3%
5174	Satellite Telecommunications	0.6	77	68	-11.7%
5179	Other Telecommunications	0.7	790	733	-7.2%
5182	Data Processing, Hosting, and Related Services	1.1	4,363	3,821	-12.4%
5191	Other Information Services	0.9	4,273	4,822	12.8%
5211	Monetary Authorities-Central Bank	0.4	96	77	-19.8%
5221	Depository Credit Intermediation	0.9	20,105	17,877	-11.1%
5222	Nondepository Credit Intermediation	0.8	6,115	5,905	-3.4%
5223	Activities Related to Credit Intermediation	0.6	2,243	2,502	11.5%
5231	Securities and Commodity Contracts Intermediation and Brokerage	0.9	5,429	6,544	20.5%

NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
5232	Securities and Commodity Exchanges	1.5	142	179	26.1%
5239	Other Financial Investment Activities	3.7	22,048	29,789	35.1%
5241	Insurance Carriers	2.0	32,176	34,464	7.1%
5242	Agencies, Brokerages, and Other Insurance Related Activities	1.4	19,879	23,606	18.7%
5251	Insurance and Employee Benefit Funds	2.8	86	69	-19.8%
5259	Other Investment Pools and Funds	17.7	857	1,090	27.2%
5311	Lessors of Real Estate	1.0	8,214	8,822	7.4%
5312	Offices of Real Estate Agents and Brokers	0.9	3,398	3,618	6.5%
5313	Activities Related to Real Estate	0.8	6,935	8,071	16.4%
5321	Automotive Equipment Rental and Leasing	1.0	2,670	2,851	6.8%
5322	Consumer Goods Rental	0.6	1,306	1,526	16.8%
5323	General Rental Centers	0.7	360	412	14.4%
5324	Commercial and Industrial Machinery and Equipment Rental and Leasing	1.2	2,277	2,980	30.9%
5331	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	1.0	319	346	8.5%
5411	Legal Services	1.7	25,937	27,481	6.0%
5412	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	1.1	15,126	16,307	7.8%
5413	Architectural, Engineering, and Related Services	1.0	20,008	22,024	10.1%
5414	Specialized Design Services	1.4	2,461	3,251	32.1%
5415	Computer Systems Design and Related Services	1.5	36,459	47,933	31.5%
5416	Management, Scientific, and Technical Consulting Services	1.5	26,125	31,247	19.6%
5417	Scientific Research and Development Services	1.9	17,502	19,761	12.9%
5418	Advertising, Public Relations, and Related Services	1.2	7,854	8,932	13.7%
5419	Other Professional, Scientific, and Technical Services	1.3	11,241	13,838	23.1%
5511	Management of Companies and Enterprises	1.6	46,464	53,879	16.0%
5611	Office Administrative Services	0.2	1,327	1,333	0.5%
5612	Facilities Support Services	1.4	2,728	3,622	32.8%
5613	Employment Services	0.7	31,401	41,597	32.5%
5614	Business Support Services	0.7	8,565	7,917	-7.6%
5615	Travel Arrangement and Reservation Services	1.1	3,073	3,205	4.3%
5616	Investigation and Security Services	1.3	15,388	17,973	16.8%
5617	Services to Buildings and Dwellings	1.2	31,791	35,237	10.8%
5619	Other Support Services	1.7	6,974	8,492	21.8%
5621	Waste Collection	1.2	2,653	3,175	19.7%
5622	Waste Treatment and Disposal	0.5	829	961	15.9%
5629	Remediation and Other Waste Management Services	0.9	1,722	2,204	28.0%
6111	Elementary and Secondary Schools	0.9	95,030	93,081	-2.1%
6112	Junior Colleges	0.6	5,456	5,302	-2.8%
6113	Colleges, Universities, and Professional Schools	1.5	59,440	61,522	3.5%

NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
6114	Business Schools and Computer and Management Training	0.8	777	811	4.4%
6115	Technical and Trade Schools	0.9	1,791	2,048	14.3%
6116	Other Schools and Instruction	1.2	6,064	6,946	14.5%
6117	Educational Support Services	1.7	3,375	3,789	12.3%
6211	Offices of Physicians	1.0	34,934	37,785	8.2%
6212	Offices of Dentists	1.0	11,862	12,916	8.9%
6213	Offices of Other Health Practitioners	1.0	11,083	14,114	27.3%
6214	Outpatient Care Centers	1.2	12,822	15,506	20.9%
6215	Medical and Diagnostic Laboratories	1.4	4,912	5,987	21.9%
6216	Home Health Care Services	1.0	17,132	27,129	58.4%
6219	Other Ambulatory Health Care Services	1.7	6,943	9,065	30.6%
6221	General Medical and Surgical Hospitals	1.1	81,076	87,344	7.7%
6222	Psychiatric and Substance Abuse Hospitals	1.5	4,932	5,771	17.0%
6223	Specialty (except Psychiatric and Substance Abuse) Hospitals	5.0	17,014	23,939	40.7%
6231	Nursing Care Facilities (Skilled Nursing Facilities)	1.1	26,577	30,447	14.6%
6232	Residential Intellectual and Developmental Disability, Mental Health, and Substance Abuse Facilities	2.0	19,531	23,131	18.4%
6233	Continuing Care Retirement Communities and Assisted Living Facilities for the Elderly	2.0	23,750	28,815	21.3%
6239	Other Residential Care Facilities	0.8	1,889	1,997	5.7%
6241	Individual and Family Services	1.5	44,038	60,060	36.4%
6242	Community Food and Housing, and Emergency and Other Relief Services	1.5	3,086	3,608	16.9%
6243	Vocational Rehabilitation Services	0.7	3,147	3,518	11.8%
6244	Child Day Care Services	1.5	17,134	20,380	18.9%
7111	Performing Arts Companies	1.1	1,722	1,831	6.3%
7112	Spectator Sports	1.3	2,512	2,886	14.9%
7113	Promoters of Performing Arts, Sports, and Similar Events	1.3	2,297	2,720	18.4%
7114	Agents and Managers for Artists, Athletes, Entertainers, and Other Public Figures	0.3	79	86	8.9%
7115	Independent Artists, Writers, and Performers	0.8	558	609	9.1%
7121	Museums, Historical Sites, and Similar Institutions	1.1	3,651	3,946	8.1%
7131	Amusement Parks and Arcades	0.8	2,024	2,094	3.5%
7132	Gambling Industries	0.9	3,161	3,413	8.0%
7139	Other Amusement and Recreation Industries	1.0	17,677	19,850	12.3%
7211	Traveler Accommodation	0.5	14,023	15,464	10.3%
7212	RV (Recreational Vehicle) Parks and Recreational Camps	0.4	306	299	-2.3%
7213	Rooming and Boarding Houses	0.5	86	108	25.6%
7223	Special Food Services	1.7	14,784	15,789	6.8%
7224	Drinking Places (Alcoholic Beverages)	1.1	5,330	5,589	4.9%
7225	Restaurants and Other Eating Places	0.8	103,342	115,434	11.7%

