



Montana Post-Secondary Workforce Report

A Report on Workforce Needs and
Labor Market Outcomes of Graduates



Montana Department of
LABOR & INDUSTRY



MONTANA POST-SECONDARY WORKFORCE REPORT

A REPORT ON WORKFORCE NEEDS AND LABOR MARKET OUTCOMES OF GRADUATES

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Executive Summary

Montana is experiencing a significant workforce shortage due to aging demographics and strong job growth. One way to mitigate the workforce shortage is to ensure Montana's workers have the skills, education, and training needed for in-demand jobs. Because Montana post-secondary institutions are a critical component of educating the workforce, it is essential to understand if post-secondary students are graduating in fields that align with workforce demand. Therefore, the Montana Department of Labor and Industry (MTDLI) has partnered with the Office of the Commissioner of Higher Education (OCHE) and other private and public post-secondary training institutions to produce this report on whether the state's workforce training systems are effectively providing a skilled workforce for the Montana economy.

Thirty-six different institutions are considered a part of the state's post-secondary education system – all fifteen Montana University System (MUS) schools, three private four-year institutions, seven tribal colleges, Montana Registered Apprenticeship programs, and ten other vocational institutions throughout the state. Over 11,700 students graduate from these institutions each year, providing a critical source of labor supply to fill the state's estimated 16,800 annual job openings that require some post-secondary education. The report finds post-secondary training institutions draw students to the state, and most graduates from the institutions work in Montana following graduation.

Highlights from the analysis include:

- Nearly 75% of graduates from Montana post-secondary institutions work in Montana at some point in the ten years following graduation. Approximately 69% work in Montana one year after graduation, with roughly 56% still working in the state after ten years ([Section 1.1](#)).
- Graduates who enter the Montana labor force work in every county in the state ([Section 1.1](#)).
- Four-year colleges recruit more students to Montana than the number who leave the state after graduation, making them a net importer of workers. About 60% of four-year college students are from Montana while 40% are from out-of-state ([Section 1.5](#)).
- After graduation, most graduates in Montana work in industries commonly associated with their degree. Healthcare and education industries employ the most graduates ([Section 1.11](#)).
- After earning an initial degree, 10% of all graduates immediately continued to a higher degree program, while an additional 24% pursued further education after obtaining a job. Most graduates pursuing additional education enrolled at another Montana institution ([Section 1.6](#)).

This report also includes data on the workforce outcomes of Montana post-secondary graduates, which allows future students, parents, and workers to identify occupations with a high likelihood for profitable future employment. These data were generated by matching post-secondary graduate data with MTDLI Unemployment Insurance administrative wage data, and MT Department of Revenue income tax returns in the ten years following graduation. Highlights include:

- The median income of graduates is \$31,800 a year after graduation, with half earning somewhere between \$20,000 and \$47,000 in income. Graduates median incomes exceeded the statewide median in the first year after graduation and was roughly \$54,000 ten years after graduation ([Section 1.2](#)).
- Employers value work experience. Graduates with prior work experience in the Montana labor market earned about \$11,000 more than those without in the year after graduation. Most graduates (56%) have worked for Montana employers in the five years prior to graduation ([Section 1.3](#)).
- Graduates experienced positive returns to increased education in the long-run. Ten years after graduation, an increase in educational attainment is associated with an increase in income ranging between \$1,800 and \$22,000, depending on the industry ([Section 1.4](#)).
- Montana's Registered Apprenticeship program completers have more than double the wage earnings of those earning an associate or bachelor's degree after one year. Approximately 94% of apprenticeship completers work in Montana after graduation and earn an average wage of \$63,500 ([Section 1.4](#)).
- Registered nurses, dental hygienists, electricians, and plumbers have the best workforce outcomes among short-term degrees. Graduates from these programs reported average incomes above \$55,000 one year after graduation and 90% or better retention in the Montana economy ([Section 1.7](#)).
- Engineering, health professions, business, computer and information science, and construction technology graduates reported the highest income levels among bachelor's degree programs. Education programs had the highest retention rates in the Montana labor market ([Section 1.8](#)).
- Students with a graduate degree earn nearly \$60,000 one year after graduation and over \$75,000 ten years after graduation. About 20% of graduates from Montana colleges hold a graduate degree, which includes master's and doctoral degrees, and graduate certificates ([Section 1.9](#)).

Further analysis identifies gaps where Montana's education and training systems are not meeting the worker needs and skill needs of employers. The supply and demand analysis compares the number of post-secondary students graduating in each program to the projected workforce need according to MTDLI 2020-2030 employment projections. Combining this analysis with the workforce outcomes of graduates help policy makers and workforce planners understand how the post-secondary education system is meeting the needs of Montana businesses. Highlights include:

- 62% of high-demand occupations are undersupplied ([Section 2.1](#)). Many of these occupations are in education (preschool and kindergarten teachers), healthcare (nursing assistants, medical and dental assistants, LPNs and LVNs, substance abuse and mental health counselors, physical therapists, and nurse practitioners), and construction (heavy tractor-trailer truck drivers, electricians, plumbers, carpenters).
- More early childhood education (ECE) graduates are needed to meet the demand for preschool and kindergarten teachers as well as childcare workers. Over 80% percent of ECE graduates work in Montana a year after graduation. However, their earnings fall below average for their educational attainment ([Sections 1.7 and 1.8](#)). Addressing this income discrepancy would encourage more students to pursue an ECE degree.
- Mental health and social work graduates are insufficient to meet estimated demand. Undersupplied social work occupations include healthcare; mental health and substance abuse; and child, family, and school social workers ([Section 2.1.2 and 2.1.3](#)). Low wages relative to other occupations with similar education requirements likely contributes to the significant shortage of mental health professionals and social workers.
- Additional graduate-level healthcare professionals are needed to meet demand. Physical therapy (DPT), physician assistant (PA), nurse practitioner (NP), and physician (M.D) programs are all candidates for expansion ([Section 2.1.3](#)).
- Large supply gaps in construction and transportation suggest there are insufficient workers to fill Montana jobs, particularly among occupations requiring less than a four-year degree. Examples of undersupplied fields in construction include carpenters, automotive service technicians and mechanics, electricians, and plumbers ([Section 2.2.3](#)).
- General studies was the largest and most significantly oversupplied program at Montana post-secondary institutions, graduating approximately 1,100 students per year. The general studies program is consistently oversupplied in every region of the state ([Section 2.2.5](#)).
- Rural areas have the most significant unmet demand. Of the programs offered in the rural Eastern region, only 22% are supplying enough graduates to meet regional employer demand. Employers in the East will need to recruit workers from other regions of the state to fill their estimated workforce needs ([Section 2.3](#)).

As Montana faces a worker shortage, the post-secondary education system provides an important source of workforce supply. The information provided in this report indicates that Montana colleges are successful in meeting both student and employer needs, but improvements could always be made. With insights provided in this report, the education and training systems in the state are better prepared to meet future workforce needs and design strategies for continual improvement.

Introduction

Due to our aging demographics and strong job growth, Montana is experiencing a significant workforce shortage. Montana's labor force participation rate has been slowly declining over the last fifteen years as more of the population moves into retirement. Unemployment rates have dipped to historic lows, and businesses throughout the state report increasing difficulty recruiting and retaining a qualified workforce. Workforce development efforts have focused on several strategies aimed at increasing the state's labor force – such as encouraging those who have dropped out of the labor force to reenter, promoting in-migration of prime working-age adults, and improving worker productivity to better utilize each worker.

A critical element of addressing the state's workforce shortage is ensuring the state's post-secondary education system is aligned with our economic needs. Post-secondary training institutions graduate thousands of students each year who enter the Montana labor force. They also provide a key avenue for increasing the productivity of the existing workforce through retraining. Recognizing the important role the post-secondary education system plays in the state's workforce development efforts, the Montana Department of Labor and Industry (MTDLI) has partnered with the Office of the Commissioner of Higher Education (OCHE) and other post-secondary training institutions to share data and create analytics aimed at understanding whether the state's workforce training systems are effectively providing a skilled workforce for the Montana economy.

The data for this report comes from the employment projections from MTDLI for the state, with analysts matching the programs at each educational institution to the skills and education levels required in each occupation. The forecasts of worker demand from employers was then matched with the supply of workers from the post-secondary education system. Graduates from thirty-six different institutions in Montana are considered apart of graduate workforce supply – including graduates from all fifteen Montana University System (MUS) schools, three private four-year institutions, seven tribal colleges, Montana Registered Apprenticeship programs, and ten other vocational institutions throughout the state. These institutions are shown in the map below. The analysis identifies gaps where our education and training systems are not meeting the worker needs and skill needs of Montana employers.

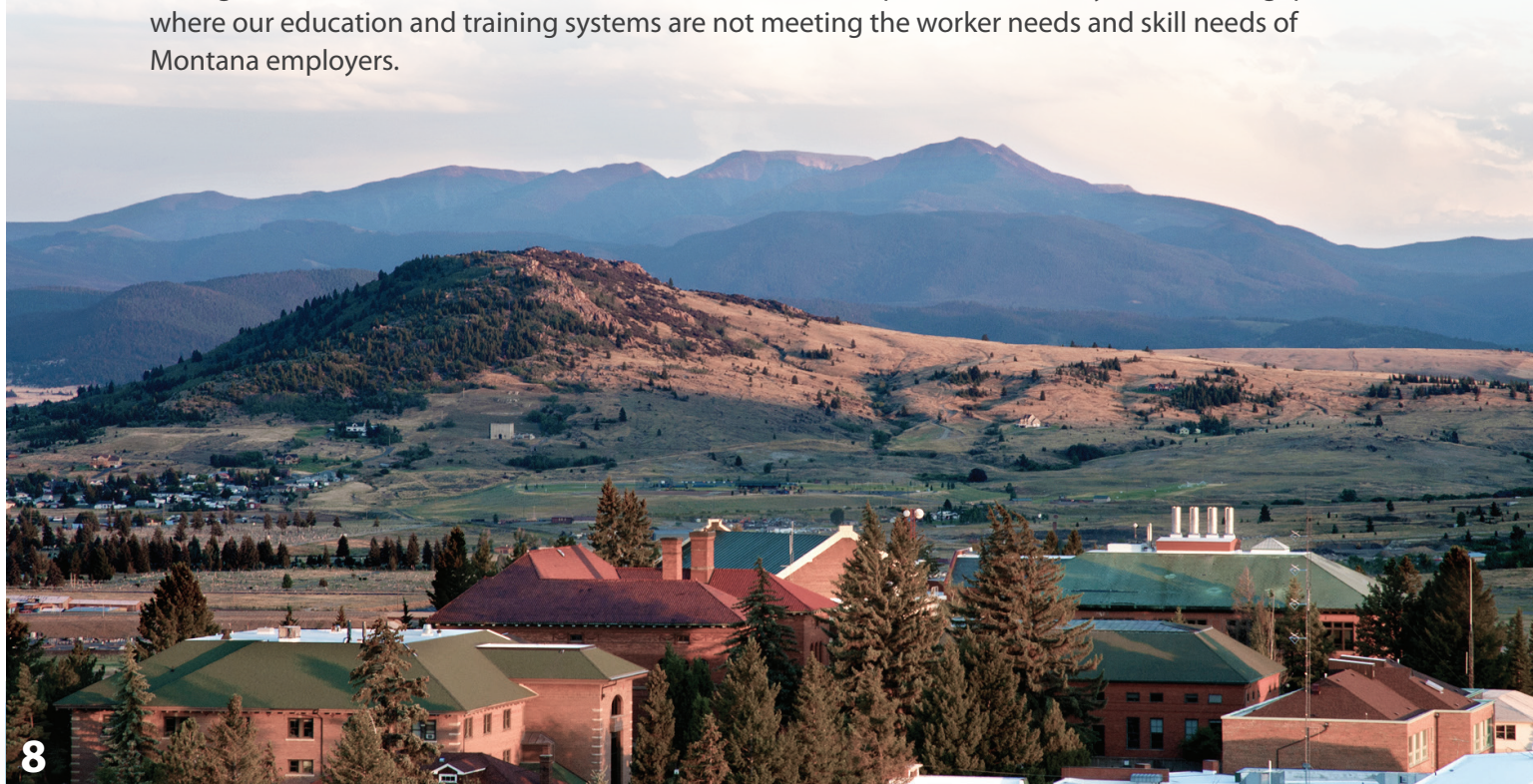
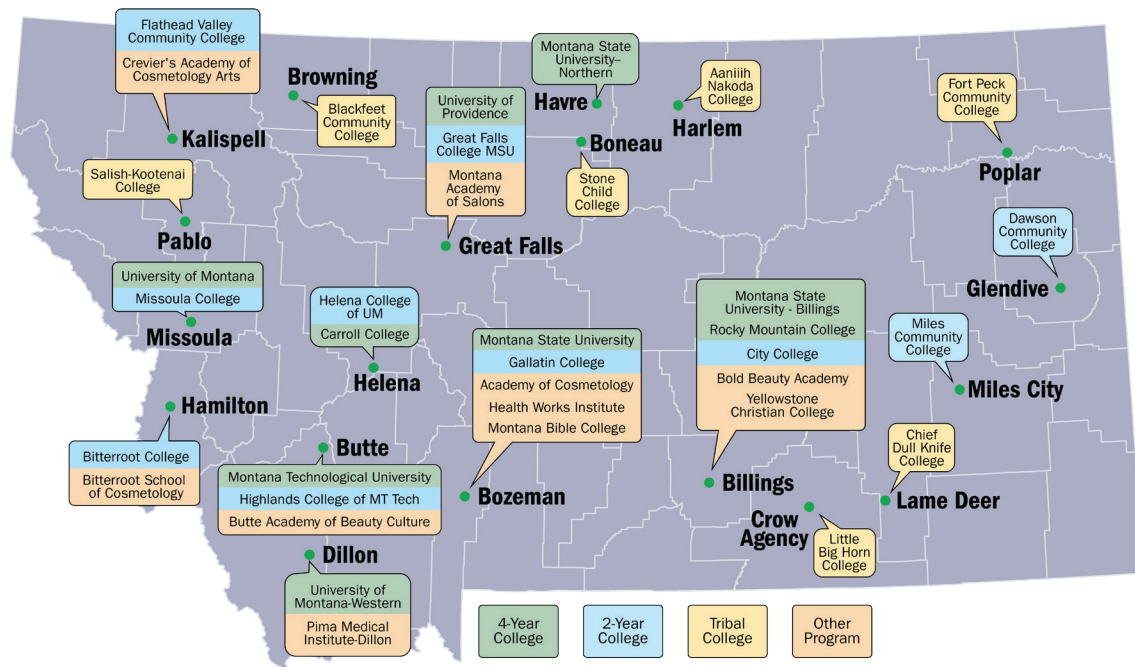


FIGURE 2.14
Map of Institutions



The Montana economy is projected to add roughly 5,750 jobs per year through 2030, translating to about 1.1% growth annually. Faster growth is expected in the near term due to strong job growth momentum exiting the pandemic recession. Job growth is expected to slow in the long run due in part to restricted labor supply resulting from the state's aging population. Over 55,490 workers will retire or otherwise leave their jobs in Montana every year through 2030. These replacement openings combined with annual employment growth of 5,750 jobs means that Montana will need roughly 61,240 workers each year to fill job openings. Workers who retire will need to be replaced by new workers, who may need to be trained through the education system. Individuals switching between jobs may also need additional training to meet employer's needs.

Montana's robust economic growth has maintained historically low unemployment rates below 3.0%. While low unemployment rates signal employment opportunities for graduates, sustained low unemployment rates are a sign of tight labor markets that can make it difficult for employers to find the workers they need. Higher wages and more job opportunities will help attract workers to Montana and increase labor force participation rates. However, these natural market forces may not be enough to fill the demand for workers. Understanding workforce supply from Montana's post-secondary education system is a timely task in the face of workforce shortages throughout the state.

The administrative data on graduates available through OCHE, Rocky Mountain College, University of Providence, and Carroll College were also matched to wage and income records maintained by MTDLI and the Montana Department of Revenue (DOR). Matching graduate data with income and wage data provides an understanding of the workforce outcomes of graduates, allowing us to determine whether graduates obtain lucrative careers in Montana after graduation. The match between graduate data and UI administrative wage records was governed by the security requirements outlined in the Memorandum of Understanding between the MTDLI and OCHE, which was designed to protect the

confidentiality of the unemployment insurance wage files and protect the privacy of graduates. The resulting information provides insight on how quickly each graduate finds a job, whether that job is steady employment, and whether the student is experiencing wage progression in the ten years after graduation. However, the UI administrative wage records only capture payroll employment. To capture other forms of income, such as self-employment and personal contracting income, the graduate data were also matched to income tax records maintained by DOR.

The graduate workforce outcomes is critical to understanding and confirming of the supply and demand analysis, as the in-demand fields should have higher job placement and better wages than occupations where colleges are over-supplying the labor market. Workforce outcomes also provide information on how many graduates work in Montana, thus helping businesses meet their worker demands and grow the state economy. Income and employment information is also necessary for program evaluation. Mismatches between program of study and industry of employment may indicate that the skills taught within the educational program are not the skills needed for employment success, suggesting that curriculum updates may be needed. Finally, employment outcome information is helpful for students searching for a degree program that ensures their employability after graduation.

The report is organized into two primary sections. The first section, “Graduate Workforce Outcomes” provides a summary of the workforce outcomes of graduates in Montana, including breakdowns by degree, program, and industry. Continuing the evaluation, the second section, “Post-Secondary Supply and Demand Analysis”, answers the primary research question of whether Post-Secondary institutions are producing enough graduates in the right fields to meet statewide worker demand. The supply and demand analysis is presented for high-demand occupations and for each program offered by the post-secondary education system. Finally, the supply and demand analysis looks at the geographical distribution of supply and demand, asking if employers throughout the state have enough workers to meet their demands. The last section concludes. The methodology is presented in the appendix. Utilizing the supply and demand analysis will help students join the labor market quickly and efficiently, saving money for students, employers, and taxpayers.

The analysis faces some drawbacks due to data limitations. Only the state’s post-secondary education system is considered a part of workforce supply. High school graduates who do not pursue post-secondary education in Montana are not included in this analysis due to a lack of available data. Furthermore, only Montana earnings data is captured in graduate’s workforce outcomes. While this helps to determine whether the worker remains in Montana post-graduation, the lack of data from other states likely places downward bias on the percent of graduates employed, with greater bias for programs that help fill national talent pools. Further, the wage data does not include the number of hours worked, preventing calculations of hourly wages and making it difficult to determine whether workers are “better off” post-graduation. If the graduate has higher wage earnings after graduation, the difference may be due to working more hours, not to higher hourly wages. However, the insight provided through the partial match was deemed valuable enough to share with these limitations.



Part One

Graduate Workforce Outcomes

This section provides information on the wage, employment, and income levels achieved by graduates from Montana's post-secondary institutions, demonstrating how their degree influences their economic success. Education data from the Office of the Commissioner of Higher Education (OCHE) was matched with wage data from the Montana Department of Labor and Industry (MTDLI) and income data from the Montana Department of Revenue (DOR) to provide insight into the value of a post-secondary education to Montana employers and the state economy.

The OCHE provided MTDLI with data on the graduates from the sixteen colleges that are included in the Montana University System data warehouse (MUS) from 2001 to 2020. Rocky Mountain College, Carroll College, and Providence University also agreed to participate in this report, providing data on their graduates over the same nineteen-year period. Montana registered apprenticeship program completers are included as the final post-secondary institution in the workforce outcomes analysis. Combined, the workforce outcomes section includes data on roughly 140,000 individuals who earned over 160,000 degrees and certificates from twenty different institutions across the state.

1.1 Graduates Fuel Montana's Labor Force

The majority of graduates from Montana post-secondary institutions work in Montana after graduation, providing a critical supply of workers to the state's economy. Approximately 69% of graduates work in Montana one year after graduation, and 74% will work in Montana at some point within ten years after graduation.

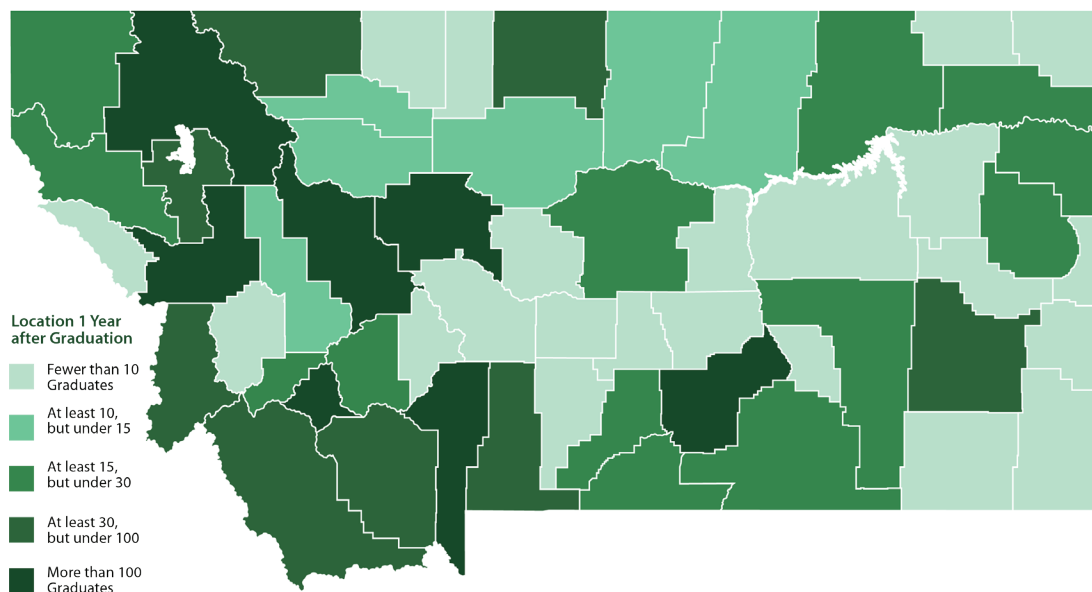
Graduates work in every county in Montana, demonstrating the important role of post-secondary education in workforce development throughout the state.

