



# **LEGISLATIVE REPORT ON THE SKILLS FOR JOBS ACT**

**SUBMITTED JANUARY 2016**

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**This report was prepared by the Colorado Department of Higher Education (DHE) pursuant to the requirements of §23-1-130 Colorado Revised Statutes.**

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## Executive Summary

In accordance with 23-1-130 C.R.S., the Skills for Jobs report was prepared by the Colorado Department of Higher Education. This report explores the state's anticipated workforce needs and the number of postsecondary credentials that are being issued, identifying any workforce needs that may not be met by education and training programs.

In 2014, public institutions in Colorado awarded 56,233 certificates and degrees, a 3.1 percent increase from the year prior. Colorado has a highly educated workforce and experts project that more jobs will continue to demand some level of postsecondary education (Carnevale, Smith & Strohl, 2013). The state unemployment rate is also lower for people who have a postsecondary credential than for those who have a high school degree or less.

In alignment with the Talent Pipeline report, we have isolated a selection of jobs with high projected growth rates and openings, while offering a sustainable living wage. While not exhaustive of occupations that offer opportunities for Coloradans, it provides a glimpse into promising industries in our state overall and can help guide our efforts in developing our state's workforce talent in various sectors. Jobs on this list are concentrated in skilled trades, healthcare, business/finance, and information technology (IT) occupation clusters. See the complete list in [Appendix A](#). While not exhaustive of all skills gaps, when analyzing related completions to average annual openings by occupation group, data show that we are potentially not meeting job openings for a number of skilled trades, mid-level and bachelor's level IT, bachelor's level finance, and graduate/professional level healthcare practitioner positions.

Recommendations include continuing efforts to,

- Use and improve state data sets and data alignment across agencies so as to better understand aggregate trends and use data to address policy questions;
- Develop effective career pathways, prioritizing a focus on fields that are in high demand and offer good employment opportunities for Coloradans;
- Closely examine and address supply-demand relationships in high demand areas such as healthcare, IT and skilled trades;
- Build strong industry-institution partnerships;
- Find ways to increase postsecondary success for our fastest growing demographic groups; and
- Provide students and families with the tools and knowledge to make informed educational decisions.

## Introduction

As Colorado continues to grow and evolve, it is important for our state to have a nuanced understanding of economic and educational forces, and to be able to develop the educational and training opportunities that meet the needs of individual workers and the demands of the economy. In light of the Great Recession, the increasing cost of postsecondary education for the consumer, and a decade of wage stagnation for the majority of workers, the public and policy makers alike want to make informed decisions regarding the roles of postsecondary training and education in their lives and communities. While this report relies on recent postsecondary education and workforce patterns, it also ties in labor market projections to estimate where we may or may not be meeting industry demand for educated and trained workers. In turn, we hope this report sheds light as to where our anticipated high demand and high growth fields are, and whether credentials are being awarded that align with the economic needs of our state.

Pursuant to statute (23-1-130 C.R.S.), the Colorado Department of Higher Education (DHE) is required to submit a report concerning the state workforce need projections and credential production. In fulfillment of this requirement, this report identifies trends in the state's anticipated workforce needs and the number of degrees and certificates that have been produced. This report will be submitted to the Education Committees of the Senate and House of Representatives, the Economic and Business Development Committee of the House of Representatives, the Business, Labor, and Technology Committee of the Senate, and the Governor. Additionally, it will be sent to every public postsecondary governing board and be made available through the Department of Education to the state's public, private, and charter schools and districts, as well as be publicly available on the DHE website.

Highlights from this report include:

- An overview of national trends regarding postsecondary education and workforce needs, alongside Colorado-specific facts and figures; and
- Analysis of the state's anticipated workforce needs by occupation type and education levels, alongside the number of related certificates and degrees that Colorado postsecondary institutions issue.

Certainly, a report such as this has its limitations in scope. While we do orient this report as a statewide analysis, we recognize that unique regional trends exist. As part of our state's efforts to provide relevant information to interested stakeholders, we would like to recognize two other informational tools that are also available on related topics. The Colorado Workforce Development Council, in collaboration with the Colorado Department of Higher Education, the Colorado Department of Labor and Employment, the Colorado Department of Education, the Office of Economic Development and International Trade, the Office of State Planning and Budgeting and the State Demography Office at the Department of Local Affairs, released the second

annual [Talent Pipeline Report](#) in October 2015. In the spring of 2015, the [EdPays website](#) was launched in collaboration with College Measures and the Lumina Foundation, which provides information on median earnings trends in Colorado for postsecondary graduates one, five and ten years following graduation.

### National Trends

In recent years there has been a surge of research, reports and media attention surrounding postsecondary education and employment, as both the educational and economic landscapes of our country have shifted considerably in recent history. Nationwide, it has been projected that by 2020, 65 percent of all jobs will require postsecondary education or training (Carnevale, Smith & Strohl, 2013). Colorado's projected workforce requirements even exceed the national average with 74 percent of all jobs requiring some level of postsecondary education by 2020. By these numbers, Colorado ranks third nationally in terms of our anticipated postsecondary training needs (Carnevale et al., 2013).

The national and Colorado-based conversations on workforce readiness and fulfilling employers' workforce needs have begun to shift perspectives on long held assumptions and biases toward different kinds of postsecondary education, and the alignment of pathways to supporting the success of youth and adults alike. According to research from Georgetown University's Center on Education and the Workforce on nationwide trends, when the projected postsecondary credential requirements for jobs in 2020 are more specifically defined, 36 percent of jobs will demand a baccalaureate degree or higher (or 42 percent of jobs in Colorado), while 30 percent will require a lesser degree of postsecondary training, such as an associate degree or certificate award (or 32 percent for Colorado) (Carnevale et al., 2013).

Ultimately, at the individual and state level, we all benefit from a well-educated workforce. Education supports an individual's employability and economic security. That individual can then afford to engage in the local economy through purchasing goods and services and paying taxes. Furthermore, during economic downturns, those with lower levels of educational attainment experience the most significant declines in employment and greater wage deterioration (Grusky, Red Bird, Rodrigues & Wimer, 2013), indicating one such way that a postsecondary education can often serve as an economic shield.

### Colorado's Supply and Demand for Educated and Trained Workers

Colorado's economy is one of the strongest in the nation, with an unemployment rate of 3.6 percent as of November 2015 (Colorado Department of Labor and Employment, 2015). Data show that unemployment rates are lower for people with a postsecondary credential as compared to those without any postsecondary educational experience (Current Population Survey, 2015). Unemployment in 2015 in Colorado hovers at 3.8

percent for people with some college or an associate degree and at 2.1 percent for an adult with a bachelor’s degree or higher—lower than the unemployment rate for high school graduates (4.8 percent) and for those with less than a high school education (6.4 percent), although all rates of unemployment have declined since the previous Skills for Jobs Report was released. Median earnings continue to be higher for those with higher levels of education (U.S. Census Bureau, 2014).

**Table 1: Colorado Unemployment and Earnings by Education Level**

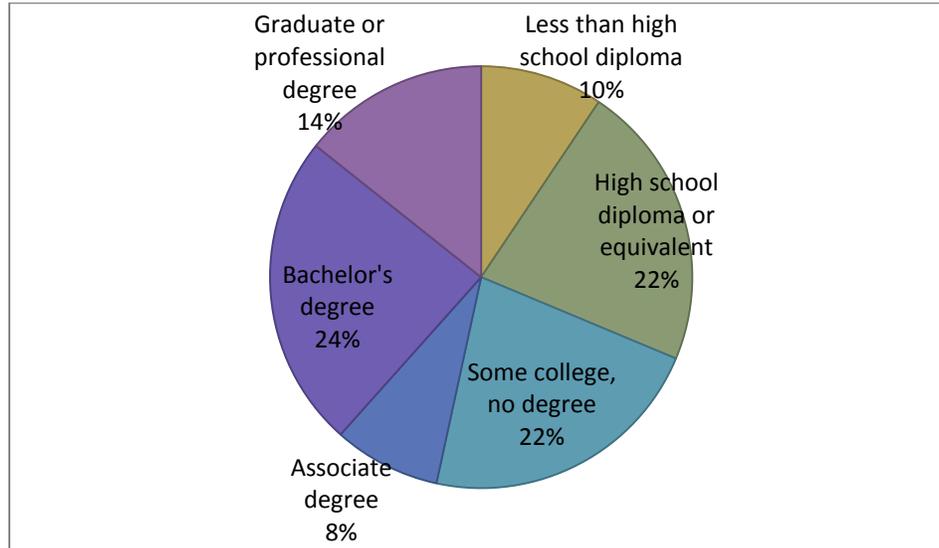
Educational Attainment	Unemployment Rate	Median Earnings
Less than high school graduate	6.4%	\$23,004
High School graduate	4.8%	\$30,568
Some college or associate degree	3.8%	\$35,329
Bachelor’s degree	2.1%	\$48,818
Graduate or professional degree		\$64,861

Source: U.S. Census Bureau, 2014 American Community Survey, 1-year estimates; Current Population Survey, 2015

In addition, Colorado has a workforce with one of the highest proportions of non-routine analytical and interpersonal skills—that is, skills such as critical thinking, social perceptiveness and creativity that are engaged in by educated and highly adept workers. Economies with high proportions of workers who typically use high-level analytical and interpersonal skills are positioned for better performance in the present and future as technologies evolve ([Colorado Office of State Planning and Budgeting](#), 2014). Maintaining a high share of workers with these types of non-routine skills will help sustain Colorado’s economic performance.

Overall, Colorado has a highly educated population relative to the rest of the nation, with nearly 47 percent of adults holding an associate degree or higher, and an additional 22 percent having some college experience or a certificate (Figure 1)—yet we also have an economy that demands a highly educated workforce. Experts project that by 2020, 74 percent of jobs in Colorado will require some level of postsecondary education or training (Carnevale et al., 2013). Along with the national goals for credential attainment, the Colorado Department of Higher Education has also been targeting a 66 percent postsecondary certificate or degree attainment level for Coloradans ages 25 to 34 by 2025 (for more information, see the Colorado Commission on Higher Education [Master Plan](#)). Colorado’s educational attainment goals are higher than most states, due to current education levels of our workforce and the composition of jobs in our state’s economy.

**Figure 1: Colorado Educational Attainment, Adults 25 Years and Older**



Source: U.S. Census Bureau; 2014 American Community Survey, 1-year estimates

While Colorado’s adult population overall has a high educational attainment level, there are significant disparities in educational attainment levels by race/ethnicity. Exemplifying this gap is the difference in educational attainment for our non-Hispanic white and Hispanic population in Colorado: 20 percent of Hispanic adults have a college degree whereas 53 percent of non-Hispanic white adults have a degree (U.S. Census Bureau, 2014). It is important to consider that by 2040 the non-white share of our primary working adult population (ages 25 to 64) is projected to be 43 percent (in 2010 it was 26 percent) (State Demography Office, 2013). Our state’s diversifying racial/ethnic composition will also mean more layers of support will likely be needed for students, especially those from underserved populations who tend to have lower educational attainment rates, in order to achieve higher levels of academic success. These factors may impact the long-term sustainability of our educated workforce and the development of our state economy.

Initial analysis from the Colorado State Demographer’s Office also shows that if Colorado does *not* continue to experience gains in educational attainment by race/ethnicity, then we can expect to see declines in the share of the population with a bachelor’s degree or higher and even more significant declines in the share of the population with a graduate or professional degree. The share of the population with less than a high school education would also increase given the expected changes in our demographic structure. If Colorado continues to experience similar increases that it has in recent years for attainment levels of high school diplomas and above by race/ethnicity, Colorado will see increases in the share of the population with a bachelor’s degree or higher, as well as increases in the share of the population with some college or an associate degree.