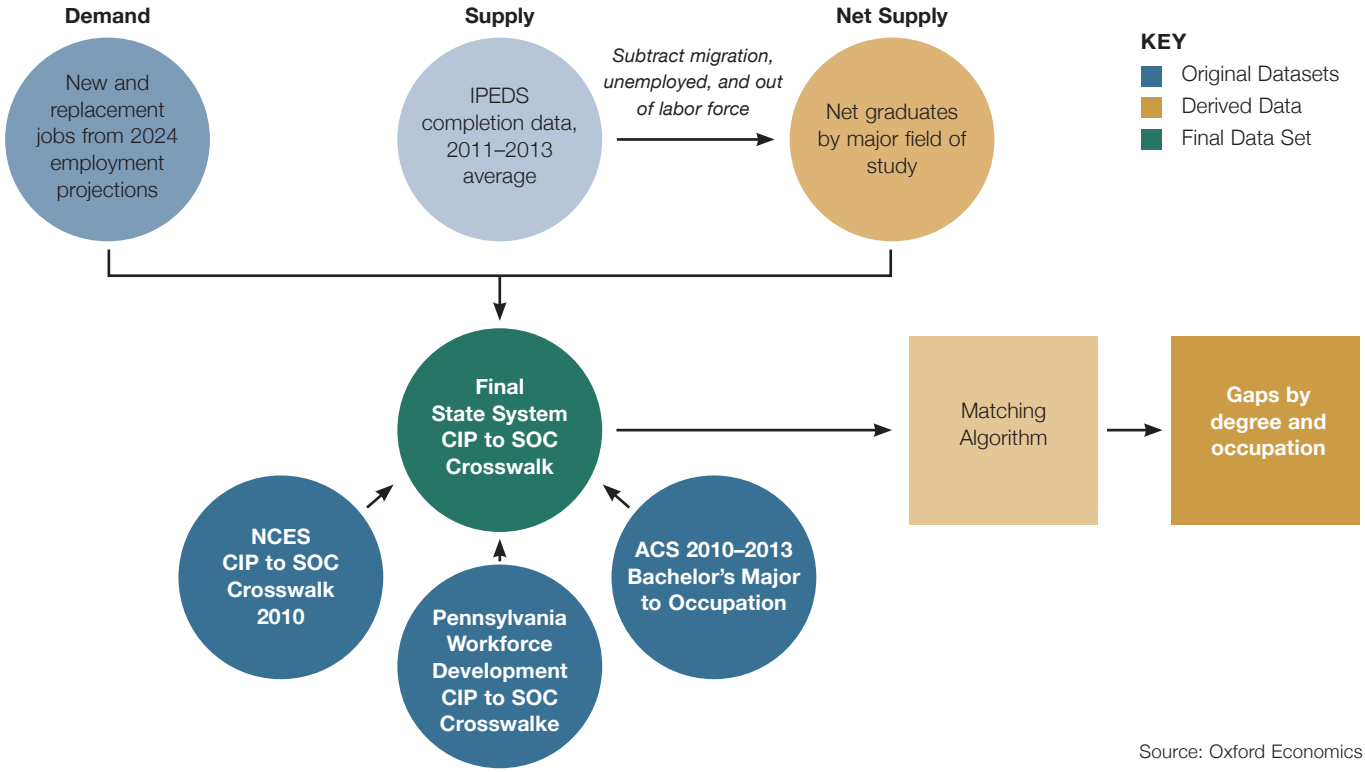
NAICS Code	Industry Title	2014 LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
8111	Automotive Repair and Maintenance	1.0	11,451	12,501	9.2%
8112	Electronic and Precision Equipment Repair and Maintenance	1.0	1,411	1,526	8.2%
8113	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	0.5	1,514	1,690	11.6%
8114	Personal and Household Goods Repair and Maintenance	0.6	584	551	-5.7%
8121	Personal Care Services	1.7	14,783	18,090	22.4%
8122	Death Care Services	0.9	1,704	1,833	7.6%
8123	Drycleaning and Laundry Services	0.8	3,179	3,405	7.1%
8129	Other Personal Services	1.6	6,477	7,401	14.3%
8131	Religious Organizations	1.2	2,974	3,385	13.8%
8132	Grantmaking and Giving Services	1.5	2,755	3,084	11.9%
8133	Social Advocacy Organizations	1.2	3,416	3,901	14.2%
8134	Civic and Social Organizations	1.6	8,557	9,401	9.9%
8139	Business, Professional, Labor, Political, and Similar Organizations	1.1	6,539	7,277	11.3%
8141	Private Households	0.6	2,285	2,267	-0.8%
9211	Executive, Legislative, and Other General Government Support	0.7	28,577	27,966	-2.1%
9221	Justice, Public Order, and Safety Activities	0.9	24,231	22,715	-6.3%
9231	Administration of Human Resource Programs	0.7	7,553	7,181	-4.9%
9241	Administration of Environmental Quality Programs	0.5	2,303	2,216	-3.8%
9251	Administration of Housing Programs, Urban Planning, and Community Development	2.0	2,301	2,246	-2.4%
9261	Administration of Economic Programs	0.5	4,007	3,689	-7.9%
9281	National Security and International Affairs	0.9	7,079	6,519	-7.9%