Graduates work in every county in the state. **Figure 1.1** shows the average annual number finding employment in each county one year after graduation. Gallatin and Missoula County, where the state universities are located, employ the most graduates one year after graduation, with Gallatin at 1,280 per year. Missoula employs roughly 900 new graduates every year. However, graduates tend to move further away from their school as time passes, dispersing from the more populated areas to every corner of Montana.

The post-graduate migration demonstrates labor force mobility, which leads to better job matches, improves wages, and promotes economic growth. Labor force mobility is particularly important in the early stages of a worker's career as they gain experience and move up the career ladder. Labor force mobility also helps to stabilize the economy during downturns. Workers with the flexibility to move can better respond to changes in employment opportunities.

FIGURE 1.1

Annual Number of Graduates Employed One-Year After Graduation by County



Source: MTDLI, OCHE, RMC, CC and UP graduate data wage match. Average annual number of graduates employed in each county one-year after graduation since the 2016-17 academic year. County location determined based on the location of the graduate's primary employer.

1.2 Graduates Earn Above-Median Wages and Income

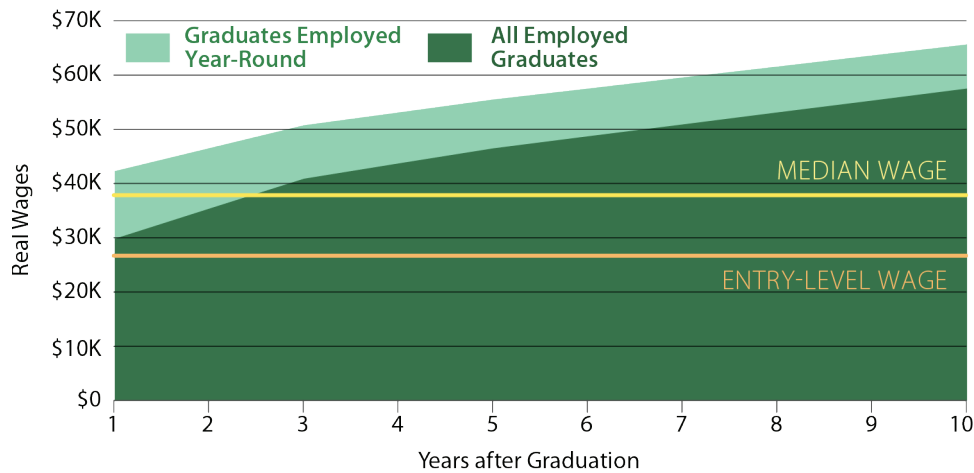
Graduates earn above the state's entry-level wage in the first year after graduation and surpass the median wage within three years of graduation. Ten years after graduation, students earned an average of \$57,500 in wages, with year-round wage earners over \$65,000. **Figure 1.2** depicts the average wage progression of Montana graduates.

The average wage earned by graduates reflects the total wages earned in any quarter, regardless of whether the work was part-time, full-time, temporary, or seasonal employment. However, the data does not include information on the number of hours worked and cannot be used to estimate an hourly wage. Those graduates who worked year-round earned \$42,000 one year after graduation, roughly \$12,000 more than the average across all graduates. After ten years, year-round wage earners had average wages of \$65,600. The increase in wages for the consistently employed compared to the average is certainly due to more hours worked but may also be from a higher hourly wage.

69% of graduates from Montana's post-secondary institutions work in the state after graduation. Those working year-round made **\$42,000** one year after graduation, which is above the state median wage.

FIGURE 1.2**Real Average Wage Earnings for Graduates**

Compared to Statewide Median and Entry-Level Wages



Source: MTDLI, OCHE, RMC, CC, UP, and apprenticeship graduate data wage match. Real wages reported in 2021 dollars using the CPI-U. Median and entry-level wages from 2020 Occupation Employment and Wage Statistics.

Wages are the primary source of income for most graduates; however, they are not the only source of income. Business, rental, and farm income are other sources of earned income. The percentage of income generated from non-wage sources tends to increase as the graduate ages. A year after graduation, the average wage of graduates was approximately \$30,000, with average income higher at nearly \$37,000.¹ Graduates had average income of roughly \$52,000 after five years and \$66,900 after ten years. **Figure 1.3** summarizes the workforce outcomes of graduates from Montana colleges and apprenticeship programs.

FIGURE 1.3**Workforce Outcomes for Students by Years After Graduation**

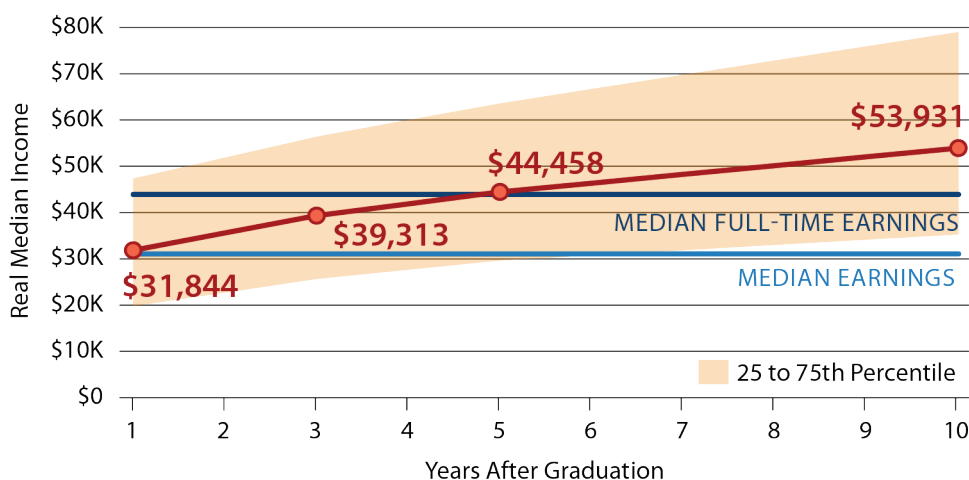
	1 Year	3 Years	5 Years	10 Years
Employed in Montana	69%	55%	51%	45%
Average Real Wages (All Graduates)	\$29,789	\$40,889	\$46,472	\$57,501
Annual Wage Growth (All Grads)	--	17%	12%	8%
Avg Real Wages (Year-Round Employee)	\$42,284	\$50,751	\$55,496	\$65,654
Filing Montana Tax Return	70%	62%	59%	56%
Average Real Income (All Grads)	\$36,813	\$44,843	\$51,737	\$66,883

Source: MTDLI, OCHE, RMC, CC and UP graduate data wage match. DOR, OCHE, RMC, CC, and UP income data match summarized by MTDLI. Real wages reported in 2021 dollars using the CPI-U.

Over half of Montana graduates were still earning income in Montana ten years after graduation. Roughly 45% of graduates worked for a Montana employer after ten years, earning wage income. An additional 11% did not earn Montana-source wages, but still earned income in Montana, possibly from self-employment. The drop off from 70% to 56% of graduates with income in the ten-year timeframe is expected as workers move out of state or drop out of the labor force to have a family, go back to school, or make other life decisions.

Those working in Montana experienced stable income growth in the ten years following graduation, with the average increasing up to \$67,000 ten years after graduation. However, the income earned by graduates is subject to a significant amount of variation based on degree earned, program of study, and career choice. **Figure 1.4** illustrates the dispersion of graduate incomes using the median (instead of the mean used in **Figure 1.3**) and the range earned by the middle two quartiles. The median earnings for all workers in Montana is also shown in **Figure 1.4** for comparison. The median of graduates exceeds the median for all workers in the first year after graduation, and exceeds the full-time worker median earnings by the fifth year.

FIGURE 1.4
Central Quartiles of Graduate Income
Compared to Statewide Median Earnings



Source: DOR, OCHE, RMC, CC, UP, and apprenticeship income data match summarized by MTDLI. Real income reported in 2021 dollars using the CPI-U. U.S. Census Bureau 2016-2020 ACS 5-Year estimate of total median earnings, and median earnings for full-time, year-round workers. Earnings includes wage and business income.

Graduates reported a median income of \$31,800 a year after graduation, with half of graduates earning somewhere between \$20,000 and \$47,000 in income. Median income grew to nearly \$54,000 ten years after graduation, with most graduates earning above the median earnings for full-time workers. This income progression translates to approximately 6% real annual income growth for graduates in the first ten years after graduation, which is significantly faster than the statewide average of 2.5%.² Real income growth was slightly higher (6.6%) for those in the bottom quartile of the income distribution.

1.3 Employers Value Work Experience; Most Students Work

Graduates who worked while obtaining their degree achieved higher wages and better employment outcomes post-graduation than graduates who had no prior connection to the Montana labor market. Fifty-six percent of graduates had experience working for Montana employers in the five years prior to graduation. **Figure 1.5** shows how work experience varies by educational attainment, with 72% of associate degree earners having prior work experience, compared to 54% of bachelor's degree earners, 43% of master's degree holders, and only 35% of doctorates. Graduates that worked at least two quarters per year in the five years prior to graduation are referred to as incumbent workers in this report.

56% of post-secondary graduates have prior work experience in the Montana labor market.

FIGURE 1.5

Graduates with Work Experience by Degree

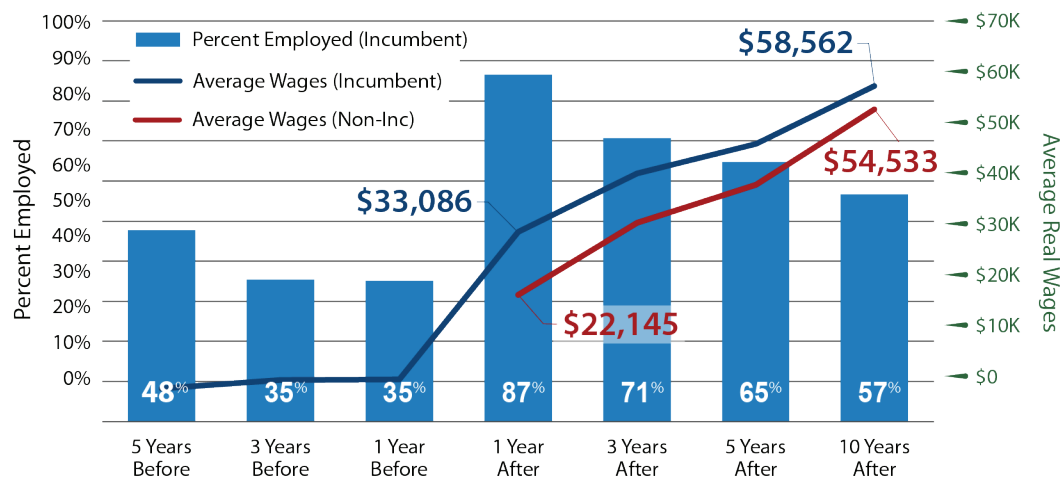
Degree	Percent
CTS <1 year	59%
CAS >1 year	63%
Associate Degree	72%
Bachelor's Degree	54%
Master's Degree	43%
Graduate Certificate	50%
Doctoral Degree	35%

Connection to the Montana labor market increased the likelihood of working in Montana after graduation. Eighty-seven percent of incumbent workers were employed in Montana a year after graduation, compared to only about 47% of non-incumbent workers. They were also more likely to remain employed. Ten years after graduation, 57% of incumbent workers were still working in Montana compared to 28% of non-incumbents. **Figure 1.6** depicts wage and employment outcomes for incumbent workers before and after graduation, compared to those without work experience.

Source: MTDLI, OCHE, RMC, CC, UP, and app data wage match.

FIGURE 1.6

Workforce Outcomes for Incumbent Workers Before and After Graduation



Source: MTDLI, OCHE, RMC, CC, UP, and apprenticeship graduate data wage match. Real wages reported in 2021 dollars using the CPI-U. Incumbent workers were employed at least two quarters per year five years before graduating.

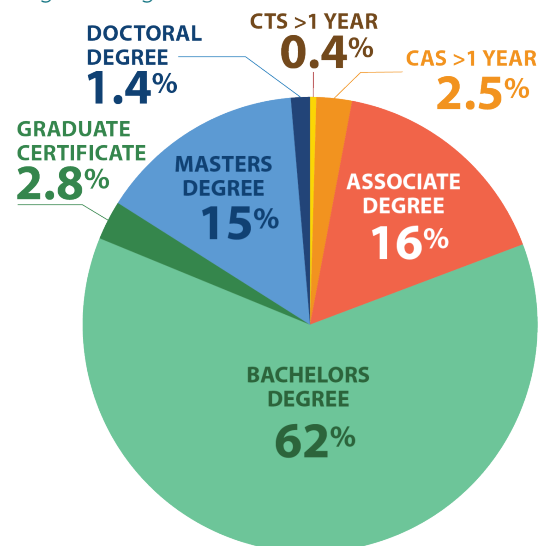
Wages for incumbent workers were higher than wages of non-incumbent workers by about \$11,000 one year after graduation. The wage premium decreased over time as non-incumbent workers gained work experience. Ten years after graduation, the wage premium decreased to \$4,000.

Graduates with **work experience** made **\$11,000** more a year after graduation than those without prior connections to the Montana labor market.

1.4 Positive Returns to Increased Educational Attainment

One of the primary determinates of graduate workforce outcomes in Montana is educational attainment. Post-secondary attainment is broken out into seven different certificate and degree types – Certificate of Technical Studies (CTS), Certificate of Applied Science (CAS), Associate, Bachelors, Masters, Doctorate, and other graduate certificates. Registered Apprenticeship graduates are placed into these categories based on the average time to completion. A bachelor's degree is the most common degree earned, with 62% of graduates from 2001 to 2020 earning a bachelor's degree. An additional 18% earned a graduate degree (includes master's or PhD). **Figure 1.7** shows the educational attainment of graduates from Montana colleges and apprenticeship programs over the last nineteen academic years.³

FIGURE 1.7
Educational Attainment of Graduates
Highest Degree Attained



Source: OCHE, CC, RMDC, UP, and Apprenticeship graduate data from 2001-02 to 2019-20. CTS (<1 year) = Certificate of Technical Studies. CAS (>1 year) = Certificate of Applied Science. Apprenticeship program categorized into degree based on time-to-completion.

Graduates obtaining higher levels of education have higher income potential in the ten years following graduation than those with lower levels of education. Positive returns to educational attainment is demonstrated in **Figure 1.8**.

FIGURE 1.8
Workforce Outcomes of Graduates by Degree

	1 Year After		10 Years After		Annual Income Growth Rate
	% Filing	Median Income	% Filing	Median Income	
CTS < 1 year	79%	\$26,818	64%	\$37,412	4%
CAS > 1 year	85%	\$28,250	72%	\$41,096	4%
Associate Degree	85%	\$32,452	73%	\$51,095	5%
Bachelor's Degree	67%	\$28,584	52%	\$52,883	7%
Master's Degree	62%	\$44,144	50%	\$62,397	4%
Graduate Certificate	58%	\$59,474	58%	\$97,721	6%
Doctoral Degree	54%	\$58,053	38%	\$75,766	3%

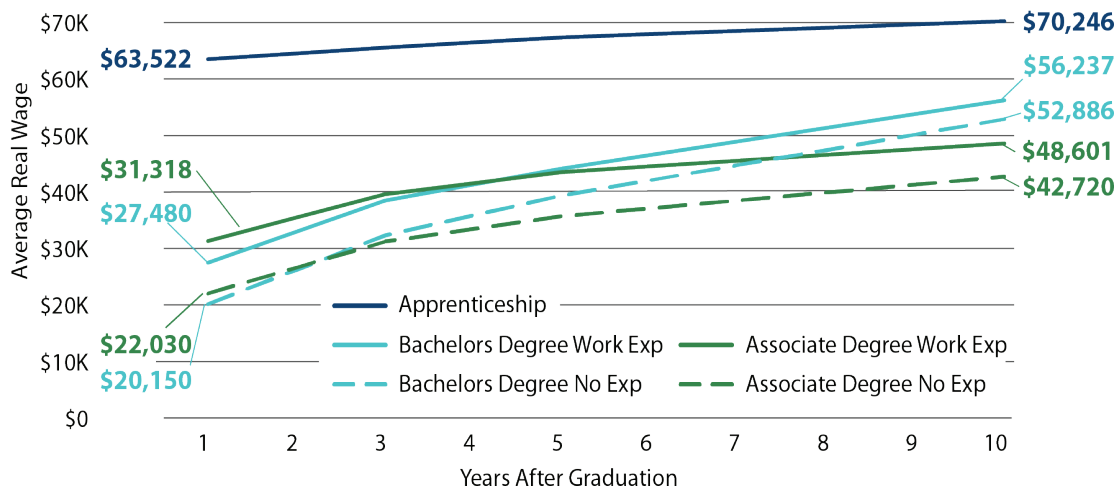
Source: DOR, OCHE, RMC, CC, UP, and apprenticeship income data match summarized by MTDLI. Real income reported in 2021 dollars using the CPI-U. Percent filing resident or non-resident Montana income taxes.

Figure 1.8 shows the median income of graduates by degree one year and ten years after graduation, as well as the percent filing income taxes in Montana. Ten years after graduation, an increase in educational attainment is associated with an increase in income ranging between \$1,800 and \$22,000. The largest income premium exists for graduate certificate attainment – which includes a Doctorate of Physical Therapy (DPT), Juris Doctorate (J.D.), and Doctorate of Pharmacy (PharmD).⁴

While bachelor's degree earners have a greater long-run income potential than associate degree earners, associate degree earners report higher income levels in the first few years after graduation. Bachelor's degree earners report \$28,500 in median income one year after graduation, which is about \$4,000 less than associate degree holders. Associate degree workforce outcomes includes several apprenticeship programs with high earnings – namely the large electrical and plumbing apprenticeship programs. Associate degree holders are also more likely than bachelor's degree earners to have prior work experience in the Montana economy, which is associated with higher income after graduation. However, even after controlling for these factors, associate degree earners report higher earnings in the first years after graduation. **Figure 1.9** shows the average wages reported by associate and bachelor's degree earners in the first ten years after graduation controlling for work experience and apprenticeship program participation.

Graduates from Montana's **Registered Apprenticeship** program have **more than double** the wage earnings of those earning an associate or bachelor's degree after one year.

FIGURE 1.9
Apprenticeship, Bachelor's, and Associate Degree Wages by Work Experience



Source: MTDLI, OCHE, RMC, CC, UP, and apprenticeship graduate data wage match. Wages reflect average real wages reported in 2021 dollars using the CPI-U. Apprenticeship includes all degree types. Work experience defined as working at least two quarters per year in the five years prior to graduation. All apprenticeship completers have work experience.

Montana Registered Apprenticeship program completers report more than twice the average wage in the first year after graduation than bachelor's and associate degree holders from other institutions. Associate degree graduates with prior work experience reported the next highest wages, followed by bachelor's degree graduates with prior work experience. Associate degree earners are more likely than bachelor's degree earners to have prior work experience. However, most bachelor's graduates (54%) have worked in Montana prior to graduation. Those with prior work experience reported higher wages regardless of their degree attainment.

Although no wage premium exists for bachelor's degree attainment a year after graduation, bachelor's degree earners have faster wage growth over time and surpass associate degree wages within three years of graduation. The median income for bachelor's degree holders is \$53,000 ten years after graduation (compared to \$51,000 for associate degree earners). Bachelor's degree earners also appear to have greater income potential than associate degree earners. The average income for bachelor's degree earners are higher than associate degree earners after five years, suggesting greater upward spread among bachelor's degrees.

1.4.1 Income Premium for Bachelor's by Program of Study

Most bachelor's degree earners have higher reported median incomes than associate degree earners within the same program, suggesting positive returns to bachelor's degree attainment within a field of study. **Figure 1.10** shows median income by program between associate and bachelor's degree earners one and ten years after graduation. Programs with the greatest return to bachelor's degree attainment are listed first. Only programs offering a bachelor's and associate degree are included in **Figure 1.10**.

The returns to bachelor's degree attainment vary widely by program. Programs like construction engineering technology, education, automotive technology, health information technology (HIT), and computer and information technology have significantly higher income for bachelor's degree earners. Most of these programs train graduates to work in occupations requiring a bachelor's degree. Ten years after graduation, both construction technology and secondary education graduates with a bachelor's degree earn twice as much as those earning an associate degree.

Associate vs. Bachelor's Earnings

Associate degree graduates report **higher initial income** than bachelor's degree earners. However, bachelor's degree have a **greater long-run income potential** – surpassing associate degree income three years after graduation.

Construction Engineering Tech & Secondary Education graduates with a bachelor's degree earn twice as much as those with an associate degree. However, there is little income difference between degree types for **Registered Nursing**.

Computer and information science, other is the only category with consistently higher income reported among associate degree instead of bachelor's degree holders after graduation. Computer user support specialists is the largest program within this category. Graduates from this program are prepared to work as Computer Network Support Specialists, which is a high-demand occupation that does not require a bachelor's degree. Workforce outcomes for computer user support specialist graduates suggest employers prefer to hire associate degree graduates over those with a bachelor's degree.