One variable that complicates analysis of a state’s workforce supply are migration patterns across state lines. On average, three-quarters of Colorado residents graduating from a public postsecondary institution are found in our workforce within the year following graduation. However, entry into our state’s workforce varies based on residency status, program major and degree level (for more information, see [Appendix C](#)). Some graduates will continue their education and delay entry into the workforce, some will pursue opportunities out-of-state, and some will leave and then return to the state for employment years later. Typically, people with higher levels of education tend to have higher levels of geographic mobility, so while we may lose a portion of our educated Coloradans to out-of-state opportunities, our state still attracts a large share of highly educated people. While we have consistently been able to attract qualified talent from outside of Colorado, we must also anticipate an increase in national and global competition for these workers as older skilled workers continue to retire in large numbers.

Completion figures show a 3.1 percent growth rate for credentials issued by a public institution from the previous academic year. While nearly half of these credentials issued are bachelor’s level degrees, the growth rate for less-than-one year certificates in particular (10 percent from academic year 2012/13 to 2013/14) exceeds that of all other credentials.

**Table 2: Postsecondary Credentials Awarded (2013-14)**

Credential Type	Public		Private
	Growth rate from year prior	AY 2013-14	AY 2013-14
<b>Total</b>	<b>3.1%</b>	<b>56,233</b>	<b>32,388</b>
Certificates	7.2%	13,797	6,466
Associate	-2.0%	8,337	5,506
Bachelor	4.0%	25,145	9,016
Graduate	0.0%	8,954	8,839

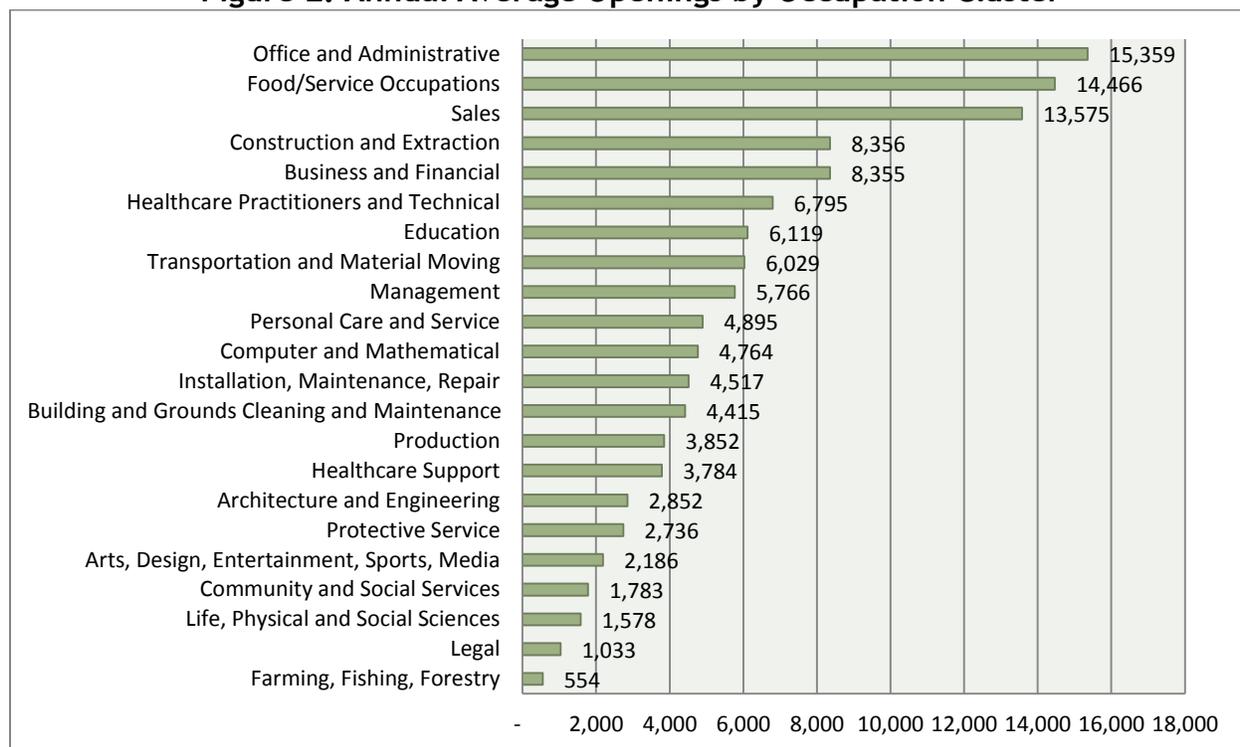
Source: IPEDS

Despite potential challenges we may face in terms of future degree production, we do have one of the most highly educated workforces in the country, and an economy that continues to attract an educated workforce and motivates many to acquire additional education. As we increase our credential production, it is also important to look beneath the surface of degree levels awarded and examine the structural nuances of our degrees and credentials earned to assess if we have any gaps in certain areas of training. The state is actively engaging in strategies, such as supporting sector partnerships and developing industry-led career pathways, to ensure we are training Coloradans for the jobs of today and tomorrow. A career pathway is a series of connected education and training programs, work experiences and student support services that enable individuals to secure a job or advance in an industry or occupation. The vehicle for creating such pathways is sector partnerships— regional,

industry-led partnerships of private and public partners, in a specific region, for a specific industry. The goal of sector partnerships is for private and public partners to coordinate and collaborate around the opportunities and requirements for the industry to grow in their region. Active sector partnerships have the ability to help drive the development of career pathways with education partners, so as to better meet their workforce needs. In 2015, legislation was passed to prioritize the development of healthcare, technology and skilled trades career pathways.

When we look forward to what we can anticipate for the jobs of tomorrow, Colorado’s ten year labor market projections estimate over 123,000 average annual openings due to the replacement of workers and economic growth; Figure 2 depicts where annual openings are dispersed by occupation group. In the following sections we provide additional analysis related to high growth occupations and credential completions alongside projected openings for occupation groups. A complete list of occupation groups can be found [here](#).

**Figure 2: Annual Average Openings by Occupation Cluster**



Source: Analysis of Colorado Labor Market Information

## Colorado's Top Jobs: Supply and Demand

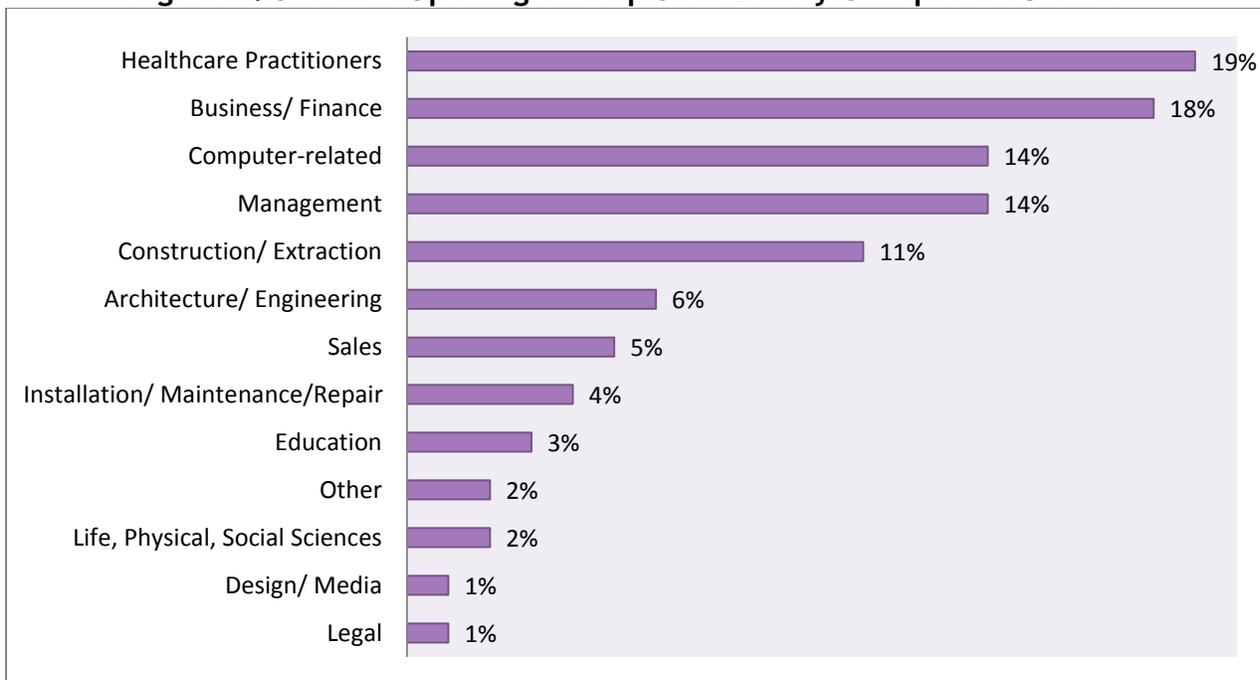
To pinpoint “top jobs” in our state, this report uses labor market data from Colorado’s Office of Labor Market Information to identify jobs that meet three criteria: above average growth rates, projected high annual openings, and typically offer a living wage for a family of three with one working adult. This is not an exhaustive list of occupations that offer opportunities for Coloradans; rather, it offers a glimpse into some promising fields in our state overall and can help guide our efforts in developing our state’s workforce talent in various sectors.

Many occupations that do not exist today may be in high demand in the near future, so we look to this list to provide us with fields where we can anticipate burgeoning opportunity. We’ve delineated the occupations by typical education requirements for entry. Table 3 shows mid-level occupations that are classified as requiring some college, an associate degree or extensive postsecondary training (such as an apprenticeship) for employment; Table 4 shows occupations that typically require a bachelor’s or graduate degree for employment.

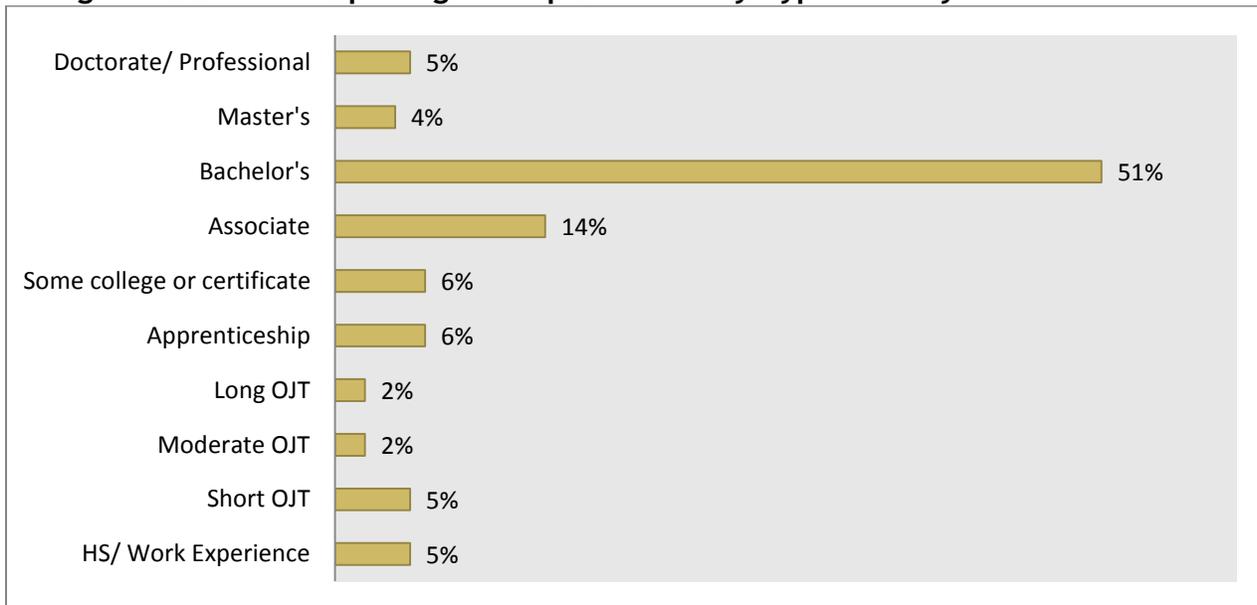
These tables includes related completions (per 2014 Integrated Postsecondary Education Data System data) alongside projected annual openings by occupation, when available, as some occupations do not have specific educational/training pathways or some training program types are not recorded in the IPEDS data set (such as some apprenticeships or industry certificates). While regional differences do exist in terms of completions and occupation demand, for the purposes of this report we focus on a statewide perspective. Depending on your interests in a specific specialized skill, program or region, further examination of a potential supply-demand gap is recommended to better understand talent development strategies that should be implemented.