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

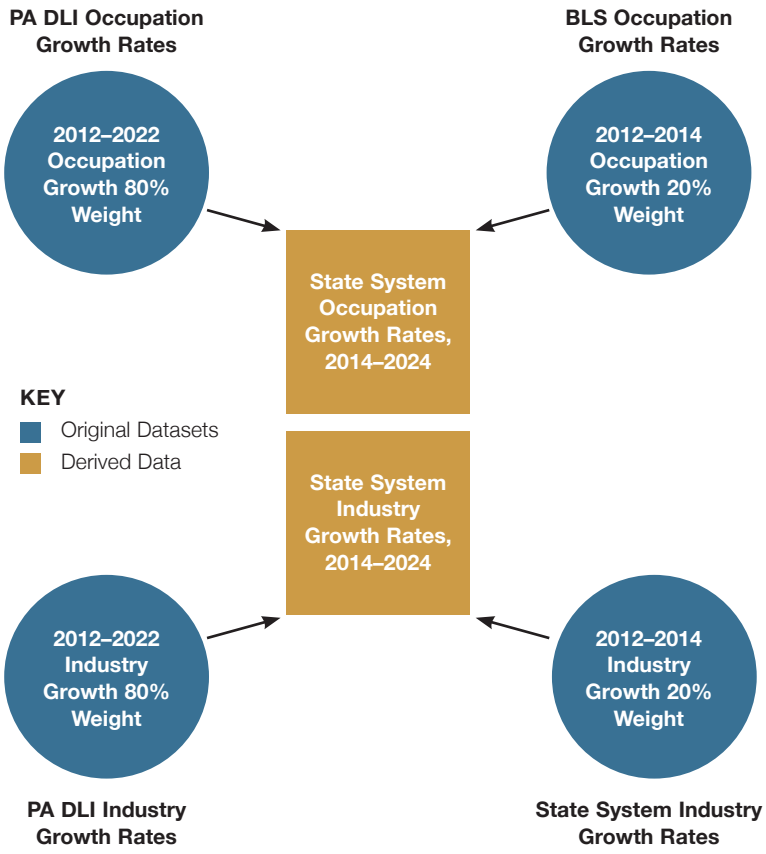


Source: Oxford Economics

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



APPENDIX F: GAP ANALYSIS RESULTS

The following table provides the results of the gap analysis for all detailed occupations in WCU'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		72	65	7	0.90	0	0	0	61	33	28	11	32	-21
11-1021	General and Operations Managers	4		539	586	-47	1.09	0	0	0	409	217	192	130	370	-240
11-2011	Advertising and Promotions Managers	4		4	6	-2	1.50	0	0	0	4	6	-2	0	0	0
11-2021	Marketing Managers	4		61	88	-27	1.44	0	0	0	52	63	-11	8	25	-17
11-2022	Sales Managers	4		74	107	-33	1.45	0	0	0	64	76	-12	10	30	-20
11-2031	Public Relations and Fundraising Managers	4		15	36	-21	2.40	0	0	0	9	15	-6	6	21	-15
11-3011	Administrative Services Managers	3		24	12	12	0.50	0	0	0	24	12	12	0	0	0
11-3021	Computer and Information Systems Managers	4		194	271	-77	1.40	0	0	0	119	55	64	76	216	-140
11-3031	Financial Managers	4		90	122	-32	1.36	0	0	0	58	31	27	32	91	-59
11-3051	Industrial Production Managers	4		17	18	-1	1.06	0	0	0	14	7	7	3	11	-8
11-3061	Purchasing Managers	4		7	7	0	1.00	0	0	0	5	3	2	1	4	-3
11-3071	Transportation, Storage, and Distribution Managers	4		18	9	9	0.50	0	0	0	18	9	9	0	0	0
11-3111	Compensation and Benefits Managers	4		3	2	1	0.67	0	0	0	3	2	1	0	0	0
11-3121	Human Resources Managers	4		46	74	-28	1.61	0	0	0	24	12	12	22	62	-40
11-3131	Training and Development Managers	4		15	23	-8	1.53	0	0	0	9	5	4	6	18	-12
11-9021	Construction Managers	4		43	25	18	0.58	0	0	0	43	25	18	0	0	0
11-9031	Education Administrators, Preschool and Childcare Center/Program	4		31	93	-62	3.00	0	0	0	9	5	4	22	88	-66
11-9032	Education Administrators, Elementary and Secondary School	5		66	263	-197	3.98	0	0	0	0	0	0	66	263	-197
11-9033	Education Administrators, Postsecondary	5		52	237	-185	4.56	0	0	0	0	0	0	52	237	-185
11-9039	Education Administrators, All Other	5		14	58	-44	4.14	0	0	0	4	2	2	10	56	-46
11-9041	Architectural and Engineering Managers	5		52	124	-72	2.38	0	0	0	29	28	1	23	96	-73
11-9051	Food Service Managers	3		23	102	-79	4.43	8	52	-44	15	50	-35	0	0	0
11-9061	Funeral Service Managers	3		2	1	1	0.50	0	0	0	2	1	1	0	0	0
11-9071	Gaming Managers	3		2	1	1	0.50	0	0	0	2	1	1	0	0	0
11-9081	Lodging Managers	3		11	41	-30	3.73	2	12	-10	9	29	-20	0	0	0

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
11-9111	Medical and Health Services Managers	5		125	389	-264	3.11	0	0	0	76	78	-2	49	311	-262
11-9121	Natural Sciences Managers	5		29	51	-22	1.76	0	0	0	9	10	-1	20	41	-21
11-9131	Postmasters and Mail Superintendents	3		2	1	1	0.50	0	0	0	2	1	1	0	0	0
11-9141	Property, Real Estate, and Community Association Managers	4		35	18	17	0.51	0	0	0	35	18	17	0	0	0
11-9151	Social and Community Service Managers	4		80	163	-83	2.04	0	0	0	43	56	-13	37	107	-70
11-9199	Managers, All Other	4		71	476	-405	6.70	0	0	0	55	275	-220	16	201	-185
13-1021	Buyers and Purchasing Agents, Farm Products	4		3	12	-9	4.00	0	0	0	2	9	-7	2	3	-1
13-1022	Wholesale and Retail Buyers, Except Farm Products	3		23	19	4	0.83	0	0	0	23	19	4	0	0	0
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	4		71	57	14	0.80	0	0	0	56	35	21	15	22	-7
13-1031	Claims Adjusters, Examiners, and Investigators	4		162	84	78	0.52	0	0	0	162	84	78	0	0	0
13-1032	Insurance Appraisers, Auto Damage	3		13	7	6	0.54	0	0	0	13	7	6	0	0	0
13-1041	Compliance Officers	4		135	106	29	0.79	0	0	0	99	51	48	36	54	-18
13-1051	Cost Estimators	4		96	51	45	0.53	0	0	0	96	51	45	0	0	0
13-1071	Human Resources Specialists	4		253	257	-4	1.02	0	0	0	179	91	88	74	166	-92
13-1075	Labor Relations Specialists	4		20	19	1	0.95	0	0	0	14	7	7	6	12	-6
13-1081	Logisticians	4		45	34	11	0.76	0	0	0	37	19	18	8	15	-7
13-1111	Management Analysts	4		376	644	-268	1.71	0	0	0	194	101	93	182	543	-361
13-1121	Meeting, Convention, and Event Planners	4		52	94	-42	1.81	0	0	0	43	81	-38	9	14	-5
13-1131	Fundraisers	4		64	34	30	0.53	0	0	0	32	21	11	32	13	19
13-1141	Compensation, Benefits, and Job Analysis Specialists	4		19	14	5	0.74	0	0	0	16	8	8	3	6	-3
13-1151	Training and Development Specialists	4		117	112	5	0.96	0	0	0	86	44	42	31	67	-36
13-1161	Market Research Analysts and Marketing Specialists	4		506	535	-29	1.06	0	0	0	290	226	64	216	309	-93
13-1199	Business Operations Specialists, All Other	4		59	66	-7	1.12	0	0	0	41	23	18	18	43	-25
13-2011	Accountants and Auditors	4		959	806	153	0.84	0	0	0	768	427	341	191	379	-188

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
13-2021	Appraisers and Assessors of Real Estate	4		8	4	4	0.50	0	0	0	8	4	4	0	0	0
13-2031	Budget Analysts	4		40	45	-5	1.13	0	0	0	24	13	11	16	33	-17
13-2041	Credit Analysts	4		36	39	-3	1.08	0	0	0	23	12	11	13	26	-13
13-2051	Financial Analysts	4		281	269	12	0.96	0	0	0	200	110	90	81	160	-79
13-2052	Personal Financial Advisors	4		316	236	80	0.75	0	0	0	271	149	122	44	87	-43
13-2053	Insurance Underwriters	4		88	48	40	0.55	0	0	0	88	48	40	0	0	0
13-2061	Financial Examiners	4		29	32	-3	1.10	0	0	0	18	10	8	11	22	-11
13-2071	Credit Counselors	4		24	20	4	0.83	0	0	0	19	10	9	5	9	-4
13-2072	Loan Officers	3		87	47	40	0.54	0	0	0	87	47	40	0	0	0
13-2081	Tax Examiners and Collectors, and Revenue Agents	3		19	10	9	0.53	0	0	0	19	10	9	0	0	0
13-2082	Tax Preparers	3		9	6	3	0.67	2	3	-1	6	4	2	0	0	0
13-2099	Financial Specialists, All Other	4		17	16	1	0.94	0	0	0	12	7	5	5	10	-5
15-1121	Computer Systems Analysts	4		515	263	252	0.51	0	0	0	390	111	279	125	152	-27
15-1122	Information Security Analysts	4		51	29	22	0.57	0	0	0	35	9	26	16	20	-4
15-1131	Computer Programmers	4		433	180	253	0.42	0	0	0	333	89	244	100	92	8
15-1132	Software Developers, Applications	4		499	216	283	0.43	0	0	0	352	100	252	147	116	31
15-1133	Software Developers, Systems Software	4		9	7	2	0.78	0	0	0	6	2	4	3	5	-2
15-1134	Web Developers	3		59	15	44	0.25	0	0	0	59	15	44	0	0	0
15-1141	Database Administrators	4		103	55	48	0.53	0	0	0	74	21	53	28	35	-7
15-1142	Network and Computer Systems Administrators	4		47	28	19	0.60	0	0	0	37	10	27	11	18	-7
15-1143	Computer Network Architects	4		51	27	24	0.53	0	0	0	36	10	26	15	18	-3
15-1151	Computer User Support Specialists	3		310	153	157	0.49	83	92	-9	227	61	166	0	0	0
15-1152	Computer Network Support Specialists	4		38	253	-215	6.66	8	238	-230	23	6	17	7	9	-2
15-1199	Computer Occupations, All Other	4		79	47	32	0.59	0	0	0	62	16	46	18	31	-13
15-2011	Actuaries	4		44	53	-9	1.20	0	0	0	25	26	-1	19	26	-7
15-2031	Operations Research Analysts	5		58	44	14	0.76	0	0	0	40	21	19	17	23	-6
15-2041	Statisticians	5		73	102	-29	1.40	0	0	0	0	0	0	73	102	-29
17-1011	Architects, Except Landscape and Naval	4		49	148	-99	3.02	0	0	0	28	50	-22	21	98	-77