FIGURE 1.10**Bachelor's and Associate Degree Median Income by Program**

Program	Associate Degree		Bachelor's Degree		Income Premium	
	1 Year	10 Year	1 Year	10 Year	1 Year	10 Year
Construction Engineering Technology	\$32,052	\$38,951	\$52,572	\$84,920	\$20,520	\$45,969
Secondary Education	\$16,321	\$23,570	\$30,508	\$47,504	\$14,187	\$23,934
Automotive Technology	\$31,949	\$54,518	\$46,051	\$60,564	\$14,102	\$6,046
HIT and Medical Coding	\$26,613	\$36,634	\$40,420	--	\$13,806	--
Computer Programming**	\$32,604	\$50,251	\$46,362	\$74,840	\$13,758	\$24,589
Elementary Education	\$14,977	\$42,749	\$28,039	\$43,734	\$13,062	\$985
Information Technology	\$28,457	\$46,404	\$40,024	\$55,283	\$11,568	\$8,879
Health Care Office Management*	\$29,411	\$33,600	\$40,423	\$49,795	\$11,012	\$16,195
Diesel Technology	\$36,594	\$52,626	\$47,331	\$63,524	\$10,738	\$10,898
General Studies	\$18,781	\$42,560	\$29,178	\$46,765	\$10,397	\$4,205
Accounting Technology	\$28,593	\$41,914	\$36,084	\$61,684	\$7,491	\$19,771
Aviation*	\$24,827	\$57,411	\$31,793	\$48,237	\$6,966	-\$9,174
Network Technology	\$30,099	\$51,645	\$37,045	\$67,612	\$6,945	\$15,967
Agriculture	\$23,085	\$37,245	\$28,717	\$46,969	\$5,632	\$9,724
Early Childhood Education	\$24,706	\$32,026	\$30,213	\$40,331	\$5,506	\$8,306
Business	\$27,529	\$38,727	\$32,146	\$58,338	\$4,617	\$19,611
Engineering Technologies, Other	\$39,303	\$65,306	\$43,735	\$68,907	\$4,431	\$3,600
Drafting and Design Technology	\$34,441	\$49,754	\$38,411	\$51,310	\$3,969	\$1,556
Education, General	\$21,616	\$22,632	\$25,419	\$45,485	\$3,803	\$22,854
Registered Nursing	\$54,230	\$65,662	\$56,633	\$67,161	\$2,403	\$1,500
Substance Abuse/Addiction Counseling	\$29,294	\$39,141	\$31,592	\$43,666	\$2,299	\$4,525
Criminal Justice	\$32,285	\$32,652	\$31,561	\$50,143	-\$725	\$17,491
Paralegal Studies	\$28,979	\$32,810	\$27,320	\$41,184	-\$1,659	\$8,374
Visual and Performing Arts	\$24,532	\$28,274	\$21,119	\$37,480	-\$3,413	\$9,206
Allied Health Dx, Intervention, Tx***	\$46,786	\$66,535	\$42,556	\$71,842	-\$4,230	\$5,307
Health Tech/ Assistant	\$39,714	\$53,780	\$33,976	\$57,499	-\$5,738	\$3,719
Computer/Info Science, Other	\$55,691	\$71,205	\$38,910	\$65,829	-\$16,781	-\$5,376

Source: DOR, OCHE, RMC, CC, UP, and apprenticeship income data match summarized by MTDLI. Real income reported in 2021 dollars using the CPI-U. * = Bachelor's degree income reported five instead of ten years after graduation. ** = Computer programming and app development associate degree compared to Computer Science bachelor's degree. *** = Allied Health master's degree reported instead of bachelors.

Aviation is the only other program in **Figure 1.10** with bachelor's degree income below associate degree income ten years after graduation. Commercial pilots typically need a bachelor's degree and flight training, as well as specific certificates and rating from the Federal Aviation Administration (FAA) before they can fly.⁵ While bachelor's degree attainment is associated with higher income levels in the short-term for aviation graduates, long-run income levels are likely determined by work experience and standing with the FAA rather than educational attainment.

Registered nursing graduates report some of the lowest returns to bachelor's degree attainment among programs with a positive income premium. Despite the prevalence of bachelor's degrees (BSN) among registered nurses, BSN registered nurses only make 4% more than registered nurses with an associate degree (ASN). The income premium diminishes over time, with BSN registered nurses reporting a median income only 3% higher than those with associate degrees ten years after graduation. Within the nursing profession, educational attainment does not translate into higher income levels, unless that increased education results in a more advanced nursing license.⁶ Associate and bachelor's trained registered nurses hold the same nursing license, and therefore, their wages do not differ significantly.

1.4.2 Income Premium for Graduate Degrees by Program

The largest increase in the income occurs as students move from bachelor's to master's degree attainment. Master's degree earners earn \$15,500 more in income at the median a year after graduation compared to bachelor's degree earners. The increase in income is similar for doctorate and graduate certificate earners compared to master's degree graduates. The income premium for graduate certificate attainment, which primarily consists of Doctorates of Physical Therapy (DPT) and Juris Doctorate (JD) degrees, increase over time. Ten years after graduation, DPT and JD graduates earn \$35,000 more in income than master's degree graduates.

Returns to graduate degree attainment vary by program.

Figure 1.11 shows the difference in median income one and ten years after graduation for bachelor's and master's degree earners by program, sorted by the size of the premium. Nearly every program shown in **Figure 1.11** reports positive returns to master's degree attainment. Engineering technologies, finance, and architecture graduates report twice the income of bachelor's graduates one year after earning their degree. There are only two programs that do not demonstrate positive returns to graduate degree attainment in the short-term – communication and general studies. These programs do not train graduates to work in occupations that require a graduate degree; therefore, employers do not offer an income premium for increased education attainment.

Engineering Technology, Finance, & Architecture graduates with a master's degree earn twice as much as those with a bachelor's degree.

While most programs demonstrate positive returns to graduate degree attainment, the premium tends to diminish over time. There are only a few programs where the income premium increased over time, including registered nursing. Registered nursing graduates with a master's degree earned 33% more than their counterparts holding a bachelor's degree one year post-graduation. This income premium increased to 50% ten years after graduation. Master's degree nurses typically hold an Advanced Practice Registered Nursing (APRN) license. APRN licensees have a broader scope of practice than registered nursing licensees. As a result, nurses holding a master's degree earn significantly more than bachelor's degree nurses.

FIGURE 1.11**Income Premium for Graduate Degree Attainment by Program**

Program	Bachelor's Degree		Master's Degree		Income Premium	
	1 Year	10 Year	1 Year	10 Year	1 Year	10 Year
Engineering Technologies, Other	\$43,735	\$68,907	\$87,982	\$95,172	\$44,248	\$26,265
Finance*	\$36,305	\$43,658	\$71,253	\$83,928	\$34,948	\$40,270
Health Care Office Management*	\$40,423	\$49,795	\$66,492	\$87,728	\$26,069	\$37,932
Architecture	\$18,329	\$63,585	\$41,903	\$71,772	\$23,574	\$8,187
Business	\$32,146	\$58,338	\$55,038	\$82,523	\$22,893	\$24,186
Education, General	\$25,419	\$45,485	\$47,502	\$59,427	\$22,083	\$13,942
Science Teacher	\$29,609	\$45,192	\$50,758	\$61,466	\$21,149	\$16,274
Engineering, General	\$50,630	\$82,072	\$71,661	\$101,740	\$21,031	\$19,667
Health Science, Other	\$25,545	\$68,907	\$45,188	\$81,307	\$19,643	\$12,400
Visual and Performing Arts	\$21,119	\$37,480	\$40,442	\$46,000	\$19,323	\$8,520
Social Science Teacher	\$27,773	\$44,829	\$46,515	\$54,850	\$18,742	\$10,020
Registered Nursing	\$56,633	\$67,161	\$75,164	\$100,514	\$18,531	\$33,353
Journalism	\$25,039	\$48,139	\$43,379	\$48,521	\$18,340	\$383
Cinematography and Film	\$20,773	\$42,433	\$38,036	\$68,161	\$17,263	\$25,728
Geology	\$27,881	\$56,074	\$44,492	\$63,884	\$16,611	\$7,810
Special Education	\$29,788	\$45,190	\$45,888	\$51,052	\$16,100	\$5,862
Computer Science	\$46,362	\$74,840	\$61,298	\$79,013	\$14,936	\$4,174
Economics*	\$24,164	\$48,155	\$39,057	\$58,998	\$14,893	\$10,843
Health and PE/Fitness	\$23,033	\$53,974	\$37,598	\$66,818	\$14,565	\$12,844
Physician Assistant	\$80,358	\$105,824	\$94,610	\$136,500	\$14,252	\$30,676
Kinesiology and Exercise Science	\$23,340	\$46,037	\$37,064	\$56,492	\$13,724	\$10,455
Natural Res Conserv & Mgmt	\$24,981	\$55,373	\$38,640	\$66,593	\$13,659	\$11,220
Geography	\$25,406	\$48,527	\$38,794	\$59,182	\$13,389	\$10,655
Fish and Wildlife Management*	\$24,247	\$35,248	\$37,631	\$44,802	\$13,383	\$9,555
Social Work	\$28,390	\$40,988	\$41,642	\$56,716	\$13,252	\$15,729
Industrial Engineering*	\$39,366	\$67,844	\$52,402	\$72,382	\$13,037	\$4,538
Physical Science, Other	\$23,048	\$50,638	\$34,954	\$56,563	\$11,906	\$5,925
Accounting	\$36,084	\$61,684	\$47,203	\$80,985	\$11,119	\$19,300
Mathematics and Data Science	\$26,903	\$57,331	\$37,988	\$61,235	\$11,085	\$3,904
Civil Engineering	\$47,540	\$75,177	\$58,520	\$94,063	\$10,980	\$18,886
Public Relations	\$30,957	\$55,679	\$41,897	\$65,196	\$10,940	\$9,517
Environmental Engineering*	\$45,509	\$62,372	\$55,991	\$76,063	\$10,482	\$13,691
Music	\$21,992	\$45,823	\$32,452	\$33,253	\$10,460	-\$12,570
Forestry	\$30,915	\$60,443	\$41,255	\$65,836	\$10,341	\$5,392
Pharmacy**	\$100,051	\$116,719	\$110,357	\$122,489	\$10,306	\$5,771
Anthropology	\$21,444	\$39,658	\$31,102	\$52,173	\$9,658	\$12,515
Substance Abuse Counseling*	\$31,592	\$43,666	\$40,799	\$46,097	\$9,207	\$2,431
Environmental Science	\$23,210	\$46,986	\$31,671	\$51,818	\$8,462	\$4,832
Electrical/Electronic Engineering	\$48,970	\$86,122	\$56,924	\$97,743	\$7,955	\$11,620
English and Creative Writing	\$21,717	\$41,207	\$29,012	\$45,857	\$7,295	\$4,651
Plant Science	\$27,490	\$49,612	\$34,252	\$50,640	\$6,762	\$1,027
History	\$22,713	\$45,692	\$28,651	\$41,889	\$5,938	-\$3,803
Psychology	\$24,178	\$44,953	\$28,588	\$58,401	\$4,410	\$13,447
Secondary Education, Other	\$30,508	\$47,504	\$33,854	\$58,438	\$3,345	\$10,934
Physics	\$23,590	\$52,663	\$25,972	\$56,029	\$2,382	\$3,366
Mechanical Engineering*	\$42,674	\$66,525	\$44,316	\$70,718	\$1,642	\$4,193
Communication Studies	\$25,764	\$44,823	\$24,464	\$45,236	-\$1,300	\$414
General Studies	\$29,178	\$46,765	\$27,106	\$29,860	-\$2,072	-\$16,905

Source: DOR, OCHE, RMC, CC, UP, and apprenticeship income data match summarized by MTDLI.

Real income reported in 2021 dollars using CPI-U.

* = Five instead of ten years after graduation shown due to data availability.

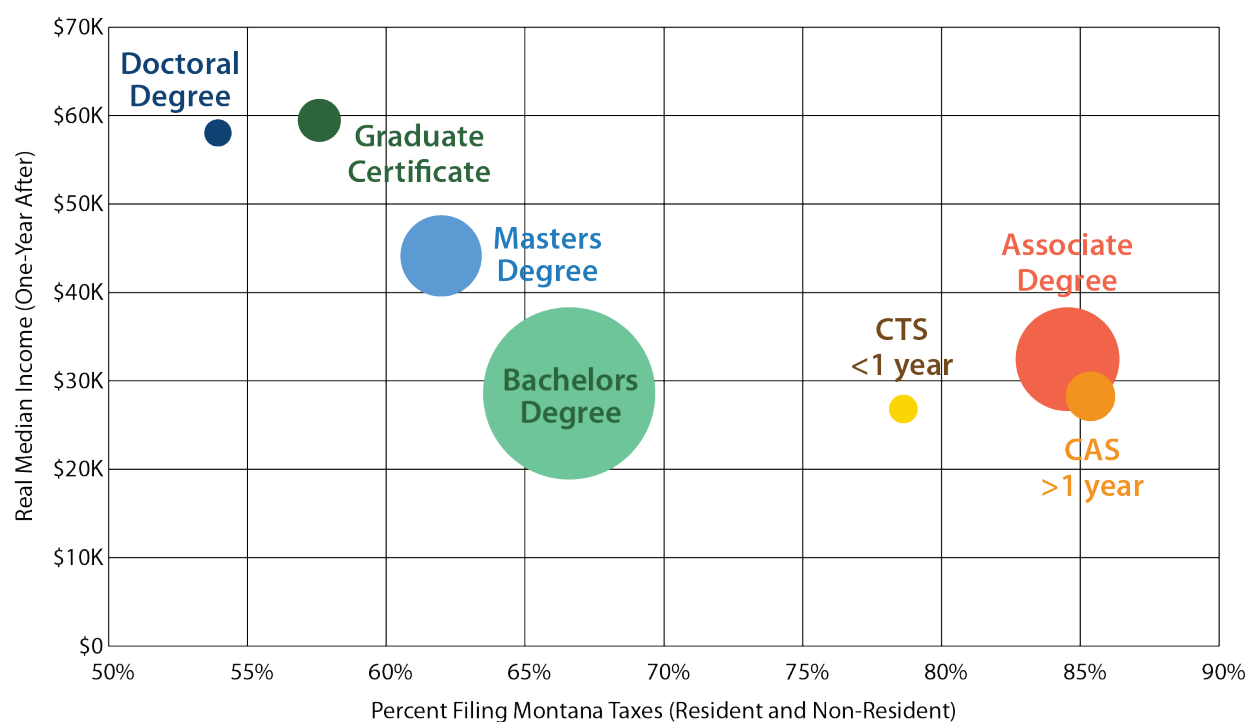
** = Pharmacy master's degree reflects graduate certificate.

1.5 More Education Leads to Higher Income but Lower Retention

Graduates with higher levels of education report higher levels of income, demonstrating positive returns to increasing educational attainment. However, as graduate's educational level rises, it becomes more likely that they will seek work outside the state. The negative relationship between remaining in Montana and higher education levels likely arises because individuals with more education pursue higher-wage jobs. Montana's high-wage jobs tend to pay less than high-wage jobs in other states, whereas low-wage jobs pay just as well in Montana as in other states.⁷ **Figure 1.12** shows workforce outcomes by degree, where the horizontal axis is the percent filing income taxes one year after graduation and the vertical axis is median income. The size of the bubble corresponds to the number of graduates in each degree type since 2001.

FIGURE 1.12

Workforce Outcomes One-Year After Graduation by Degree Type



Source: DOR, OCHE, RMC, CC, UP, and apprenticeship income data match summarized by MTDLI. Real income reported in 2021 dollars using the CPI-U.

The largest drop in graduate retention occurs between an associate and bachelor's degrees. About 84% of associate degree graduates work in Montana a year after graduation, compared to 67% of bachelor's degree earners. Shorter training times for associate degrees and stronger connections between two-year colleges and local labor markets result in greater retention of associate degree graduates in the Montana workforce. Two-thirds of graduates from two-year colleges worked in Montana prior to graduation, compared to 52% of four-year college graduates.

Associate degree workforce outcomes also include many registered apprenticeship programs, which contributes to the degree's higher retention rates.⁸ Registered apprenticeship's work-based learning model engages participants in the state's labor force and maintains their work relationship during

their program, resulting in very high retention of completers in the Montana economy. Approximately 94% of apprenticeship completers work in Montana after graduation and earn an average wage of \$63,500, which is more than double the wages reported by two-year and four-year colleges in the state. **Figure 1.13** shows the workforce outcomes by type of post-secondary institution.

94% of Registered Apprenticeship completers work in Montana a year after graduation and earn an average wage of **\$63,500**, which is more than twice as much as graduates from other post-secondary institutions in the state.

FIGURE 1.13

Average Wage and Employment Outcomes by Post-Secondary Institution Type

Years After Grad	2- Year College		4-Year College		Apprenticeship	
	% Employed	Wages	% Employed	Wages	% Employed	Wages
1	83%	\$28,290	66%	\$28,876	94%	\$63,522
3	74%	\$36,444	51%	\$40,995	87%	\$65,580
5	68%	\$40,124	47%	\$47,184	84%	\$67,374
10	60%	\$45,905	42%	\$59,484	75%	\$70,246
Any Year After	87%		71%		96%	

Source: MTDLI, OCHE, RMC, CC, UP, and apprenticeship graduate data wage match. Wages reflect average real wages reported in 2021 dollars using the CPI-U.

Four-year colleges **recruit MORE** students to Montana than the number who leave the state after graduation.

The lower retention rates among bachelor's degree earners also reflects a different student demographic in the four-year colleges than the two-year schools. Graduates from four-year colleges tend to be young adults, with 72% of students at public four-year colleges between the ages of 18-24. In contrast, two-year college graduates are older, with 24% falling above this traditional college age range, and likely already embedded in their Montana

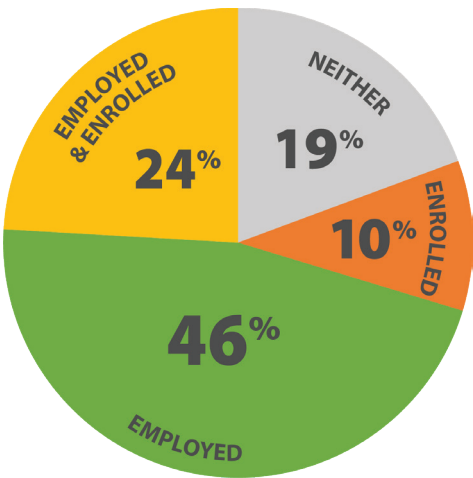
communities through work and family ties.⁹ Further, the universities attract students from around the country to attend college in Montana, with 40% of students from out-of-state.¹⁰ Despite lower retention rates than two-year colleges, four-year colleges work as a net importer of workers as 67% of bachelor's degree earners work in Montana after graduation.

1.6 Academic Progression of Graduates

Not all graduates enter the workforce directly after completion of their program. Ten percent of graduates choose to continue their education either at a Montana institution or out-of-state. Further, roughly 24% of graduates who find employment also continue their education, either simultaneously or after working for a while. **Figure 1.14** shows the percentage of graduates who enter the workforce versus continue their education after earning their post-secondary degree.

The likelihood of further education depends largely on the type of degree earned from the Montana post-secondary institution. Those at higher education levels are less likely to pursue further education. Certificate of Technical Studies (CTS) has the highest rate of continuing education, followed by Certificate of Applied Science (CAS) and associate degrees. **Figure 1.15** shows the rate of continuing education by degree and the percent of graduates who pursue further education at another Montana institution or who enroll in an out-of-state college.

FIGURE 1.14
Graduates Employed or Continuing Education



Source: MTDLI, OCHE, RMC, CC, UP, and apprenticeship graduate data wage match. National Student Clearinghouse (NSC) enrollment data.

FIGURE 1.15
Continued Education of Graduates by Degree Type

	% of Graduates Continue Ed	% Enrolled in Montana	Top 3 Out-of-State Enrollments		
			1	2	3
CTS <1 year	68%	96%	--	--	--
CAS >1 year	44%	90%	AZ	WA	WY
Associate Degree	42%	78%	UT	AZ	ID
Bachelor's Degree	37%	49%	WA	CO	OR
Master's Degree	20%	64%	WA	CO	AZ
Graduate Certificate	28%	45%	CO	WA	CA
Doctoral Degree	14%	50%	CA	OR	--

Source: OCHE graduate data matched to 2001-2021 National Student Clearinghouse enrollment data. Not enough CTS graduates pursuing education outside Montana to report top three out-of-state enrollments.

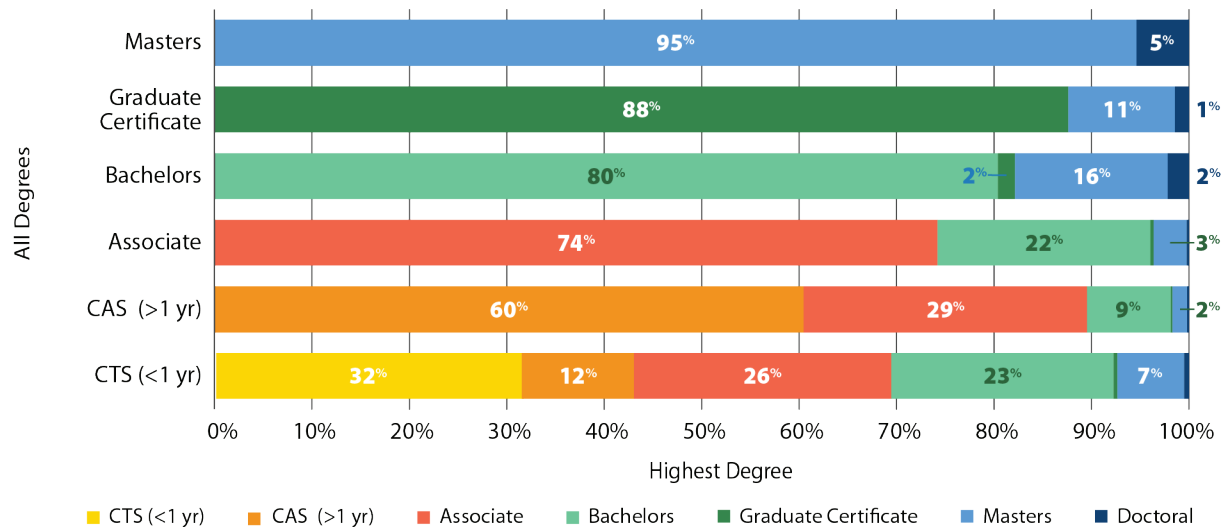
32% of graduates who pursue further education outside Montana return to the state for employment.