Based on current Colorado labor market data, occupations on the Top Jobs list are highly concentrated in construction and extraction, healthcare, business and finance, and IT occupations (Figure 3). Eighty-eight percent of job openings on this list are for occupations that typically require some level of postsecondary education or training for entry, whether it is an employer-sponsored formal training program, apprenticeship, certificate or degree (Figure 4).

**Figure 3: Share of Openings in Top Jobs List by Occupation Cluster**

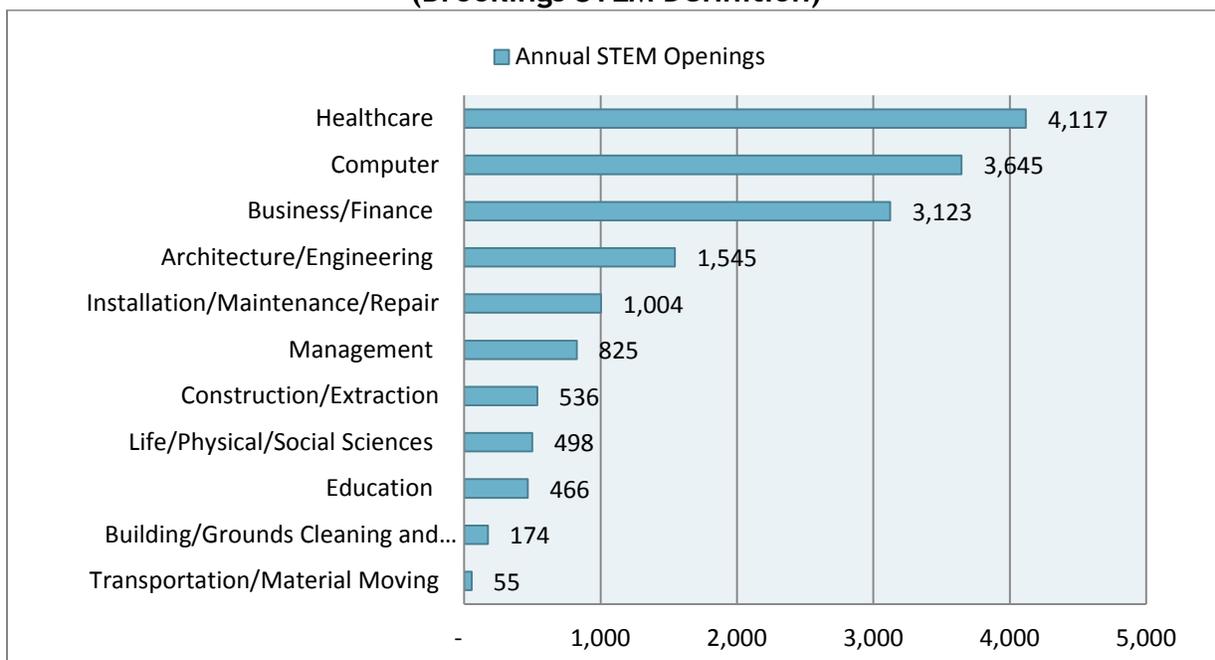


**Figure 4: Share of Openings in Top Jobs List by Typical Entry Level Education**



For the purposes of this analysis, we expanded our definition of STEM occupations and programs beyond that of the more limited occupation codes for IT, math, engineering and science professionals (e.g., jobs that largely require a bachelor’s degree or higher) to align with the Brookings Institution definition, which is based on actual skill levels in the areas of science, technology/computers, engineering and/or mathematics as typically required to perform an occupation.<sup>1</sup> Sixty-two percent of the job openings on this list are considered STEM per the Brookings Institution definition of STEM occupations, while about 20 percent of jobs across the state’s workforce are considered STEM by this definition. According to the Bureau of Labor Statistics’ definition of STEM occupations, 45 percent of jobs in this list are STEM, while out of all occupations in Colorado, about 14 percent are STEM by this definition. Brookings defined STEM jobs that are represented on this list are highly concentrated in IT, healthcare and finance occupations (Figure 5).

**Figure 5: Top Jobs: Number of Annual STEM Job Openings by Occupation Cluster (Brookings STEM Definition)**



The following two tables include occupations that are part of the Top Jobs list, with columns showing median earnings, projected change, related completions, and typically expected education and training. The complete list of top jobs can be found in [Appendix A](#).

<sup>1</sup> Brookings has conducted analysis of all occupations using O\*NET skills scores, and has defined STEM occupations as those that require above average skill/knowledge levels in science, technology, engineering and/or mathematics areas. This definition includes not only occupations in the science, computer, math and engineering job clusters, but includes jobs in other fields such as healthcare, skilled trades and finance occupations.

**Table 3: Mid-Level Top Jobs**

<sup>a</sup> Designates completions at community or technical colleges and is not necessarily comprehensive of all related training (i.e., apprenticeship completions, employer-sponsored training programs).

\* Indicates an inadequate number of shared completions across multiple related occupations.

**(N/A)** Indicates specific programs do not crosswalk to this occupation code, it is difficult to ascertain which completers would enter this occupation or there are no related programs at a Colorado-based institution.

Occupation Code	Occupation	Median Annual Earnings	Total % Change 2014-2024	Avg. Annual Openings	Related Completions (2014)	Entry Education Level	Additional Training Level
15-1134	Web Developers	\$55,227	38.0	212	*	Associate degree	None
15-1151	Computer User Support Specialists	\$50,910	34.6	695	*	Some college, no degree	Moderate-term OJT
19-4041	Geological and Petroleum Technicians	\$58,105	34.3	47	20	Associate degree	Moderate-term OJT
23-2011	Paralegals and Legal Assistants	\$49,202	31.2	269	250	Associate degree	None
29-1126	Respiratory Therapists	\$57,724	32.9	84	108	Associate degree	None
29-1141	Registered Nurses	\$68,295	33.0	2,351	2,665	Associate degree	None
29-2021	Dental Hygienists	\$81,091	37.6	254	92	Associate degree	None
29-2032	Diagnostic Medical Sonographers	\$77,684	60.8	60	44	Associate degree	None
29-2034	Radiologic Technologists and Technicians	\$58,986	32.7	139	232	Associate degree	None
29-2055	Surgical Technologists	\$50,274	45.0	82	61	Postsecondary non-degree award	None
29-2061	Licensed Practical and Licensed Vocational Nurses	\$45,843	31.4	315	300	Postsecondary non-degree award	None
31-2021	Physical Therapist Assistants	\$50,203	46.0	68	110	Associate degree	None
47-2021	Brickmasons and Blockmasons	\$44,582	64.2	123	8a	HS diploma or equiv.	Apprenticeship
47-2111	Electricians	\$46,847	45.4	1,006	859a	HS diploma or equiv.	Apprenticeship
47-2152	Plumbers, Pipefitters, and Steamfitters	\$46,143	45.0	536	389a	HS diploma or equiv.	Apprenticeship
49-3042	Mobile Heavy Equipment Mechanics, Except Engines	\$47,625	26.8	163	N/A	HS diploma or equiv.	Long-term OJT
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	\$48,760	43.5	341	245a	Postsecondary non-	Long-term OJT

						degree award	
49-9041	Industrial Machinery Mechanics	\$52,710	39.1	415	N/A	HS diploma or equiv.	Long-term OJT
49-9062	Medical Equipment Repairers	\$48,736	42.4	85	9	Associate degree	Moderate-term OJT

**Table 4: Bachelor's and Graduate Degree Level Top Jobs**

\* Indicates an inadequate number of shared completions across multiple related occupations.

(N/A) Indicates specific programs do not crosswalk to this SOC, it is difficult to ascertain which completers would enter this occupation or there are no related programs at a Colorado-based institution.

Occupation Code	Occupation	Median Annual Earnings	Total % Change 2014-2024	Avg. Annual Openings	Related Completions (2014)	Entry Education Level	Additional Training Level
11-1021	General and Operations Managers	\$100,247	25.2	1,809	N/A	Bachelor's degree	None
11-2021	Marketing Managers	\$133,308	25.0	127	N/A	Bachelor's degree	None
11-3021	Computer and Information Systems Managers	\$140,037	26.6	253	N/A	Bachelor's degree	None
11-3121	Human Resources Managers	\$122,692	30.4	84	N/A	Bachelor's degree	None
11-9021	Construction Managers	\$83,436	28.1	572	N/A	Bachelor's degree	Moderate-term OJT
11-9033	Education Administrators, Postsecondary	\$77,162	27.0	133	N/A	Master's degree	None
11-9111	Medical and Health Services Managers	\$101,250	34.3	241	N/A	Bachelor's degree	None
11-9151	Social and Community Service Managers	\$68,578	26.8	85	N/A	Bachelor's degree	None
13-1051	Cost Estimators	\$60,095	43.4	419	N/A	Bachelor's degree	None
13-1081	Logisticians	\$74,114	43.1	161	N/A	Bachelor's degree	None
13-1111	Management Analysts	\$80,445	33.4	509	N/A	Bachelor's degree	None
13-1151	Training and Development Specialists	\$61,866	26.5	230	N/A	Bachelor's degree	None
13-1161	Market Research Analysts and Marketing Specialists	\$66,975	46.3	818	338	Bachelor's degree	None
13-2011	Accountants and Auditors	\$67,473	27.0	2,044	1,218*	Bachelor's degree	None
13-2051	Financial Analysts	\$74,924	36.9	231	406*	Bachelor's degree	None
13-2052	Personal Financial Advisors	\$76,751	41.5	268	377*	Bachelor's degree	None
15-1121	Computer Systems Analysts	\$86,663	37.3	552	*	Bachelor's degree	None
15-1122	Information Security Analysts	\$92,559	53.1	104	*	Bachelor's degree	None

