

# A Skilled and Educated Workforce

## 2015 Update



**An analysis of postsecondary education, workforce preparation, and employer demand in Washington**

# A Skilled and Educated Workforce: 2015 Update

## Joint Agency Report

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## Summary

Employment projections in Washington for 2018–2023 show a robust demand for workers with postsecondary education. As businesses, industries, and workplaces become increasingly complex, employers need workers with skills and education that allow them to adapt and excel in evolving environments. More than three-quarters of all projected job openings will require at least some education beyond high school, with two-thirds requiring mid-level education or higher.\*

### Key Results

**At the mid-level,** overall degree production in health care is generally keeping pace with demand, but gaps are still present in specific occupations, including dental hygienists, emergency medical technicians, EMTs and paramedics, radiologic technologists, and opticians (dispensing). Supply-demand gaps are seen in production and trades fields, such as auto and diesel mechanics and machine tool technicians; business, management, and sales occupations; and service occupations, where there is demand for workers with management skills in a range of fields, such as the culinary and hospitality industries.

**At the baccalaureate level,** degree production in computer science, engineering, health, and other STEM fields has been increasing steadily. Computer and information science degree completions increased by nearly 38 percent from 2007 to 2013. Degree production in the fields of engineering and related technology (27 percent), health (29 percent), and all other STEM fields as a group (44 percent) also grew substantially. However, gaps between degree production and employer demand at the baccalaureate level still persist in key fields. In computer and information science, the projected demand gap exceeds the current rate of degree production by 94 percent. Demand in this field is fairly strong across the spectrum, but some occupations stand out. Jobs for software developers represent 42 percent of projected openings, followed by computer programmers (17 percent) and systems analysts (10 percent). Demand in engineering also remains fairly high across all areas of specialization.

**At the graduate level,** the largest gaps are in computer science and health occupations. In computer science, the same occupations are driving demand that are seen at the baccalaureate level. In the top group, job openings for software developers represent 59 percent of the total, followed by openings for computer programmers (12 percent) and systems analysts (10 percent). In the health professions, 36 percent of projected openings are for physicians, surgeons, dentists, and pharmacists, while 48 percent are for advanced practice registered nurses, physical and occupational therapists, and medical technicians.

**In K-12 education,** Washington is facing a challenging teacher shortage, driven by a wave of teachers leaving the profession, a downward trend in teacher program enrollment and completions in the state, and pressures calling for class size reductions, among other factors.

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\*Mid-level includes individuals with at least a year of college but less than a bachelor's degree. The category includes associate degrees, long term certificates, and apprenticeship completers.

## Background

### Purpose of the Report

The purpose of this report is to provide an overview of the current status of workforce preparation in Washington; to identify high employer demand occupations, as well as fields in which academic degree production is failing to keep pace with demand; and to highlight occupation fields in which students may find expanding employment opportunities. This report focuses on projected workforce needs from 2018 to 2023.

The Washington Student Achievement Council (WSAC) prepares this analysis in collaboration with the State Board for Community and Technical Colleges (SBCTC) and the Workforce Training and Education Coordinating Board (Workforce Board), in accordance with statutory responsibilities specified in RCW 28B.77.080. This 2012 statute directs these agencies, as part of a broader educational needs assessment process, to analyze “the number of forecasted net job openings at each level of higher education and training, and the number of credentials needed to match the forecast of net job openings.”

The report is also used in the state’s broader educational planning. In 2013, WSAC issued *The Roadmap*, a ten-year guide for the development of a coordinated, long-term strategy to increase educational attainment in the state. It identified key challenges and priorities the state must address in the development of the plan. Among these key challenges were closing existing workforce skills gaps and meeting the demand for an educated workforce to complement Washington’s modern, dynamic economy. A complementary strategic action plan is updated biyearly to monitor progress, adjust to changes in the landscape, and maximize success.

Similarly, SBCTC and the Workforce Board use the report in their strategic planning, focusing on meeting Washington’s needs for mid-level education. This includes meeting employer demand for graduates with middle-skills credentials through apprenticeships, certificate programs, and associate degrees.


## Current Context

### Overview of National Workforce Trends

Recent reports have commented on the ongoing economic recovery and its effect on employer demand, as well as national trends associated with the preparedness of college graduates for the workplace.

**In the wake of a more robust economic recovery, waves of high-paying jobs with benefits are beginning to return.** A new report from the Georgetown Center on Education and the Workforce highlights the fact that, after several years of slow growth following the Great Recession, we are now seeing a surge in openings for good, high-paying jobs with benefits.<sup>1</sup>

The national unemployment rate is currently about 5.3 percent, a marked improvement since 2009, when the rate peaked at nearly 10 percent. The economy added 250,000 jobs per month in 2014, the best year in job growth since the beginning of the millennium. Job growth had fallen off slightly by the end of 2015, but has continued to advance steadily, adding more than 200,000 jobs per month on average.



**Although many of the new jobs created in the early years of the recovery were at the low-wage level, the recent surge is for “good jobs” concentrated at the other end of the scale.**

[Georgetown Center on Education and the Workforce](#)

The authors stress that, although many of the new jobs created in the early years of the recovery were at the low-wage level, the recent surge is for “good jobs” concentrated at the other end of the scale. They define good jobs as those that are in the upper-third by median wages of occupations in which they are classified. A majority of these jobs are full-time (86 percent), offer health insurance (68 percent), and provide an

employer-sponsored retirement plan (61 percent). High-wage jobs have grown the most in this recent surge. Overall, of the 6.6 million jobs added during the recovery, 2.9 million were good jobs, compared to 1.8 million low-wage jobs and 1.9 million middle-wage jobs.

Almost all of these good jobs have gone to college graduates. This is good news for students working toward degrees, but this study also shows that most of these new job openings have been in a relatively narrow range of fields. Out of the 2.9 million good jobs created since the recovery, 2.8 million (97 percent) have been filled by workers with at least a bachelor’s degree. Jobs for managers; science, technology, engineering, and mathematics (STEM) workers; and healthcare professionals account for the majority of good jobs in the recovery. In contrast, middle-wage jobs have not fully recovered from the recession. In spite of the 1.9 million middle-wage jobs added in the recovery, middle-wage occupations remain 900,000 jobs below their prerecession employment levels. Low-wage jobs have recovered all recession-related job losses (800,000 jobs above their pre-recession employment), but in 2015 are still growing at a slower rate than good jobs as defined in the study.

These findings run counter to common media perceptions, which have been dominated by stories concluding that we are mired in a low-wage, part-time jobs recovery. The authors point out that the conclusions of their analysis differ from the picture portrayed in media stories mainly because, when grouping jobs, they focus on occupations rather than on industries. Occupational groupings yield a more accurate view. An industry refers primarily to the employers and the kinds of products and services they produce, whereas an occupation classifies a specific set of activities performed on the job. If only the industry average earnings are used to sort jobs, then everyone from the CEO to a janitor who works at the same firm is assigned the same average pay. Yet the skills required and the wages paid are vastly different among workers who are employed in different occupations within the same industry.




A recent national employer survey conducted by Michigan State University's College Employment Research Institute (CERI)<sup>2</sup> provides another view of this trend. The authors report that "employers are recruiting new college graduates at levels not seen since the dot-com frenzy of 1999-2000." The report shows that several drivers are influencing the college labor market. Sixty-six percent of employers indicated growth was very important for their hiring. Growth as an engine of change in both companies and the labor market has reached its highest level since 2008. Three years ago employers rarely talked about turnover; workers wanted to keep the jobs they had. But in 2015, 45 percent of employers reported turnover as an important consideration in the number of new graduates that they will seek. Twenty percent of employers indicated retirement influenced their hiring decisions. The percentage may seem small but represents employers that cannot tap easily into global labor markets (e.g., educational services, government, retail, transportation, and utilities.)

**The demand for workers with postsecondary education is expanding as the country shifts to a post-industrial service economy.** Another report by researchers at the Georgetown University Center on Education and the Workforce<sup>3</sup> analyzes the continuing national shift from an industrial and manufacturing economy to a high-skilled service economy. They track this trend over the last several decades. In the current environment, more college-educated workers are in demand but not enough are graduating. The report chronicles the changing dynamics of the workplace and the premium placed on education beyond high school, as we continue our push into a post-industrial service economy.

In 1947, nearly half of U.S. workers were employed in goods-producing industries (i.e., manufacturing, mining, agriculture, and construction). By 2007, that share had dropped to less than 19 percent of the workforce. Those numbers seem to prove that our economy is out of balance and to confirm fears that the good manufacturing jobs of the past are being replaced with low-paid, dead-end service jobs. But many of the findings in this report contradict those fears. The percentage of U.S. workers with high-skill, high-wage jobs is actually larger today than ever before. In addition, the education level of the American workforce has increased dramatically over the past four decades. In the 45 years between 1967 and 2012, the proportion of high school dropouts fell from 38 percent of working-age adults to just 10 percent, while workers with at least some postsecondary education went from one-quarter to 61 percent.