Most graduates who pursued further education enrolled at another Montana post-secondary institution. At least 90% of certificate earners who continued their education enrolled in a Montana college. Associate degree earners were also most likely to pursue education in the state. The likelihood of out-of-state enrollment increased with educational attainment. Those who left Montana to pursue further education primarily stayed in the western U.S., with Washington, California, Colorado, Idaho, and Oregon as the most common states.

However, in-state enrollment remained the most common option pursued regardless of degree attainment. Of those who pursue further education outside the state, 32% returned to Montana for employment.

While a total of 34% of graduates enrolled in further education, as shown in [Figure 1.14](#), not all of them completed a subsequent degree. About 25% percent of graduates from Montana post-secondary institutions earned another higher degree after graduation. About 60% of those who earned a higher degree received their degree from another Montana institution, and 40% earned their degree outside the state. [Figure 1.16](#) shows the academic progression of graduates from Montana colleges by degree type. The vertical access reflects all degrees earned at Montana colleges. The horizontal access compares the degree earned to the individual's highest degree.

FIGURE 1.16
Academic Progression of Graduates by Degree



Source: OCHE, RMC, CC, UP, and apprenticeship graduate data. 2001-21 National Student Clearinghouse (NSC) graduation data.

Certificate earners have the highest rates of continuing education and subsequent degree attainment. 68% of CTS and 40% of CAS earners went on to achieve an associate degree or higher, suggesting most certificate earners who enroll in further education will graduate with a higher degree. Associate degree graduates have the next highest rates of educational attainment, with 42% enrolling in further education and 26% earning a bachelor's degree or higher.¹¹ Bachelor's degree attainment among associate degree graduates varies by program. [Figure 1.17](#) shows the percentage of associate degree earners who obtain a bachelor's degree or higher by program.

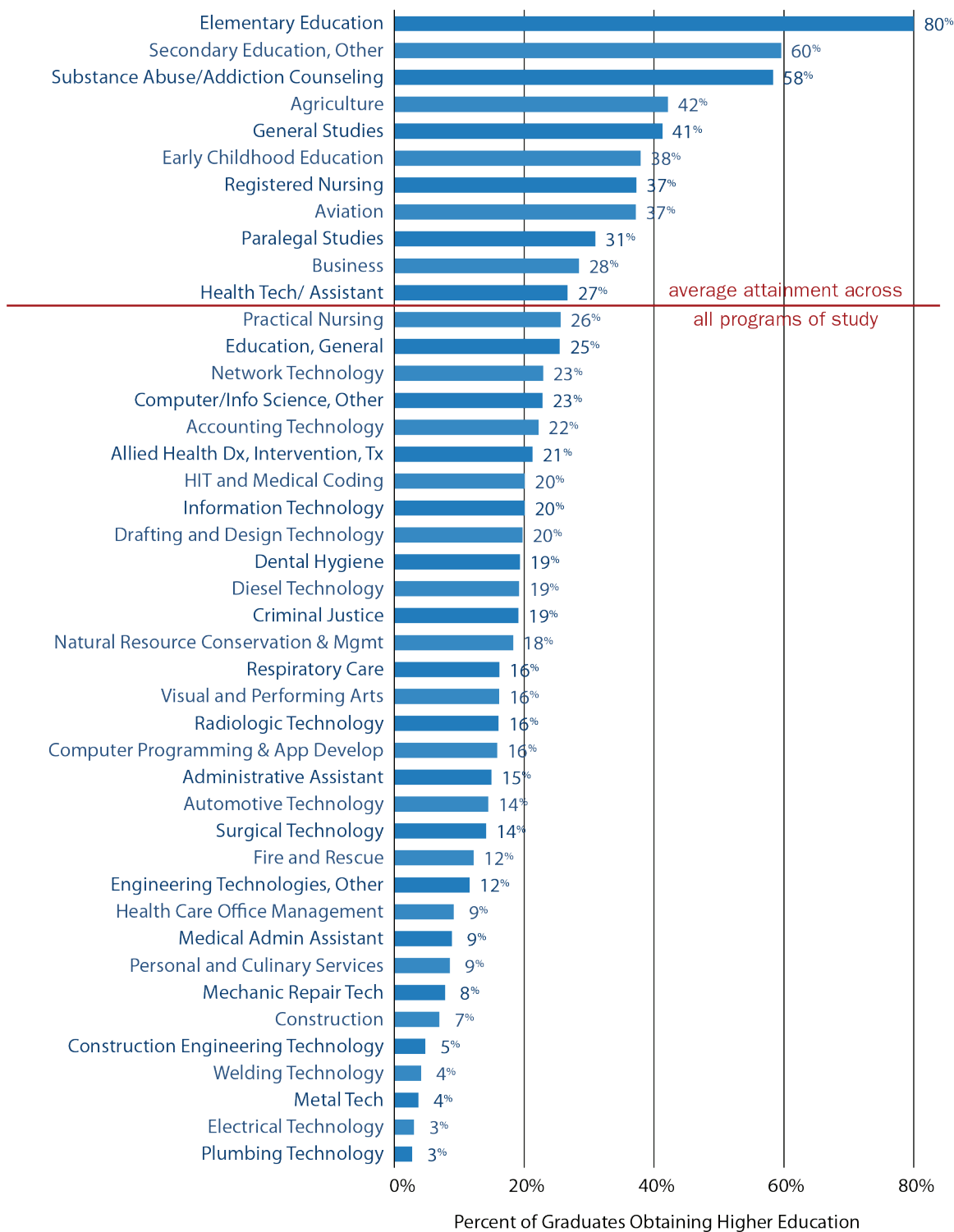
Elementary and secondary education programs had the highest rates of bachelor's degree attainment among associate degree programs. Approximately 80% of elementary education and 60% of secondary education associate degree graduates subsequently earned a bachelor's degree or higher. These programs train graduates to work as elementary and secondary school teachers, which typically requires a bachelor's degree.¹² Early childhood education (ECE) was the other education program with above average bachelor's degree attainment among associate degree programs. ECE students typically pursue careers as preschool or kindergarten teachers, both of which generally require a bachelor's degree.

25% of graduates from Montana colleges go on to earn a higher degree after graduation.

60% earn their subsequent degree from another Montana institution.

FIGURE 1.17

Bachelor's Degree Attainment or Higher of Associate Degree Graduates by Program



Source: OCHE, RMC, CC, UP, and apprenticeship graduate data, excluding graduates after the 2015-16 academic year. 2001-21 National Student Clearinghouse (NSC) graduation data. Excludes programs with less than ten associate degree graduates.

Elementary, ECE, and secondary education graduates who earned a bachelor's degree experienced an income premium over associate degree earners, as shown in **Figure 1.10**. The median income of secondary education graduates with a bachelor's was more than twice the income of associate degree holders ten years after graduation. Similarly, elementary education graduates with a bachelor's degree earned 52% more than associate degree holders one year after graduation, and an average of 73% more ten years after graduation. The income premium for bachelor's degree attainment among ECE graduates begins at 20% one year after graduation and grows to 34% after ten years.

Elementary, Early Childhood, and Secondary Education programs have above average rates of bachelor's degree attainment among associate degree programs.

Registered nursing, substance abuse and addiction counseling, and aviation are other programs with above average rates of bachelor's degree attainment. These programs train students to work in specific occupations that typically require a bachelor's degree. There is an income premium associated with bachelor's degree attainment for the programs. However, the premiums diminish over time as work experience and licensure become the primary determinates of income for registered nurses, pilots, and substance abuse counselors.

The general studies program is designed for students to transfer to a four-year institution. As a result, general studies graduates have higher bachelor's degree attainment rates than average. Forty-one percent of general studies associate degree earners obtain a bachelor's degree. While this percentage is higher than average, it still may not be high enough considering the purpose of a transfer program is to help students transition to a four-year program.

Agriculture, business, paralegal studies, and health technology and assisting are the other associate degree programs with above average bachelor's degree attainment. Agriculture and business programs train students to work in a variety of occupations, some of which may require a bachelor's degree or higher. The income premium shown in **Figure 1.10** for these programs suggest students

41% of **General Studies** associate degree graduates earn a higher degree after graduation.

see positive returns to increased education attainment. However, paralegal studies and health tech and assisting programs did not have positive returns to bachelor's degree attainment. It's possible that those who achieved higher education within these programs have chosen to pursue a different career path with higher income potential.



1.7 Certificate and Associate Degrees in the Montana Workforce

Graduates from two-year colleges and registered apprenticeship programs have quicker training times, lower tuition costs, and greater retention in the Montana labor market compared to those four-year colleges. However, workforce outcomes vary by program. Understanding which programs lead to the best workforce outcomes can help students maximize their returns to education.

There are several associate and certificate programs with above-average income. **Figure 1.18** shows the workforce outcomes for associate and certificate programs. The horizontal axis is the percent of graduates filing Montana income taxes one year after graduation, and the vertical axis is their reported average income. The size of the bubble corresponds to the number of graduates in each program since 2001. The programs are colored based on their program categories. Programs in the upper-right hand corner have better workforce outcomes than those in the lower-left hand corner.

The registered apprentice programs of plumbing and electrical technology programs had some of the best workforce outcomes among short-term

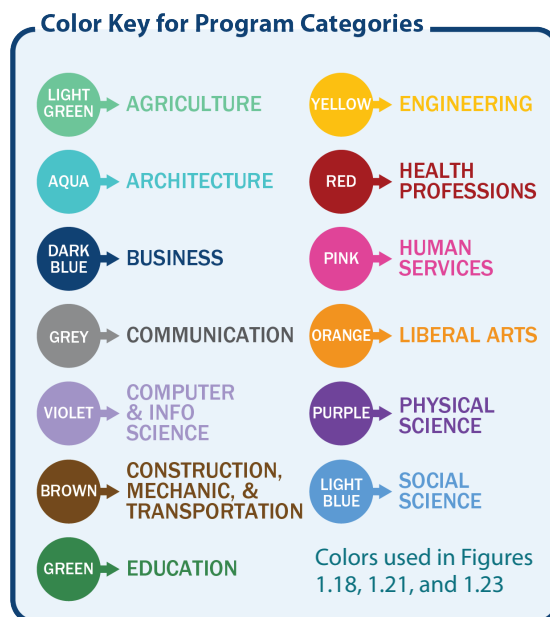
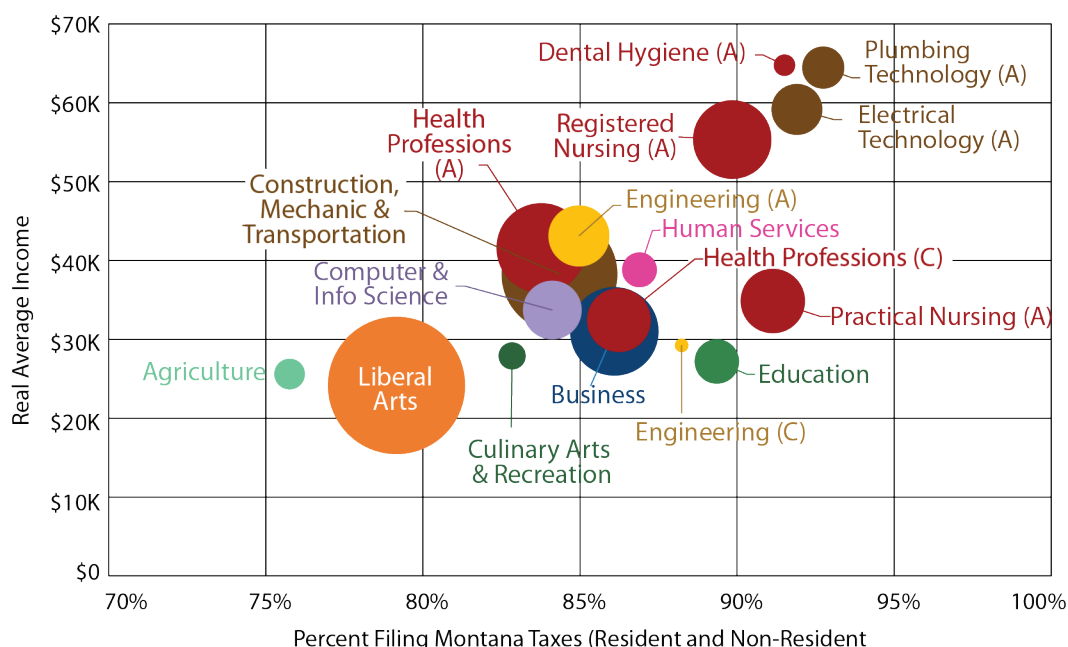


FIGURE 1.18

Associate and Certificate Workforce Outcomes One-Year After Graduation by Program



degrees. The classroom training portion of the apprenticeship can include attainment of certificates or associate degrees. Approximately 92% of electrician and plumbing registered apprenticeship completers worked in Montana a year after graduation and earned an average income of about \$60,000. Other construction, mechanic, and transportation short-term degrees earners reported approximately \$38,000 in income on average, substantially less than electrical and plumbing graduates, but similar to the average across all programs.

Healthcare professions programs, colored red, also have some of the best workforce outcomes among short-term degrees. Dental hygiene graduates had the highest average income among associate degree earners a year after graduation, reporting \$64,700 in income. Over 90% of graduates from this program worked in Montana, matching electrician and plumbing graduates for the highest retention rate among short-term programs. The retention for the registered nursing program was around 90% a year after graduation and an average income of \$55,300. This average income level was only \$3,000 less than registered nurses with a bachelor's degree and was more than the average earnings of many other bachelor's degree programs.

Short-term programs with an average income above \$50,000 one year after graduation:

- Dental Hygiene
- Plumbing Technology
- Electrical Technology
- Registered Nursing

General studies was the most common program and had the lowest workforce outcomes among short-term degrees. About 80% of general studies graduates were employed one year after graduation, primarily in low-wage jobs earning less than \$20,000 per year. These graduates may be working part-time as they continue their education. The general studies program is designed for students who are unsure of their career interests and are looking to transfer to a four-year college. Fifty-six percent of general studies graduates subsequently enrolled in another post-secondary institution, and 41% achieved a bachelor's degree or higher.

Figure 1.18 reflects the workforce outcomes for selected programs. **Figures 1.19 and 1.20** show the workforce outcomes for all programs both one year and ten years after graduation. Only programs averaging at least four graduates over the last four academic years are included. The figures also indicate which programs are available through Montana Registered Apprenticeship.

The programs with the highest median incomes in the first year after graduation tended to have lower income growth rates over the ten-year time frame. Registered nursing, dental hygiene, electrical, and plumbing graduates averaged between 0% and 2% annual income growth in the ten years after graduation, which is less than the average across all associate degree programs. Associate degree graduates experienced 5% average annual income growth in the ten years after graduation, and certificate earners averaged 4% annual growth. General studies graduates experienced the fastest income growth of 10% over the ten-year time frame, helping to raise their income levels closer to the average for short-term degree earners.

FIGURE 1.19**Associate Degree Workforce Outcomes by Program**

Program Category	Program	MT APP	1 Year After		10 Years After		Annual Income Growth Rate
			% Filing	Median Income	% Filing	Median Income	
Agriculture	Agriculture		76%	\$23,085	80%	\$37,245	5%
Business	Accounting Technology		88%	\$28,593	76%	\$41,914	4%
	Administrative Assistant		88%	\$25,703	77%	\$33,890	3%
	Business		85%	\$27,529	70%	\$38,727	4%
Computer and Info Science	Computer Programming & Application Development		86%	\$32,604	79%	\$50,251	5%
	Computer/Info Science, Other	Y	86%	\$55,691	76%	\$71,205	3%
	Information Technology		85%	\$28,457	72%	\$46,404	6%
	Network Technology		76%	\$30,099	48%	\$51,645	6%
Construction, Mechanic and Transportation	Automotive Technology	Y	85%	\$31,949	76%	\$54,518	6%
	Construction	Y	86%	\$48,153	78%	\$61,716	3%
	Diesel Technology		82%	\$36,594	77%	\$52,626	4%
	Electrical Technology	Y	92%	\$59,611	80%	\$68,761	2%
	Mechanic Repair Tech	Y	88%	\$46,739	72%	\$60,869	3%
	Metal Tech	Y	86%	\$44,656	79%	\$59,896	3%
	Plumbing Technology	Y	93%	\$62,590	84%	\$70,337	1%
	Welding Technology		84%	\$35,363	66%	\$42,971	2%
Culinary Arts & Recreation	Personal and Culinary Services		84%	\$22,757	61%	\$38,907	6%
Education	Early Childhood Education		89%	\$24,706	81%	\$32,026	3%
	Secondary Education, Other		85%	\$16,321	86%	\$23,570	4%
Engineering	Drafting and Design Tech		84%	\$34,441	74%	\$49,754	4%
	Engineering Tech, Other	Y	85%	\$39,303	76%	\$65,306	6%
Liberal Arts	General Studies		79%	\$18,781	66%	\$42,560	10%
	Visual and Performing Arts		80%	\$24,532	63%	\$28,274	2%
Health Professions	Allied Health Diagnostic, Intervention, Treatment		86%	\$46,786	60%	\$66,535	4%
	Dental Hygiene		92%	\$60,133	78%	\$58,341	0%
	Health Care Office Mgmt		75%	\$29,411	58%	\$35,968	2%
	Health Tech/ Assistant		80%	\$39,714	71%	\$53,780	3%
	HIT and Medical Coding	Y	76%	\$26,613	62%	\$36,634	4%
	Medical Admin Assistant		89%	\$27,299	77%	\$35,249	3%
	Practical Nursing		91%	\$31,637	73%	\$51,853	6%
	Radiologic Technology		85%	\$44,810	76%	\$56,673	3%
	Registered Nursing		90%	\$54,230	76%	\$65,662	2%
	Respiratory Care		79%	\$43,671	62%	\$55,634	3%
	Substance Abuse/Addiction Counseling		83%	\$29,294	75%	\$47,986	6%
	Surgical Technology		87%	\$41,961	68%	\$45,372	1%
Human Services	Criminal Justice		87%	\$32,285	64%	\$32,652	0%
	Fire and Rescue	Y	87%	\$37,649	82%	\$67,930	7%
Legal	Paralegal Studies		83%	\$28,979	66%	\$32,810	1%

Source: DOR, OCHE, RMC, CC, UP, and apprenticeship income data match summarized by MTDLI. Real income reported in 2021 dollars using the CPI-U. Percent filing resident or non-resident Montana income taxes. MT APP = Montana Registered Apprenticeship program.

The certified nursing assistant (CNA) program was the third largest registered apprenticeship program, after electrical and plumbing technology. An average of forty nursing assistants have completed the registered apprenticeship program in the last two academic years. Nearly 90% worked in Montana after graduation earning a median income of almost \$23,000. Ten years after graduation, CNA graduate income reached \$40,000, which is similar to the average across all certificate programs. Graduates who pursue a nursing assistant certificate often used the degree as a starting point in their nursing career, eventually moving up the career ladder to pursue higher-paying nursing occupations. Nursing assistants are the most in-demand nursing occupation in the state, providing critical support to the state's healthcare system.¹³

FIGURE 1.20**Certificate Workforce Outcomes by Program**

Program Category	Program	MT APP	1 Year After		10 Years After		Annual Income Growth Rate
			% Filing	Median Income	% Filing	Median Income	
Business	Accounting Technology	Y	92%	\$26,773	79%	\$36,550	4%
	Administrative Assistant		84%	\$24,837	75%	\$31,128	3%
	Business (CAS)		90%	\$32,500	75%	\$31,902	0%
	Business (CTS)		67%	\$26,645	53%	\$43,928	6%
Computer & Info Science	Computer/Info Science, Other		86%	\$23,652	64%	\$29,410	2%
Construction, Mechanic & Transportation	Construction	Y	80%	\$32,830	66%	\$48,409	4%
	Heavy Equipment Operation		84%	\$31,468	74%	\$39,844	3%
	Metal Tech		91%	\$31,565	65%	\$42,635	3%
	Welding Technology		84%	\$29,169	75%	\$52,106	7%
Education	Early Childhood Education	Y	96%	\$22,869	73%	\$29,605	3%
Health Professions	Nursing Assistant	Y	88%	\$27,700	72%	\$40,084	4%
	Health Tech/ Assistant (CTS)		85%	\$24,098	79%	\$30,901	3%
	HIT and Medical Coding		82%	\$29,782	72%	\$34,249	2%
	Medical Admin Assistant	Y	86%	\$26,170	66%	\$42,674	6%
	Practical Nursing		93%	\$33,180	74%	\$56,101	6%

Source: DOR, OCHE, RMC, CC, UP, and apprenticeship income data match summarized by MTDLI. Real income reported in 2021 dollars using the CPI-U. Percent filing resident or non-resident Montana income taxes. MT APP = Montana Registered Apprenticeship program. CTS= Certificate of Technical Studies. CAS= Certificate of Applied Science.