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
17-1012	Landscape Architects	4		17	52	-35	3.06	0	0	0	10	17	-7	7	35	-28
17-1021	Cartographers and Photogrammetrists	4		2	2	0	1.00	0	0	0	2	2	0	0	0	0
17-1022	Surveyors	4		20	28	-8	1.40	0	0	0	13	14	-1	6	14	-8
17-2011	Aerospace Engineers	4		34	54	-20	1.59	0	0	0	22	11	11	13	43	-30
17-2021	Agricultural Engineers	4		2	1	1	0.50	0	0	0	2	1	1	0	0	0
17-2031	Biomedical Engineers	4		14	27	-13	1.93	0	0	0	9	8	1	5	19	-14
17-2041	Chemical Engineers	4		16	28	-12	1.75	0	0	0	11	9	2	5	19	-14
17-2051	Civil Engineers	4		159	122	37	0.77	0	0	0	104	56	48	56	66	-10
17-2071	Electrical Engineers	4		81	126	-45	1.56	0	0	0	45	14	31	36	111	-75
17-2072	Electronics Engineers, Except Computer	4		6	9	-3	1.50	0	0	0	3	1	2	3	8	-5
17-2081	Environmental Engineers	5		57	38	19	0.67	0	0	0	36	28	8	22	10	12
17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	4		13	7	6	0.54	0	0	0	10	5	5	3	1	2
17-2112	Industrial Engineers	4		74	36	38	0.49	0	0	0	56	30	26	18	6	12
17-2131	Materials Engineers	4		26	39	-13	1.50	0	0	0	19	10	9	7	28	-21
17-2141	Mechanical Engineers	4		106	116	-10	1.09	0	0	0	87	48	39	19	69	-50
17-2151	Mining and Geological Engineers, Including Mining Safety Engineers	4		2	2	0	1.00	0	0	0	1	1	0	1	2	-1
17-2161	Nuclear Engineers	4		28	9	19	0.32	0	0	0	16	6	10	12	4	8
17-2199	Engineers, All Other	4		51	107	-56	2.10	0	0	0	29	18	11	22	90	-68
17-3011	Architectural and Civil Drafters	4		33	76	-43	2.30	17	48	-31	17	28	-11	0	0	0
17-3013	Mechanical Drafters	3		6	10	-4	1.67	3	9	-6	3	1	2	0	0	0
17-3019	Drafters, All Other	3		2	6	-4	3.00	1	4	-3	1	2	-1	0	0	0
17-3022	Civil Engineering Technicians	3		15	10	5	0.67	7	2	5	8	8	0	0	0	0
17-3023	Electrical and Electronics Engineering Technicians	3		5	96	-91	19.20	2	94	-92	2	2	0	0	0	0
17-3025	Environmental Engineering Technicians	4		9	5	4	0.56	4	1	3	5	3	2	0	0	0
17-3026	Industrial Engineering Technicians	3		5	13	-8	2.60	2	11	-9	3	2	1	0	0	0
17-3027	Mechanical Engineering Technicians	3		10	15	-5	1.50	5	11	-6	5	4	1	0	0	0
17-3029	Engineering Technicians, Except Drafters, All Other	3		21	34	-13	1.62	10	26	-16	11	8	3	0	0	0
19-1012	Food Scientists and Technologists	4		4	8	-4	2.00	0	0	0	2	5	-3	2	3	-1

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19-1013	Soil and Plant Scientists	5		4	5	-1	1.25	0	0	0	2	5	-3	2	0	2
19-1021	Biochemists and Biophysicists	5		72	129	-57	1.79	0	0	0	0	0	0	72	129	-57
19-1022	Microbiologists	5		39	51	-12	1.31	0	0	0	18	13	5	21	38	-17
19-1029	Biological Scientists, All Other	5		5	29	-24	5.80	0	0	0	2	23	-21	3	6	-3
19-1031	Conservation Scientists	4		8	25	-17	3.13	0	0	0	6	17	-11	2	7	-5
19-1042	Medical Scientists, Except Epidemiologists	5		173	238	-65	1.38	0	0	0	0	0	0	173	238	-65
19-1099	Life Scientists, All Other	5		2	3	-1	1.50	0	0	0	0	0	0	2	3	-1
19-2031	Chemists	4		135	135	0	1.00	0	0	0	70	50	20	64	85	-21
19-2032	Materials Scientists	5		5	4	1	0.80	0	0	0	2	2	0	2	2	0
19-2041	Environmental Scientists and Specialists, Including Health	4		71	66	5	0.93	0	0	0	42	44	-2	29	21	8
19-2042	Geoscientists, Except Hydrologists and Geographers	4		16	22	-6	1.38	0	0	0	10	10	0	7	12	-5
19-2043	Hydrologists	4		3	5	-2	1.67	0	0	0	0	0	0	3	5	-2
19-3011	Economists	5		12	24	-12	2.00	0	0	0	0	0	0	12	24	-12
19-3022	Survey Researchers	5		44	63	-19	1.43	0	0	0	0	0	0	44	63	-19
19-3031	Clinical, Counseling, and School Psychologists	5		62	501	-439	8.08	0	0	0	0	0	0	62	501	-439
19-3039	Psychologists, All Other	5		7	53	-46	7.57	0	0	0	0	0	0	7	53	-46
19-3041	Sociologists	5		1	19	-18	19.00	0	0	0	0	0	0	1	19	-18
19-3051	Urban and Regional Planners	5		27	75	-48	2.78	0	0	0	0	0	0	27	75	-48
19-3099	Social Scientists and Related Workers, All Other	4		2	44	-42	22.00	0	0	0	0	0	0	2	44	-42
19-4021	Biological Technicians	4		120	87	33	0.73	0	0	0	120	87	33	0	0	0
19-4031	Chemical Technicians	3		63	30	33	0.48	0	0	0	63	30	33	0	0	0
19-4041	Geological and Petroleum Technicians	4		1	1	0	1.00	1	1	0	0	0	0	0	0	0
19-4051	Nuclear Technicians	3		5	3	2	0.60	5	3	2	0	0	0	0	0	0
19-4061	Social Science Research Assistants	4		22	11	11	0.50	0	0	0	17	5	12	4	6	-2
19-4091	Environmental Science and Protection Technicians, Including Health	4		43	35	8	0.81	0	0	0	34	29	5	9	7	2
19-4092	Forensic Science Technicians	4		2	1	1	0.50	0	0	0	2	1	1	0	0	0
19-4093	Forest and Conservation Technicians	3		5	4	1	0.80	0	0	0	5	4	1	0	0	0