Perhaps the most telling evidence of the growing importance of college-educated workers is their rising contributions to total earnings relative to their share of the workforce. In 1967, people with Bachelor's or graduate degrees represented a little more than 10 percent of the workers and a little more than 20 percent of the wages. More than 70 percent of all workers had high school diplomas as their highest level of educational attainment and generated more than 60 percent of all earnings. By 2012, workers with a bachelor's degree or higher- grew to more than 30 percent of the workers and produced more than half the earnings in the economy. The share of high school workers had fallen below 40 percent of all workers and their share of earnings had fallen below 30 percent.

This is a remarkable upgrading in the skills and earnings share for employees with at least some college. Demand is high for these elevated levels of skill and employers are paying substantially more for workers with postsecondary education. The college wage premium – the difference between the average wages of college- and high school-educated workers – has increased substantially since the 1970s. In 1979 the wage premium was just 36 percent for both male and female workers. It has grown steadily until reaching its maximum level in 2007 with the male premium at 82 percent and the female premium at 75 percent.



**In the country's ongoing shift from an industrial economy based on production to a more complex system that values variety, customization, technology, and innovation . . . college-intensive business services have replaced manufacturing as the U.S. economy's largest industry cluster.**

[Georgetown Center on Education and the Workforce](#)

The authors emphasize that contrary to conventional wisdom, the good jobs in the middle haven't been "hollowed out" by the collapse in manufacturing. The labor market for middle-skill workers remains robust. The share of low-skill jobs in the economy, however, has been steadily declining. The U.S. economy's largest and fastest growing sectors – business services, finance, healthcare, and education – offer very few jobs for high school-educated workers. The increasing technological sophistication of our economy has only


increased the demand for educated workers who can utilize that technology. As employers have bid up the price for college-educated workers, the real wages of high school-educated workers have fallen.

College-intensive business services have replaced manufacturing as the U.S. economy's largest industry cluster. This includes jobs in consulting, accounting, management, legal services, and finance. In 1967, manufacturing was responsible for 31 percent of all value added in the economy and now it is 16 percent, while the business services sector has expanded from 12 percent to 26 percent of the economy. The report outlines the fundamental shift from an industrial economy based on production to a more complex system that values variety, customization, technology, and innovation. This has driven demand for more educated workers, even those with some postsecondary training needed for middle-level jobs that often involve deeper and broader sets of skills.

**Nearly half of all U.S. jobs are at the middle skill level.** Although current trends reveal a strong surge in job openings for high-skilled positions at the bachelor's level or above, demand for skills at the mid-level remains robust. Middle-skill jobs, those that require more than a high school diploma but less than a four-year degree, now comprise about half of all U.S. jobs. They generally offer solid wages and pathways to advancement. But in many cases, employers are finding mid-level positions difficult to fill even when overall unemployment remains high. National reports have projected that nearly 50 percent of job openings will be at the middle-skill level through 2022.<sup>4</sup>



A 2015 report by the U.S. Department of Education on projected employment, skills gaps, and training needs within the transportation industry over the next 10 years provides an illustrative example.<sup>5</sup> According to this report, transportation industry employers will need to hire and train roughly 4.6 million workers, an equivalent of 1.2 times the current workforce, to meet the needs of growth, retirement, and turnover in the next decade. The greatest demand lies in semi-skilled and skilled jobs in operations and maintenance. The authors estimate that “for every future job opening in central services or construction in the transportation industry, there will be an estimated two jobs in maintenance and 21 in operations.”



**Technological advances are revolutionizing many industries, transforming the nature of employee tasks, the kind of activities they engage in, and their responsibilities.**

In a 2014 employer survey conducted by Accenture, 73 percent of employers expected their need for middle-skills jobs to grow.<sup>6</sup> Among survey respondents, 56 percent found middle-skills jobs hard to fill, with finance and insurance (68 percent) and healthcare (54 percent) companies experiencing the greatest challenges. Fully 69 percent of the overall sample and over 70 percent of the largest

companies (those with revenues greater than \$2 billion) indicated that their inability to attract and retain middle-skills talent frequently affected their performance. Over one-third of respondents believed that inadequate availability of middle-skilled workers had undermined their productivity, with manufacturing (47 percent) and healthcare (35 percent) the hardest hit.

**Employers remain concerned about deficiencies in the soft skills of college graduates.**

Consistent with previous studies in recent years, a 2014 survey of senior executives conducted by the Economist Intelligence Unit, sponsored by the Lumina Foundation, revealed continued widespread concern among employers about worker preparedness across the entire skill spectrum.<sup>7</sup> Employers consider both hard and soft skills to be valuable but consider the most important to be critical thinking and problem solving (72 percent of executives select this as one of their top three), collaboration and teamwork (63 percent), communication (54 percent), the technical skills associated with specific jobs (54 percent), and adaptability and the managing of multiple priorities (48 percent).

This study concludes that U.S. employers’ concerns about these “soft skill” deficits are rising because these are the skills that are becoming increasingly necessary to flourish in our expanding post-industrial service-based economy. Technological advances are revolutionizing many industries, transforming the nature of employee tasks, the kind of activities they engage in, and their responsibilities. Manufacturing, once focused on the mass production of standardized goods, has come to be dominated by companies whose fortunes rest instead on variety and constant innovation. In many cases, the actual manufacture of goods, the one-time bedrock of the U.S. economy, now represents only a fraction of the cost of an item and is often outsourced abroad.

Amid the shift to a post-industrial, service-based economy, working environments are now requiring more and more collaboration, rather than the performance of repetitive tasks or the operation of machinery. Thus, we have seen the rise in both the necessity of and demand for skills in critical thinking and flexible problem-solving, collaboration and teamwork, and effective and timely communication. At all career levels, employees are increasingly required to integrate knowledge from a number of areas and work in teams to find innovative solutions to problems.

**Washington ranks fourth among states in adapting to the demands of the new innovation economy.** In a 2014 nationwide state comparison conducted by the Information Technology and Innovation Foundation—a nonprofit think tank focusing on the nexus of public policy and the emerging innovation economy—Washington ranked high in factors essential to vitality in the changing economic landscape.<sup>8</sup> The study examined how states compare in a wide range of economic and workforce characteristics, such as the percentage of knowledge-centered jobs, economic dynamism as reflected in numbers of new business startups and patents granted, use of digital technology in the workforce, numbers of jobs located in the technology sector, and the extent to which companies have a globalized export orientation for products and services.

Regionally, the leading states were clustered in the Northeast, the mid-Atlantic, the Mountain West, and the Pacific. All three states along the Pacific coast, four of five in the Mid-Atlantic, and four of six states in New England made the top 15. Washington ranked fourth overall, among the elite bracket that included Massachusetts, Delaware, California, and Maryland. Washington ranked second in information technology jobs; fifth in managerial, professional, and technical jobs; third in export focus of manufacturing and services; and seventh in fastest-growing firms.

**Washington faces challenges related to its dynamic STEM-driven economy.** Washington has the advantage of possessing a dynamic economy driven largely by its growing technology sector, with leading companies in fields such as aerospace, electronic commerce, information technology, clean energy, and biomedicine. This widespread and expanding technological environment poses special challenges in aligning the state’s education and career training system with the workforce needs of its employers. It requires a focus on STEM education to effectively meet workforce demand.