The early childhood education (ECE) certificate programs also serve a critical workforce need. Many graduates from this program pursue careers as preschool teachers or child care providers. Licensed child care supply meets only 44% of the estimated demand for care in Montana. A lack of affordable child care prevents many Montana parents from fully engaging in the labor force and exacerbates the state's workforce shortage.¹⁴ An average of twenty students have graduated with a certificate in early childhood education per year over the last four academic years, which includes the child care provider and assistant registered apprenticeship program completers. These graduates have the highest retention rates in the Montana economy a year after graduation. However, their earnings fall below the average for certificate earners in the state. Addressing this income discrepancy would encourage more students to pursue an ECE certificate and help alleviate the childcare shortage.

1.8 Bachelor's Graduates in the Montana Workforce

Most graduates from Montana's colleges hold a bachelor's degree. The state's two flagship universities produce the most bachelor's graduates, primarily in the fields of liberal arts, health professions, engineering, and business. These universities draw students to Montana from a variety of different states in pursuit of a high-quality education. After graduation, some return to their home state, while others remain Montana to work. The likelihood of a graduate staying in Montana for work varies depending on their program of study. Analyzing workforce outcomes by program helps students understand their earnings potential and allows them to make informed decisions about investing in their education.

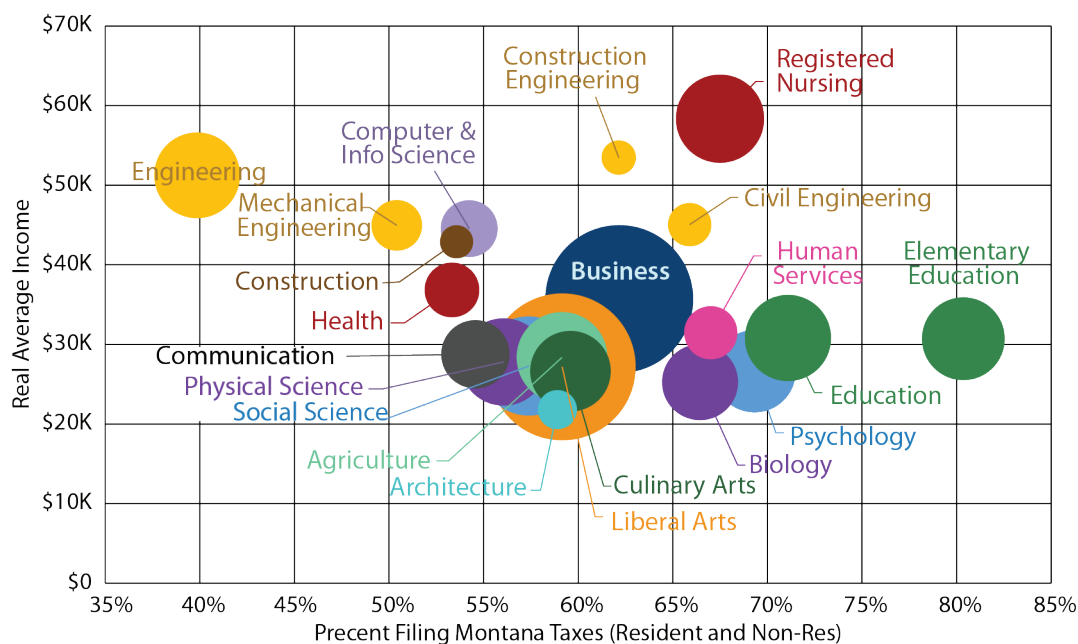
Graduates in engineering, health professions, business, computer and information science, and construction technology reported higher income levels than those in other fields. **Figure 1.21** shows the workforce outcomes by bachelor's degree programs. The horizontal axis is the percent of graduates filing Montana income taxes one year after graduation, and the vertical axis is their reported average income. The size of the bubble corresponds to the number of graduates in each program since 2001. The programs are colored based on their program categories. Programs in the upper-right hand corner have better workforce outcomes than those in the lower-left hand corner.

Bachelor's programs with an average income above \$50,000 one year after graduation:

- Petroleum Engineering
- Construction Engineering Technology
- Engineering, General
- Geological Engineering
- Registered Nursing

FIGURE 1.21

Workforce Outcomes for Bachelor's Graduates One-Year After Graduation by Program



Source: DOR, OCHE, RMC, CC, UP, and apprenticeship income data match summarized by MTDLI. Real income reported in 2021 dollars using CPI-U. Only programs with at least ten graduates per year are included. Color key for program categories consistent with Figure 1.18.

Registered nurses have some of the best workforce outcomes among bachelor's degree programs considering both income levels and retention rates. Sixty-seven percent of registered nurses with a bachelor's work in Montana a year after graduation and earn \$58,300 in income on average. The only other programs with average income above \$50,000 one-year post-graduation are engineering programs – petroleum, construction, geological, and general engineering. While these programs lead to high income levels, the retention rate falls below the average of 67% for bachelor's degree programs. Education programs have the highest retention rates among bachelor's degree programs, followed by human services. **Figure 1.22** shows the workforce outcomes for detailed bachelor's degree program one through ten years after graduation. Only programs averaging at least ten graduates over the last four academic years are included.

FIGURE 1.22**Bachelor's Degree Workforce Outcomes by Program**

Program Category	Program	1 Year After		10 Years After		Annual Income Growth Rate
		% Filing	Median Income	% Filing	Median Income	
Agriculture, Natural Resource and Conservation	Forestry	65%	\$30,915	45%	\$60,443	8%
	Natural Resource Conserve & Mgmt	66%	\$24,981	50%	\$55,373	9%
	Fish and Wildlife Management	66%	\$24,247	43%	\$52,124	9%
	Environmental Science	65%	\$23,210	50%	\$46,986	8%
	Animal Science	77%	\$24,188	66%	\$40,889	6%
	Agriculture	71%	\$28,717	64%	\$46,969	6%
	Plant Science	69%	\$27,490	53%	\$49,612	7%
Architecture	Architecture	63%	\$18,329	39%	\$63,585	15%
Business	Accounting	78%	\$36,084	61%	\$61,684	6%
	Marketing	63%	\$28,977	49%	\$60,502	9%
	Business	69%	\$32,146	54%	\$58,338	7%
	Finance	67%	\$36,305	59%	\$68,165	7%
	Communication Studies	60%	\$25,764	43%	\$44,823	6%
Communication	Journalism	56%	\$25,039	40%	\$48,139	8%
	Public Relations	66%	\$30,957	51%	\$55,679	7%
Computer and Info Science	Network Technology	65%	\$37,045	58%	\$67,612	7%
	Computer Science	67%	\$46,362	54%	\$74,840	5%
Construction & Transportation	Diesel Technology	56%	\$47,331	57%	\$63,524	3%
	Aviation	64%	\$31,793	38%	\$59,542	7%
Culinary Arts & Recreation	Recreation Management	64%	\$23,536	50%	\$46,069	8%
	Kinesiology and Exercise Science	71%	\$23,340	57%	\$46,037	8%
	Health and PE/Fitness	70%	\$23,033	55%	\$53,974	10%
Health Professions	Health Care Office Management	76%	\$40,423	--	--	--
	Health Science	65%	\$25,545	52%	\$68,907	12%
	Registered Nursing	67%	\$56,633	67%	\$67,161	2%

(Table continues on the next page.)

FIGURE 1.22**Bachelor's Degree Workforce Outcomes by Program (continued)**

Program Category	Program	1 Year After		10 Years After		Annual Income Growth Rate
		% Filing	Median Income	% Filing	Median Income	
Education	Early Childhood Education	87%	\$30,213	74%	\$40,331	3%
	Art and Music Teacher	83%	\$27,879	67%	\$41,526	5%
	Elementary Education	80%	\$28,039	67%	\$43,734	5%
	Science Teacher	78%	\$29,609	69%	\$45,192	5%
	Special Education	78%	\$29,788	65%	\$45,190	5%
	Secondary Education, Other	77%	\$30,508	65%	\$47,504	5%
	Social Science Teacher	76%	\$27,773	60%	\$44,829	5%
	Health and PE Teacher	74%	\$29,043	63%	\$52,482	7%
	Education, General	74%	\$25,419	62%	\$45,485	7%
Engineering	Petroleum Engineering	25%	\$80,965	15%	\$161,143	8%
	Construction Engineering Tech	62%	\$52,572	58%	\$84,920	5%
	Geological Engineering	37%	\$50,679	31%	\$92,198	7%
	Engineering, General	55%	\$50,630	45%	\$82,072	6%
	Electrical & Electronic Engineering	59%	\$48,970	43%	\$86,122	6%
	Mechanical Engineering Tech	62%	\$47,645	55%	\$77,566	6%
	Environmental Engineering	55%	\$45,509	38%	\$81,466	7%
	Civil Engineering	66%	\$47,540	55%	\$75,177	5%
	Mechanical Engineering	50%	\$42,674	38%	\$82,222	8%
	Industrial Engineering	49%	\$39,366	38%	\$81,380	8%
	Chemical Engineering	42%	\$33,811	30%	\$90,110	12%
Liberal Arts	Foreign Languages & Literatures	62%	\$23,001	40%	\$49,920	9%
	History	64%	\$22,713	45%	\$45,692	8%
	English and Creative Writing	65%	\$21,717	46%	\$41,207	7%
	Linguistics	60%	\$17,044	37%	\$33,270	8%
	Philosophy/Theology	60%	\$20,669	37%	\$44,370	9%
	Cinematography and Film	59%	\$20,773	31%	\$42,433	8%
	General Studies	68%	\$29,178	54%	\$46,765	5%
	Visual and Performing Arts	68%	\$21,119	47%	\$37,480	7%
	Music	68%	\$21,992	47%	\$45,823	8%
Human Services	Human Services	82%	\$28,857	68%	\$38,944	3%
	Social Work	74%	\$28,390	53%	\$40,988	4%
	Criminal Justice	71%	\$31,561	61%	\$50,143	5%

(Table continues on the next page.)

FIGURE 1.22**Bachelor's Degree Workforce Outcomes by Program (continued)**

Program Category	Program	1 Year After		10 Years After		Annual Income Growth Rate
		% Filing	Median Income	% Filing	Median Income	
Physical Science	Microbiology	72%	\$28,597	47%	\$68,255	10%
	Cell Biology	70%	\$20,711	40%	\$115,409	21%
	Geology	64%	\$27,881	42%	\$56,074	8%
	Physics	57%	\$23,590	40%	\$52,663	9%
	Chemistry	59%	\$24,513	41%	\$66,422	12%
	Physical Science, Other	64%	\$23,048	44%	\$50,638	9%
	Mathematics and Data Science	66%	\$26,903	46%	\$57,331	9%
	Biology	66%	\$22,985	48%	\$55,544	10%
Social Science	Psychology	69%	\$24,178	50%	\$44,953	7%
	Sociology	69%	\$27,466	54%	\$48,762	7%
	Geography	62%	\$25,406	45%	\$48,527	7%
	Economics	61%	\$24,164	48%	\$64,559	12%
	Political Science	62%	\$23,518	44%	\$57,898	11%
	Anthropology	62%	\$21,444	40%	\$39,658	7%

Source: DOR, OCHE, RMC, CC, UP, and apprenticeship income data match summarized by MTDLI. Real income reported in 2021 dollars using the CPI-U. Percent filing resident or non-resident Montana income taxes.

Early childhood education graduates have the highest retention rates in the labor market, likely due to the high demand for preschool teachers and child care providers. Eighty-seven percent of bachelor's degree graduates in this field work in Montana a year after graduation. Elementary education also reports retention rates above 80%. All bachelor's degree education programs retain at least 74% of their graduates in the Montana workforce, suggesting high-quality educators are in high demand.

While bachelor's degree programs report lower median income levels than associate degree programs initially, bachelor's graduates experience faster income growth in the ten years after graduation – averaging 7% annual growth. Programs with lower initial reported income levels tend to experience the fastest annual wage growth. Architecture, economics, political science, chemistry, biology, health science and chemical engineering graduates all experienced double-digit annual income growth in the ten years after graduation. These programs all train graduates to work in careers that typically require a graduate-level education. Therefore, bachelor's degree graduates may have suppressed initial income levels as they continue to pursue higher education. Ten years later, graduates are likely to have finished their education and are working full-time in their desired career.

Bachelor's programs with 10% annual income growth or higher:

- Architecture
- Health Science
- Chemical Engineering
- Biology
- Chemistry
- Political Science
- Economics

1.9 Highest Earning Potential for Graduate Degree Holders

About 20% of graduates from Montana colleges hold a graduate degree, which includes master's and doctoral degrees, and graduate certificates. These students have the highest earnings potential in Montana, earning nearly \$60,000 one year after graduation and over \$75,000 ten years after graduation. Programs that primarily award graduate degrees (such as law, architecture, physical therapy, and pharmacy) tend to have higher wages than other programs. **Figure 1.23** shows the workforce outcomes for students obtaining a graduate degree by program (including only those with at least ten graduates per year). The programs in the upper-right hand corner have better workforce outcomes than those in the lower-left, and the bubble size indicates the number of graduates since 2001.

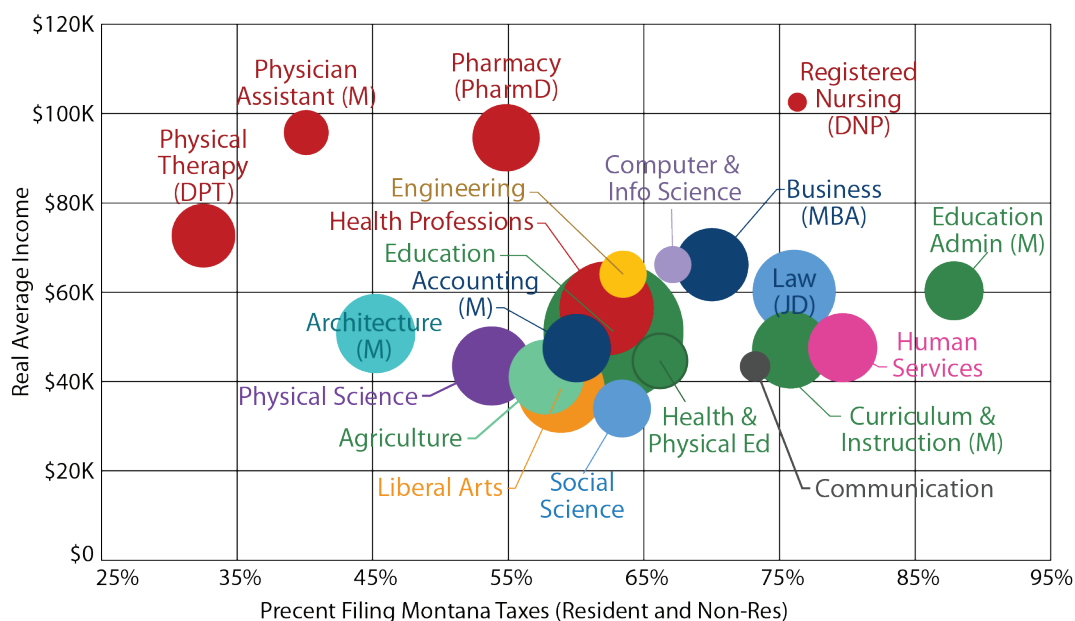
Healthcare graduate programs (in red) report the highest levels of income a year after graduation. Doctor of Nursing Practice (DNP) graduates from Montana State University earned a six-figure income on average in their first year working, as did graduates from the University of Montana's Doctor of Pharmacy (PharmD) program. These programs reported the highest income of any graduate program a year after graduation. Most graduates from these programs join the state's labor force, with 75% of DNP graduates and 55% of PharmD graduates employed in Montana after graduation.

Graduate programs with income over \$70,000:

- Pharmacy (PharmD)
- Physician Assistant (M)
- Physical Therapy (DPT)
- Registered Nursing (DNP)

FIGURE 1.23

Workforce Outcomes One-Year After Graduation for Graduate Degrees by Program



Source: DOR, OCHE, RMC, CC, UP, and apprenticeship income data match summarized by MTDLI. Real income reported in 2021 dollars using CPI-U. Only programs with at least ten graduates per year are included. (DNP)= Doctor of Nursing Practice (DPT)= Doctor of Physical Therapy (PharmD)= Doctor of Pharmacy (M)= Master's degree (JD)=Juris Doctorate (MBA)= Master's of Business Administration

The highest earning master's degree program is also in healthcare. Physician assistant (PA) graduates from Rocky Mountain College's master's program earn \$94,610 in median income a year after graduation. The median wage for PA graduates continues to grow by 4% annually, reaching over \$136,000 ten years after graduation. While the income of PAs with a master's degree rivals that of high-

earning doctorate programs, the retention rate in the state's labor force is significantly lower. Only 40% of PA graduates remain in Montana for work after graduation, which is less than the average for master's and doctoral programs.

Education programs at the graduate level also demonstrate high retention rates, similar to the bachelor's degree education programs. Eighty-eight percent of graduates with a master's in education administration remain in the state for work. Similarly, 85% of master's graduates in school counseling find employment in the state after graduation. The only other graduate-level program with retention rates above 80% is the Masters of Social Work (MSW) program offered by the University of Montana. Education and social work remain high-demand fields of study in the state. The significant number of job openings in these fields likely contributes to the high graduate retention rate in the Montana workforce.

Workforce outcomes for liberal arts, social science, agriculture, communication, and physical science are below average among graduate degrees. Graduates from these programs earn less than the median income for master's degree programs and less than the average of bachelor's degrees after ten years. Students pursuing these degrees should understand their earnings potential to make an informed decision about investing in their education.

**Only payroll
employment
is included.**



Programs with high levels of self-employment may not be accurately represented. For example, agriculture graduates working on their own farm isn't captured in payroll employment.

FIGURE 1.24
Graduate Degree Workforce Outcomes by Program

Program Category	Program	1 Year After		10 Years After		Annual Income Growth Rate
		% Filing	Median Income	% Filing	Median Income	
Agriculture	Natural Res Conserve & Mgmt	53%	\$38,640	50%	\$66,593	6%
	Environmental Science	58%	\$31,671	45%	\$51,818	6%
	Fish and Wildlife Management	62%	\$37,631	40%	\$49,800	3%
Architecture	Architecture	45%	\$41,903	37%	\$71,772	6%
Business	Business (MBA)	70%	\$55,038	59%	\$82,523	5%
	Accounting	60%	\$47,203	55%	\$80,985	6%
Computer Science	Computer Science	67%	\$61,298	49%	\$79,013	3%
Culinary Arts & Rec	Health & Physical Ed	58%	\$37,598	42%	\$66,818	7%
Education	Education Administration	88%	\$58,000	78%	\$75,856	3%
	Special Education	71%	\$45,888	60%	\$51,052	1%
	Science Teacher	22%	\$50,758	24%	\$61,466	2%
	Education, General	77%	\$47,502	70%	\$59,427	3%
	School Counselor	85%	\$42,036	72%	\$56,190	3%
	Curriculum and Instruction	76%	\$42,432	73%	\$58,121	4%
Engineering	Engineering, General	62%	\$71,661	82%	\$101,740	4%
	Civil Engineering	76%	\$58,520	58%	\$94,063	5%
	Mechanical Engineering	49%	\$44,316	57%	\$73,519	6%

(Table continues on the next page.)

FIGURE 1.24**Graduate Degree Workforce Outcomes by Program (Continued)**

Program Category	Program	1 Year After		10 Years After		Annual Income Growth Rate
		% Filing	Median Income	% Filing	Median Income	
Legal	Law	76%	\$53,475	64%	\$91,047	6%
Liberal Arts	Visual & Performing Arts	66%	\$40,442	47%	\$46,000	1%
	English & Creative Writing	53%	\$29,012	36%	\$45,857	5%
Health Professions	Physician Assistant	40%	\$94,610	36%	\$136,500	4%
	Health Care Office Mgmt	59%	\$66,492	70%	\$91,492	4%
	Health Science	51%	\$45,188	50%	\$81,307	7%
	Pharmacy (PharmD)	55%	\$110,357	55%	\$121,776	1%
	Physical Therapy (DPT)	33%	\$67,524	45%	\$72,869	1%
	Registered Nursing (DNP)	76%	\$104,500	--	--	--
	Athletic Training	36%	\$42,556	--	--	--
	Substance Abuse/Addiction Counseling	78%	\$40,799	65%	\$48,464	2%
Human Services	Public Administration	75%	\$45,274	50%	\$64,715	4%
	Social Work (MSW)	87%	\$41,642	69%	\$56,716	3%
Physical Science	Geology	48%	\$44,492	32%	\$63,884	4%
	Math and Data Science	57%	\$37,988	30%	\$61,235	5%
	Physical Science, Other (M)	44%	\$34,954	33%	\$56,563	5%
	Physical Science, Other (PhD)	45%	\$48,134	29%	\$80,420	6%
	Physics	79%	\$25,972	36%	\$56,029	9%
Social Science	Economics	47%	\$39,057	46%	\$41,341	1%
	Anthropology	55%	\$31,102	31%	\$52,173	6%
	Psychology	76%	\$28,588	37%	\$58,401	8%

Source: DOR, OCHE, RMC, CC, UP, and apprenticeship income data match summarized by MTDLI. Real income reported in 2021 dollars using the CPI-U. Percent filing resident or non-resident Montana income taxes. Master's degree outcomes shown unless otherwise indicated. (DNP)= Doctor of Nursing Practice (DPT)= Doctor of Physical Therapy (PharmD)= Doctor of Pharmacy (M)= Master's degree (PhD)= Doctorate degree.