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19-4099	Life, Physical, and Social Science Technicians, All Other	3		26	19	7	0.73	0	0	0	26	19	7	0	0	0
21-1011	Substance Abuse and Behavioral Disorder Counselors	5		54	69	-15	1.28	0	0	0	20	27	-7	34	42	-8
21-1012	Educational, Guidance, School, and Vocational Counselors	5		89	176	-87	1.98	0	0	0	0	0	0	89	176	-87
21-1013	Marriage and Family Therapists	5		16	59	-43	3.69	0	0	0	0	0	0	16	59	-43
21-1014	Mental Health Counselors	5		99	122	-23	1.23	0	0	0	0	0	0	99	122	-23
21-1015	Rehabilitation Counselors	5		109	134	-25	1.23	0	0	0	0	0	0	109	134	-25
21-1019	Counselors, All Other	5		7	24	-17	3.43	0	0	0	0	0	0	7	24	-17
21-1021	Child, Family, and School Social Workers	4		204	271	-67	1.33	0	0	0	136	187	-51	68	83	-15
21-1022	Healthcare Social Workers	5		136	167	-31	1.23	0	0	0	0	0	0	136	167	-31
21-1023	Mental Health and Substance Abuse Social Workers	5		154	204	-50	1.32	0	0	0	102	141	-39	51	63	-12
21-1029	Social Workers, All Other	5		9	12	-3	1.33	0	0	0	6	8	-2	3	4	-1
21-1091	Health Educators	4		29	73	-44	2.52	0	0	0	19	28	-9	10	45	-35
21-1092	Probation Officers and Correctional Treatment Specialists	4		48	71	-23	1.48	0	0	0	34	53	-19	15	18	-3
21-1093	Social and Human Service Assistants	4		220	342	-122	1.55	37	105	-68	141	186	-45	42	51	-9
21-1094	Community Health Workers	4		11	29	-18	2.64	0	0	0	8	11	-3	4	18	-14
21-1099	Community and Social Service Specialists, All Other	4		14	19	-5	1.36	0	0	0	0	0	0	14	19	-5
21-2011	Clergy	5		28	241	-213	8.61	0	0	0	13	85	-72	16	156	-140
21-2021	Directors, Religious Activities and Education	4		38	103	-65	2.71	0	0	0	27	27	0	11	76	-65
21-2099	Religious Workers, All Other	4		1	7	-6	7.00	0	0	0	1	7	-6	0	0	0
23-1011	Lawyers	5		318	899	-581	2.83	0	0	0	0	0	0	318	899	-581
23-1012	Judicial Law Clerks	5		10	28	-18	2.80	0	0	0	0	0	0	10	28	-18
23-1021	Administrative Law Judges, Adjudicators, and Hearing Officers	5		2	6	-4	3.00	0	0	0	0	0	0	2	6	-4
23-1022	Arbitrators, Mediators, and Conciliators	5		5	16	-11	3.20	0	0	0	0	0	0	5	16	-11

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23-2011	Paralegals and Legal Assistants	3		143	224	-81	1.57	21	92	-71	122	132	-10	0	0	0
23-2091	Court Reporters	3		4	4	0	1.00	0	0	0	4	4	0	0	0	0
23-2093	Title Examiners, Abstractors, and Searchers	3		29	49	-20	1.69	5	23	-18	24	26	-2	0	0	0
23-2099	Legal Support Workers, All Other	3		1	2	-1	2.00	0	0	0	1	2	-1	0	0	0
25-1011	Business Teachers, Postsecondary	5		69	187	-118	2.71	0	0	0	0	0	0	69	187	-118
25-1021	Computer Science Teachers, Postsecondary	5		28	60	-32	2.14	0	0	0	0	0	0	28	60	-32
25-1022	Mathematical Science Teachers, Postsecondary	5		26	57	-31	2.19	0	0	0	0	0	0	26	57	-31
25-1031	Architecture Teachers, Postsecondary	5		8	37	-29	4.63	0	0	0	0	0	0	8	37	-29
25-1032	Engineering Teachers, Postsecondary	5		43	170	-127	3.95	0	0	0	0	0	0	43	170	-127
25-1042	Biological Science Teachers, Postsecondary	5		34	73	-39	2.15	0	0	0	0	0	0	34	73	-39
25-1051	Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary	5		11	24	-13	2.18	0	0	0	0	0	0	11	24	-13
25-1052	Chemistry Teachers, Postsecondary	5		19	42	-23	2.21	0	0	0	0	0	0	19	42	-23
25-1053	Environmental Science Teachers, Postsecondary	5		2	5	-3	2.50	0	0	0	0	0	0	2	5	-3
25-1054	Physics Teachers, Postsecondary	5		14	33	-19	2.36	0	0	0	0	0	0	14	33	-19
25-1061	Anthropology and Archeology Teachers, Postsecondary	5		2	19	-17	9.50	0	0	0	0	0	0	2	19	-17
25-1062	Area, Ethnic, and Cultural Studies Teachers, Postsecondary	5		5	40	-35	8.00	0	0	0	0	0	0	5	40	-35
25-1063	Economics Teachers, Postsecondary	5		16	36	-20	2.25	0	0	0	0	0	0	16	36	-20
25-1064	Geography Teachers, Postsecondary	5		4	12	-8	3.00	0	0	0	0	0	0	4	12	-8
25-1065	Political Science Teachers, Postsecondary	5		13	48	-35	3.69	0	0	0	0	0	0	13	48	-35
25-1066	Psychology Teachers, Postsecondary	5		25	196	-171	7.84	0	0	0	0	0	0	25	196	-171
25-1067	Sociology Teachers, Postsecondary	5		22	52	-30	2.36	0	0	0	0	0	0	22	52	-30
25-1069	Social Sciences Teachers, Postsecondary, All Other	5		8	20	-12	2.50	0	0	0	0	0	0	8	20	-12

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25-1071	Health Specialties Teachers, Postsecondary	5		59	245	-186	4.15	0	0	0	0	0	0	59	245	-186
25-1072	Nursing Instructors and Teachers, Postsecondary	5		22	174	-152	7.91	0	0	0	0	0	0	22	174	-152
25-1081	Education Teachers, Postsecondary	5		27	59	-32	2.19	0	0	0	0	0	0	27	59	-32
25-1082	Library Science Teachers, Postsecondary	5		5	21	-16	4.20	0	0	0	0	0	0	5	21	-16
25-1111	Criminal Justice and Law Enforcement Teachers, Postsecondary	5		5	57	-52	11.40	0	0	0	0	0	0	5	57	-52
25-1112	Law Teachers, Postsecondary	5		7	21	-14	3.00	0	0	0	0	0	0	7	21	-14
25-1113	Social Work Teachers, Postsecondary	5		1	3	-2	3.00	0	0	0	0	0	0	1	3	-2
25-1121	Art, Drama, and Music Teachers, Postsecondary	5		83	246	-163	2.96	0	0	0	0	0	0	83	246	-163
25-1122	Communications Teachers, Postsecondary	5		21	78	-57	3.71	0	0	0	0	0	0	21	78	-57
25-1123	English Language and Literature Teachers, Postsecondary	5		29	77	-48	2.66	0	0	0	0	0	0	29	77	-48
25-1124	Foreign Language and Literature Teachers, Postsecondary	5		22	68	-46	3.09	0	0	0	0	0	0	22	68	-46
25-1125	History Teachers, Postsecondary	5		17	39	-22	2.29	0	0	0	0	0	0	17	39	-22
25-1126	Philosophy and Religion Teachers, Postsecondary	5		16	164	-148	10.25	0	0	0	0	0	0	16	164	-148
25-1191	Graduate Teaching Assistants	5		21	33	-12	1.57	0	0	0	8	4	4	12	29	-17
25-1193	Recreation and Fitness Studies Teachers, Postsecondary	5		6	14	-8	2.33	0	0	0	0	0	0	6	14	-8
25-1194	Vocational Education Teachers, Postsecondary	3		12	7	5	0.58	0	0	0	12	7	5	0	0	0
25-1199	Postsecondary Teachers, All Other	5		65	241	-176	3.71	0	0	0	0	0	0	65	241	-176
25-2011	Preschool Teachers, Except Special Education	3		197	206	-9	1.05	44	133	-89	153	73	80	0	0	0
25-2012	Kindergarten Teachers, Except Special Education	4		40	42	-2	1.05	0	0	0	29	19	10	11	23	-12
25-2021	Elementary School Teachers, Except Special Education	4		412	711	-299	1.73	0	0	0	134	133	1	278	579	-301
25-2022	Middle School Teachers, Except Special and Career/Technical Education	4		286	514	-228	1.80	0	0	0	93	92	1	193	422	-229