Occupation Code	Occupation	Median Annual Earnings	Total % Change 2014-2024	Avg. Annual Openings	Related Completions (2014)	Entry Education Level	Additional Training Level
15-1132	Software Developers, Applications	\$98,909	34.9	1,109	*	Bachelor's degree	None
15-1133	Software Developers, Systems Software	\$104,685	39.1	605	*	Bachelor's degree	None
15-1141	Database Administrators	\$96,561	28.9	127	*	Bachelor's degree	None
15-1143	Computer Network Architects	\$101,632	26.5	185	*	Bachelor's degree	None
15-2031	Operations Research Analysts	\$80,252	41.3	56	179	Bachelor's degree	None
17-1011	Architects, Except Landscape and Naval	\$70,533	31.3	197	N/A	Bachelor's degree	Internship /residency
17-2011	Aerospace Engineers	\$118,977	36.8	147	260	Bachelor's degree	None
17-2051	Civil Engineers	\$79,764	32.5	418	469	Bachelor's degree	None
17-2061	Computer Hardware Engineers	\$107,450	25.5	186	82	Bachelor's degree	None
17-2071	Electrical Engineers	\$93,307	25.6	184	424	Bachelor's degree	None
17-2081	Environmental Engineers	\$84,033	36.5	130	104	Bachelor's degree	None
17-2112	Industrial Engineers	\$88,025	24.5	151	27	Bachelor's degree	None
17-2171	Petroleum Engineers	\$134,949	41.7	132	170	Bachelor's degree	None
19-2021	Atmospheric and Space Scientists	\$92,177	30.8	97	55	Bachelor's degree	None
19-2041	Environmental Scientists and Specialists, Including Health	\$74,018	27.5	179	210	Bachelor's degree	None
19-2042	Geoscientists, Except Hydrologists and Geographers	\$100,521	34.2	175	220	Bachelor's degree	None
21-1022	Healthcare Social Workers	\$52,132	36.5	125	N/A	Master's degree	None
21-1091	Health Educators	\$51,457	31.3	41	N/A	Bachelor's degree	None
25-1011	Business Teachers, Postsecondary	\$72,178	26.9	67	N/A	Doctoral or professional degree	None
25-1042	Biological Science Teachers, Postsecondary	\$55,623	31.4	44	N/A	Doctoral or professional degree	None
25-1071	Health Specialties Teachers, Postsecondary	\$102,273	51.0	269	N/A	Doctoral or professional degree	None
25-1072	Nursing Instructors and Teachers, Postsecondary	\$61,391	50.2	86	N/A	Master's degree	None
25-1081	Education Teachers, Postsecondary	\$51,880	26.9	51	N/A	Doctoral or professional degree	None
25-1121	Art, Drama, and Music Teachers, Postsecondary	\$51,005	28.3	107	N/A	Master's degree	None

Occupation Code	Occupation	Median Annual Earnings	Total % Change 2014-2024	Avg. Annual Openings	Related Completions (2014)	Entry Education Level	Additional Training Level
27-1025	Interior Designers	\$46,373	26.9	85	115	Bachelor's degree	None
27-3042	Technical Writers	\$65,703	26.3	83	99	Bachelor's degree	Short-term OJT
27-3091	Interpreters and Translators	\$48,108	67.7	117	N/A	Bachelor's degree	Short-term OJT
29-1031	Dietitians and Nutritionists	\$56,997	30.5	44	274	Bachelor's degree	Internship/residency
29-1041	Optometrists	\$106,802	31.1	50	N/A	Doctoral or professional degree	None
29-1051	Pharmacists	\$121,108	28.5	257	273	Doctoral or professional degree	None
29-1067	Surgeons	\$192,958	30.6	67	*	Doctoral or professional degree	Internship/residency
29-1069	Physicians and Surgeons, All Other	\$192,942	24.5	131	*	Doctoral or professional degree	Internship/residency
29-1071	Physician Assistants	\$92,160	50.5	145	71	Master's degree	None
29-1122	Occupational Therapists	\$80,850	36.6	141	44	Master's degree	None
29-1123	Physical Therapists	\$74,520	45.9	324	176	Doctoral or professional degree	None
29-1131	Veterinarians	\$77,789	24.9	135	157	Doctoral or professional degree	None
29-1171	Nurse Practitioners	\$97,940	42.7	130	138	Master's degree	None
29-1199	Health Diagnosing and Treating Practitioners, All Other	\$44,652	36.5	69	156	Master's degree	None
29-2011	Medical and Clinical Laboratory Technologists	\$62,126	26.1	131	21	Bachelor's degree	None

## Occupational Demand by Credential Level

This section presents an overview of where potential gaps exist in certain occupation areas by credential level based on a snapshot of current completion levels alongside current projected openings. Projections of job openings are certainly not a guarantee that such demand will arise, but we are using them in this report to help guide our attention in prioritizing further exploration of various fields. Here we examine projected openings for occupation clusters as defined by Standard Occupational Codes (SOC) by level of postsecondary education. We use three education levels: *mid-level* (e.g., certificates, associate degrees), *bachelor's level* and *graduate level*. Limitations to this analysis are outlined in [Appendix B](#), along with additional information and data tables.

### *Mid-level*

Mid-level completions correspond to jobs that typically require more than a high school education, but less than a bachelor's degree (such as associate degrees or certificates and credentials acquired at community and technical colleges). Fields with notable gaps are consistent with last year's findings. While there may be unique discrepancies in supply and demand at individual occupation levels, there appear to be inadequate completions for *IT* occupations (e.g., computer user support specialists),<sup>2</sup> various *skilled trades* (e.g., industrial machinery mechanics) and *science technicians* (e.g., geological and petroleum technicians), in particular.

Per the Brookings Institution definition of STEM occupations (i.e., jobs that typically require above average skill/knowledge levels in science, technology, engineering and/or mathematics), all of the IT and 96 percent of science technician openings are for STEM jobs. For job openings in the construction trades, and installation, maintenance and repair occupation groups, STEM job openings hover around 50 percent of jobs in these categories.

*Production* occupations (such as plant operators and machinists) have particularly high aged workforces, so it is important to train the next generation of skilled workers. In September 2012, the U.S. Department of Labor awarded a \$25 million grant to a consortium of Colorado community colleges to develop advanced manufacturing programs; in addition, HB 13-1165 was passed in 2013, authorizing the creation of Manufacturing Career Pathways. There are currently four active manufacturing sector partnerships, along with statewide organizations, such as Manufacturer's Edge and the Colorado Advanced Manufacturing Alliance, that are collaborating around a variety of resources to build out regional and statewide career pathways.

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<sup>2</sup> For IT occupations, additional analysis of specific technical skills that are in high demand by industry is also important. Some coding languages are currently seen in job postings at higher rates than others, and the demand for these languages change over time, as well.

## *Bachelor's and Graduate Level*

At the baccalaureate and graduate level there are a number of occupation groups that showed potential insufficient completions to related industry demand. Because the highly educated workforce is quite mobile, many of these graduates have the option to pursue opportunities in other states. Consistent with last year's findings, data show we are likely not producing enough graduates trained to enter *financial* occupations (e.g., accountants, financial analysts), *computer-related* occupations (e.g., programmers, computer systems analysts), *healthcare* occupations (e.g., physicians, occupational therapists), or *air transportation* (pilots). The number of completers from college/university educator preparation programs in Colorado have declined by 22.7 percent over the past five years. Certain areas of specialization for *K-12 teachers* (e.g., math, science, special education) continue to be in high demand and rural districts continue to report challenges in retaining a teaching workforce. In response, the Colorado Department of Education and DHE have targeted initiatives in place to develop a stronger educator pipeline to the rural areas in the state.

While data show that overall engineering degree completions meet projected related job openings, engineers in particular are often recruited out-of-state, and this may impact how many graduates we are able to retain in-state for our own workforce needs. There may certainly be supply deficits by certain areas of specialization that this type of occupation cluster analysis does not provide. For example, per the 2016 Colorado Business Economic Outlook, with several extensive transportation projects being conducted in the state, engineers with specific skills such as highway and bridge design are hard to source locally.

Based on current credential production, we may also risk maintaining current graduate-level educational attainment levels of workers in financial and IT occupations. Of additional note, many of these occupation areas that have highly educated workers and education requirements—such as finance, engineering, architecture and healthcare professionals—are occupation clusters that tend to be more skewed to older age workers. This is important to consider as we plan and implement talent development strategies, especially as we continue to gain distance from the last recession, and as baby boomers continue to retire.

Examination of potential deficits in completions for the graduate/professional level group of healthcare practitioners is complicated by the fact that many of these jobs could require upwards of ten years of schooling, and the healthcare industry will continue to evolve in staffing structures as practices and technology change. However, there are also many variables that impact these completion figures for physicians in particular, such as the limited number of residency positions nationwide and current funding structures. This is then compounded by the impending baby boomer population that will face increasing healthcare needs, as well as by that of the potential increase in practitioner demand as a result of more insured patients under the Affordable Care Act. Colorado is currently participating in a National Governor's Association policy academy to support mechanisms for the more targeted

development of our state's healthcare workforce, and there are nine active or emerging healthcare sector partnerships and most have identified workforce as a critical issue on which to focus.

Per the Brookings definition of STEM occupations, the majority of job openings in these occupation groups (finance, IT, healthcare, air transportation [pilots]) with potential supply-demand gaps are considered STEM occupations. Ninety percent of bachelor's level finance occupations and 87 percent of graduate level healthcare occupation openings are defined as STEM. All bachelor's level IT and air transportation occupations are defined as STEM. While national conversation circles around low representation of females employed in computer science occupations, women also complete related computer and information science degrees at far lower numbers than men. Of the 2014 computer and information science degrees awarded, 16 percent were earned by females; 23 percent of workers in an IT occupation are female. Similar gender ratios can be found for completions for aviation programs (15 percent female graduates).

### Two and Four Year Public Institution Profiles

Per additional evaluation as proposed by the Colorado Commission on Higher Education Master Plan, this report also includes the roles and missions, locations and service areas of public colleges and universities. Colorado is a state with diverse regions and regional economies and, as such, many Colorado state agencies use a common planning and management regional guideline, dividing the state into 14 regions. The first map below (Figure 6) orients us to main and satellite campus locations of two and four year institutions overlaying Colorado's planning and management regions. The second map (Figure 7) shows sector partnerships by region, demonstrating where current and emerging industries exist across our state. Alongside supply-demand analysis, these maps provide a reference for potential institution-industry partnerships by regional need. [Appendix D](#) includes a table outlining each institution's location, role and mission. While of course there is inter-regional activity, whether it be economic, educational or otherwise, all of our regions have one or more public postsecondary institutions that can play a role in serving region-specific demands. Seven regions have both community college and four year institution campuses (regions 2, 3, 4, 7, 8, 9, 11), one region has only a four year institution (region 10) and five regions have only main and/or satellite community college campuses (regions 1, 5, 6, 12, 13, 14).