1.10 Graduates Work in High-Wage Industries

The healthcare industry and the education industry employ the most graduates from Montana's post-secondary institutions, with each industry employing about 20% of graduates working in Montana. In comparison, only 16% of the state workforce works in healthcare, and only 9% work in education. Healthcare and education are two of the top four largest programs of study for graduates; however, both industries hire a larger-than-expected share of graduates. **Figure 1.25** shows employment and real wage outcomes for graduates by industry in the years after graduation.

FIGURE 1.25
Employment and Wage Outcomes by Industry

Industry	1 Year After		10 Years After		2020 State Average Wage
	% of Employed Graduates	Average Real Wage	% of Employed Graduates	Average Real Wage	
Mining	0.5%	\$54,415	0.9%	\$102,344	\$89,552
Utilities	0.7%	\$85,759	1.3%	\$100,176	\$100,188
Professional & Technical Services	7.7%	\$37,218	9.5%	\$76,173	\$73,141
Wholesale Trade	1.9%	\$32,606	2.8%	\$71,297	\$65,310
Finance and Insurance	3.5%	\$33,439	5.3%	\$71,083	\$76,376
Manufacturing	3.1%	\$31,935	3.6%	\$66,549	\$54,178
Information	1.7%	\$30,893	1.9%	\$63,971	\$65,642
Healthcare & Social Assistance	20.6%	\$35,718	20.1%	\$59,548	\$53,897
Public Administration	4.7%	\$37,144	9.8%	\$57,727	\$52,715
Construction	5.8%	\$39,350	5.6%	\$57,363	\$55,873
Transportation	1.3%	\$24,485	1.3%	\$52,498	\$48,895
Educational Services	18.9%	\$28,777	19.1%	\$50,696	\$33,560
Retail Trade	9.6%	\$21,652	5.9%	\$47,698	\$33,861
Admin and Waste Mgmt	4.6%	\$21,696	3.5%	\$46,128	\$39,006
Real Estate and Rental Leasing	1.0%	\$24,018	1.0%	\$45,721	\$42,788
Other Services	2.7%	\$21,605	2.8%	\$39,315	\$34,323
Agriculture	0.8%	\$22,163	1.0%	\$36,936	\$42,295
Arts, Entertainment, & Recreation	2.2%	\$13,930	1.5%	\$25,882	\$25,845
Accommodation and Food Service	8.6%	\$14,520	3.1%	\$25,231	\$20,008

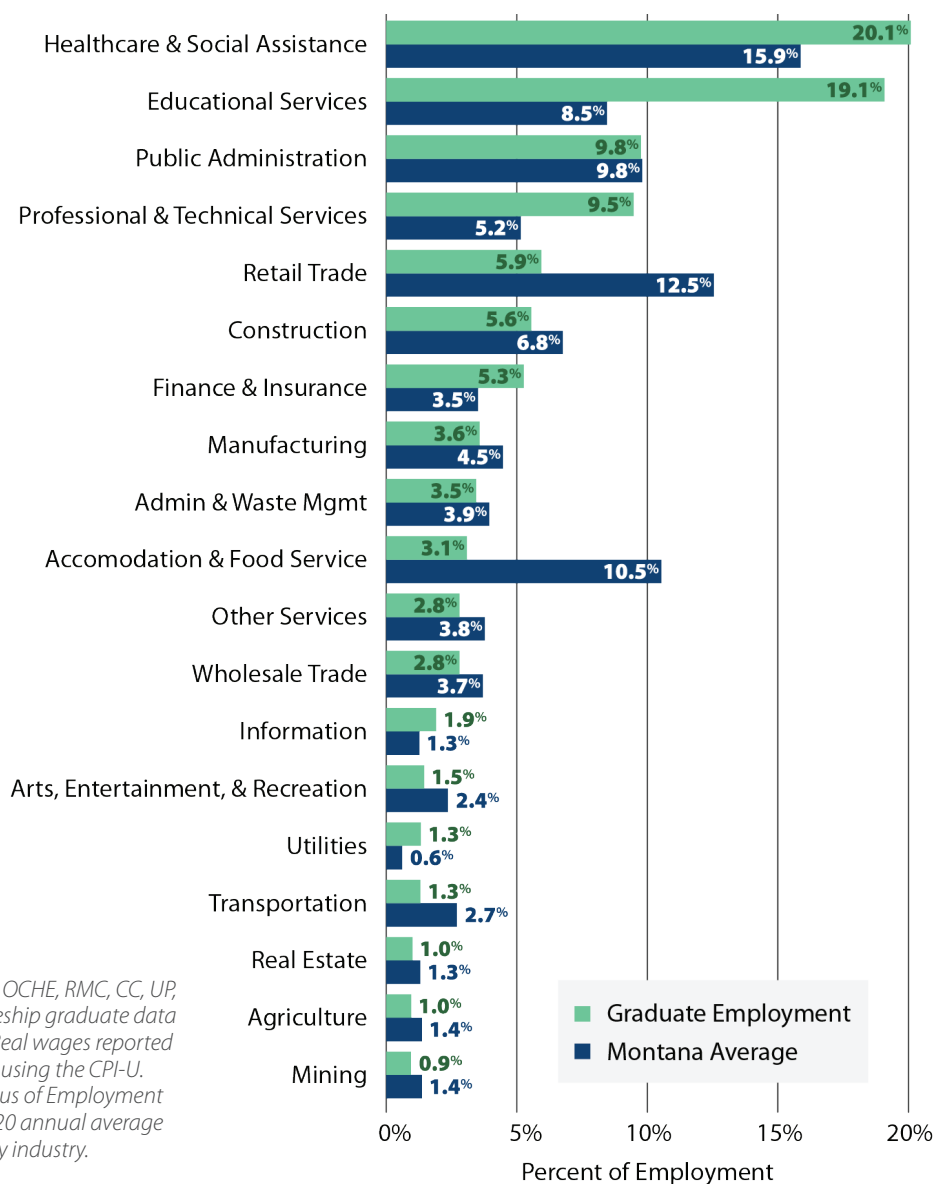
Source: MTDLI, OCHE, RMC, CC, UP, and apprenticeship graduate data wage match. Real wages reported in 2021 dollars using the CPI-U. Quarterly Census of Employment and Wages 2020 annual average wage by industry.

Over time, graduates who remain employed in Montana tend to move into higher-paying industries. One year after graduation, 9% of graduates work in the accommodation and food service industry and 10% work in retail trade, which are the two lowest-paying industries in the state. Ten years later, these shares drop to only 3% in accommodation and food service and 6% in retail trade. This drop suggests graduates work as retail sales workers or waiters temporarily while continuing their education or searching for career opportunities in higher-paying industries.

Figure 1.26 shows the distribution of graduate employment by industry ten years after graduation compared to the statewide distribution of industry employment. After ten years, the largest employing industry was healthcare, followed by education, public administration, and professional and technical services. Professional and technical services includes occupations like lawyers, engineering, architects, and other high-wage occupations typically requiring a post-secondary education.

FIGURE 1.26**Employment by Industry**

Statewide Compared to Montana Post-Secondary Graduates



What is in each Industry?

Super Sector	Industry	Establishments primarily engaged in:	Examples
Agriculture	11 Agriculture	Raising crops or animals, harvesting timber, and harvesting animals from natural habitats.	Farms, ranches, greenhouses, orchards, hatcheries and logging operations
Mining and Utilities	21 Mining	Extracting naturally occurring mineral solids, liquids, and gases.	Oil and gas, coal and mineral mining, and associated support activities.
	22 Utilities	The provision power, natural gas, water supply, and sewage removal.	Utility companies, sewage removal
Construction	23 Construction	Construction of buildings, highways, or engineering projects.	Contractors, plumbing and electrical companies, highway construction
Manufacturing	31-33 Manufacturing	Transformation of materials into new products.	Machine shops, breweries, wood product and food manufacturing
Trade and Transportation	42 Wholesale Trade	Arranging the sale of non-consumer goods, and raw materials used in production	manufacturers' sales representatives, merchant wholesalers
	44-45 Retail Trade	Selling merchandise in small quantities to the public.	Automotive dealers, office supply stores, gas stations, grocery stores, clothing stores
	48-49 Transportation & Warehousing	Transportation of passengers and cargo, warehousing and storage, and sightseeing.	Trucking companies, air, rail and water transport, postal and delivery services
Information	51 Information	Producing, distributing, or transmitting information and entertainment.	Newspapers, TV and radio, telecommunication companies
Financial Activities	52 Finance	Facilitating financial transactions.	Banks, credit unions, and insurance agencies
	53 Real Estate	Renting, leasing, and providing related services.	Real estate agents and brokers, auto, machinery and general goods rental
Business Services	54 Professional and Technical Services	Performing professional, scientific, and technical activities for others.	Legal, accounting, architectural, payroll, engineering, computer programming, and scientific research
	55 Management of Companies	Manage the strategic role of the company or enterprise. Facilitate mergers.	Managing offices, holding companies
	56 Admin and Waste	Performing support activities of other organizations. Temporary employment firms.	Office administrative and facilities support services, collection agencies, security services
Healthcare and Education	61 Educational Services	Providing instruction and training. They may be private for-profit, non-profit or public.	Schools, colleges, universities, and training centers.
	62 Healthcare and Social Assistance	Delivering healthcare and social assistance from trained professionals.	Hospitals, elderly care facilities, childcare, mental health and family services
Leisure Activities	71 Arts, Entertainment, and Recreation	Cultural, entertainment, and recreational services.	Casinos, museums, theatre, amusement parks, sports and recreation facilities
	72 Accommodation and Food Service	Providing lodging, meals, snacks, and beverages for immediate consumption.	Restaurants, hotels, bars, caterers RV parks
Other	81 Other Services	Any other service not previously classified.	Auto and machine repair, religious activities, grant making, dry-cleaning and laundry services
Public Admin	92 Public Administration	Federal, state and local government agencies. Excludes education and public works construction classified above.	Local and state agencies, police and fire protection

Source: North American Classification System 2012.

1.11 Graduates Work in their Field of Study

After graduation, most graduates in Montana work in industries commonly associated with their degree. Consistent matches between program of study and industry of employment indicates graduates are well prepared to work in their field of study and that their field of study is in demand.

Figure 1.27 shows the top industries of employment for graduates by program of study.

FIGURE 1.27

Industries Hiring the Most Graduates by Program

Program of Study	Top Employer		2nd Largest Employer		3rd Largest Employer	
	Industry	% of Emp	Industry	% of Emp	Industry	% of Emp
Ag & Natural Resource	Education	21%	Accom & Food	9%	Prof & Tech	9%
Architecture	Prof & Tech	51%	Accom & Food	9%	Construction	9%
Business	Finance	14%	Prof & Tech	13%	Accom & Food	10%
Communication	Information	17%	Accom & Food	14%	Education	13%
Computer & Info Science	Prof & Tech	23%	Education	12%	Information	8%
Construction & Transport	Construction	41%	Retail Trade	8%	Manufacturing	7%
Culinary Arts & Rec	Healthcare	25%	Education	16%	Accom & Food	14%
Education	Education	71%	Healthcare	10%	Accom & Food	4%
Engineering	Prof & Tech	27%	Construction	14%	Education	9%
Liberal Arts	Education	17%	Accom & Food	16%	Healthcare	13%
Health Professions	Healthcare	75%	Public Admin	5%	Retail Trade	4%
Human Services	Healthcare	38%	Public Admin	20%	Education	10%
Legal Professions	Prof & Tech	50%	Public Admin	31%	Admin & Waste	3%
Physical Science	Education	27%	Healthcare	19%	Accom & Food	10%
Social Science	Healthcare	24%	Accom & Food	14%	Education	12%

Source: MTDLI, OCHE, RMC, CC, UP, and apprenticeship graduate data wage match. Accom & Food = Accommodation and Food Service (NAICS 72). Prof & Tech = Professional and Technical Services (NAICS 54). Program of study shown is the program associated with the graduate's highest degree earned in Montana.

Graduates in agriculture, liberal arts, education, and physical science are most commonly employed in the education industry. Architecture, computer and information science, engineering, and legal profession graduates are most commonly working in the professional and technical services industry. Three-fourths of healthcare graduates working in Montana are employed in the healthcare industry. Four percent are working in retail trade, likely pharmacists working in grocery or drug stores like Safeway, Costco, or Walgreens.

A mismatch between industry of employment and program of study can indicate that either employers do not have enough qualified applicants for their positions, or that graduates working in industries outside their program of study do not have the qualifications to obtain a job in their field. There are not many cases of this mismatch occurring between Montana graduates and employers. One program-industry match that may look inconsistent is culinary arts and recreation graduates working in healthcare, education, and government. These graduates may be working in hospital cafeterias utilizing their degree. Graduates from this program also include those studying fitness, physical education, kinesiology, and exercise science, which may be working as exercise therapists, physical education teachers, or in health policy.

At least 10% of graduates in communication, liberal arts, social science, business, and physical science work in accommodation and food service a year after graduation. Accommodation and food service is not an industry commonly associated with these programs. Business, liberal arts, communication, social and physical science graduates working in accommodation and food service may not be able to find desirable employment opportunities in their field of study, or they are not qualified to fill positions in their field. Fourteen percent of culinary arts and recreation graduates also work in accommodation and food service, but these graduates are likely working in their desired careers based on their field of study.





Part Two

Post-Secondary Supply & Demand Analysis

The primary research question of this report considers how well the Montana post-secondary education system meets the workforce demand of Montana employers, thus ensuring public tax dollars are achieving the greatest benefit for both students and businesses. Matching post-secondary graduates with worker demand ensures that students are pursuing lucrative careers, and businesses can find the workforce they need to promote economic growth.

The gaps between employer demand and post-secondary graduate supply are presented from two perspectives – by occupation and by program of study.

- The occupational analysis compares workforce demand for an occupation to the number of post-secondary graduates who will likely work in the occupation.
- The program analysis compares the number of students graduating from post-secondary education programs to the projected demand for those programs.

Historical employment patterns are used to determine program demand and occupational supply. In both analyses, the demand is presented as a range to accurately reflect the uncertainty inherent in using historic patterns to estimate the future. Considering these analyses alongside the graduate workforce outcomes presented in the prior section provides the most comprehensive assessment of employer demand.

Historical Employment Patterns Methodology

PROS

Considers other sources of supply for an occupation.

Only includes graduates who are likely to go into that occupation as a part of supply.

CONS

Includes demand from occupations that do not require a college degree.

New or emerging occupations not included in historic data.

How is Supply Calculated?

The supply of workers is the average number of graduates per year over the last four academic years exiting Montana's post-secondary education system, including both private and public institutions. Graduates from 36 different institutions in Montana are included:



15 Montana University System (MUS) Schools



3 Private, 4-year Institutions



7 Tribal Colleges



10 Vocational Institutions¹⁷



The Montana Registered Apprenticeship Program

Because of differences in data used, the supply and demand analysis covers more schools than the analysis on employment and wage outcomes.

The supply of graduates is provided by program of study. Historical employment patterns inform the allocation of graduates into occupations. For example, among graduates exiting the early childhood education program:

- 24% become preschool and kindergarten teachers;
- 12% become home health aides;
- 10% become childcare workers; and
- the remainder work as bank tellers, elementary teachers, religious education directors, or other occupations.

This research assumes that graduates continue these historic employment patterns in the future. Typically, workers choose careers with the highest pay (assuming all other job happiness factors are equal), meaning that the assumption of workers following the historic employment patterns is likely more accurate for higher wage careers than for lower-wage careers. However, the use of historic employment patterns adjusts the supply of graduates into each occupation to reflect the complexities of the Montana labor market, allowing workers from nontraditional backgrounds to fill part of the demand for a job. The use of historic employment patterns also adjusts the supply for those who leave the state after graduation.

How is Demand Calculated?

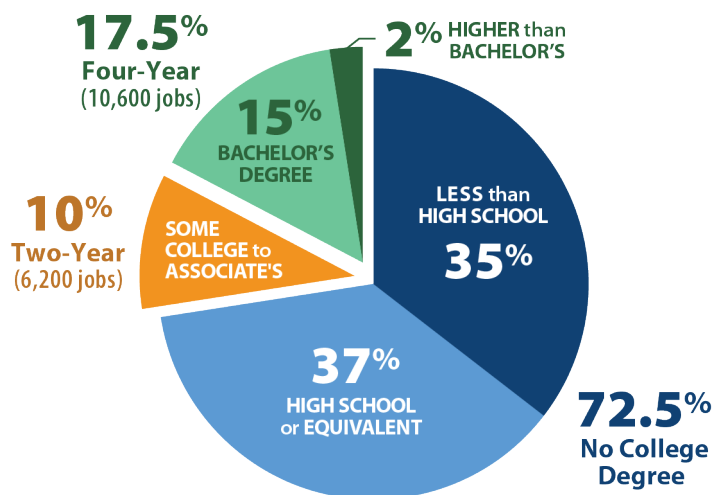
The demand for workers in Montana is estimated using employment projections developed by the Montana Department of Labor & Industry (MTDLI). MTDLI produces employment projections by occupation every year over a ten-year timeframe for the state and each of the five regions.¹⁶ These projections include both new job growth (growth openings) and the number of workers needed to replace workers who leave the occupation (replacement openings). Montana is projected to add 5,800 new jobs every year through 2030. However, job growth is just one element of overall worker demand. Job openings can also occur because of workers exiting the labor force or transferring to a new career. In total, MTDLI projects 61,200 total job openings per year in Montana, with most of these openings occurring due to workers changing jobs. Total openings are the sum of the openings due to growth plus the replacement openings.

The projected job growth is provided by occupation, along with the typical education level needed to enter that career. Workforce demand is best interpreted as a relative instead of absolute measure. While the exact number of job openings is difficult to predict, drawing conclusions about the demand for one occupation relative to another is more reliable.

Most job openings in Montana are in occupations the require low levels of education. Food preparation and serving-related occupations are projected to have the most job openings, averaging nearly 10,000 openings per year (occupations include cashiers, fast food and counter workers, waiters and waitresses, and retail salespersons). Low-education, low-wage jobs tend to have higher levels of turnover as workers quickly gain skills and move up the career ladder. The high turnover and high share of jobs in lower-skill occupations means that over 72% of all expected job openings over the next ten years require a high school education or less (**Figure 2.1**).

FIGURE 2.1

Montana Projected Job Openings through 2030
by Minimum Education Required



Source: Montana Department of Labor & Industry Employment Projections, 2020-2030.

How do you know what education level is typically required to fill a position?

The U.S. Department of Labor (DOL) determines the typical education level most workers need to enter an occupation. The typical education level is determined based on analyses of qualitative and quantitative information. Sources of quantitative data include educational attainment data from the American Community Survey; data on education from the Occupational Information Network (O*NET); and data on postsecondary program completions from the National Center for Education Statistics. In addition, DOL economists evaluated qualitative information obtained from educators, employers, workers in the occupation, training experts, and representatives of professional and trade associations and unions.

Occupations that require some college, but less than a bachelor's degree, make up another 10% of annual openings (6,200 opening per year). Occupations that require a bachelor's degree or higher make up 17.5% of annual job openings.

The occupational supply and demand analysis focuses on only high-demand occupations in Montana that require a postsecondary degree. High-demand occupations are in the top 25% for total annual job openings among all occupations that require the same level of education. There are 84 high-demand occupations in Montana requiring at least some college education.

Post-Secondary System Does Not Need to Meet the Full Demand

As Montana's population continues to age and labor markets tighten, the post-secondary training system will need to fill job openings generated by retirements as well as new job openings. Individuals looking to change careers may also need retraining from the post-secondary system. The post-secondary training system is considered to have met demand for an occupation if supply is enough to fill the openings from new job growth and from retirements, but not more than the total number of job openings (which includes career changes or job-to-job movement of workers).

Historic employment patterns are also used to adjust demand in the analysis by program (in contrast to adjusting supply in the occupational analysis). For example, if 75% of Montana's current registered nurses hold a nursing degree from a Montana institution, then the program analysis assumes that the state's nursing programs will need to meet at least 75% of the demand for registered nurses in the future. As another example, among current credit analysts in Montana, 51% hold a general business degree, 39% hold a business management degree, and 10% have a background in transportation sciences. This report assumes that future credit analysts will have similar backgrounds, with the occupation demanding workers from all three fields.

What does it mean for the education system to “meet demand”?

The state's post-secondary education system is expected to have the capacity to fill new job openings and job openings due to retirements. Post-secondary institutions may also need the capacity to train existing workers looking to change careers. The post-secondary training system is considered to have met demand for an occupation if supply falls within a range, where the lower bound is equal to the number of new job openings and openings due to retirements. The upper bound is total job openings, which includes career changes (job-to-job).



2.1 Supply and Demand Analysis by Occupation

Supply for each occupation is measured as the average number of graduates from a program over the last four years who have historically worked in the occupation. For example, if 25% of business graduates historically become general operations managers, then 25% of business graduates are considered part of the supply of general operations managers.

62% of high-demand occupations requiring **some post-secondary education** are **undersupplied** by Montana institutions.

The demand for post-secondary graduates from each high-demand occupation is determined based on MTDLI employment projections by occupation. Demand for graduates by occupation is defined as a range where the lower bound is equal to the sum of annual openings due to growth and retirements, and the upper bound is the total number of annual openings projected for the occupation over the next ten years. The supply and demand analysis by occupation groups occupations into three categories: undersupplied, meets demand, and oversupplied. **Figure 2.2** summarizes the results of the occupational supply and demand analysis by category for high-demand occupations requiring post-secondary education.

FIGURE 2.2
Supply and Demand Analysis by Occupation

	Number of Occupations	Percent of Occupations
Undersupplied	52	62%
Meets Demand	22	26%
Oversupplied	10	12%

Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from 2017 - 2020 IPEDS and RAPIDS, ACS 2015-2019 IPUMS micro data.