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25-2023	Career/Technical Education Teachers, Middle School	4		10	18	-8	1.80	0	0	0	3	3	0	6	15	-9
25-2031	Secondary School Teachers, Except Special and Career/Technical Education	4		456	851	-395	1.87	0	0	0	152	194	-42	305	658	-353
25-2032	Career/Technical Education Teachers, Secondary School	4		32	60	-28	1.88	0	0	0	11	11	0	21	49	-28
25-2051	Special Education Teachers, Preschool	4		8	15	-7	1.88	0	0	0	2	1	1	6	14	-8
25-2052	Special Education Teachers, Kindergarten and Elementary School	4		89	184	-95	2.07	0	0	0	24	17	7	66	167	-101
25-2053	Special Education Teachers, Middle School	4		27	55	-28	2.04	0	0	0	7	4	3	20	50	-30
25-2054	Special Education Teachers, Secondary School	4		70	143	-73	2.04	0	0	0	19	12	7	52	132	-80
25-2059	Special Education Teachers, All Other	4		2	5	-3	2.50	0	0	0	0	0	0	2	5	-3
25-3011	Adult Basic and Secondary Education and Literacy Teachers and Instructors	4		5	6	-1	1.20	0	0	0	4	2	2	2	4	-2
25-3021	Self-Enrichment Education Teachers	3		34	20	14	0.59	0	0	0	34	20	14	0	0	0
25-3097	Teachers and Instructors, All Other, Except Substitute Teachers	3		47	28	19	0.60	0	0	0	47	28	19	0	0	0
25-3098	Substitute Teachers	3		50	107	-57	2.14	0	0	0	35	21	14	15	86	-71
25-4011	Archivists	5		5	24	-19	4.80	0	0	0	0	0	0	5	24	-19
25-4012	Curators	5		10	28	-18	2.80	0	0	0	0	0	0	10	28	-18
25-4013	Museum Technicians and Conservators	4		13	33	-20	2.54	0	0	0	3	7	-4	10	26	-16
25-4021	Librarians	5		48	193	-145	4.02	0	0	0	0	0	0	48	193	-145
25-4031	Library Technicians	4		36	48	-12	1.33	0	0	0	24	45	-21	12	3	9
25-9011	Audio-Visual and Multimedia Collections Specialists	4		2	8	-6	4.00	0	0	0	0	0	0	2	8	-6
25-9031	Instructional Coordinators	5		21	99	-78	4.71	0	0	0	0	0	0	21	99	-78
25-9041	Teacher Assistants	3		198	169	29	0.85	55	65	-10	143	104	39	0	0	0
25-9099	Education, Training, and Library Workers, All Other	4		3	10	-7	3.33	0	0	0	0	0	0	3	10	-7
27-1011	Art Directors	4		20	56	-36	2.80	0	0	0	16	43	-27	4	13	-9

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27-1013	Fine Artists, Including Painters, Sculptors, and Illustrators	3		3	7	-4	2.33	0	0	0	3	7	-4	0	0	0
27-1014	Multimedia Artists and Animators	4		7	23	-16	3.29	0	0	0	6	18	-12	1	5	-4
27-1021	Commercial and Industrial Designers	4		1	3	-2	3.00	0	0	0	1	3	-2	0	0	0
27-1022	Fashion Designers	3		1	3	-2	3.00	0	0	0	1	3	-2	0	0	0
27-1024	Graphic Designers	4		127	338	-211	2.66	0	0	0	127	338	-211	0	0	0
27-1025	Interior Designers	4		41	109	-68	2.66	0	0	0	41	109	-68	0	0	0
27-1026	Merchandise Displayers and Window Trimmers	3		43	115	-72	2.67	0	0	0	43	115	-72	0	0	0
27-1027	Set and Exhibit Designers	5		5	13	-8	2.60	0	0	0	5	13	-8	0	0	0
27-2012	Producers and Directors	4		53	269	-216	5.08	0	0	0	53	269	-216	0	0	0
27-2022	Coaches and Scouts	4		54	78	-24	1.44	0	0	0	34	35	-1	20	44	-24
27-2023	Umpires, Referees, and Other Sports Officials	3		1	1	0	1.00	0	0	0	1	1	0	0	0	0
27-2032	Choreographers	4		5	13	-8	2.60	0	0	0	5	13	-8	0	0	0
27-2042	Musicians and Singers	3		4	9	-5	2.25	0	0	0	4	9	-5	0	0	0
27-3011	Radio and Television Announcers	3		12	56	-44	4.67	0	0	0	12	56	-44	0	0	0
27-3022	Reporters and Correspondents	4		11	34	-23	3.09	0	0	0	8	18	-10	4	16	-12
27-3031	Public Relations Specialists	4		54	133	-79	2.46	0	0	0	46	99	-53	8	34	-26
27-3041	Editors	4		21	76	-55	3.62	0	0	0	17	63	-46	3	13	-10
27-3042	Technical Writers	4		10	19	-9	1.90	0	0	0	7	11	-4	3	8	-5
27-3043	Writers and Authors	4		15	57	-42	3.80	0	0	0	10	38	-28	5	19	-14
27-3091	Interpreters and Translators	4		1	1	0	1.00	0	0	0	1	1	0	0	0	0
27-4011	Audio and Video Equipment Technicians	3		15	38	-23	2.53	3	16	-13	12	22	-10	0	0	0
27-4012	Broadcast Technicians	3		4	7	-3	1.75	0	0	0	4	7	-3	0	0	0
27-4021	Photographers	3		9	148	-139	16.44	2	107	-105	6	41	-35	0	0	0
27-4031	Camera Operators, Television, Video, and Motion Picture	3		1	7	-6	7.00	0	0	0	1	7	-6	0	0	0
29-1011	Chiropractors	5		20	23	-3	1.15	0	0	0	0	0	0	20	23	-3
29-1021	Dentists, General	5		47	192	-145	4.09	0	0	0	0	0	0	47	192	-145
29-1022	Oral and Maxillofacial Surgeons	5		1	5	-4	5.00	0	0	0	0	0	0	1	5	-4
29-1023	Orthodontists	5		2	6	-4	3.00	0	0	0	0	0	0	2	6	-4