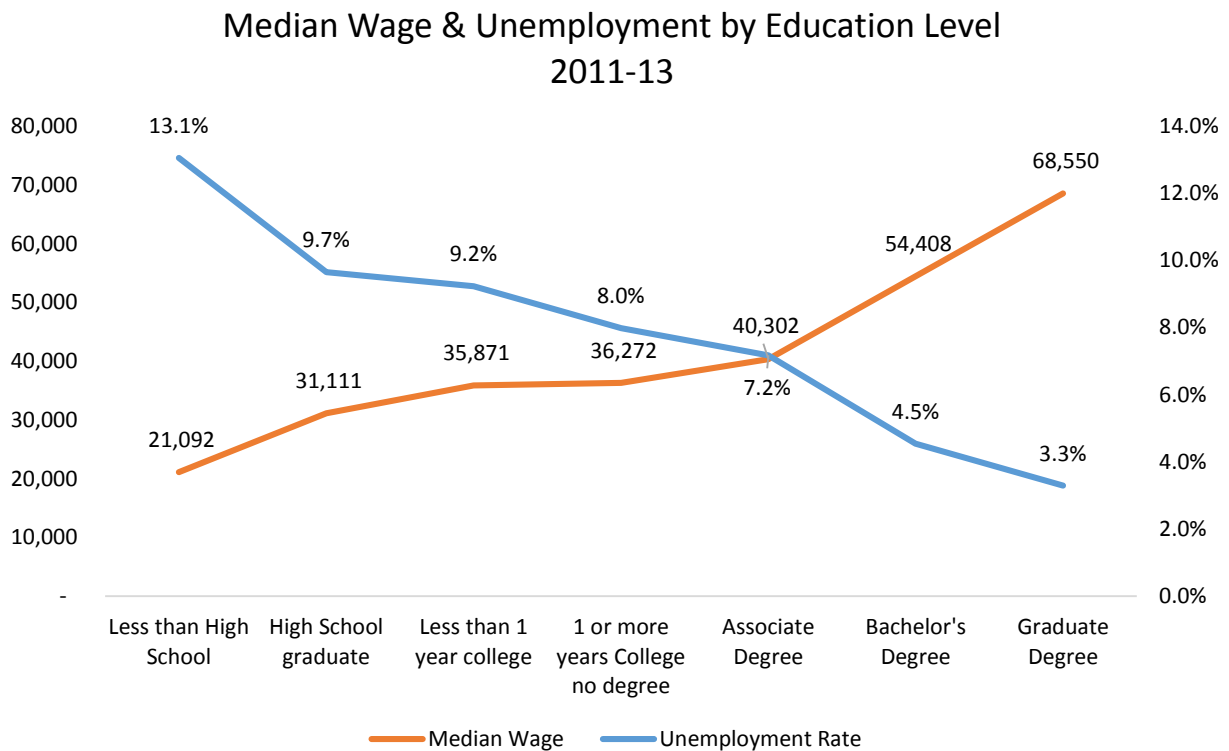
A recent report by the Washington STEM Education Innovation Alliance highlights these challenges.<sup>9</sup> The creation of the STEM Alliance was proposed by Governor Inslee and approved by the Legislature in 2013. The Alliance brings together leaders from a broad range of business, labor, industry, education, and nonprofit organizations to build effective industry-education partnerships and to advise on strategic planning STEM education initiatives. The report notes that Washington is among the elite states in the areas of innovation and research development, has one of the highest proportions of STEM jobs in the nation, and is one of the largest importers of technology degrees as a proportion of the population. But the state also ranks low in the production of degrees in key technology fields, such as computer science and others.

The effects of this STEM education challenge will be seen in much of the following analysis. STEM plays an important role at all education levels, from middle-skills credentials through graduate degrees.

## Key Indicators of Demand: Wage, Unemployment, and In-Migration Rates

Two important indicators of the demand for educated workers are 1) the effect of educational attainment levels on wages and unemployment rates and 2) the rate of in-migration of educated workers to Washington from other states and nations. In Washington, mirroring national trends, we see a stable and consistent relationship between these indicators and education level. On average, earnings tend to rise and unemployment rates decline with additional years of formal training and education (see Figure 1). With that said, both of these indicators also show significant variation by occupation and major field of study.

**Figure 1**

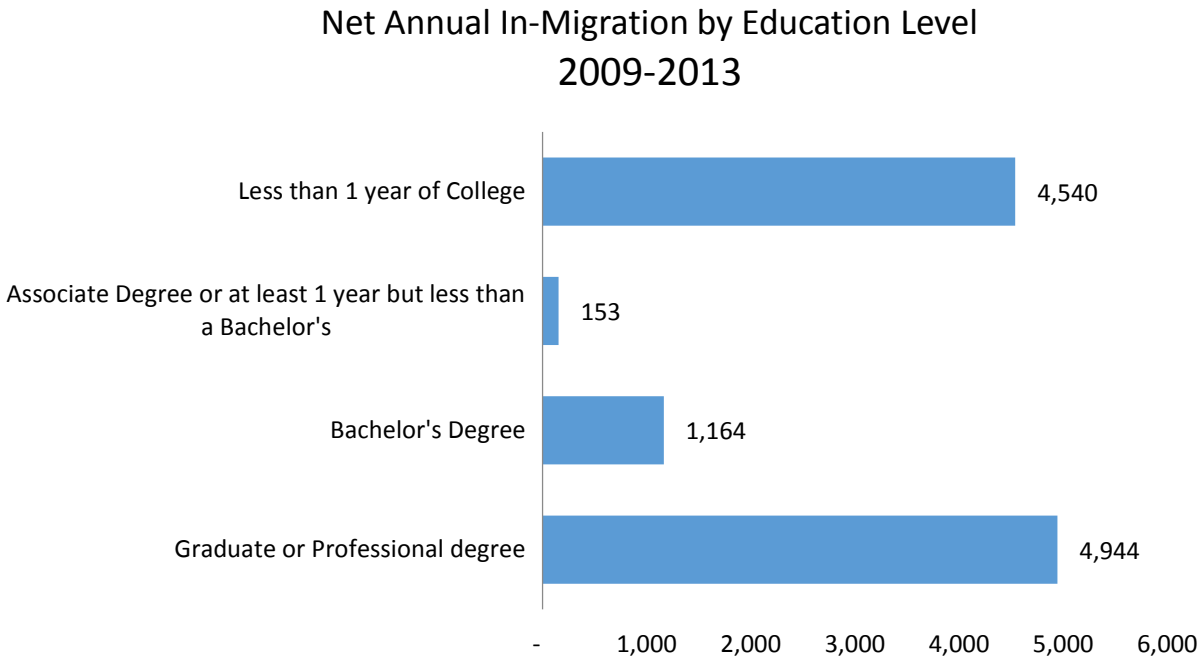


Source: 2013 American Community Survey. Wages Include civilian employed WA residents age 25-64. Unemployed rate reflects civilian labor force for WA residents age 25-64.

Washington is a growing state, so in-migration is generally expected. However, Washington continues to rely heavily on workers trained in other states and nations to meet the needs of the economy, particularly at the higher educational levels. Between 2009 and 2013, Washington annually attracted a net of almost 1,200 workers each year at the bachelor’s level, and over 4,900 at the graduate level, from other states.

The results of a Washington State population survey showed that nearly two-thirds of working adults who moved to Washington did so for job-related reasons.<sup>10</sup> Moreover, analysis by the Workforce Board of H1-B visa petitions shows that, in 2010, Washington employed 17,800 H1-B visa holders. The majority of new visa activity (approximately 75 percent) was to meet demand for computer and mathematical occupations.

**Figure 2**



Source: WSAC Staff Analysis of 2009-2013 American Community Survey Data

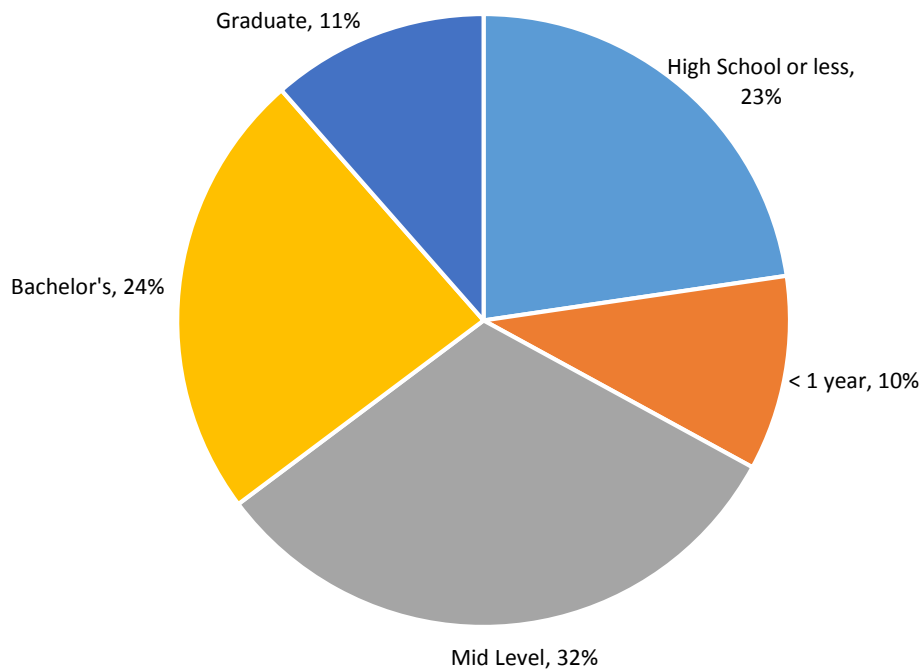
These trends help set the context for the analysis of supply and demand of educated and trained workers in Washington. It should be noted, however, that although in-migration has been a key source of talent in Washington over the last two decades, in-migration was not included in the supply analysis for this report.

## Overall Supply and Demand Outlook by Education Level

**Employment projections in the state of Washington for the period from 2018 to 2023 show a robust demand for workers with postsecondary education.** The trend toward increasing complexity in the workplace and the need for more skilled and educated workers that were observed in recent national studies are clearly reflected in Washington’s employment outlook. The vast majority of all job openings (77 percent) will require at least some education beyond high school, with 67 percent requiring at least a year or more of postsecondary training.