The supply and demand analysis by occupation suggests that Montana post-secondary institutions are undersupplying most of the high-demand occupations requiring post-secondary education. The state’s post-secondary education system is estimated to meet the workforce demand for approximately 38% of high-demand occupations. Some specific examples of occupations that fall into each category are displayed in **Figure 2.3**.

UNDERSUPPLIED – The average annual supply of graduates available to work in the occupation is less than the projected number of new job openings and openings due to retirements.

MEETS DEMAND – The average annual supply of graduates from post-secondary institutions over the last four years falls within openings due to growth and retirements, and total openings.

OVERSUPPLIED – The average annual supply of graduates is greater than the number of projected total openings.

FIGURE 2.3**Select High-Demand Occupations by Supply and Demand Category**

UNDERSUPPLIED		
<ul style="list-style-type: none"> • Nursing Assistants • Heavy Tractor-Trailer Truck Drivers • Electricians • Plumbers • Carpenters • Preschool & Kindergarten Teachers 	<ul style="list-style-type: none"> • Substitute Teachers • Bookkeepers, Accounting, Auditing Clerks • Medical & Dental Assistants • LPNs & LVNs • Substance Abuse, Behavior Disorder, & Mental Health Counselors 	<ul style="list-style-type: none"> • Child, Family, & School Social Workers • Physical Therapy • Nurse Practitioner • Software Developer
MEETS DEMAND		
<ul style="list-style-type: none"> • Registered Nurses • Civil Engineers • Construction Managers • Financial Managers • Accountants 	<ul style="list-style-type: none"> • Elementary & Middle School Teachers • Automotive Service Technicians & Mechanics • Respiratory Therapists • Radiological Technicians 	<ul style="list-style-type: none"> • Lawyers • Speech-Language Pathologists • EMT & Paramedics • Pharmacy
OVERSUPPLIED		
<ul style="list-style-type: none"> • Computer Network Support Specialists • Personal Service, Entertainment, & Recreation Managers 	<ul style="list-style-type: none"> • Hairdressers, Hairstylists, & Cosmetologists • Forest and Conservation Technicians 	<ul style="list-style-type: none"> • Welding, Soldering & Brazing Workers • Chemical Engineers

Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from 2017 - 2020 IPEDS and RAPIDS. ACS 2015-2019 IPUMS micro data.

2.1.1 Occupations Requiring Less than Four Years of Post-Secondary Education

Approximately 10% of job openings in Montana are projected to require some post-secondary education, but less than a four-year degree – including certificates, apprenticeship program completion, and associate degrees. Many high-demand occupations within this educational category are construction, mechanic, and transportation jobs. There are also several high-demand healthcare occupations requiring less than four years of post-secondary education. **Figure 2.4** lists the high-demand occupation that fall within this category, along with the demand range and supply of graduates from the state's post-secondary institutions. Of the twenty-seven high-demand occupations listed in **Figure 2.4**, twenty are undersupplied by Montana post-secondary institutions.

74% of occupations requiring **less than four years** of post-secondary education are **undersupplied** by Montana institutions.

Bookkeeping, accounting, and auditing clerks is the occupation with the highest estimated demand for Montana graduates among occupations requiring less than four years of post-secondary education. There are an average of 83 accounting technology graduates from Montana colleges per year. These graduates are prepared to work as bookkeepers; however, not all graduates have historically pursued the career. Based on historical employment patterns, an estimated 66 graduates will likely be seeking work as bookkeepers, accounting, or auditing clerks each year. This supply estimate falls well below the number of job openings, which ranges from 560 to 950 openings per year. Therefore, bookkeepers, accounting, and auditing clerk demand is undersupplied by Montana post-secondary institutions.

FIGURE 2.4**High Demand Occupations Requiring Less than a Four-Year Degree**

Occupation		Education	Demand		Grads	GAP	Median Wage
			Lower	Upper			
Very-High Demand	Bookkeeping, Accounting & Auditing Clerks	SC ND	561	951	66	Under	\$36,900
	Heavy Tractor-Trailer Truck Drivers*	PS ND	340	783	98	Under	\$48,900
	Nursing Assistants*	PS ND	448	767	275	Under	\$31,070
	Carpenters	APP	246	679	103	Under	\$44,960
	Teaching Assistants	SC ND	232	396	85	Under	\$26,600
	Electricians	APP	138	346	109	Under	\$60,560
	Plumbers, Pipefitters, and Steamfitters	APP	117	303	70	Under	\$57,010
	Automotive Service Techs & Mechanics	PS ND	102	298	154	Meets	\$41,530
	LPN and LVN	PS ND	120	210	53	Under	\$46,210
	Medical Assistants	PS ND	93	182	50	Under	\$36,690
	Paralegals & Legal Assistants*	Associate	57	124	33	Under	\$46,940
	Forest & Conservation Techs	Associate	30	100	122	Over	\$34,920
	Dental Hygienists	Associate	45	63	23	Under	\$77,630
	Radiologic Techs	Associate	35	58	46	Meets	\$57,410
High Demand	Dental assistants*	PS ND	85	171	50	Under	\$37,070
	Hairdressers, Hairstylists, & Cosmetologists	PS ND	79	143	218	Over	\$24,360
	Heating, AC, & Refrigeration Mechanics & Installers	PS ND	52	129	10	Under	\$46,250
	Health Techs, All Other	PS ND	63	123	76	Meets	\$42,020
	Library Technicians	PS ND	43	71	28	Under	\$31,030
	Phlebotomists*	PS ND	36	70	13	Under	\$31,510
	Web Developers	Associate	22	55	15	Under	\$53,810
	Veterinary Techs	Associate	29	54	3	Under	\$32,210
	Physical Therapy Assistants	Associate	26	49	22	Under	\$52,830
	Architectural & Civil Drafters	Associate	17	42	11	Under	\$51,690
	Environmental Science & Protection Technicians	Associate	12	34	25	Meets	\$41,470
	Computer Network Support Specialists	Associate	11	34	46	Over	\$52,460
	Respiratory Therapists	Associate	23	32	15	Under	\$59,480

Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from 2017 - 2020 IPEDS and RAPIDS.

Notes: PS ND = post-secondary non-degree award. SC ND = some college, no degree. APP = Apprenticeship. Supply of is estimated based on historical employment patterns of graduates by program. Forest and conservation techs supply is the total supply of all programs training graduates to work in the occupation. * = training for the occupation offered as non-degree or non-credit program, which isn't captured in IPEDS database.

Heavy tractor-trailer truck drivers demands the second largest number of graduates among the occupations listed in **Figure 2.4**. MTDLI estimates between 340 and 780 annual openings for truck drivers will be available for graduates from Montana post-secondary institutions. By comparison, supply estimates suggest there is only an average of approximately 100 graduates prepared and looking for work as truck drivers each year, leaving the occupation significantly undersupplied. However, truck driver training is also provided as a non-credit program, which is not captured in the graduate data. Therefore, the supply of heavy tractor-trailer truck drivers presented in **Figure 2.4** is understated.

Carpenters, electricians, and plumbers are three additional very-high demand, yet undersupplied, occupations requiring the completion of a registered apprenticeship program. MTDLI estimates between 250 and 680 annual openings for carpenters available for registered apprenticeship program graduates to fill. However, only about 100 registered apprenticeship completers are estimated to be looking for work as carpenters in Montana each year. Electrician and plumber job openings are both estimated to top 300 per year as well. Despite this significant demand, only about 100 electrician apprenticeship completers and 70 plumbing apprenticeship completers are estimated to be available to fill these openings each year. Furthermore, wages for electricians and plumbers are above average among high-demand occupations requiring less than four years of post-secondary education, making them candidates for program expansion.



Carpentry, Electrician, & Plumbing apprenticeship programs are **undersupplying** estimated demand, and are candidates for program expansion.

Many of the high-demand occupations listed in **Figure 2.4** are healthcare occupations. Nursing assistants (CNAs) are estimated to have the most job openings among healthcare occupations requiring less than a four-year degree. MTDLI estimates the healthcare industry will demand between 450 and 770 nursing assistant graduates per year. Yet, historical employment patterns suggest there will only be about 275 CNA graduates per year available to fill job openings, leaving the occupation undersupplied. Additional supply of nursing assistants comes from non-credit programs frequently offered at post-secondary institutions. It is unclear whether enough nursing assistants are trained



Nursing Assistant job openings significantly **outpace the estimated supply** of CNAs from Montana post-secondary institutions.

through non-credit programs to meet demand. The other undersupplied nursing occupation in high demand is Licensed Practical Nurses (LPN). Wages for practical nurses are higher than nursing assistants, but Montana post-secondary institutions are only estimated to supply about half of the LPNs demanded by healthcare providers in the state.

Medical and dental assistants are also high-demand health assistant occupations, in addition to nursing assistants. The Montana labor market is estimated to demand between 90 and 180 graduates from each assistant program per year. However, colleges are only estimated to supply about 50 dental assisting and 50 medical assisting graduates per year, leaving both occupations undersupplied.

The highest earning occupation listed in **Figure 2.4** is dental hygienists with a median wage of over \$77,000. To become a dental hygienist, most students earn

Dental Hygienists have the **highest median wage** among in-demand occupations requiring an associate degree. However, the occupation remains **undersupplied** by Montana post-secondary institutions.



an associate degree in dental hygiene. An average of 23 graduates per year are estimated to earn this degree and be available for work. The demand for dental hygienists outstrips estimated supply, leaving the occupation undersupplied.

The remaining undersupplied healthcare occupations in **Figure 2.4** are veterinary technicians, other health technicians, respiratory therapists, physical therapy assistants, and phlebotomists. There are a total of eleven healthcare occupations listed in **Figure 2.4**, and all except for radiologic technologists are categorized as undersupplied. Healthcare occupations make up over 40% of the high-demand occupations that require less than four years of post-secondary education.

2.1.2 Occupations Requiring a Bachelor's Degree

Approximately 15% of the projected job openings through 2030 are estimated to require a bachelor's degree to fill. There are forty high demand occupations falling within this educational category, many of which are in education, office and administrative support, and professional services. **Figure 2.5** details the supply and demand analysis for each of these occupations, as well as the median wage by occupation. Most (68%) of the high demand occupations requiring a bachelor's degree are undersupplied by Montana post-secondary institutions.

68% of high-demand occupations requiring a bachelor's degree are undersupplied by Montana post-secondary institutions.

Healthcare Job Openings in Nursing, Mental Health, and Social Work

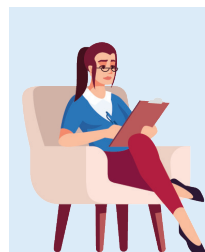
Registered nursing (RN) is projected to have the most job openings of any occupation requiring a bachelor's degree. Demand for registered nursing graduates from Montana's post-secondary institutions is estimated to be between 470 and 710 graduates per year over the next ten years. The state's colleges have responded to this need and are currently producing an average of 520 RN graduates per year, which falls within the estimated workforce demand range. Therefore, the state's post-secondary education system is estimated to meet the demand for registered nurses with their existing capacity.

Registered Nursing is the most in-demand among bachelor's degree occupations. Montana colleges are estimated to **meet the demand** for RNs over the next ten years.



Another very-high demand occupation in the healthcare field is substance abuse and mental health counselors. Demand for the occupation is estimated to be between 130 and 250 job openings per year. Unlike registered nursing, the number of graduates who leave Montana post-secondary

institutions to become substance abuse and mental health counselors is insufficient to meet the growing need for their services. An estimated 52 students per year enter the career after graduating from substance abuse and addiction counseling programs at Montana colleges, which is less than half of estimated demand.



Post-secondary institutions are not producing enough graduates to meet the growing demand for **Substance Abuse and Mental Health Counselors** in the state, leaving the occupation **undersupplied**.

FIGURE 2.5**High Demand Occupations Requiring a Bachelor's Degree**

Occupation		Demand		Grads	GAP	Median Wage
		Lower	Upper			
Very-High Demand	Registered Nurses	473	712	520	Meets	\$68,740
	Substitute Teachers	369	628	46	Under	\$21,970
	General & Operations Mgrs	231	595	65	Under	\$87,810
	Elementary & Middle School Teachers	271	496	381	Meets	\$51,560
	Project Mgmt & Business Ops Specialists	171	403	123	Under	\$60,500
	Accountants and Auditors	152	362	163	Meets	\$63,240
	Coaches and Scouts	130	260	24	Under	\$19,960
	Secondary School Teachers	131	250	99	Under	\$50,720
	Substance Abuse & Mental Health Counselors	128	246	52	Under	\$39,360
	Market Research Analysts	86	201	14	Under	\$55,800
	Medical & Health Service Mgrs	113	198	83	Under	\$90,370
	Personal Service, Entmt & Rec Mgrs	57	195	319	Over	\$82,390
	Software Developers	92	191	84	Under	\$85,940
	HR Specialists	72	180	83	Meets	\$55,240
	Management Analysts	84	171	110	Meets	\$74,220
	Preschool & Kindergarten Teachers	68	135	51	Under	\$40,670
	Civil engineers	48	123	95	Meets	\$76,520
High Demand	Buyers and Purchasing Agents	39	121	21	Under	\$52,000
	Child, Family, & School Social Workers	54	119	16	Under	\$39,670
	Cost estimators	42	104	22	Under	\$55,970
	Construction Managers	43	103	49	Meets	\$93,920
	Loan Officers	37	103	30	Under	\$62,930
	Compliance Officers	40	96	22	Under	\$61,210
	Fundraisers	41	87	11	Under	\$50,900
	Clergy	44	84	27	Under	\$49,380
	Training & Development Specialists	36	80	17	Under	\$55,310
	Financial Managers	37	80	75	Meets	\$100,530
	Graphic Designers	26	78	17	Under	\$39,800
	Clinical Lab Techs	43	74	31	Under	\$57,650
	Event Planners	31	74	9	Under	\$43,070
	Community & Social Service Specialists	32	68	14	Under	\$45,360
	Social & Community Service Mgr	34	65	44	Meets	\$60,730
	Computer & Info Systems Mgr	26	65	42	Meets	\$103,010
	Computer Occupations, all other	25	62	80	Over	\$71,200
	Directors, Religious Activities and Ed	27	60	5	Under	\$28,100
	Conservation Scientists and Foresters	23	79	79	Meets	\$67,700
	Architects	25	57	22	Under	\$66,090
	Biological Technicians	14	56	4	Under	\$34,920
	Public Relations Specialists	22	56	21	Under	\$51,540
	Social Workers, all other	22	55	65	Over	\$39,210

Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from 2017 - 2020 IPEDS and RAPIDS.


Notes: Supply is estimated using historical employment patterns of graduates by program. Preschool & kindergarten teachers, elem & middle school teachers, and conservation scientists and foresters average wage shown. Conservation Scientist & Forester supply is the average number of forestry and conservation mgmt grads with atleast bachelor's degree in the last four years.

At \$39,000 per year, wages for substance abuse and addiction counselors are less than average for occupations requiring a bachelor's degree. Below-average wages could explain why some graduates choose not to pursue the career after graduation. However, even if every substance abuse and addiction counseling graduate from Montana colleges became mental health and addiction counselor, the occupation would still be undersupplied.

An increase in the number of social work graduates is also needed to meet the projected demand for child, family, and school social workers in Montana. MTDLI estimates between 50 and 120 job openings for child, family, and school social workers that may need to be filled by social work graduates from Montana colleges. Social work programs have averaged about 80 graduates per year over the last four academic years. While this may be sufficient to meet the need for child, family, and school social workers if every social work graduate entered this career, doing so would leave every other social work occupation undersupplied. An overall increase in social work graduates is needed to meet the demand for social workers in Montana.

Education Occupations in High Demand

Teachers at all levels of education are in very-high demand in the Montana economy, including preschool, kindergarten, elementary, middle, and secondary school teachers. According to MTDLI estimates, as many as 500 elementary and middle school teachers are demanded from Montana's post-secondary institutions each year. The average wage for these teachers was \$51,000 in 2020, which is below average for the occupations listed in **Figure 2.5**. The Montana post-secondary education system produces an average of 380 elementary and middle school teachers per year, which falls within the estimated demand range of 270 to 500 teachers per year. Therefore, existing capacity at the state's colleges are estimated to meet the demand for elementary and middle school teachers over the next ten years.



Elementary and Middle School Teachers are in very-high demand, yet the existing supply of graduates from Montana colleges is estimated to **meet demand** for these teachers over the next ten years.



There are **not enough graduates** from Montana post-secondary institutions pursuing careers as **Preschool and Kindergarten Teachers** to meet workforce demand.

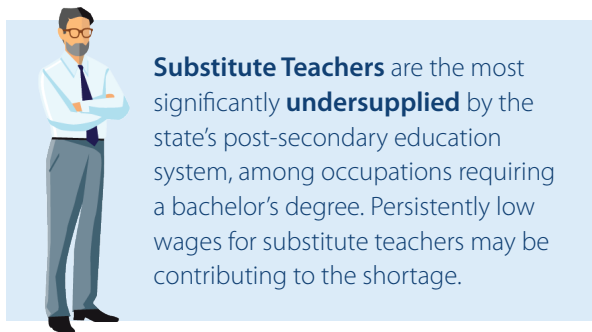
Preschool and kindergarten teachers are in very-high demand among bachelor's degree occupations. The state's workforce is estimated to need between 70 and 135 preschool and kindergarten teachers per year from the state's post-secondary education system. However, only an

estimated fifty graduates from Montana colleges go on to become preschool and kindergarten teacher each year, leaving the occupation undersupplied in the state.

An average of eighty students graduate from early childhood education (ECE) programs per year in Montana. However, not all these graduates become preschool or kindergarten teachers. Historical employment patterns suggest early childhood education graduates also pursue careers as elementary school teachers or childcare workers. There are also ECE graduates who work outside of education, perhaps due changing interests or to pursue a higher wage career. The median wage for kindergarten

teachers was \$49,490 in 2020, which is consistent with the wages of elementary school teachers. However, preschool teachers only reported a median wage of \$29,660 – 60% less than kindergarten and elementary school teachers. Increasing wages for preschool teachers may help attract more graduates into the field and help alleviate the shortage.

Secondary school teachers at Montana high schools are also in high demand. Approximately 100 graduates from the state's post-secondary education system become secondary school teachers each year. Historical employment patterns suggest these graduates come from a variety of different programs, including mathematics, arts, computer science, physical education, architecture, and communications. Each of these programs supply a few secondary school teachers each year, totaling one hundred graduates into the occupation across all programs. However, workforce demand is estimated to be between 130 and 250 graduates per year, meaning secondary school teachers are undersupplied.



A limited supply of teachers at all levels of education has also impacted the available pool of substitute teachers. The demand for substitute teachers has increased during the COVID-19 pandemic, with increased illness and quarantine requirements limiting many teachers' ability to teach in-person. As many as 630 job openings for substitute teachers are projected each year.

Despite this increase in demand, the average wage

for substitute teachers remains low at \$21,970 per year. The supply of substitute teachers often comes from retired teachers or others trained in education who do not wish to work full-time. An average of 50 graduates from Montana post-secondary institutions work as substitute teachers per year, well below the estimated demand of between 370 and 630. As a result, substitute teachers are the most significantly undersupplied occupation among those shown in **Figure 2.5**. Increasing the supply of graduates from early childhood education through secondary education programs will help increase the supply of substitute teachers.

Business and Office Administration

Many openings in business and office administration occupations require a bachelor's degree, including general and operations managers, project managers, accountants, market research analysts, human resource specialists, management analysts, and financial managers. Most of the occupations that fall within this category report a median wage above \$60,000. The number of graduates pursuing careers as financial managers (\$100,530), management analysts (\$74,220), and accountants (\$63,240) is projected to be sufficient to meet workforce demand over the next ten years. There is also estimated to be enough human resource specialists (\$55,240) to meet demand, despite below average wages. Most of the graduates pursuing this career come from general business and human resource programs, although human resource specialists have historically held a variety of different degrees.



Accountants, Financial Managers, and Management Analysts are high-wage occupations, and Montana colleges are estimated to **meet demand** for these business occupations.



There are several business and administrative occupations that are undersupplied, despite offering high wages. The demand for general and operations managers is the largest and most significantly undersupplied among business occupations. Between 230 and 600 job openings for general and operations managers may need to be filled by graduates from post-secondary institutions in Montana. Business

programs supply the most graduates into this occupation, but there are a variety of degrees general operations managers may hold. Historical employment patterns suggest graduates from journalism, education, computer science, mathematics, and history programs have also become general operations managers. Across all programs, the Montana post-secondary education system is projected to supply 65 general operations managers per year, which is insufficient to meet estimated demand.

Project managers and business operations specialists (\$60,500) and market research analysts (\$55,800) are undersupplied by Montana post-secondary institutions. The state's labor market is estimated to need between 170 and 400 project managers and between 90 and 200 market research analysts per year from Montana colleges. General business is one of the largest programs among post-secondary institutions, graduating an average of 750 students per year. Marketing programs produce an additional 80 graduates per year. However, graduates from these occupations pursue a variety of different careers upon graduation. Only 123 graduates become project managers and 14 graduates become marketing research analysts each year. Below-average wages for bachelor's degree occupations may be contributing to the undersupply.

Professional Services

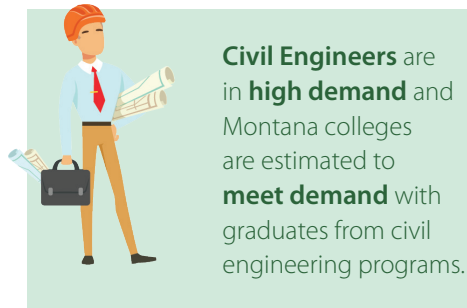
In addition to business and office administration, there are several other professional service occupations in high demand. Professional services include computer and information systems, architectural, legal, engineering, public relations, advertising, and graphic design services, among others.