Figure 6: Map of Colorado Public Colleges and Universities and Regional Designations

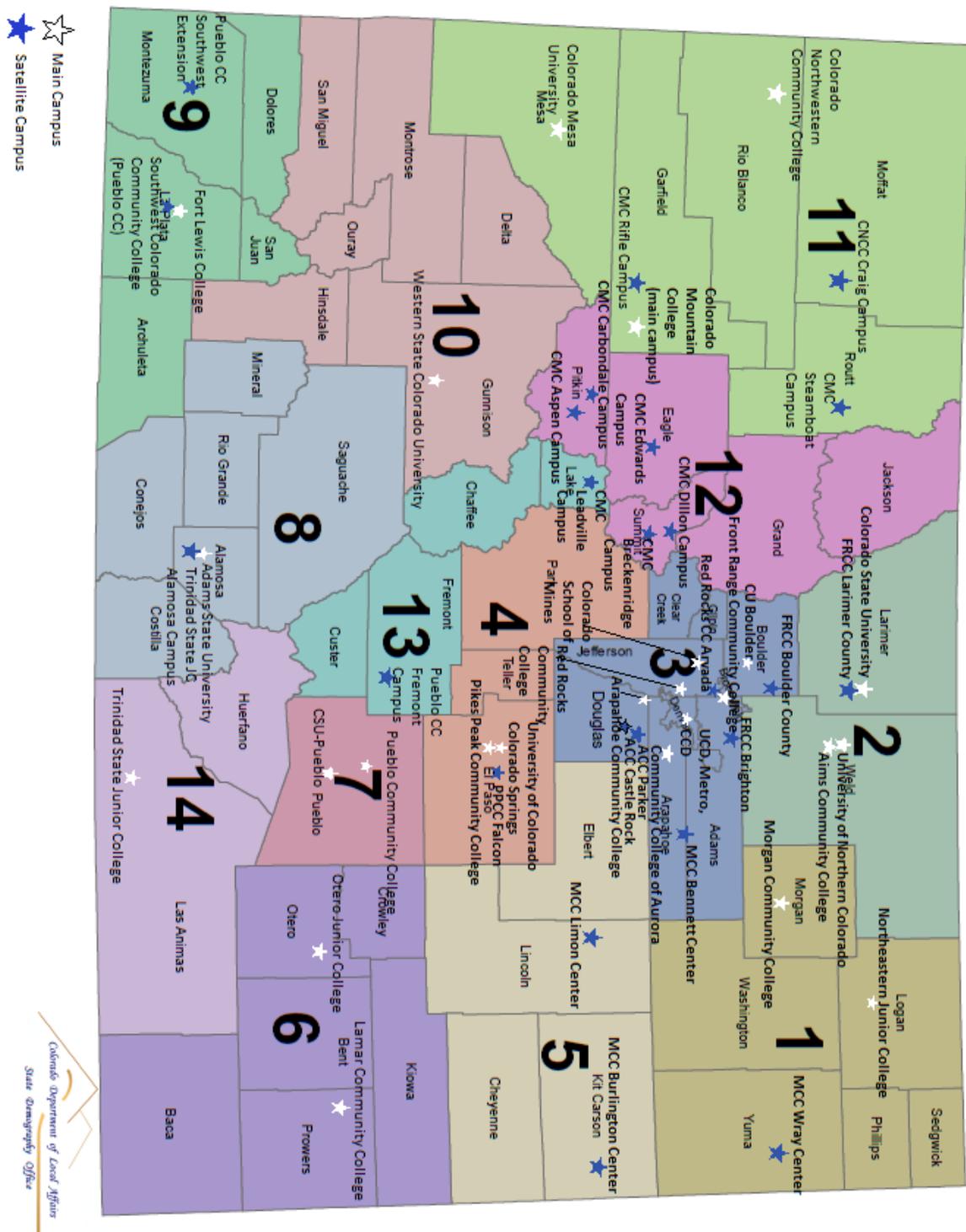
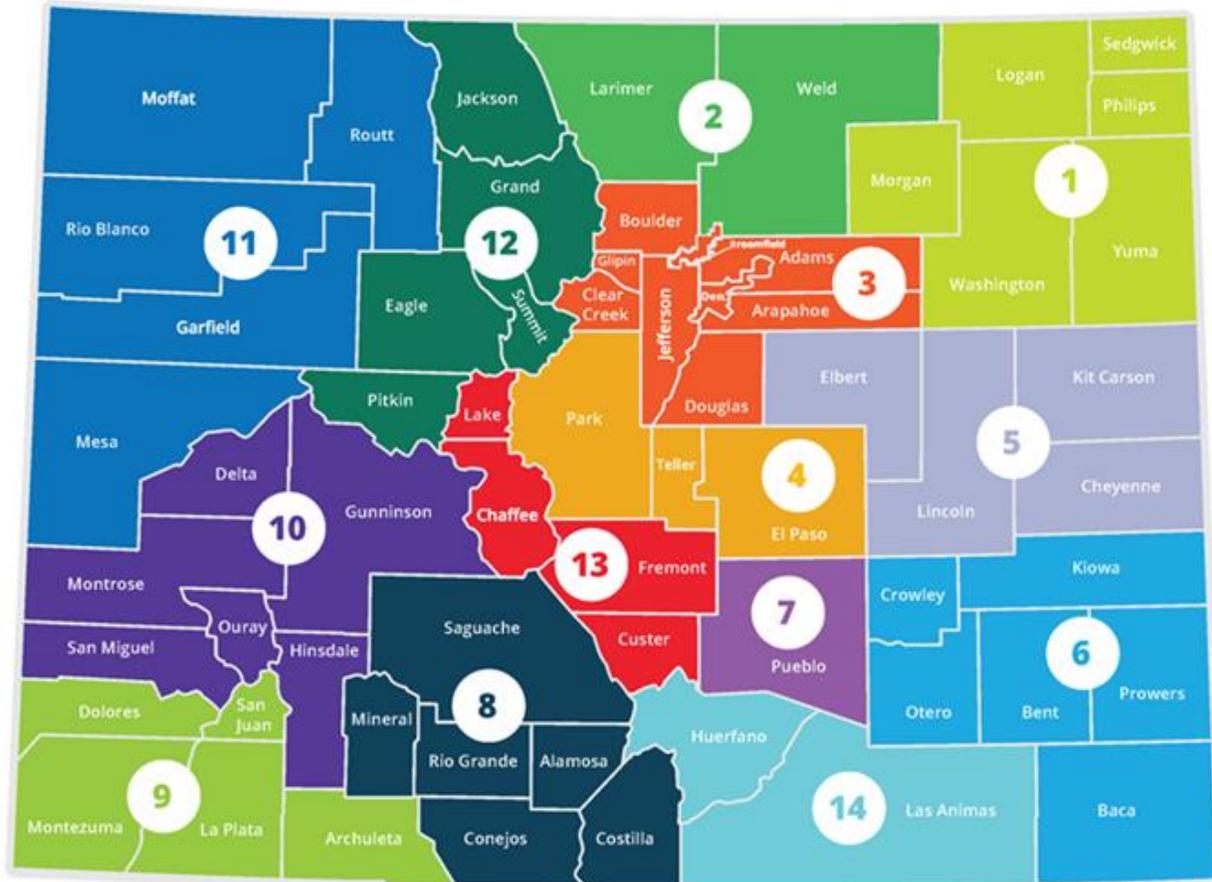


Figure 7: Map of Sector Partnerships by Region



**1** Exploring: Energy & Natural Resources

**2** Active: Health & Wellness  
Active: Advanced Manufacturing  
Exploring: Energy & Natural Resources

**3** Active: Health & Wellness  
Active: Advanced Manufacturing  
Emerging: Landscape Architecture  
Emerging: Technology & Information  
Exploring: Construction & Development

**4** Emerging: Advanced Manufacturing  
Emerging: Health & Wellness

**5** Emerging: Health & Wellness

**6** Active: Advanced Manufacturing  
Exploring: Health & Wellness

**7** Active: Advanced Manufacturing  
Active: Health & Wellness

**8** Exploring: Health & Wellness

**9** Emerging: Energy & Natural Resources

**10** Emerging: Health & Wellness

**11** Emerging: Health & Wellness (Mesa, Delta, Montrose Counties)  
Emerging: Health & Wellness (Garfield, Rio Blanco, Routt Counties)  
Emerging: Advanced Manufacturing (Mesa County)

**12** Emerging: Health & Wellness

**13** Active: Health & Wellness  
Emerging: Tourism & Outdoor Recreation

**14** Exploring: Health & Wellness



## Recommendations

The state of Colorado has an interest and commitment to educating its residents for meaningful and instrumental roles in its growing economy. While this report looks toward the future and, based on current data and information, makes inferences regarding prospects for Colorado, there is certainly room for a change of course in this fast evolving world. We conclude this report with various recommendations of issues and concerns that should be in our line of sight as we participate in, design and develop our state's economies and educational networks. Recommendations remain consistent with the previously issued Skills for Jobs Report.

In considering means to implement these recommendations it is important to consider the work Colorado has done over the last four years toward alignment of education, workforce development and economic development to meet industry needs. According to Executive Order B2010-012, the Colorado Workforce Development Council (CWDC) is responsible for ensuring effective alignment of workforce development, education and economic development initiatives related to talent development for Colorado's businesses.

The Colorado Blueprint laid the foundation for an aggressive economic development plan for the State of Colorado, including Core Objective V, Educate and Train the Workforce of the Future, which is led by the Colorado Workforce Development Council (CWDC), the state's Workforce Investment Board. This is a collaborative approach of many partners including (but not limited to) CDHE, Colorado Department of Education, Colorado Department of Labor & Employment, Colorado Department of Human Services, Colorado Department of Corrections, Colorado Community College System and Career & Technical Education, and the Office of Economic Development and International Trade, as well as local and regional partners of each of these state agencies. Through this structure, CWDC is convening leaders and subject matter experts to develop aligned solutions, leverage resources and utilize data and industry input to ensure effective outcomes.

***Analysis should be based on state-level or regional data rather than national-level data when available***

Coloradans, in general, are better educated than people from other states, but that does not mean we are better prepared to meet our specific workforce needs. The job openings that need to be filled in Colorado both now and in the next decade are more likely to require postsecondary credentials than in most other states. We must focus on Colorado-specific data or we are at risk of failing to plan adequately, potentially producing an excess of graduates with certain skills and a shortage of graduates with much needed skills.

***Strengthen data sharing relationships between Colorado’s Department of Labor and Employment, Department of Education and Department of Higher Education***

Each of the Colorado Departments, Labor and Employment, Education and Higher Education, gather and store vast quantities of data that would facilitate greater planning and coordination among institutions and employers so that workforce needs will be met and graduates will have full employment opportunities. Current information may need to be supplemented, however, with more detail about specific regional market needs and important distinctions within broad occupation categories. These agencies have been and continue to work toward connecting K-12, postsecondary education and labor data to better understand aggregate trends and address policy questions and measure effectiveness of initiatives.

***Develop effective career pathways***

We are producing an increasing number of postsecondary graduates every year, yet are still not graduating enough students in certain program areas to meet the demands of our state’s economy. Research has shown that countries with higher levels of educational attainment offer diverse pathways, as well as connect employers to the educational process to prepare students for certain careers (Symonds, Schwartz & Ferguson, 2011). Our state does have various industry-led career pathways in place and is planning to formally implement more. It is important to highlight the significance of this work and the essential continued support of it if we are to educate Coloradans and support their success in our state. As our state develops various career pathway tracks, we should bear in mind that places for entry and re-entry can be helpful for those who initially enter a field at a lower educational level and later desire to obtain additional credentials to enhance career opportunities (such as, one may have an accounting technician credential, but eventually pursues a bachelor’s degree in finance/business, or a licensed vocational/practical nurse completed a one or two year program initially, but eventually pursues a registered nursing degree, etc.).

In addition to the creation of specific career paths in demand by industry, focus should be put on the current effort of state and local partners that are working to create a statewide tapestry of career pathways including all high demand occupations and opportunities for all Coloradans. This statewide Career Pathway System is currently receiving technical assistance from the U.S. Department of Adult and Vocational Education and has potential for integrating the various career paths, as well as the work of all education and workforce development partners.