**Figure 3**

**Total Projected Job Openings by Education Level  
2018-2023**



Source: Washington State Employment Security Department, Long-Term Employment Forecast

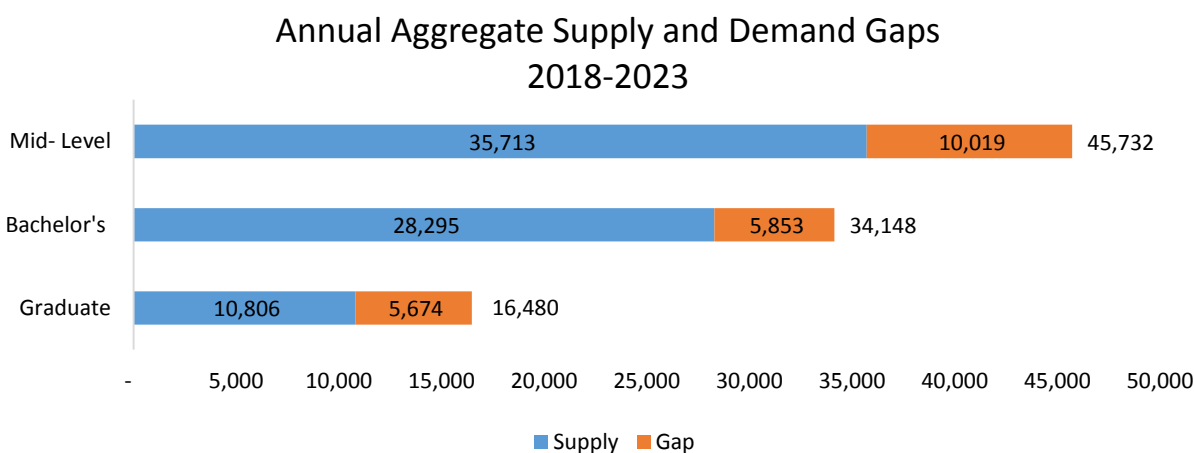
Thirty-two percent will call for workers educated at the mid-level. This category includes postsecondary education leading to an apprenticeship, one year or more of postsecondary education, training certification, or an associate degree.

Demand for workers with bachelor's and graduate degrees is also projected to be strong. Thirty-five percent of employment opportunities will be aimed at workers who have bachelor's degrees or above, with 24 percent of openings requiring a baccalaureate and 11 percent requiring graduate level education.

### **Overall Gaps Between Supply and Demand**

To assess how well the state's higher education system is responding to employer workforce needs and how well it is preparing residents to compete for employment opportunities, we compare total supply at three levels of education against the projected demand for workers trained at those levels. For the years 2018–2023, Figure 4 below shows the estimated current annual supply of workers educated at each level in blue and the additional numbers of workers that will be needed to meet projected employer demand in orange.

**Figure 4**



Source: WSAC, WTECB, SBCTC joint analysis of 2015 Washington ESD long-term employment forecast; Bureau of Labor Statistics Training Levels; IPEDS; 2014 Census PUMS data.

The supply figure was calculated by using the annual number of degrees completed at each level, adjusted to estimate the number of graduates expected to enter the workforce (See the appendix for more detail on the analytical methodology).

The largest skills gap is seen at the mid-level. There were an estimated 35,713 completers entering the workforce in 2013 with middle-skills education. But an additional 10,019 workers will be needed annually to meet the state’s employer workforce needs. This number represents nearly 22 percent of anticipated mid-level demand.

Anticipated supply also falls short of projected workforce demand at the other education levels. At the baccalaureate level, over 17 percent of demand is anticipated to be unmet by the number of annual completers entering the workforce. For workers with graduate degrees, the percent of demand unmet by supply, at over 34 percent, is the highest of the three levels.

## High Employer Demand Fields

### Mid-Level

The mid-level supply includes two-year degree graduates. It also includes completers of long-term certificates and apprenticeships from the community and technical colleges and private career schools.

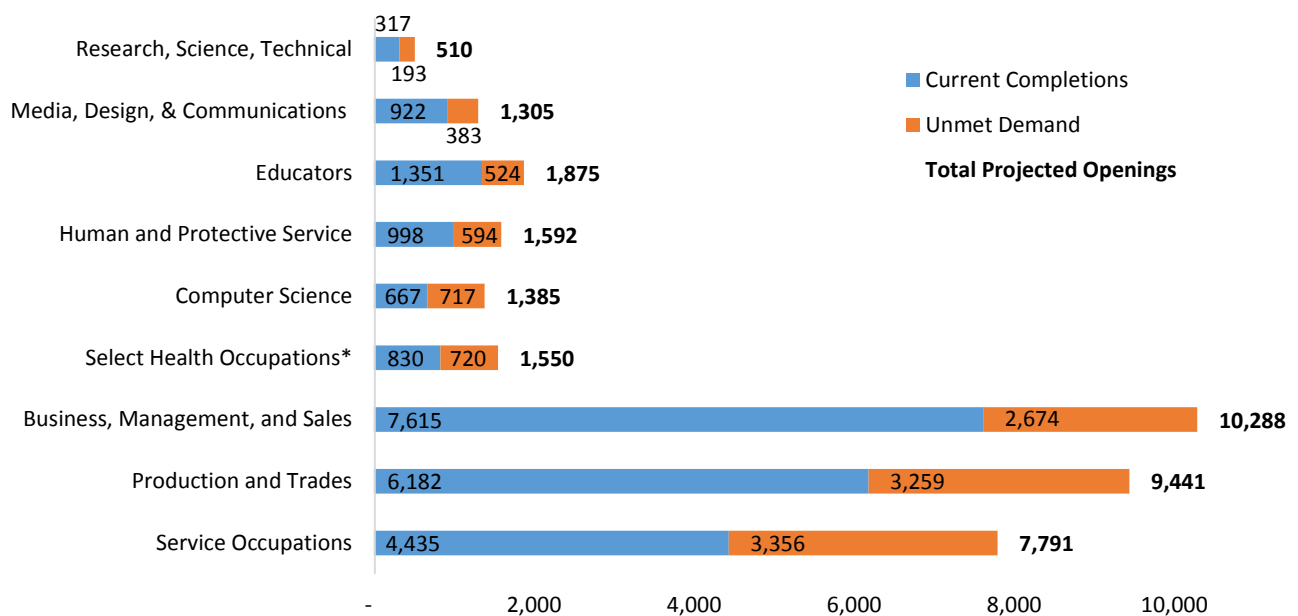
Major occupational groups for which current supply will not meet projected demand are shown in Figure 5. Business, management, and sales occupations did not appear in the 2013 report. At the mid-level, they are led by jobs in accounting. The production and trades category includes jobs such as auto and diesel mechanics and machine tool technicians. Service occupations include management jobs in both culinary and hospitality industries. In the next tier, education includes training for teacher assistants and early childhood educators. Human protective services include firefighters, criminal justice, and law enforcement. Computer science encompasses graduates trained for jobs like database administrators and analysts.



In past reports, the mid-level analysis was focused on a subset of selected occupations that had been historically salient. For this 2015 update, the first comprehensive review of supply and demand at the mid-level was conducted. As a result, inclusion of mid-level occupations in this report is done at a group level with the exception of selected health occupation shortages. With this new approach, some groups highlighted in this report are different from those in the 2013 report.

**Figure 5**

### Mid-Level Unmet Demand 2018–2023 2013 Completions and Total Projected Openings



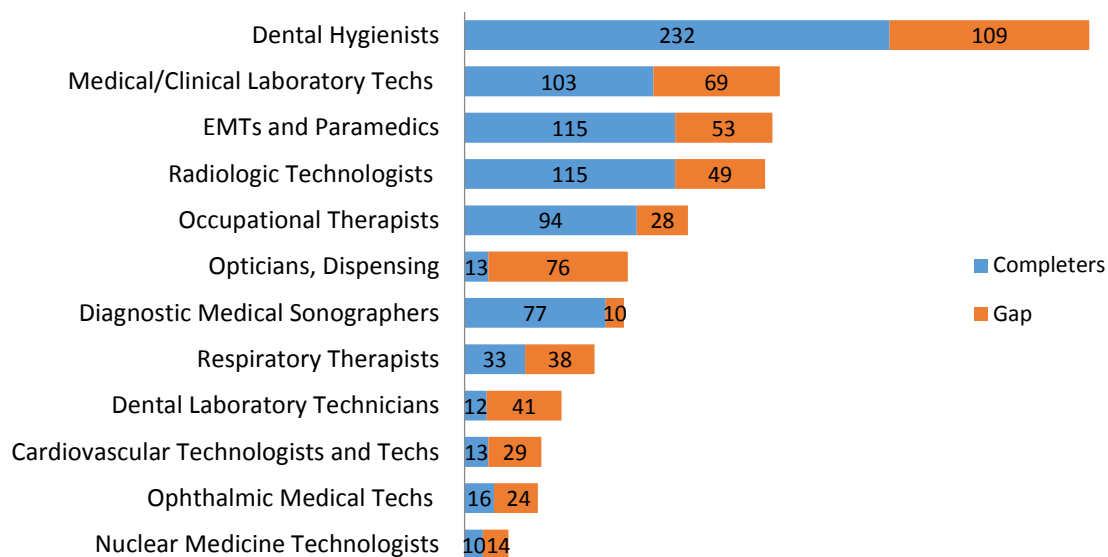
Source: WSAC, WTECB, SBCTC joint analysis of 2015 Washington ESD long-term employment forecast; Bureau of Labor Statistics Training levels; IPEDS; 2014 Census PUMS data.