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
29-1031	Dietitians and Nutritionists	5		22	34	-12	1.55	0	0	0	11	16	-5	12	18	-6
29-1041	Optometrists	5		25	128	-103	5.12	0	0	0	0	0	0	25	128	-103
29-1051	Pharmacists	5		170	360	-190	2.12	0	0	0	0	0	0	170	360	-190
29-1061	Anesthesiologists	5		16	54	-38	3.38	0	0	0	0	0	0	16	54	-38
29-1062	Family and General Practitioners	5		73	239	-166	3.27	0	0	0	0	0	0	73	239	-166
29-1063	Internists, General	5		4	13	-9	3.25	0	0	0	0	0	0	4	13	-9
29-1064	Obstetricians and Gynecologists	5		5	17	-12	3.40	0	0	0	0	0	0	5	17	-12
29-1065	Pediatricians, General	5		5	15	-10	3.00	0	0	0	0	0	0	5	15	-10
29-1066	Psychiatrists	5		11	37	-26	3.36	0	0	0	0	0	0	11	37	-26
29-1067	Surgeons	5		36	117	-81	3.25	0	0	0	0	0	0	36	117	-81
29-1069	Physicians and Surgeons, All Other	5		166	544	-378	3.28	0	0	0	0	0	0	166	544	-378
29-1071	Physician Assistants	5		53	209	-156	3.94	0	0	0	0	0	0	53	209	-156
29-1081	Podiatrists	5		11	82	-71	7.45	0	0	0	0	0	0	11	82	-71
29-1122	Occupational Therapists	5		119	146	-27	1.23	0	0	0	0	0	0	119	146	-27
29-1123	Physical Therapists	5		240	379	-139	1.58	0	0	0	0	0	0	240	379	-139
29-1124	Radiation Therapists	3		2	1	1	0.50	0	0	0	2	1	1	0	0	0
29-1125	Recreational Therapists	4		16	4	12	0.25	0	0	0	16	4	12	0	0	0
29-1126	Respiratory Therapists	3		74	72	2	0.97	56	67	-11	19	5	14	0	0	0
29-1127	Speech-Language Pathologists	5		95	76	19	0.80	0	0	0	0	0	0	95	76	19
29-1128	Exercise Physiologists	5		5	6	-1	1.20	0	0	0	1	1	0	3	5	-2
29-1129	Therapists, All Other	4		6	17	-11	2.83	0	0	0	2	1	1	4	17	-13
29-1131	Veterinarians	5		80	111	-31	1.39	0	0	0	0	0	0	80	111	-31
29-1141	Registered Nurses	3		1,932	1,729	203	0.89	861	633	228	1,071	1,096	-25	0	0	0
29-1151	Nurse Anesthetists	5		20	101	-81	5.05	0	0	0	0	0	0	20	101	-81
29-1161	Nurse Midwives	5		3	22	-19	7.33	0	0	0	0	0	0	3	22	-19
29-1171	Nurse Practitioners	5		72	311	-239	4.32	0	0	0	0	0	0	72	311	-239
29-1181	Audiologists	5		7	17	-10	2.43	0	0	0	0	0	0	7	17	-10
29-2011	Medical and Clinical Laboratory Technologists	4		102	32	70	0.31	0	0	0	86	15	71	16	17	-1
29-2012	Medical and Clinical Laboratory Technicians	3		96	37	59	0.39	29	25	4	67	12	55	0	0	0
29-2021	Dental Hygienists	3		155	71	84	0.46	113	64	49	41	7	34	0	0	0

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
29-2031	Cardiovascular Technologists and Technicians	3		32	26	6	0.81	21	24	-3	11	2	9	0	0	0
29-2032	Diagnostic Medical Sonographers	3		21	46	-25	2.19	13	3	10	7	43	-36	0	0	0
29-2033	Nuclear Medicine Technologists	3		5	1	4	0.20	3	1	2	2	0	2	0	0	0
29-2034	Radiologic Technologists	3		78	88	-10	1.13	51	74	-23	27	13	14	0	0	0
29-2035	Magnetic Resonance Imaging Technologists	3		19	4	15	0.21	12	3	9	7	1	6	0	0	0
29-2041	Emergency Medical Technicians and Paramedics	3		82	24	58	0.29	39	16	23	43	8	35	0	0	0
29-2052	Pharmacy Technicians	3		64	12	52	0.19	33	7	26	32	6	26	0	0	0
29-2053	Psychiatric Technicians	3		9	22	-13	2.44	5	22	-17	4	1	3	0	0	0
29-2055	Surgical Technologists	3		20	19	1	0.95	10	17	-7	10	2	8	0	0	0
29-2056	Veterinary Technologists and Technicians	3		39	44	-5	1.13	20	32	-12	19	13	6	0	0	0
29-2057	Ophthalmic Medical Technicians	3		7	1	6	0.14	3	1	2	3	1	2	0	0	0
29-2061	Licensed Practical and Licensed Vocational Nurses	3		155	33	122	0.21	155	33	122	0	0	0	0	0	0
29-2071	Medical Records and Health Information Technicians	3		48	43	5	0.90	18	23	-5	30	20	10	0	0	0
29-2081	Opticians, Dispensing	3		34	7	27	0.21	16	3	13	19	3	16	0	0	0
29-2091	Orthotists and Prosthetists	5		1	1	0	1.00	0	0	0	0	0	0	1	1	0
29-2099	Health Technologists and Technicians, All Other	3		7	43	-36	6.14	3	38	-35	4	6	-2	0	0	0
29-9011	Occupational Health and Safety Specialists	4		27	20	7	0.74	0	0	0	19	4	15	9	17	-8
29-9012	Occupational Health and Safety Technicians	3		3	1	2	0.33	0	0	0	3	1	2	0	0	0
29-9091	Athletic Trainers	5		23	39	-16	1.70	0	0	0	15	33	-18	7	6	1
31-2011	Occupational Therapy Assistants	3		56	29	27	0.52	39	11	28	17	18	-1	0	0	0
31-2012	Occupational Therapy Aides	3		18	10	8	0.56	13	4	9	6	6	0	0	0	0
31-2021	Physical Therapist Assistants	3		87	33	54	0.38	48	23	25	39	11	28	0	0	0
31-9011	Massage Therapists	3		21	4	17	0.19	8	2	6	13	2	11	0	0	0
31-9091	Dental Assistants	3		40	15	25	0.38	22	11	11	18	3	15	0	0	0
31-9092	Medical Assistants	3		108	121	-13	1.12	108	121	-13	0	0	0	0	0	0

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
31-9094	Medical Transcriptionists	3		5	2	3	0.40	1	0	1	4	1	3	0	0	0
31-9096	Veterinary Assistants and Laboratory Animal Caretakers	3		14	18	-4	1.29	9	14	-5	5	4	1	0	0	0
31-9097	Phlebotomists	3		27	56	-29	2.07	27	56	-29	0	0	0	0	0	0
33-1011	First-Line Supervisors of Correctional Officers	3		6	15	-9	2.50	3	10	-7	3	5	-2	0	0	0
33-1012	First-Line Supervisors of Police and Detectives	3		27	59	-32	2.19	10	32	-22	17	27	-10	0	0	0
33-1021	First-Line Supervisors of Fire Fighting and Prevention Workers	3		7	8	-1	1.14	3	3	0	3	5	-2	0	0	0
33-1099	First-Line Supervisors of Protective Service Workers, All Other	3		26	31	-5	1.19	8	1	7	19	30	-11	0	0	0
33-2011	Firefighters	3		20	26	-6	1.30	7	6	1	13	21	-8	0	0	0
33-3012	Correctional Officers and Jailers	3		39	92	-53	2.36	19	61	-42	20	31	-11	0	0	0
33-3021	Detectives and Criminal Investigators	3		16	50	-34	3.13	0	0	0	13	21	-8	3	29	-26
33-3051	Police and Sheriff's Patrol Officers	3		159	339	-180	2.13	57	178	-121	102	162	-60	0	0	0
33-9021	Private Detectives and Investigators	3		8	16	-8	2.00	1	5	-4	7	11	-4	0	0	0
35-1011	Chefs and Head Cooks	3		14	188	-174	13.43	7	159	-152	7	29	-22	0	0	0
37-1012	First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	3		6	15	-9	2.50	0	0	0	6	15	-9	0	0	0
39-1021	First-Line Supervisors of Personal Service Workers	3		54	28	26	0.52	0	0	0	54	28	26	0	0	0
39-5011	Barbers	3		2	1	1	0.50	0	0	0	2	1	1	0	0	0
39-5012	Hairdressers, Hairstylists, and Cosmetologists	3		85	6	79	0.07	85	6	79	0	0	0	0	0	0
39-6012	Concierges	3		2	1	1	0.50	0	0	0	2	1	1	0	0	0
39-7011	Tour Guides and Escorts	3		11	6	5	0.55	0	0	0	11	6	5	0	0	0
39-9011	Childcare Workers	3		64	47	17	0.73	0	0	0	64	47	17	0	0	0
39-9031	Fitness Trainers and Aerobics Instructors	3		92	95	-3	1.03	0	0	0	92	95	-3	0	0	0
39-9032	Recreation Workers	4		100	104	-4	1.04	0	0	0	100	104	-4	0	0	0
39-9041	Residential Advisors	3		66	87	-21	1.32	0	0	0	66	87	-21	0	0	0
41-1012	First-Line Supervisors of Non-Retail Sales Workers	4		11	16	-5	1.45	2	9	-7	9	7	2	0	0	0
41-3011	Advertising Sales Agents	3		60	98	-38	1.63	0	0	0	60	98	-38	0	0	0