***Continue to closely examine and address the supply-demand relationships in high growth/high demand areas such as healthcare, IT, skilled trades and finance***

This report has highlighted various areas where there may be gaps in the supply of graduates that correlate with specific occupations or occupation clusters. Various types of healthcare practitioners, IT professionals, financial specialists and skilled

trades workers have appeared in both the list of jobs with projected high growth rates and openings, as well as in general fields with potential supply-demand gaps.

Currently, Colorado has five active healthcare sector partnerships, five active manufacturing sector partnerships and additional emerging partnerships in progress. For example, existing sector partnerships (industry-specific regional partnerships) are addressing the supply-demand relationship and manufacturing workforce shortages in the state. The NoCo Manufacturing Sector Partnership has been implementing and developing strategies to address skills gaps for critical occupations, relying on collaboration between northern Colorado's manufacturing employers and education partners. Their recent report on developing manufacturing talent can be found at: [http://www.nocomfg.com/uploads/5/6/5/4/56547587/noco\\_manufacturing\\_talent\\_report\\_october\\_2015.pdf](http://www.nocomfg.com/uploads/5/6/5/4/56547587/noco_manufacturing_talent_report_october_2015.pdf)

### ***Continue to build strong industry-institution partnerships***

When we look globally to best practices in cultivating an educated workforce that fulfill economic demand, strong industry-institution partnerships and earn-and-learn models continue to stand out as effective strategies for many kinds of career pathways. Often, we think of these models as connected to the skilled trades, and as we develop additional programs in advanced manufacturing, we should be aware of educational models that encourage completion rates and smooth transitions into employment. It is worthwhile to look towards innovative and adaptable business concepts that are particularly oriented towards real world skills that specific employers and fields want.

Colorado is recognized nationally as a leader in bringing industry together with education, workforce development and economic development to address these issues. Colorado's Sector Strategies, which support regional Sector Partnerships (see map on page 22), integrate the work of economic development and the needs of industry with education and workforce partners and efforts. The resulting outcomes are comprehensive career pathways that include all levels of education, training, applied learning, connections to work experience opportunities and placement in jobs.

### ***Find ways to increase postsecondary success for Colorado's fastest growing demographic groups***

As Colorado faces an increasing demand for well-educated and credentialed graduates of postsecondary institutions to meet the workforce demands of the future, it also faces a rapidly changing demographic in its K-12 primary and secondary pipeline. An increasing percentage of those students are members of minority groups and face other risk factors, such as being low-income and coming from families where they will be the first to pursue higher education. In the past, those groups have not found postsecondary success at the same rate as their white peers. Colorado will not meet the workforce needs of the future unless it can improve the rate at which members of

those underserved groups graduate from high school are ready to enroll in college-level classes, enroll in and persist through certificate or degree completion, and enter the workforce. For that to happen, Colorado must be prepared to invest resources not only into high quality academic programs, but also toward financial aid, controlling college costs so as to maintain reasonable tuition and fees and providing academic support systems to help students successfully complete their chosen programs of study.

***Provide students and families with the tools and knowledge to make informed decisions***

It is crucial to provide students and their families with the tools and information to support them through their decision-making processes regarding postsecondary education. By providing accessible information regarding completion rates, the job market, potential earnings information, unemployment rates and the like to interested stakeholders, there is the opportunity for completions and economic demands to better align. Ultimately, if we can help students and jobseekers know where opportunities likely exist, then we can help them spend their education dollars wisely.

***Conclusion***

It is critical that our colleges and universities across Colorado focus on delivering high-quality graduates so that Colorado employers continue to respect and seek out the credentials of Colorado-educated graduates. Further developing partnerships between Colorado's postsecondary institutions and Colorado's employers is critical to the advancement of our state's economy and maintaining our competitive edge.

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## Appendix A: Colorado's Top Jobs List

<sup>a</sup> Designates completions at community or technical colleges and is not necessarily comprehensive of all related training (i.e., apprenticeship completions, employer-sponsored training programs).

\* Indicates an inadequate number of shared completions across multiple related occupations. (N/A) Indicates specific programs do not crosswalk to this SOC, it is difficult to ascertain which completers would enter this occupation or there are no related programs at a Colorado-based institution.

Occupation Code	Occupation	Median Annual Earnings	Total Percent Change 2014-2024	Avg. Annual Openings	Related Completions (2014)	Entry Education Level	Additional Training Level
11-1021	General and Operations Managers	\$100,247	25.2	1,809	N/A	Bachelor's degree	None
11-2021	Marketing Managers	\$133,308	25.0	127	N/A	Bachelor's degree	None
11-3021	Computer and Information Systems Managers	\$140,037	26.6	253	N/A	Bachelor's degree	None
11-3121	Human Resources Managers	\$122,692	30.4	84	N/A	Bachelor's degree	None
11-9021	Construction Managers	\$83,436	28.1	572	N/A	Bachelor's degree	Moderate-term OJT
11-9033	Education Administrators, Postsecondary	\$77,162	27.0	133	N/A	Master's degree	None
11-9111	Medical and Health Services Managers	\$101,250	34.3	241	N/A	Bachelor's degree	None
11-9141	Property, Real Estate, and Community Association Managers	\$64,938	25.9	194	N/A	HS diploma or equivalent	None
11-9151	Social and Community Service Managers	\$68,578	26.8	85	N/A	Bachelor's degree	None
13-1051	Cost Estimators	\$60,095	43.4	419	N/A	Bachelor's degree	None
13-1081	Logisticians	\$74,114	43.1	161	N/A	Bachelor's degree	None
13-1111	Management Analysts	\$80,445	33.4	509	N/A	Bachelor's degree	None
13-1151	Training and Development Specialists	\$61,866	26.5	230	N/A	Bachelor's degree	None
13-1161	Market Research Analysts and Marketing Specialists	\$66,975	46.3	818	338	Bachelor's degree	None
13-2011	Accountants and Auditors	\$67,473	27.0	2044	1,218*	Bachelor's degree	None
13-2051	Financial Analysts	\$74,924	36.9	231	406*	Bachelor's degree	None
13-2052	Personal Financial Advisors	\$76,751	41.5	268	377*	Bachelor's degree	None
15-1121	Computer Systems Analysts	\$86,663	37.3	552	*	Bachelor's degree	None
15-1122	Information Security Analysts	\$92,559	53.1	104	*	Bachelor's degree	None
15-1132	Software Developers, Applications	\$98,909	34.9	1,109	*	Bachelor's degree	None
15-1133	Software Developers, Systems Software	\$104,685	39.1	605	*	Bachelor's degree	None
15-1134	Web Developers	\$55,227	38.0	212	*	Associate degree	None
15-1141	Database Administrators	\$96,561	28.9	127	*	Bachelor's degree	None
15-1143	Computer Network Architects	\$101,632	26.5	185	*	Bachelor's degree	None

Occupation Code	Occupation	Median Annual Earnings	Total Percent Change 2014-2024	Avg. Annual Openings	Related Completions (2014)	Entry Education Level	Additional Training Level
15-1151	Computer User Support Specialists	\$50,910	34.6	695	*	Some college, no degree	Moderate-term OJT
15-2031	Operations Research Analysts	\$80,252	41.3	56	179	Bachelor's degree	None
17-1011	Architects, Except Landscape and Naval	\$70,533	31.3	197	N/A	Bachelor's degree	Internship/residency
17-2011	Aerospace Engineers	\$118,977	36.8	147	260	Bachelor's degree	None
17-2051	Civil Engineers	\$79,764	32.5	418	469	Bachelor's degree	None
17-2061	Computer Hardware Engineers	\$107,450	25.5	186	82	Bachelor's degree	None
17-2071	Electrical Engineers	\$93,307	25.6	184	424	Bachelor's degree	None
17-2081	Environmental Engineers	\$84,033	36.5	130	104	Bachelor's degree	None
17-2112	Industrial Engineers	\$88,025	24.5	151	27	Bachelor's degree	None
17-2171	Petroleum Engineers	\$134,949	41.7	132	170	Bachelor's degree	None
19-2021	Atmospheric and Space Scientists	\$92,177	30.8	97	55	Bachelor's degree	None
19-2041	Environmental Scientists and Specialists, Including Health	\$74,018	27.5	179	210	Bachelor's degree	None
19-2042	Geoscientists, Except Hydrologists and Geographers	\$100,521	34.2	175	220	Bachelor's degree	None
19-4041	Geological and Petroleum Technicians	\$58,105	34.3	47	20	Associate degree	Moderate-term OJT
21-1022	Healthcare Social Workers	\$52,132	36.5	125	N/A	Master's degree	None
21-1091	Health Educators	\$51,457	31.3	41	N/A	Bachelor's degree	None
23-2011	Paralegals and Legal Assistants	\$49,202	31.2	269	250	Associate degree	None
25-1011	Business Teachers, Postsecondary	\$72,178	26.9	67	N/A	Doctoral or professional degree	None
25-1042	Biological Science Teachers, Postsecondary	\$55,623	31.4	44	N/A	Doctoral or professional degree	None
25-1071	Health Specialties Teachers, Postsecondary	\$102,273	51.0	269	N/A	Doctoral or professional degree	None
25-1072	Nursing Instructors and Teachers, Postsecondary	\$61,391	50.2	86	N/A	Master's degree	None
25-1081	Education Teachers, Postsecondary	\$51,880	26.9	51	N/A	Doctoral or professional degree	None
25-1121	Art, Drama, and Music Teachers, Postsecondary	\$51,005	28.3	107	N/A	Master's degree	None
27-1025	Interior Designers	\$46,373	26.9	85	115	Bachelor's degree	None
27-3042	Technical Writers	\$65,703	26.3	83	99	Bachelor's degree	Short-term OJT
27-3091	Interpreters and Translators	\$48,108	67.7	117	N/A	Bachelor's degree	Short-term OJT
29-1031	Dietitians and Nutritionists	\$56,997	30.5	44	274	Bachelor's degree	Internship/residency

Occupation Code	Occupation	Median Annual Earnings	Total Percent Change 2014-2024	Avg. Annual Openings	Related Completions (2014)	Entry Education Level	Additional Training Level
29-1041	Optometrists	\$106,802	31.1	50	N/A	Doctoral or professional degree	None
29-1051	Pharmacists	\$121,108	28.5	257	273	Doctoral or professional degree	None
29-1067	Surgeons	\$192,958	30.6	67	*	Doctoral or professional degree	Internship/residency
29-1069	Physicians and Surgeons, All Other	\$192,942	24.5	131	*	Doctoral or professional degree	Internship/residency
29-1071	Physician Assistants	\$92,160	50.5	145	71	Master's degree	None
29-1122	Occupational Therapists	\$80,850	36.6	141	44	Master's degree	None
29-1123	Physical Therapists	\$74,520	45.9	324	176	Doctoral or professional degree	None
29-1126	Respiratory Therapists	\$57,724	32.9	84	108	Associate degree	None
29-1131	Veterinarians	\$77,789	24.9	135	157	Doctoral or professional degree	None
29-1141	Registered Nurses	\$68,295	33.0	2,351	2,665	Associate degree	None
29-1171	Nurse Practitioners	\$97,940	42.7	130	138	Master's degree	None
29-1199	Health Diagnosing and Treating Practitioners, All Other	\$44,652	36.5	69	156	Master's degree	None
29-2011	Medical and Clinical Laboratory Technologists	\$62,126	26.1	131	21	Bachelor's degree	None
29-2021	Dental Hygienists	\$81,091	37.6	254	92	Associate degree	None
29-2032	Diagnostic Medical Sonographers	\$77,684	60.8	60	44	Associate degree	None
29-2034	Radiologic Technologists and Technicians	\$58,986	32.7	139	232	Associate degree	None
29-2055	Surgical Technologists	\$50,274	45.0	82	61	Postsecondary non-degree award	None
29-2061	Licensed Practical and Licensed Vocational Nurses	\$45,843	31.4	315	300	Postsecondary non-degree award	None
31-2021	Physical Therapist Assistants	\$50,203	46.0	68	110	Associate degree	None
37-1012	First-Line Supervisors of Landscaping, Lawn Service, and Groundskeep	\$48,403	25.2	174	N/A	HS diploma or equivalent	None
41-3099	Sales Representatives, Services, All Other	\$51,915	27.3	1,219	N/A	HS diploma or equivalent	Short-term OJT
41-9021	Real Estate Brokers	\$63,430	25.0	94	96a	HS diploma or equivalent	None
47-1011	First-Line Supervisors of Construction Trades and Extraction Work	\$62,668	38.4	721	N/A	HS diploma or equivalent	None