**Selected Health Occupation Shortages.** Because most health occupations have specific qualifications, the analysis of supply and demand in most cases can be conducted at the individual occupation level. The Health Workforce Council—comprising leaders from a range of healthcare stakeholders—produces an annual report that identifies gaps in healthcare jobs. That report was the basis for inclusion of select healthcare shortages in the 2013 version of this report. The 2015 Annual Healthcare Report prepared by the staff of the Workforce Board on behalf of the Council was the source for identifying mid-level demand in this 2015 update.<sup>†</sup>

<sup>†</sup>The Healthcare Council’s report can be found online at <http://wtb.wa.gov/Documents/2015HealthWorkforceCouncilReport-Final.pdf>

**Figure 6**

### Comparison of Current Supply with Future Demand for Selected High Demand Mid-Level Health Occupations



Source: WSAC, WTECB, SBCTC joint analysis of 2015 Washington ESD long-term employment forecast; Bureau of Labor Statistics Training levels; IPEDS; 2014 Census PUMS data.

Overall, the healthcare field remains a focus of high demand at the mid-level in the 2015 report (see Figure 6). Registered nursing has the largest average annual openings from 2018 to 2023. This is consistent with past years where nursing has appeared on high demand lists. Like this report, the Health Workforce Council also relies on a gap analysis to identify healthcare shortages. One of the big successes of the past several years has been the ramp-up in nursing graduates to meet demand. In fact, the 2015 report shows that the gap between supply and demand appears to have closed for nurses.

While their gap analysis suggests there are sufficient graduates to meet demand, the Health Workforce Council also did a case study of registered nursing that pinpoints uncertainties not revealed in the data for retirements, changes due to the demands of the Affordable Care Act, and changes within nursing preparation. Based on this case study, the report concludes that it is too soon to ascertain whether the gap in the supply has been permanently closed and that the supply of registered nurses is sufficient. Registered nursing remains on the mid-level demand watch list.

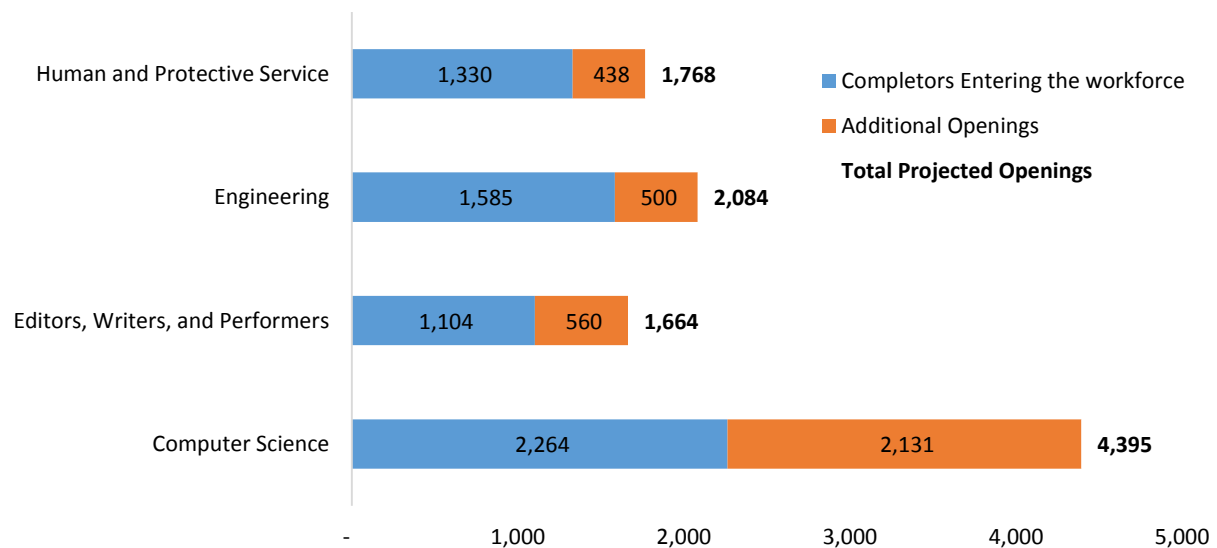
In addition to registered nursing, Figure 6 shows gaps in additional select healthcare occupations. Dental hygienist is the largest field, followed by medical/clinical laboratory techs, EMTs and paramedics, and radiological technologists. Shortages in these fields also appeared in the 2013 Skilled and Educated Workforce report, revealing a persistent trend.

## Baccalaureate Level

The largest gaps at the baccalaureate level are in the fields of computer science, engineering, human and protective services, and for media, design, and communications specialists. Figure 7 shows the estimated number of completers annually entering the workforce in each of these fields in blue and the number of openings beyond this number representing additional graduates that will be needed to meet workforce demand in orange.

**Figure 7**

**Baccalaureate Level Gaps – Estimated Completions and Projected Annual Openings 2018–2023**



Source: WSAC, WTECB, SBCTC joint analysis of 2015 Washington ESD long-term employment forecast; Bureau of Labor Statistics Training levels; IPEDS; 2014 Census PUMS data.

**Key Drivers of Demand.** Consistent with previous reports on education and the workforce in Washington, the fields that figure most prominently in the supply and demand gap at the baccalaureate level are computer science and engineering. This reflects the prominent role that technology plays in the dynamic economic life of our state.



**Computer Science.** Growth and demand for computer science skills at the baccalaureate level are fairly robust across the spectrum. But some occupations stand out as especially strong drivers of demand. In the field of computer science, 49 percent of projected openings are for software developers, 17 percent are for computer programmers, and 10 percent are for computer systems analysts.

The deep demand for individuals with software development skills reflects the dynamic nature of Washington’s computer and technology industries. Software developers analyze user needs and design software to perform a given range of required functions. This field includes systems software developers, who specialize in computer operating systems, and applications software developers, who focus on various applications, such as games, video editors, word processors, and databases. In general, computer programmers write code using the specifications that developers have designed. Thus, the healthy demand for software developers in the state reveals the strength of the underlying technical innovation that is driving the economy and the extent to which companies are incorporating digital technology in the workforce.

**Engineering.** Similarly, demand for engineers is fairly robust across all areas of specialization, but some areas stand out. Twenty-three percent of projected openings are for civil engineers. This, in part, is a reflection of the strong surge in construction the state is currently undergoing, accompanying a sustained upswing in the economic recovery. Rounding out the list of the occupations in the field with the highest employer demand at the baccalaureate level are mechanical engineering (13 percent), electrical and electronics engineering (12 percent), industrial engineering (11 percent), and aerospace engineering (9 percent).