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
41-3021	Insurance Sales Agents	4		152	79	73	0.52	0	0	0	152	79	73	0	0	0
41-3031	Securities, Commodities, and Financial Services Sales Agents	4		208	155	53	0.75	0	0	0	177	97	80	30	58	-28
41-3041	Travel Agents	3		34	19	15	0.56	16	9	7	18	10	8	0	0	0
41-3099	Sales Representatives, Services, All Other	4		461	271	190	0.59	80	11	69	301	227	74	80	32	48
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	4		18	15	3	0.83	0	0	0	18	15	3	0	0	0
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	4		209	183	26	0.88	0	0	0	209	183	26	0	0	0
41-9022	Real Estate Sales Agents	3		48	23	25	0.48	9	2	7	40	21	19	0	0	0
41-9031	Sales Engineers	4		27	19	8	0.70	0	0	0	27	19	8	0	0	0
41-9099	Sales and Related Workers, All Other	3		2	2	0	1.00	0	0	0	2	2	0	0	0	0
43-1011	First-Line Supervisors of Office and Administrative Support Workers	3		300	499	-199	1.66	78	384	-306	222	115	107	0	0	0
43-3031	Bookkeeping, Accounting, and Auditing Clerks	3		195	151	44	0.77	61	78	-17	134	73	61	0	0	0
43-3061	Procurement Clerks	3		9	6	3	0.67	3	2	1	6	3	3	0	0	0
43-4011	Brokerage Clerks	3		50	27	23	0.54	0	0	0	50	27	23	0	0	0
43-4031	Court, Municipal, and License Clerks	3		10	12	-2	1.20	3	3	0	7	10	-3	0	0	0
43-4061	Eligibility Interviewers, Government Programs	3		32	43	-11	1.34	0	0	0	32	43	-11	0	0	0
43-4131	Loan Interviewers and Clerks	3		34	24	10	0.71	14	13	1	21	11	10	0	0	0
43-4161	Human Resources Assistants, Except Payroll and Timekeeping	3		24	15	9	0.63	5	5	0	19	10	9	0	0	0
43-5061	Production, Planning, and Expediting Clerks	3		86	52	34	0.60	17	16	1	69	36	33	0	0	0
43-6011	Executive Secretaries and Executive Administrative Assistants	3		51	37	14	0.73	15	14	1	36	23	13	0	0	0
43-6012	Legal Secretaries	3		88	64	24	0.73	27	25	2	62	39	23	0	0	0
43-6013	Medical Secretaries	3		137	99	38	0.72	41	39	2	96	60	36	0	0	0
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	3		522	377	145	0.72	157	147	10	365	230	135	0	0	0

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
43-9011	Computer Operators	3		10	18	-8	1.80	4	15	-11	6	3	3	0	0	0
43-9031	Desktop Publishers	3		3	4	-1	1.33	0	0	0	3	4	-1	0	0	0
43-9041	Insurance Claims and Policy Processing Clerks	3		112	73	39	0.65	36	34	2	75	39	36	0	0	0
43-9081	Proofreaders and Copy Markers	4		1	1	0	1.00	0	0	0	1	1	0	0	0	0
43-9111	Statistical Assistants	4		8	7	1	0.88	0	0	0	5	3	2	3	4	-1
43-9199	Office and Administrative Support Workers, All Other	3		52	32	20	0.62	11	10	1	41	21	20	0	0	0
45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers	3		2	14	-12	7.00	0	0	0	2	14	-12	0	0	0
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	3		42	22	20	0.52	0	0	0	42	22	20	0	0	0
47-4011	Construction and Building Inspectors	3		58	34	24	0.59	20	13	7	39	20	19	0	0	0
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	3		69	35	34	0.51	0	0	0	69	35	34	0	0	0
49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers	3		8	3	5	0.38	0	0	0	8	3	5	0	0	0
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	3		7	1	6	0.14	5	0	5	3	1	2	0	0	0
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	3		1	0	1	0.00	0	0	0	1	0	1	0	0	0
49-3011	Aircraft Mechanics and Service Technicians	3		5	0	5	0.00	0	0	0	5	0	5	0	0	0
49-3023	Automotive Service Technicians and Mechanics	3		69	131	-62	1.90	69	131	-62	0	0	0	0	0	0
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	3		46	4	42	0.09	46	4	42	0	0	0	0	0	0
49-9041	Industrial Machinery Mechanics	3		34	1	33	0.03	34	1	33	0	0	0	0	0	0
49-9043	Maintenance Workers, Machinery	3		9	0	9	0.00	9	0	9	0	0	0	0	0	0
49-9044	Millwrights	3		6	0	6	0.00	6	0	6	0	0	0	0	0	0
49-9062	Medical Equipment Repairers	3		11	2	9	0.18	0	0	0	11	2	9	0	0	0
51-2041	Structural Metal Fabricators and Fitters	3		12	1	11	0.08	12	1	11	0	0	0	0	0	0

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
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	3		29	3	26	0.10	29	3	26	0	0	0	0	0	0
51-4041	Machinists	3		26	3	23	0.12	26	3	23	0	0	0	0	0	0
51-4111	Tool and Die Makers	3		3	0	3	0.00	3	0	3	0	0	0	0	0	0
51-5111	Prepress Technicians and Workers	3		3	4	-1	1.33	1	0	1	2	4	-2	0	0	0
51-5112	Printing Press Operators	3		13	1	12	0.08	13	1	12	0	0	0	0	0	0
51-6052	Tailors, Dressmakers, and Custom Sewers	3		5	9	-4	1.80	1	0	1	3	9	-6	0	0	0
51-8011	Nuclear Power Reactor Operators	3		4	1	3	0.25	2	0	2	1	1	0	0	0	0
51-8012	Power Distributors and Dispatchers	3		4	0	4	0.00	4	0	4	0	0	0	0	0	0
51-8021	Stationary Engineers and Boiler Operators	3		13	5	8	0.38	0	0	0	13	5	8	0	0	0
51-8031	Water and Wastewater Treatment Plant and System Operators	3		9	1	8	0.11	9	1	8	0	0	0	0	0	0
51-8092	Gas Plant Operators	3		5	1	4	0.20	5	1	4	0	0	0	0	0	0
51-9082	Medical Appliance Technicians	3		5	1	4	0.20	5	1	4	0	0	0	0	0	0
53-6051	Transportation Inspectors	3		1	2	-1	2.00	0	0	0	1	2	-1	0	0	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	•	•	•