Occupation Code	Occupation	Median Annual Earnings	Total Percent Change 2014-2024	Avg. Annual Openings	Related Completions (2014)	Entry Education Level	Additional Training Level
47-2021	Brickmasons and Blockmasons	\$44,582	64.2	123	8a	HS diploma or equivalent	Apprenticeship
47-2111	Electricians	\$46,847	45.4	1,006	859a	HS diploma or equivalent	Apprenticeship
47-2152	Plumbers, Pipefitters, and Steamfitters	\$46,143	45.0	536	389a	HS diploma or equivalent	Apprenticeship
47-5012	Rotary Drill Operators, Oil and Gas	\$51,702	26.7	53	N/A	Less than high school	Moderate-term OJT
47-5013	Service Unit Operators, Oil, Gas, and Mining	\$44,897	29.3	310	N/A	Less than high school	Moderate-term OJT
47-5021	Earth Drillers, Except Oil and Gas	\$45,240	43.8	48	N/A	HS diploma or equivalent	Moderate-term OJT
49-3042	Mobile Heavy Equipment Mechanics, Except Engines	\$47,625	26.8	163	N/A	HS diploma or equivalent	Long-term OJT
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	\$48,760	43.5	341	245a	Postsecondary non-degree award	Long-term OJT
49-9041	Industrial Machinery Mechanics	\$52,710	39.1	415	N/A	HS diploma or equivalent	Long-term OJT
49-9062	Medical Equipment Repairers	\$48,736	42.4	85	9	Associate degree	Moderate-term OJT
51-9012	Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders	\$46,792	25.5	61	N/A	HS diploma or equivalent	Moderate-term OJT
53-7021	Crane and Tower Operators	\$48,641	42.4	42	14a	HS diploma or equivalent	Moderate-term OJT
53-7073	Wellhead Pumpers	\$55,006	27.7	55	N/A	Less than high school	Moderate-term OJT

## Appendix B: Technical Information

### *Calculations*

To create the Top Jobs list, we isolated occupations from Colorado's Office of Labor Market Information (LMI) 2014 to 2024 projections that met three criteria: above average projected growth (23.74 percent), average annual openings of 40 or above and offers a median hourly wage of \$21.18 or higher (meeting the threshold of sustainable living wage averaged across the state for a family of three with one working adult). Related completions are from Integrated Postsecondary Educational Data System (IPEDS) and program completions are crosswalked to related occupations based on the National Center for Education Statistics (NCES) SOC-CIP crosswalk.

To develop our analysis of occupational demand by credential level, we had to take into account both the entry education level requirements and the actual educational attainment levels of those employed in the occupation (what we denote as the competitive education level) so as to provide a more accurate present day education level expectation. Colorado LMI projections and BLS data reflecting educational attainment percentages by Standard Occupational Classification (SOC) code were primarily used to reach our figures.

To analyze by credential level demand we first isolated occupations by SOC occupation group and sub-groups. For example, for the SOC major group 13 (business and financial operations occupations), greater specificity in the supply-demand relationship was yielded by conducting analysis separately for the two sub-groups (business operations specialists and financial specialists). Conducting analysis by SOC groups allows us to better account for CIP codes that align with more than one SOC code and to avoid duplicate counts as much as possible.

For each instance, we first isolated occupations by SOC group. We then calculated projected annual openings by typical educational level clusters (mid-level, bachelor's level and graduate level). We then crosswalked SOC codes to the associated CIP codes and established completion figures by credential/degree level. This provides the supply (or completions) by credential level, as well as the projection by entry education level. To establish the competitive education figures, we calculated education attainment levels by percent for the group of SOC codes being analyzed and then translated the SOC group's total annual openings into absolute numbers by education level based on these education attainment percentages. Supply and demand figures are rounded in recognition of potential error inherent in data and projections.

### *Limitations*

In reviewing the tables and figures in this report, these limitations should be considered:

- While data depict program completions as they are aligned to occupation codes by the National Center for Education Statistics (NCES) crosswalk, not all completers enter into the specific occupation to which the education program typically aligns, and some occupation codes simply do not seamlessly link to a specific program code, or link to multiple program codes. When possible, we try to avoid or we acknowledge such redundancy. Completions are only inclusive of institutions that report to the Integrated Postsecondary Educational Data System (IPEDS); there are a number of private occupational schools or apprenticeship programs that are not recorded in this data collection.
- This section examines general trends within large occupation clusters and there may be deficits or excesses in completions for individual occupations within larger occupation groups. The list of top jobs focuses on supply and demand for a number of individual occupations.
- Some completers do not enter Colorado's workforce immediately following graduation for various reasons, such as continuing education or pursuing opportunities out-of-state. Some graduates are already members of the workforce and are perhaps pursuing an additional credential for professional development, to increase compensation potential and the like. This analysis does not isolate the exchange of workers across state and country borders, both with our Colorado-educated workers leaving the state and out-of-state educated workers entering Colorado. We do not account for the number of existing residents with specific skill sets/training levels who are currently available to fill openings and are seeking work in Colorado.
- Currently we are unable to produce a quality projection of anticipated postsecondary credential completions through 2020 as an additional piece of information.
- This type of analysis tends to focus on technical-oriented degrees and occupations, as it is difficult to directly link a specific occupation with a liberal arts completer (who would also presumably embody a number of skill sets in high demand by employers, such as critical thinking, speaking and writing skills).
- We can only base projections upon what we know today, accounting for occupations and industries that exist today. Projections are derived from algorithms that are based on current regional growth patterns. As exemplified by our most recent recession, our economic trajectory can shift dramatically and surprisingly in a short period of time, tossing aside any number of economic projections and models that are out there. Furthermore, without a crystal ball, we cannot account for new or emerging industries and occupations. Certainly we don't know the full extent of growth in areas such as big data or the renaissance of American manufacturing or whatever next great idea that is down the pike.
- Analysis in this report is state-wide. Individual regions may experience unique supply-demand relationships.

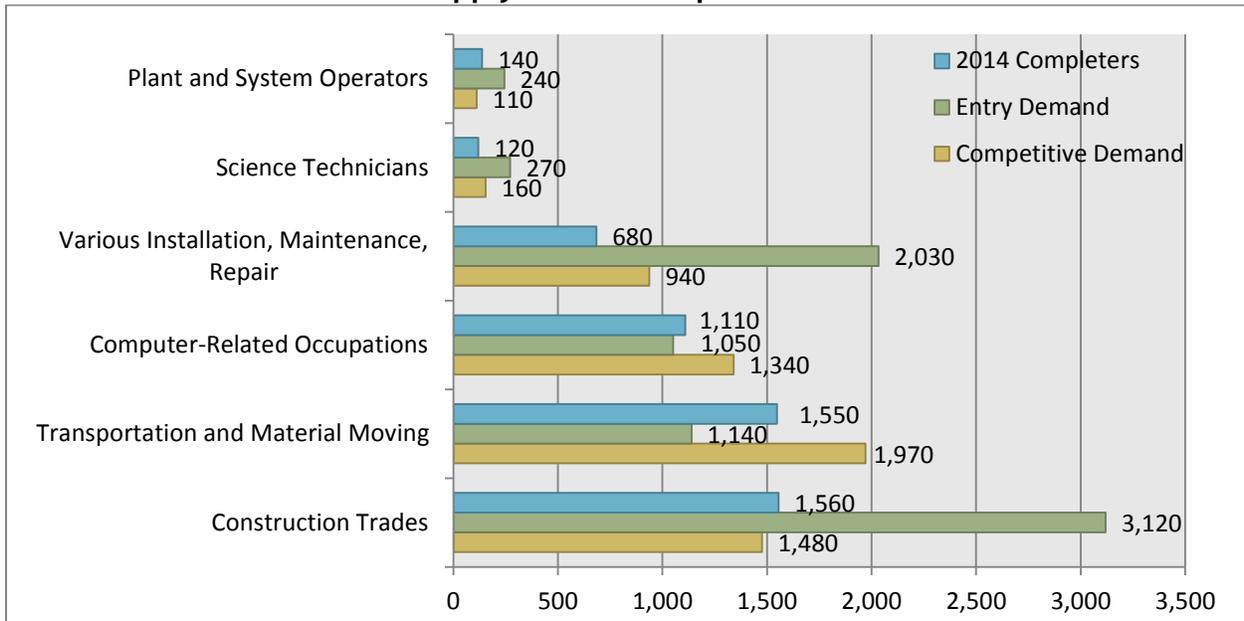
### Estimates for Potential Gap Occupations

There are two ways by which we analyze the demand by credential level:

- By education requirements assigned to occupations as typically categorized by the Bureau of Labor Statistics (BLS), which are described as *entry education levels*. This is represented by the green bars in the following graphs.
- By the actual education attainment percentage rates of people employed in these occupations, per American Community Survey (ACS) data. This, in a sense, shows the *competitive level* of education currently experienced in each occupation. This is represented by the yellow bars in the following graphs.

It is especially helpful to consider credential-level supply and demand from both of these angles in our current economy, especially when many employers are hiring candidates with higher levels of education for certain positions than prior to the recession. Essentially, for some occupations, the BLS education level designation presents as an entry level requirement, and may differ from the educational attainment level rates of people current employed in that occupation.