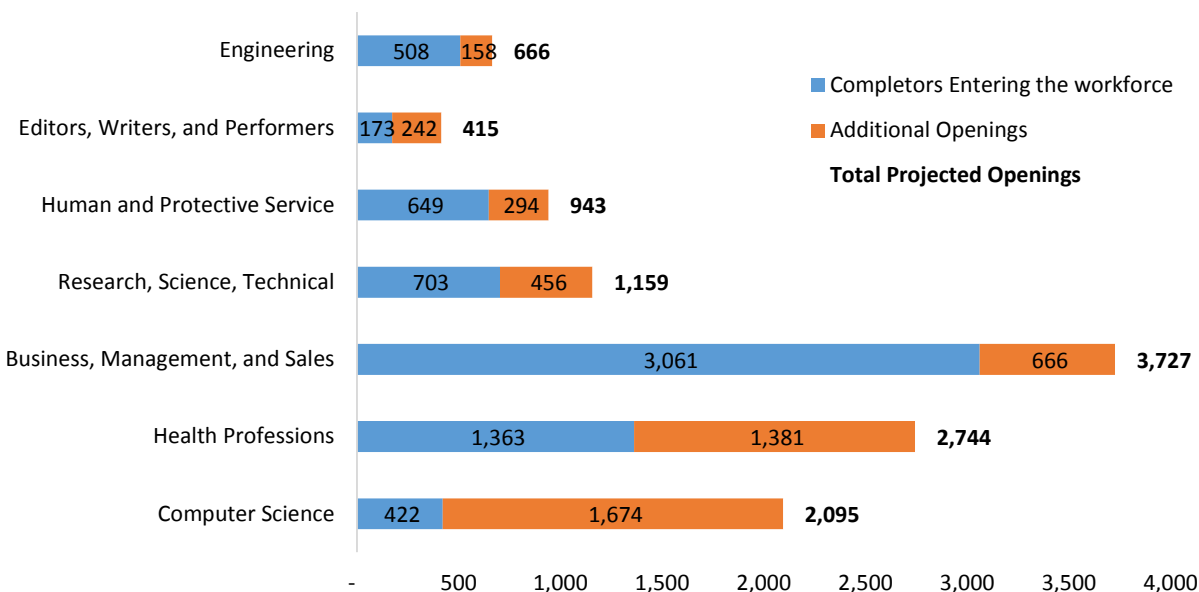


**Other Fields in Demand at the Baccalaureate Level.** The projected gap in the human and protective services field is primarily driven by demand in a few key fields. In the top group, 20 percent of forecast job openings are for social workers, followed by counselors (14 percent) and social and human services assistants (13 percent). Employment growth in this field is primarily driven by increased demand for healthcare and social services. Social workers, for example, help people cope with a wide range of problems. They are employed in a variety of settings, including mental health clinics, schools, child welfare and human service agencies, and hospitals. One group of social workers—clinical social workers—also diagnose and treat mental, behavioral, and emotional issues.

Demand in the media, design, and communications occupational cluster is tied to the strength of Washington’s technology sector as well as the expansion of business accompanying the ongoing economic recovery. Positions in the areas of multimedia art and animation, art direction, interpreting, translation, and technical writing account for the fastest growth in this field. Twenty-one percent of projected openings are for designers.

**Figure 8**

### Graduate Level Gaps – Estimated Completions and Projected Openings 2018-2023



Source: WSAC, WTECB, SBCTC joint analysis of 2015 Washington ESD long-term employment forecast; Bureau of Labor Statistics Training levels; IPEDS; 2014 Census PUMS data.

## Graduate Level

**Key Drivers of Demand.** By far the largest gaps at the graduate level are in computer science and the health professions, as shown in Figure 8. Other areas with substantial gaps are business, management, and sales; research, science, and technical; engineering; human and protective services; and editors, writers, and performers.

**Computer Science.** Computer science is also a prominent field among those showing skills gaps at the graduate level. Within this general field, the same occupations that predominate at the baccalaureate level lead the demand. At the graduate level, job openings for software developers stand in even higher relief, representing 59 percent of the total. Employment opportunities for computer programmers (12 percent) and computer systems analysts (10 percent) round out the top group.

The higher demand for software developers at the graduate level probably reflects the hierarchical nature of the profession. In general, software developers operate at a higher level. They design the software and computer programmers write code to their specifications. Given a strong need for individuals in this area, employers tend to prefer those with graduate-level training. However, even though a few specific occupations in the field tend to lead the pack, demand remains strong across the spectrum in computer science.

**Health Professions.** Consistent with analysis done in 2013, the current data show a fairly narrow supply-demand gap for the health professions at the baccalaureate level. Forty-nine percent of projected openings at the baccalaureate level are for registered nurses.

However, as shown in previous reports, persistent gaps remain at the graduate level for health professionals. Nearly 20 percent of projected openings are for physicians and surgeons. Other occupations that figure prominently in projected job openings include physical and occupational therapists (15 percent), pharmacists (9 percent), and dentists (7 percent).

Registered nurses and nurse practitioners are also in demand at the graduate level for positions with advanced practice responsibilities. Nurse practitioners are qualified to diagnose medical problems, order treatments, perform advanced procedures, prescribe medications, and make referrals for a wide range of acute and chronic medical conditions within their scope of practice. They perform vital functions that fill an important need for primary medical care as healthcare demand continues to expand in Washington.



A 2014 report by the University of Washington Center for Health Workforce Studies highlighted supply and demand gaps for physicians in the state, particularly in rural areas.<sup>11</sup> The report noted that Washington's overall physician supply, on a per capita basis, is generally comparable to national averages. But significant differences in distribution are apparent between urban and rural areas of the state. Rural areas, particularly in the eastern part of the state, are experiencing serious shortages of physicians, in both generalist and specialist fields. Compounding this difficulty is the fact that more than half the physicians in many rural communities are currently age 55 or older and are expected to retire in the near future.

The 2015 Annual Report by the Health Workforce Council emphasizes studies showing that the location where physicians complete their residency is the strongest predictor of where they will choose to practice.<sup>12</sup> For this reason, the Council stresses the importance of increasing slots for in-state residencies, with special attention paid to underserved areas in rural parts of the state.

**Other Fields in Demand at the Graduate Level.** Projected openings in the business, management, and sales field at the graduate level are highest for management analysts, accountants, and auditors. The gap in this area is likely due in part to currently steady economic growth and a steep rise in business activity after a prolonged period of stagnation and decline during the Great Recession. Projected openings for general and operations managers, accountants, and auditors represent 18 percent of the total. Openings for business operations specialists, general and operations managers, and market research analysts account for another 18 percent.



Moderate gaps in the research, science, and technical occupational cluster have been shown in previous analyses conducted over the last decade. Current analysis reveals that this trend persists. Forty-eight percent of projected openings are in the areas of life science, environmental and geoscience, and biological science. The demand in this area stems in part from the vitality of Washington’s growing biotechnology industry.

**Education and the Teacher Shortage: An Emerging High Demand Field at the Baccalaureate and Graduate Levels.** Education does not appear as a high employer demand field in the above analysis, primarily because the methodology is based on historical trend data. For this reason, the effects of high-impact, short-term activity—such as decisions by large employers regarding expansion, contraction, or relocation of facilities, or recent major shifts in public policy—are not apparent.

One such effect is class size reduction in response to the Washington State Supreme Court’s McCleary decision on public education funding and reform, which directed the state to address the implementation plan for K–3 class size reduction and full-day kindergarten outlined in Substitute House Bill (SHB) 2776. As a result of this decision and related legislation, sharply increased demand for more elementary school teachers is anticipated. Moreover, the decision fostered political pressures for further measures, such as voter-approved Initiative 1351, which reduces class sizes for all grades. So there is anticipation of increased demand for teachers at the middle school and high school levels down the road as well.

Compounding the pressure for more teachers caused by class size reduction is an anticipated need to replace a large wave of teachers who are in the process of leaving the system. A recent analysis conducted by the State of Washington Professional Educator Standards Board (PESB) reports that a large number of teachers are either currently leaving the profession or are anticipated to leave in the near future.<sup>13</sup> Many of those in the process of leaving are teachers who had postponed retirement or otherwise delayed plans to move, having stayed longer than intended in their positions for the duration of the recession. Adding to this challenge is a downward trend in teacher program enrollment and completions in the state.

PESB also produced a report assessing the state’s capacity to meet the increased demand for elementary school teachers stemming from SHB 2776 and the McCleary Supreme Court decision.<sup>14</sup> Washington currently has 21 approved teacher preparation programs, and about 1,500 students complete programs in teaching at the elementary school level in a typical year. But only about 60 percent of those completers continue on to be hired in teaching positions in Washington during their first year. It is unknown how many are choosing not to enter the teaching workforce in Washington for some reason or how many are simply unable to find positions where they are willing to reside.

A 2015 teacher shortage survey<sup>15</sup> conducted jointly by the Office of Superintendent of Public Instruction and the Association of Washington School Principals highlighted teacher supply-demand gaps confronted by state school leaders. Ninety-three percent of principals reported that, even beyond the challenge posed by McCleary, they struggle to find and hire qualified teachers. Particular areas of concern are difficulties in: (1) filling vacancies in urban and economically disadvantaged schools and (2) finding qualified teachers in the areas of special education, elementary, math, and science. The survey also reports that there is currently a serious shortage of substitute teachers in the state, with a majority of school leaders describing the situation as a “crisis.”

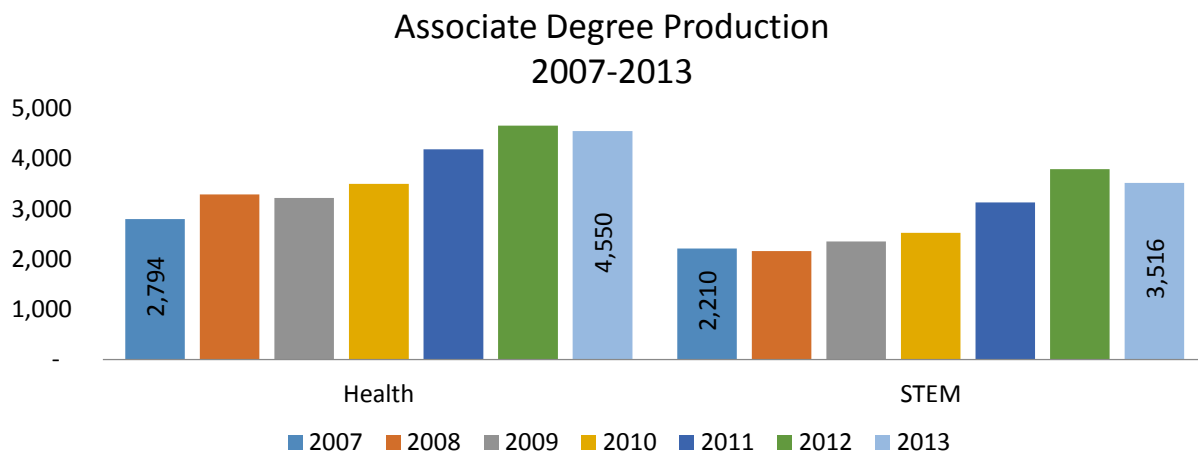
To address the teacher shortage challenge, PESB has recommended a multi-pronged approach. Several strategies could be pursued, including exploring ways to make the teaching profession more attractive, increasing the pipeline through recruitment efforts and scholarships, expanding alternative route programs for teacher certification, and broadening interstate teacher certification reciprocity agreements.

## Closing the Gaps

Washington is home to many fine educational institutions that have laid the groundwork for postgraduate success for many students and prepared them for the opportunities and challenges of the state’s dynamic economy and innovative employers. But the gaps between supply and demand in key occupational fields demonstrate that there is still room for improvement at all levels. Fortunately, our institutions provide a solid foundation on which further progress can be built.

Over the course of recent years, data indicate that continuous progress has been made in increasing degree and certificate production in high employer demand fields of study. Depending on the field and the educational level, progress in some areas has been more dramatic than others. But in all of these key fields degree production has moved in a positive direction during this time.

**Figure 9**



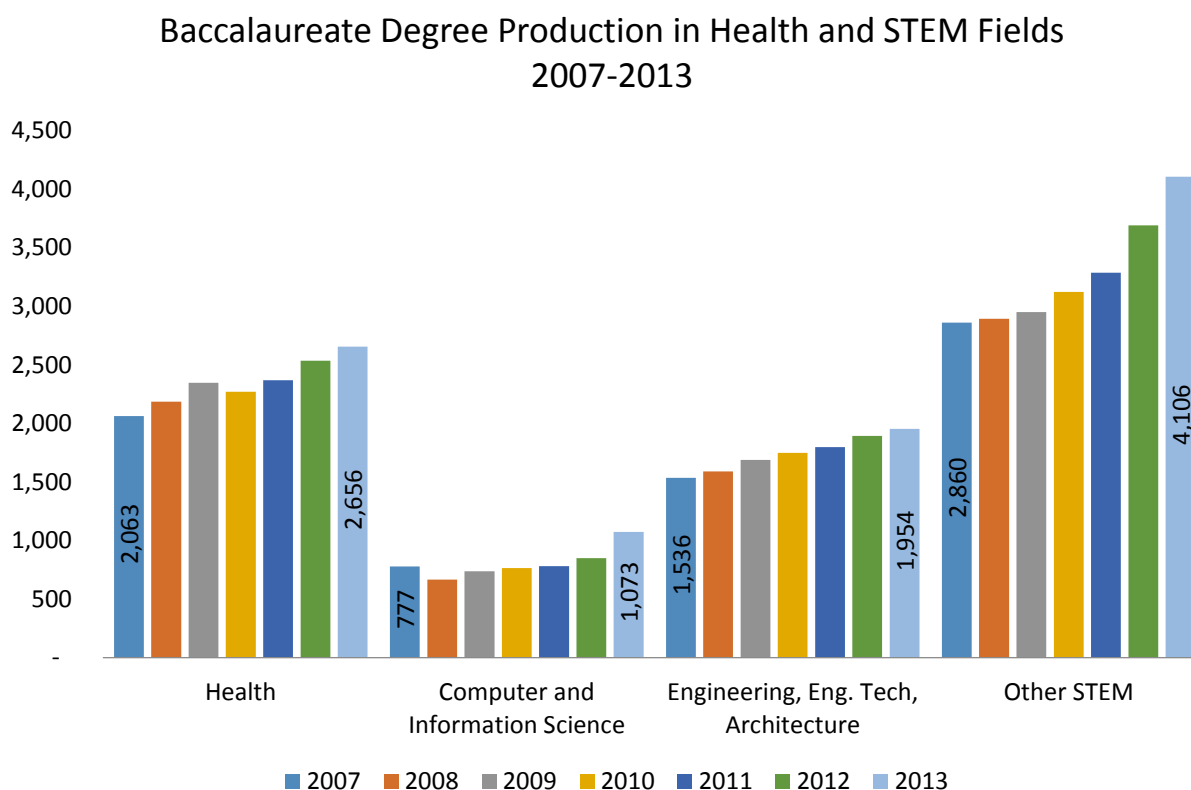
Source: Integrated Postsecondary Education Data System (IPEDS).

## Mid-Level

At the mid-level, as shown in Figure 9, degree and certificate production in the health, computer science, engineering, and science and mathematics fields has increased fairly steadily from 2007 to 2013. The one exception is a slight dip in the year 2013. This is the result of enrollment increases during the recession years peaking in 2012. The following year saw a slight decline in enrollments as the economy was rebounding rapidly and large numbers of people were returning to work. Current indications show that enrollments are once again on the rise.

In the health occupations, production grew by 63 percent from 2007 to 2013. Progress in degrees and certificates granted in STEM fields overall also rose significantly, growing by 59 percent during this same period.

**Figure 10**



Source: Integrated Postsecondary Education Data System (IPEDS).

## Baccalaureate Level

Figure 10 shows the trend at the baccalaureate level. Degree production in health, computer science, engineering, and other science and mathematics fields increased steadily over the last several years. In computer and information science, there has been consistent growth in degree completions, with a 38 percent increase from 2007 to 2013. Degree production saw gains in the fields of engineering and related technology (27 percent) and health (29 percent) during this period. Other STEM fields as a group grew by 44 percent.

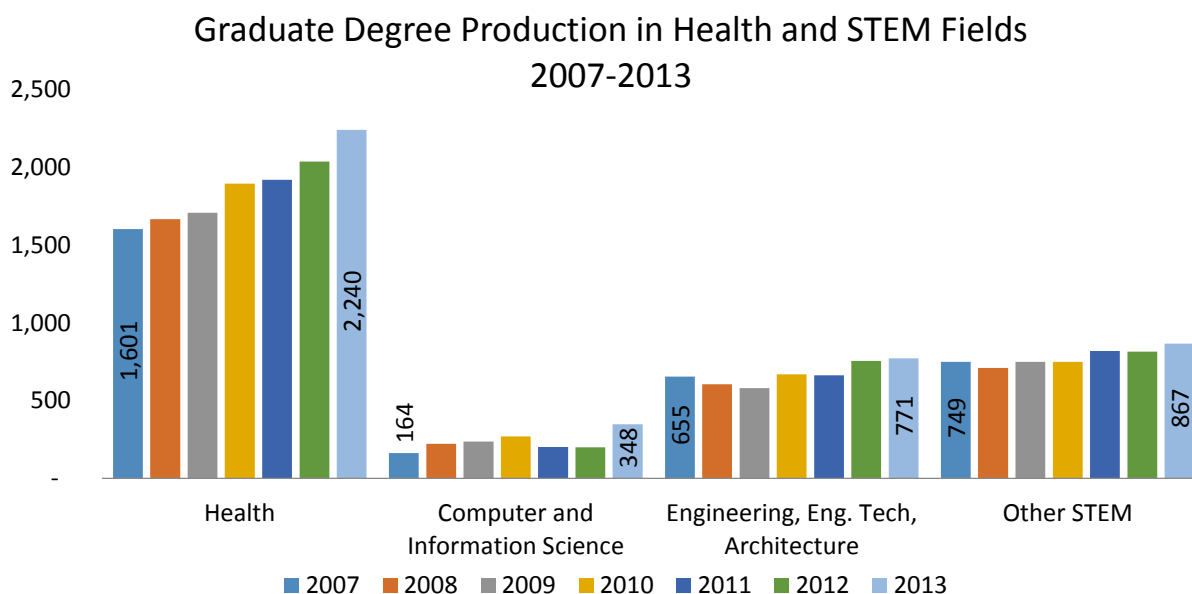
It should be noted that targeted funding for expanding STEM programs at Washington’s public universities included in recent legislative budgets was instrumental in fueling successful gains in production. For example, in order to increase degree production in the STEM fields generally, the Legislature’s 2012 budget reallocated over \$9 million in targeted funding to the state’s public universities and colleges. These funds were dedicated to expanding enrollments in engineering at the research universities and to expanding enrollments in science, technology, engineering, and mathematics fields at the regional institutions and the Evergreen State College.