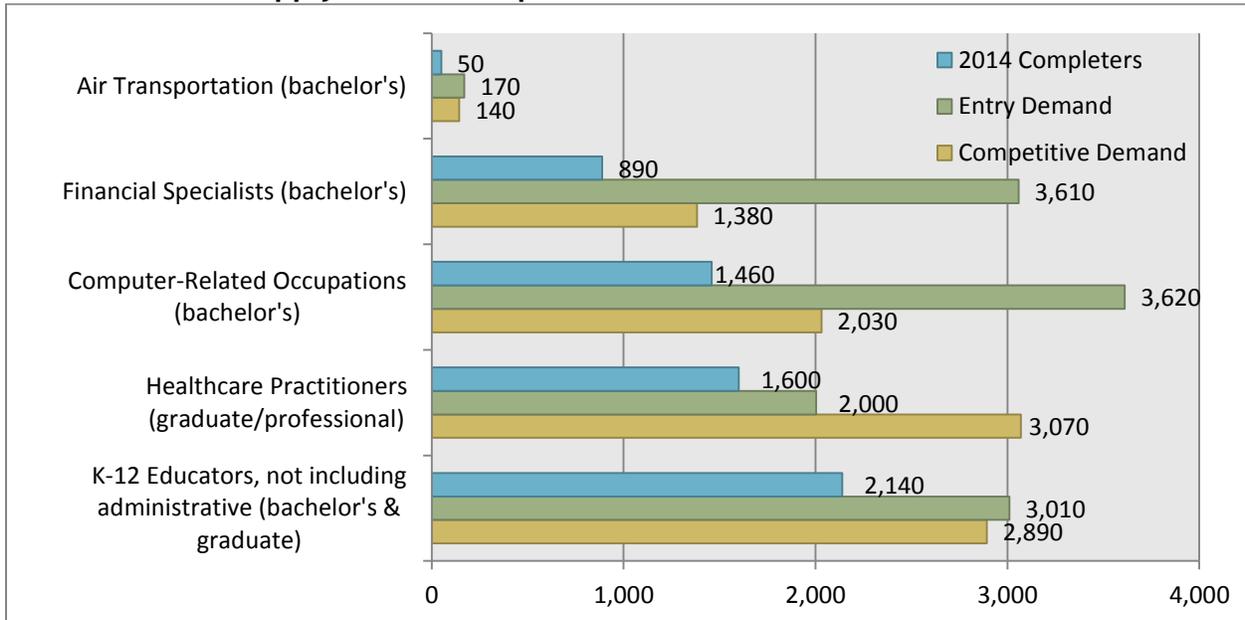
**Potential Supply-Demand Gaps at the Mid-Level**



Potential Supply-Demand Gaps at the Mid-Level					
Occupation Cluster	Current Completions (2014)			Projected Annual Openings	
	Public Inst.	Private Inst.	Total Completions	Entry Education Level	Competitive Education Level
Plant and System Operators	140	0	140	240	110
Science Technicians	115	5	120	270	160

Installation, Maintenance, Repair	410	270	680	2,030	940
Construction Trades	1,510	50	1,560	3,120	1,480
Computer (IT)	910	200	1,110	1,050	1,340
Transportation and Material Moving	1,550	0	1,550	1,140	1,970

### Potential Supply-Demand Gaps at the Bachelor's and/or Graduate Level



### Potential Supply-Demand Gaps at the Bachelor's and/or Graduate Level

Occupation Cluster	Current Completions (2014)			Projected Annual Openings	
	Public Inst.	Private Inst.	Total Completions	Entry Education Level	Competitive Education level
Air Transportation (bachelor's)	50	0	50	170	140
Financial Specialists (bachelor's)	290	600	890	3,060	1,380
Computer (IT) (bachelor's)	720	740	1,460	3,610	2,030
Healthcare (graduate/professional level)	1,190	410	1,600	2,000	3,070
K-12 Educators, not including administrative (bachelor's and graduate)	1,845	295	2,140	3,010	2,890

## Appendix C: Variation of College Graduations Entering the State Workforce

While much of the analysis in this report assumes most completers will enter the Colorado workforce the year following program completion, there is variation in the percentage of graduates who typically do, depending on residency status, major and credential level. We hope future analysis can better take into account these extensive complexities. The following depicts some of the variation in the portion of graduates found employed in Colorado within a year following graduation. Keep in mind that a number of factors are impacting how many graduates enter the workforce in Colorado, such as the pursuit of additional education or self-employment, moving out-of-state for work or personal reasons, the influence of industry compositions within and outside of Colorado, and the natural churn in the workforce.

Examples of the Percentage of Graduates Found Working in Colorado  
the Year Following Program Completion

Credential Level	Program	Percentage of Completers
Certificate	Industrial Production Technology/Technician	72%
Certificate	Practical, Vocational, Nursing Assistants	80%
Associate Degree	Precision Metalworking	76%
Associate Degree	Computer and Information Sciences	74%
Associate Degree	Registered Nursing	90%
Bachelor's Degree	Petroleum Engineering	24%
Bachelor's Degree	Civil Engineering	63%
Bachelor's Degree	Accounting	81%
Master's Degree	Electrical, Electronics and Communications Engineering	32%
Master's Degree	Social Work	81%
Doctorate	Physics	42%
Doctorate	Law	78%

## Appendix D: Public Two and Four Year Postsecondary Institutions in Colorado

Institution	Main Campus, Region	Role/Mission
Adams State University	Alamosa, Region 8	General baccalaureate institution with moderately selective admission standards. Offers undergraduate liberal arts and sciences, teacher preparation, and business degree programs, a limited number of master's level programs, and two-year transfer programs with a community college role and mission. Adams State University does not offer vocational education programs. Adams State University has a significant responsibility to provide access to teacher education in rural Colorado, and serves as a regional education provider. In addition, Adams State University offers programs, when feasible, that preserve and promote the unique history and culture of the region.
Aims Community College	Greeley, Region 2	Two-year local district college with three campuses. Offers courses designed to transfer to four year institutions, and career and technical education programs.
Colorado Mesa University	Grand Junction, Region 11	A general baccalaureate and graduate institution with selective admission standards. Colorado Mesa University offers liberal arts and sciences, professional, and technical degree programs and a limited number of graduate programs. Colorado Mesa University also maintains a community college role and mission, including career and technical education programs, and serves as a regional education provider.
Colorado Mountain College	Glenwood Springs, Region 12	Two-year local district college with 11 campuses serving nine counties in north central Colorado: Chaffee, Eagle, Garfield, Grand, Jackson, Lake, Pitkin, Routt and Summit. Offers select Bachelor's degrees to serve the needs of this region.
Colorado State University	Fort Collins, Region 2	Comprehensive graduate research university with selective admission standards offering a comprehensive array of baccalaureate, master's, and doctoral degree programs. Consistent with the tradition of land grant universities, CSU has exclusive authority to offer graduate and undergraduate programs in agriculture, forestry, natural resources, and veterinary medicine. The Colorado commission on higher education, in consultation with the board of governors of the Colorado state university system, shall designate those graduate level programs that are the primary responsibility of Colorado state university. Colorado state university has the responsibility to provide on a statewide basis, utilizing when possible and appropriate the faculty and facilities of other educational institutions, those graduate level programs.
Colorado State University - Pueblo	Pueblo, Region 7	A regional, comprehensive university, with moderately selective admissions standards. The university offers a broad array of baccalaureate programs with a strong professional focus and a firm grounding in the liberal arts and sciences. The university also offers selected master's-level graduate programs.
Colorado School of Mines	Golden, Region 3	A specialized baccalaureate and graduate research institution with high admission standards. Has a unique mission in energy, mineral, and material science and engineering and associated engineering and science fields. It is the primary institution of higher education offering energy, mineral, and material science and mineral engineering degrees at both the graduate and undergraduate levels.

<i>Community College System</i>		
Arapahoe Community College	Littleton, Region 3	<p>The state board for community colleges and occupational education is charged to develop and establish state policy for occupational education and to govern the state system of community colleges. The board is responsible for the establishment of statewide vocational education policy for all the entities which provide that education and coordinates all aspects of vocational education in the state to assure quality programming and efficient delivery of such education. In its role as the governing authority for the state system of community colleges, the board assures a system of two-year program delivery throughout the state coordinated, where appropriate, with the local district colleges. In order to assist the board in carrying out its responsibilities, the general assembly provides for the establishment of local councils to advise the board on the operation of individual community and junior colleges from a local perspective. The function of the two-year college system is to conduct occupational, technical, and community service programs with no term limitations and general education, including college transfer programs with unrestricted admissions. It is further the intent of this article to develop appropriate occupational education and adult education programs in these and other postsecondary educational institutions, to maintain and expand occupational education programs in the elementary and secondary schools of the state permitting local school districts already having vocational schools to continue to operate them, and to develop work study and on-the-job training programs designed to acquaint youth with the world of work and to train and retrain youth and adults for employment. The general assembly intends that state agencies concerned with occupational education in the public schools shall cooperate with the board in planning and implementing occupational education programs, to the end that the state of Colorado has complete and well-balanced occupational and adult education programs available to the people of Colorado at all educational levels.</p>
Colorado Northwestern Community College	Rangely, Region 11	
Community College of Aurora	Aurora, Region 3	
Community College of Denver	Denver, Region 3	
Front Range Community College	Westminster, Region 3	
Lamar Community College	Lamar, Region 6	
Morgan Community College	Fort Morgan, Region 1	
Northeastern Junior College	Sterling, Region 1	
Otero Junior College	La Junta, Region 6	
Pikes Peak Community College	Colorado Springs, Region 4	
Pueblo Community College	Pueblo, Region 7	
Red Rocks Community College	Lakewood, Region 3	
Trinidad State Junior College	Trinidad, Region 14	
Fort Lewis College	Durango, Region 9	<p>A public liberal arts college, with selective admission standards with a historic and continuing commitment to Native American education. Offers professional programs and a limited number of graduate programs to serve regional needs. The center of southwest studies provides a valuable regional, national, and international resource.</p>

Metropolitan State University of Denver	Denver, Region 3	A comprehensive institution with modified open admission standards at the baccalaureate level; except that nontraditional students at the baccalaureate level who are at least twenty years of age shall only have as an admission requirement a high school diploma, a GED high school equivalency certificate, or the equivalent thereof. Metropolitan State University of Denver shall offer a variety of liberal arts and science, technical, and educational programs. The college offers a limited number of professional programs and master's degree programs that address the needs of its urban service area.
University of Colorado Boulder	Boulder, Region 3	A comprehensive graduate research university with selective admission standards. The Boulder campus offers a comprehensive array of undergraduate, master's, and doctoral degree programs, and has exclusive authority to offer graduate programs in law. The Colorado commission on higher education, in consultation with the board of regents, shall designate those graduate level programs that are the primary responsibility of the Boulder campus of the university of Colorado. The university has the responsibility to provide on a statewide basis, utilizing when possible and appropriate the faculty and facilities of other educational institutions, those graduate level programs. The commission includes in its funding recommendations a level of general fund support for these programs.
University of Colorado Colorado Springs	Colorado Springs, Region 4	A comprehensive baccalaureate university with selective admission standards. The Colorado Springs campus offers liberal arts and sciences, business, engineering, health sciences, and teacher preparation undergraduate degree programs, and a selected number of master's and doctoral degree programs.
University of Colorado Denver	Denver, Region 3	An urban comprehensive undergraduate and graduate research university with selective admission standards. The Denver campus offers baccalaureate, master's, and a limited number of doctoral degree programs, emphasizing those that serve the needs of the Denver metropolitan area. The Denver campus has statewide authority to offer graduate programs in public administration and exclusive authority in architecture and planning.
University of Colorado Health Sciences Campus	Aurora, Region 3	Offers specialized baccalaureate, first-professional, master's, and doctoral degree programs in health-related disciplines and professions. Affiliated with the University of Colorado hospital and other health care facilities that offer settings for education, clinical practice, and basic and applied research. Has exclusive authority in medicine, dentistry, pharmacy, and physical therapy.
University of Northern Colorado	Greeley, Region 2	A comprehensive baccalaureate and specialized graduate research university with selective admission standards. The primary institution for undergraduate and graduate degree programs for educational personnel preparation in the state of Colorado. Offers master's and doctoral programs primarily in the field of education. The university has the responsibility to offer on a statewide basis, utilizing where possible and appropriate the faculty and facilities of other educational institutions, those graduate-level programs needed by professional educators and education administrators. As part of its mission as a graduate research university specializing in programs for educational personnel, the university of northern Colorado includes the education innovation institute.

Western State Colorado University	Gunnison, Region 10	A general baccalaureate institution with moderately selective admission standards. Offers undergraduate liberal arts and sciences, teacher preparation, and business degree programs and a limited number of graduate programs. Serves as a regional education provider.
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