A more recent example of this type of targeted allocation was a substantial increase in funding that was included in the 2013–15 operating appropriations for the express purpose of expanding enrollments in computer science and engineering. These funds, for fiscal years 2014 and 2015, were allocated to the University of Washington (\$4,459,000 per year); Washington State University (2,856,000 per year); and Western Washington University (\$1,497,000 per year). These expansions, however, tend to take time to develop. With these additional funds, the universities have been adding enrollments gradually over the past few years. Going forward, degree production will begin to increase as students move toward completion of program coursework.

## Graduate Level

As shown in Figure 11, at the graduate level, the fastest growth in degree production occurred in the health sciences, with an increase of over 40 percent from 2007 to 2013. Steady growth occurred in computer and information science as well, with degree completions more than doubling during this period. Progress in engineering and related technology (18 percent) and the other STEM fields as a group (11.3 percent) experienced positive but more modest levels of expansion during this period.

**Figure 11**



Source: Integrated Postsecondary Education Data System (IPEDS).

## Conclusion

Over the last several years, degree production in the health care professions has increased, largely due to a coordinated system-wide effort to invest in this field. However, substantial shortages still exist, particularly at the professional level. For example, rural areas, particularly in the eastern part of the state, are experiencing serious shortages of physicians, in both generalist and specialist fields. Adding to this challenge is the fact that many rural physicians in the state right now are 55 years of age or older and are expected to begin retiring in the near future. Studies have shown that the location where physicians complete their residency is the strongest predictor of where they will choose to practice. For this reason, action may need to be taken to increase slots for in-state residencies, with special attention paid to underserved areas in rural parts of the state. In 2015, in part to respond to this challenge, the Legislature approved a budget that included funding to create a new Washington State University Medical School in Spokane. One of its primary missions will be to focus on training primary care physicians to work in rural and urban underserved areas. The medical school aims to begin enrolling students in 2017. Despite this ambitious effort, demand for health professionals, particularly at the graduate level, is likely to continue to warrant careful monitoring in the foreseeable future.

Current data show some progress in increased degree production in the computer science and engineering fields. Growth is seen at both the baccalaureate and graduate level. However, the rate of progress in these fields is still lagging behind surging demand. Workers with skills in this area are in demand at all education levels. More expansion will be required to meet the needs of our state's dynamic economy and provide more Washington residents with vital opportunities to compete for these high-skill, high-wage jobs.

Going forward, more detailed information from Washington's employers on the specific training and education levels they are actually seeking in applicants for various occupations could allow for more refined supply and demand gap analyses. Improved and expanded employer feedback mechanisms, through surveys and other available resources, could provide more in-depth understanding of precise employer needs in particular fields.

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## Appendix A: Notes on the Analysis

The conclusions contained in this report were based on two primary measures: 1) *workforce supply*, estimates of the annual number of graduates entering the workforce by degree level and major field of study, and 2) *employer demand*, projections of the number of net annual job openings by sector and education level.

### Workforce Supply

The analysis of workforce supply was grounded on degree production data from the Integrated Postsecondary Education Data System (IPEDS), which was adjusted to estimate the number of graduates expected to immediately enter the workforce. IPEDS compiles results from annual institutional surveys conducted by the National Center for Education Statistics. These surveys include data on enrollments and degree completions from every college, university, and technical and vocational institution that participates in federal student financial aid programs. Since not all graduates immediately enter the workforce, these completion figures must be adjusted to account for graduates who opt to continue their postsecondary education or postpone work for other reasons. These modified figures are necessary to arrive at realistic estimates of the number of graduates available to meet employer demand in a given period.

For the mid-level, IPEDS data was supplemented with administrative data from the Workforce Training and Education Coordinating Board to capture degrees and certificates awarded by schools operating in Washington but not reporting credentials in IPEDS for Washington, either because they do not participate in Title IV aid programs or because they are based out of state and report completions in their home state.

Workforce supply was adjusted using data from the 2011-2013 American Community Survey conducted by the U.S. Census Bureau, which includes the percentages of degree holders in this survey reporting that they were 1) enrolled and either unemployed or employed part-time, 2) enlisted in the military, or 3) not in the labor force. The data were used to estimate the percentage of degree completers that would not immediately be available to enter the workforce. For each degree level, the total number of completions was adjusted downward by the corresponding aggregate percentage.

### Employer Demand

Employer demand was estimated using projected job openings from the Employment Security Department's long-term occupational forecast of total openings for 2016-2023, issued in May 2015. These employment outlook projections were matched against estimates of the training and education levels required for various occupational types, based on Washington Student Achievement Council staff analysis of U.S. Census Bureau data, reflecting actual education and training levels of survey respondents in various occupations, and adjusted based on Bureau of Labor Statistics education and training assignments by detailed occupation to establish a minimum training level.

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## Limitations of the Analysis

A few limitations of this analysis that could affect the gaps reported at each level should be noted. First, the report is not able to fully address the impact of new and emerging industries and occupations, due to restrictions in the methods of the Employment Security Department's long-range forecast. In addition, because of difficulties in obtaining accurate information in this area, the numbers do not reflect any adjustments to account for workers in jobs that may require more or less education than they currently possess.

In addition, because demand is based on openings and supply is based upon program completions, gaps may be understated in fields where a significant number of workers would complete a degree or certificate as a normal part of their ongoing professional development. For example, many practicing teachers will complete a master's degree and would therefore show up in supply; however, in most cases those teachers would not change occupations and therefore would not be available to fill an opening. This is further complicated by the fact that some teachers do receive their initial training at the master's level and are seeking to fill an opening in that occupation. We see similar issues in health care, particularly among practicing nurses who often train at the associate level but then later complete a bachelor's degree, and managers who may complete an MBA as part of their professional development for their current occupation.

Finally, the analysis is not intended to fully account for the overall dynamics of the current employment market for recent graduates as the economy recovers in the wake of the Great Recession. Instead, it is based on historical trends and a forward-looking perspective, with demand assessed upon projected future openings compared to current degree production and labor force participation rates.

## Appendix B: Mid-Level Gaps – All Occupational Groups

Mid-Level	Completions	Supply	Demand	Gap
Administrative, Clerical	7,756	6,280.82	6,308	26.74
Business, Management, and Sales	9,404	7,614.68	10,288	2,673.73
Computer Science	824	667.50	1,385	717.13
Media, Design, and Communications	1,138	921.68	1,305	383.02
Educators	1,668	1,350.75	1,875	524.30
Engineering	791	640.84	388	(252.57)
Health Professions	7,155	5,793.56	4,664	(1,129.10)
Human and Protective Service	1,232	997.77	1,592	594.47
Legal	630	510.45	185	(325.88)
Production and Trades	7,634	6,181.97	9,441	3,258.93
Research, Science, Technical	392	317.20	510	192.80
Service Occupations	5,477	4,435.41	7,791	3,355.77
<b>Total</b>	<b>44,103</b>	<b>35,713</b>	<b>45,732</b>	<b>10,019</b>

## Appendix C: Baccalaureate Gaps – All Occupational Groups

Bachelor's	Completions	Supply	Demand	Gap
Administrative, Clerical	3,378	2,857.82	3,138	280.00
Business, Management, and Sales	12,440	10,525.84	11,208	682.20
Computer Science	2,675	2,263.62	4,395	2,131.38
Media, Design, and Communications	1,304	1,103.52	1,664	560.37
Educators	2,408	2,037.26	2,212	175.04
Engineering	1,873	1,584.53	2,084	499.79
Health Professions	2,742	2,320.21	2,384	63.57
Human and Protective Service	1,572	1,329.88	1,768	437.87
Legal	268	226.36	109	(117.11)
Production and Trades	2,274	1,924.08	1,996	71.84
Research, Science, Technical	569	481.02	520	39.01
Service Occupations	1,940	1,641.12	2,670	1,029.00
<b>Total</b>	<b>33,442</b>	<b>28,295</b>	<b>34,148</b>	<b>5,853</b>

## Appendix D: Graduate Gaps – All Occupational Groups

Graduate	Completions	Supply	Demand	Gap
Administrative, Clerical	261	227.16	566	338.39
Business, Management, and Sales	3,512	3,061.30	3,727	666.16
Computer Science	484	421.88	2,095	1,673.55
Media, Design, and Communications	199	173.08	415	241.83
Educators	3,152	2,747.60	3,001	253.60
Engineering	583	508.41	666	157.56
Health Professions	1,564	1,362.98	2,744	1,380.55
Human and Protective Service	745	649.04	943	294.22
Legal	856	746.39	606	(140.44)
Production and Trades	112	97.36	302	204.43
Research, Science, Technical	807	703.13	1,159	455.69
Service Occupations	124	108.17	256	148.10
<b>Total</b>	<b>12,399</b>	<b>10,806</b>	<b>16,480</b>	<b>5,674</b>