Software developers are in very-high demand among Montana employers. MTDLI estimates as many as 190 job openings for software developers each year through 2030. At least 48% of these job openings may need to be filled by graduates from the state's post-secondary institutions. An average of approximately 140 students graduates with degrees in computer science each year, with 84 of them pursuing software development. However, Montana employers require 92 to 190 graduates each year, leaving the occupation undersupplied.

Software Developer demand outpaces the estimated supply from Montana post-secondary institutions. The occupation is **undersupplied** despite offering a median wage above \$85,000.



Computer and information system managers are also an IT-related occupation in high demand. These managers' report the highest median wage of all the occupations listed in [Figure 2.5](#), earning \$103,000 per year. Historically, roughly 42 graduates per year work as computer and information system managers, which is sufficient to meet the estimated workforce demand from Montana employers.



Civil engineers are in very-high demand by Montana employers. MTDLI estimates approximately 120 job openings for civil engineers, about 40% of which may need to be filled by graduates from Montana colleges. The post-secondary education system is estimated to meet this need with graduates from civil engineering programs. An average of 95 civil engineering graduates pursue the career after graduation and earn a median wage of \$76,000.

Architects are another professional service occupation in high demand that typically requires a bachelor's degree and is undersupplied by the post-secondary education system. Workforce demand for architects ranges from 25 to 60 workers needed per year, with the annual supply of graduates estimated at 22 annually. Architects report a median wage of \$66,000, placing them above the average across all occupations listed in [Figure 2.5](#).

2.1.3 Occupations Requiring a Graduate Degree

Only 2% of estimated job openings in Montana require higher than a bachelor's degree to fill, which translates to approximately 1,500 openings per year. [Figure 2.6](#) shows the graduate degree occupations with the most projected job openings. The average wage reported by high demand graduate occupations is \$93,700 - higher than bachelor's degree earners average of \$67,000. Despite higher wages, 70% of the occupations in [Figure 2.6](#) are undersupplied by the Montana post-secondary education system.

Most of the high demand, graduate-level occupations are within healthcare and education fields. While business and professional service occupations were common among high demand bachelor's degree jobs, the only high demand graduate-level occupation in this category is lawyers. MTDLI estimates an average of approximately 144 job openings for lawyers each year in Montana, with 54% or more of the openings needing to be filling by graduates from University of Montana's (UM) Juris Doctorate (JD) program. Although the average of 79 law graduates per year is above the minimum estimated demand, historical employment patterns suggest only 73 graduates will fill job openings for lawyers. Therefore, lawyers are categorized as an undersupplied occupation in [Figure 2.6](#). UM may seek to expand their Juris Doctorate program to address the shortage. Efforts to increase the retention rates of J.D. graduates in the Montana workforce may also be effective in increasing supply.

70% of high-demand occupations requiring a **graduate degree** are **undersupplied** by Montana post-secondary institutions.

FIGURE 2.6**High Demand Occupations Requiring a Graduate Degree**

Occupation		Education	Demand		Grads	GAP	Median Wage
			Lower	Upper			
Very-High Demand	Postsecondary Teachers	Phd or Prof	166	317	250	Meets	\$78,434
	Lawyers	Phd or Prof	78	144	73	Under	\$79,410
	Education Administrators	Master's	36	92	88	Meets	\$77,886
	Physical Therapists	Phd or Prof	62	90	44	Under	\$81,440
	Physicians	Phd or Prof	49	70	30	Under	\$262,623
	Healthcare Social Workers	Master's	32	69	6	Under	\$51,310
	Physician Assistants	Master's	38	67	36	Under	\$118,760
	Nurse Practitioners	Master's	43	66	22	Under	\$114,970
	Educational, Guidance, and Career Counselors	Master's	30	65	52	Meets	\$47,470
	Pharmacists	Phd or Prof	36	62	61	Meets	\$122,160
	Clinical, Counseling, and School Psychologists	Phd or Prof	19	48	5	Under	\$64,560
High Demand	Mental Health & Substance Abuse Social Workers	Master's	22	46	3	Under	\$37,000
	Rehabilitation Counselors	Master's	19	41	--	NP	\$35,200
	Speech-Language Pathologists	Master's	22	35	32	Meets	\$72,420
	Occupational Therapists	Master's	20	33	--	NP	\$77,730
	Veterinarians	Phd or Prof	22	31	--	NP	\$81,560
	Dentists	Phd or Prof	13	18	--	NP	\$165,330

Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from 2017 - 2020 IPEDS and RAPIDS.

Notes: NP = No Program. Supply is estimated using historical employment patterns of graduates by program. Supply of Physical Therapists is equal to number of Physical Therapy graduates per year. Nurse Practitioner supply is equal to the average number of Nursing Practice graduates (51-3808). Pharmacist supply is equal to the average number of Pharmacy graduates (51-2001). Ed, Guidance, and Career Counselors is equal to the average number of School Counseling graduates (13-1101). Supply of Lawyers is equal to number of graduates with a Juris Doctorate (22-0101). Average wage reported for postsecondary teachers, education administrators, and physicians.



Education Programs Meet Demand

Postsecondary teachers and education administrators and guidance and career counselors are also listed among the graduate-level occupations with the greatest demand. The Montana post-secondary education system is estimated to meet demand for these occupations with their existing capacity, despite the high level of demand.



Postsecondary teachers top the list of in-demand education occupations, with an estimated 300 openings per year. The types of postsecondary teachers most in demand are business, mathematics, engineering, health science, nursing, English, and education teachers. The average wage for teachers in these fields is \$78,400. Demand for postsecondary teachers from Montana colleges is estimated to be between 160 and 300 graduates per year. Existing capacity produces an estimated 250 graduates per year who pursue careers as postsecondary teachers, meaning Montana colleges can meet estimated workforce demand.

Education administrators are another high-demand occupation typically held by graduates with a Master's in Education Administration. An average of 88 students per year graduate from masters or doctoral education administration programs at Montana each year and go on to pursue careers as education administrators. Supply from Montana colleges is estimated to meet demand for education administrators, which ranges from 36 to 90 graduates per year.

The state's post-secondary education system is also estimated to meet demand for education, guidance, and career counselors. These counselors primarily work with students in the elementary and secondary school system to help them develop academic and social skills and plans for after graduation. MTDLI estimates 60 job openings for education and career counselors each year. While this occupation typically requires a master's degree in school counseling, the median wages are below average for other master's degree occupations. Despite these below average wages, an average of 50 students graduate from Montana colleges every year and pursue a career as education, guidance, and career counselors.

Healthcare Providers

Most of undersupplied graduate occupations in **Figure 2.6** are in healthcare fields. Physical therapists are estimated to have the greatest workforce demand among healthcare occupations in **Figure 2.6**. MTDLI estimates as many as 90 job openings for physical therapists per year, with at least 60 openings to be filled by graduates from Montana physical therapy programs. The University of Montana offers the state's only Doctorate in Physical Therapy (DPT) program, which produces an average of 44 graduates per year over the last four academic years, but additional DPT graduates are needed to meet future demand.

Physician Assistants (PA) are in very-high demand, with an estimated 40 to 70 PA graduates needed per year to fill projected job openings. Rocky Mountain College offers a Masters in Physician Assistant Studies that prepares students to work as PAs. An average of 36 students have graduated from this program over the last four academic years, which falls just below projected demand. High wages combined with growing demand make the Masters in Physician Assistant program a candidate for expansion.

Nurse Practitioners (NP) are also in very-high demand and report median wages above \$110,000 a year. Montana State University Doctor of Nursing Practice (DNP) program prepares graduates to sit for the national nurse practitioner certification. The program has graduated an average of 22 DNP students each year, yet 40 and 66 workers are needed each year to fill openings. Therefore, the program is estimated to be undersupplying workforce demand and is a candidate for program expansion.

Healthcare Program Expansion Candidates include:

- Physical Therapy
- Physician Assistant
- Nurse Practitioner
- Physicians
- Psychologists
- Healthcare Social Workers
- Mental Health and Substance Abuse Social Workers

Physicians are also a high demand, high wage occupation. While there is not a stand-alone medical school in Montana that produces Medical Doctors (M.D), Montana State University does offer a medical education program in partnership with the University of Washington Medical School. The WWAMI program is supported by the State of Montana and guarantees that 30 qualified Montana residents can be admitted to the Medical School at the University of Washington School of Medicine each year. Montana WWAMI students can complete the first eighteen months of their medical school education at MSU, with the opportunity to complete their third year and part of their fourth year in either Billings, Bozeman, or Missoula.¹⁷ Estimated demand for physicians ranges from 50 to 70 graduates per year, with 20 in the Family Medicine specialization. Since only 30 medical students are admitted to UW School of Medicine from Montana each year, the program is estimated to be undersupplying physician demand in the state.



Pharmacy doctorate graduates in MT are estimated to **meet the demand** for Pharmacists over the next ten years.

Pharmacists are another high demand healthcare occupation requiring a graduate-level education, but training for this occupation is meeting demand. Pharmacists earn a median wage of \$122,000 per year, placing them among the highest earners in **Figure 2.6**. There will be about 60 job openings per year for

pharmacists, with 58% to 100% of these openings needing graduates from pharmacy programs in Montana. An average of 65 students have graduated with a degree in pharmacy over the last three academic years. Most of these graduates (93%) hold a doctoral level degree, which translates to roughly 60 Doctor of Pharmacy (PharmD) graduates per year. Assuming all PharmD graduates become Pharmacists in Montana, then the state's pharmacy program is estimated to meet the demand for Pharmacists in Montana.

Roughly 35 speech-language pathologists are needed each year to fill openings, placing this occupation among the highest demand for occupations requiring a graduate degree (typically a master's degree in speech language pathology). These workers assess, diagnose, treat, and help to prevent communication



Speech-Language Pathology master's degree graduates in Montana are estimated to **meet the demand** for speech therapists over the next ten years.

and swallowing disorders in children and adults. Anywhere from 22 to 35 of these openings need to be filled by graduates from Montana's post-secondary education system. Over the last four academic years, there have been an average of 32 students graduating with a master's in speech language pathology each year, suggesting that the training capacity sufficient to meet the workforce demand over the next ten years.

Mental Health and Social Work

Mental health and social work services are in high demand throughout the state. Healthcare social workers, and mental health and substance abuse social workers are both high demand graduate occupations that are undersupplied. The typical education required for social work professionals in these fields is a Master's in Social Work (MSW). While MSW programs are expanding across the state, the number of students graduating with a MSW averages about 25 per year, but only six of these are expected to become healthcare social workers, and only three are estimated to become mental health and substance abuse social workers.

While mental health and substance abuse social workers provide the state with critical support, median wages for these workers are among the lowest in [Figure 2.6](#), which may explain why many choose careers outside their field of training. Median wages were \$37,000 in 2020 for social workers specializing in mental health and substance abuse. Healthcare social workers earned more, at just over \$51,000 per year. Both occupations have earnings that are well below average for their education level.

The level of MSW candidates expected to fill positions in Montana is insufficient to meet the growing demand for healthcare social workers and mental health or substance abuse social workers. There are roughly 70 openings for healthcare social workers each year, with 46% of these openings requiring graduates from Montana post-secondary institutions. Approximately 46 job openings are projected each year for mental health and substance abuse social workers, leaving both occupations significantly undersupplied in Montana.

Social Work and Mental Health Providers are the **most significantly undersupplied** graduate-level professions. Low wages relative to other graduate occupations likely contributes to the significant shortage of mental health professionals and social workers.



Clinical, counseling, and school psychologists also provide critical mental health services to Montanans throughout the state. Between 20 and 50 psychologists are needed from Montana post-secondary institutions each year to meet the growing demand for their services, with the graduates typically holding a Doctorate of Clinical Psychology or School Psychology. Psychologists working in this field reported a median wage of \$65,000 in 2020, which is significantly less than other graduate-level healthcare practitioners.

While psychology is one of the larger programs of study offered at Montana colleges, only about 2.4% of graduates from the program hold a Ph.D. An estimated eight students per year graduate with a Ph.D. in psychology. Historical employment patterns suggest only five of these graduates will go on to become clinical, counseling, or school psychologists in the state. This supply of graduates is significantly less than the 20 to 50 job openings projected annually. Therefore, clinical, counseling, and school psychologists are categorized as undersupplied in the analysis presented in [Figure 2.6](#).

New Healthcare Program Development

There are four high demand graduate-level occupations that cannot be served by existing programs at Montana post-secondary institutions. There are currently no programs available to train rehabilitation counselors, occupational therapists, veterinarians, or dentists in Montana. These occupations may serve as areas for new program development at Montana colleges.

Among these occupations without existing programs, rehabilitation counselors have the most job openings with 40 workers needed per year. A rehabilitation counselor helps maximize the independence and employability of people coping with personal, social, or vocational difficulties that result from a variety of health conditions.¹⁸ Rehabilitation counselors reported a median wage of \$35,000 in 2020, which is the lowest of any occupation in [Figure 2.6](#).

Areas for New Graduate Program Development:

- Occupational Therapy
- Dentist
- Veterinary Medicine

Rehabilitation counselors typically hold a Master's degree in vocational rehabilitation counseling, or rehabilitation science. These programs are not offered at Montana post-secondary institutions. Despite the high demand for these counselors, vocational rehabilitation counseling is not identified as an area for new program development due to the significantly lower wage outcomes compared to other master's degree holders in the state.

Occupational therapists are in high demand and report a median wage of \$77,700, which is consistent with other master's degree occupations in the state. MTDLI estimates 33 job openings for occupational therapists per year over the next ten year, with 60% coming from Montana post-secondary institutions. Individuals typically need to achieve a Masters in Occupational Therapy to work as an occupational therapist. Rocky Mountain College has recently developed the first accredited occupational therapy program in the state, but the program has yet to begin producing graduates. Occupational therapy programs in Montana would need to produce an average of between 20 and 33 graduates per year to meet estimated workforce demand.

There are currently no graduate level veterinary programs available through the state's post-secondary education system. Veterinarians are considered a high demand occupation in Montana among those typically requiring a graduate degree with a high median wage of \$82,000 per year. These characteristics make veterinary medicine a candidate for new program development in Montana. Post-secondary institutions would need to produce 20 to 30 graduates per year with a Doctorate of Veterinary Medicine to meet workforce demand.

Doctor of Medicine in Dentistry (DMD) is another possible area for new program development with 18 annual openings for dentists. As many as 72% of estimated job openings could be filled by dental program graduates in the state. Dentists earn a median wage of \$165,000, making them the second highest earning occupation in [Figure 2.6](#).

2.2 Supply and Demand Analysis by Program

This section provides a supply and demand analysis from the perspective of each educational program, rather than for each occupation (as provided in Section 2.1). Graduates from Montana post-secondary institutions pursue a variety of different careers after graduation. Similarly, Montana employers utilize a variety of different avenues to meet workforce needs. Historical employment patterns are used to reveal the extent to which workforce demand is met by the state's post-secondary education system and provide a realistic view of demand for graduates from each program.

The analysis presented in this section allocates occupational demand into demand for graduates from a program based on historical employment patterns of graduates. For example, if 75% of financial managers hold a degree in finance and 25% graduated with a general business degree, then three-quarters of the demand for financial managers is allocated to the finance program and a quarter is allocated to the general business program. Program demand is then summed across all occupations which have historically been filled by graduates from the program to arrive at the total demand for a particular program.

The post-secondary training system is considered to have met demand for a program if supply falls within a range, where the lower bound is equal to the number of new job openings and openings due to retirements. The upper bound is total job openings across all occupations which have historically been filled by graduates from the program, which includes career changes (job-to-job openings).

Figure 2.7 shows the results of the supply and demand analysis for the 85 programs available at Montana post-secondary institutions. The bracketed bars represent estimated demand for a program, where the lower bound is total growth and retirement openings, and the upper bound is total projected openings. The colored bars indicate the average annual supply of graduates from each program over the last four academic years. The color of the bars reflects the results from the supply and demand analysis. Blue signifies an undersupplied program, green indicates the program meets estimated workforce demand, and orange indicates the program is oversupplied. The amount of the under or oversupply is equal to the difference between the colored bar and the lower, or upper bound of estimated demand, respectively.

Forty-one of 85 programs offered within the last four academic years at Montana post-secondary institutions are categorized as undersupplied, which translates to 48% of programs. Another 27 programs (31%) are estimated to meet the state's workforce needs, and 18 programs (21%) are oversupplying graduates relative to estimated workforce demand.

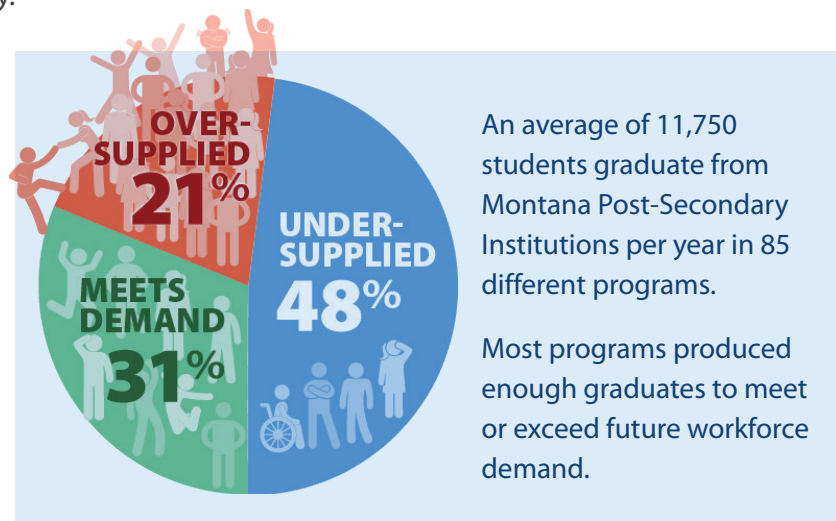
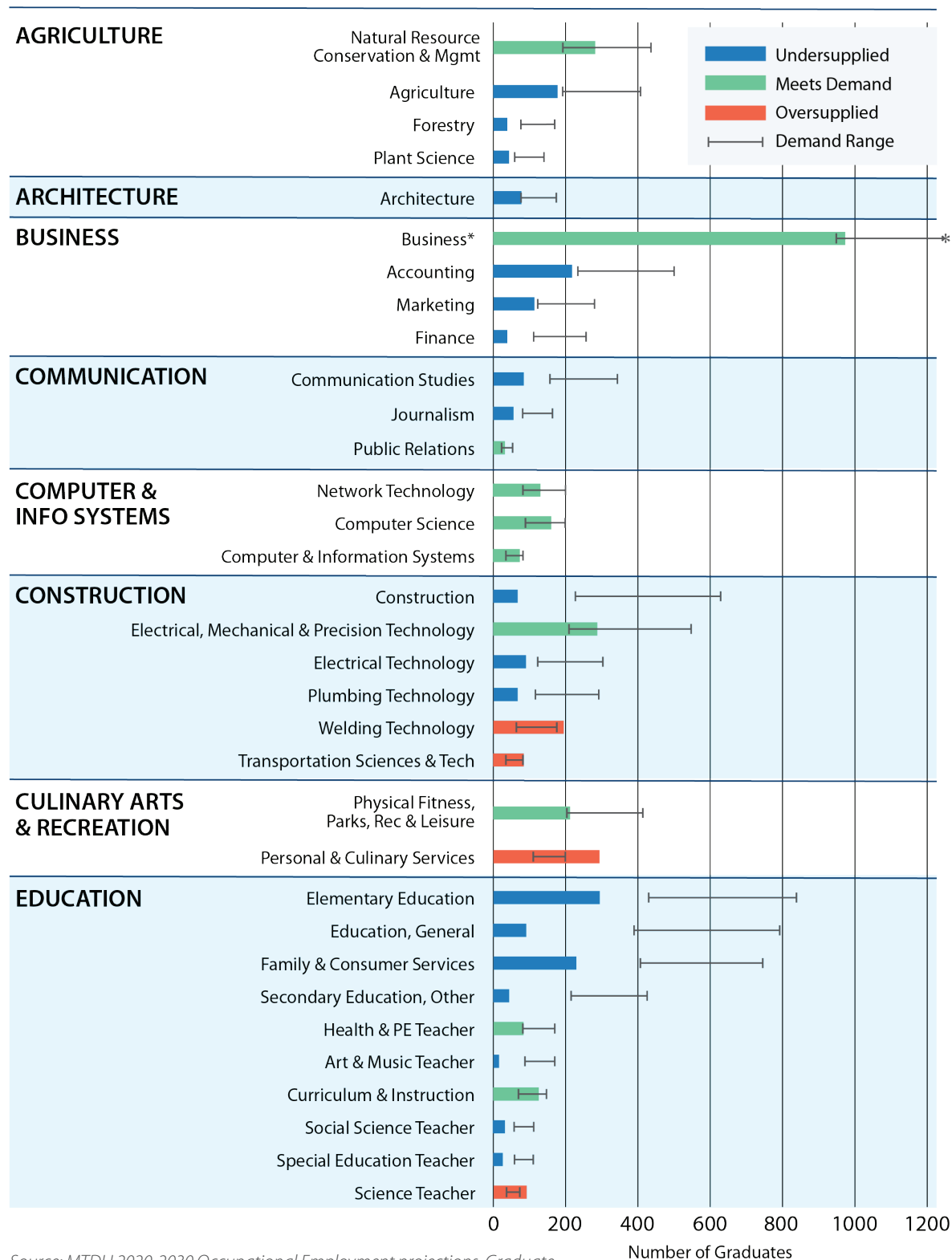
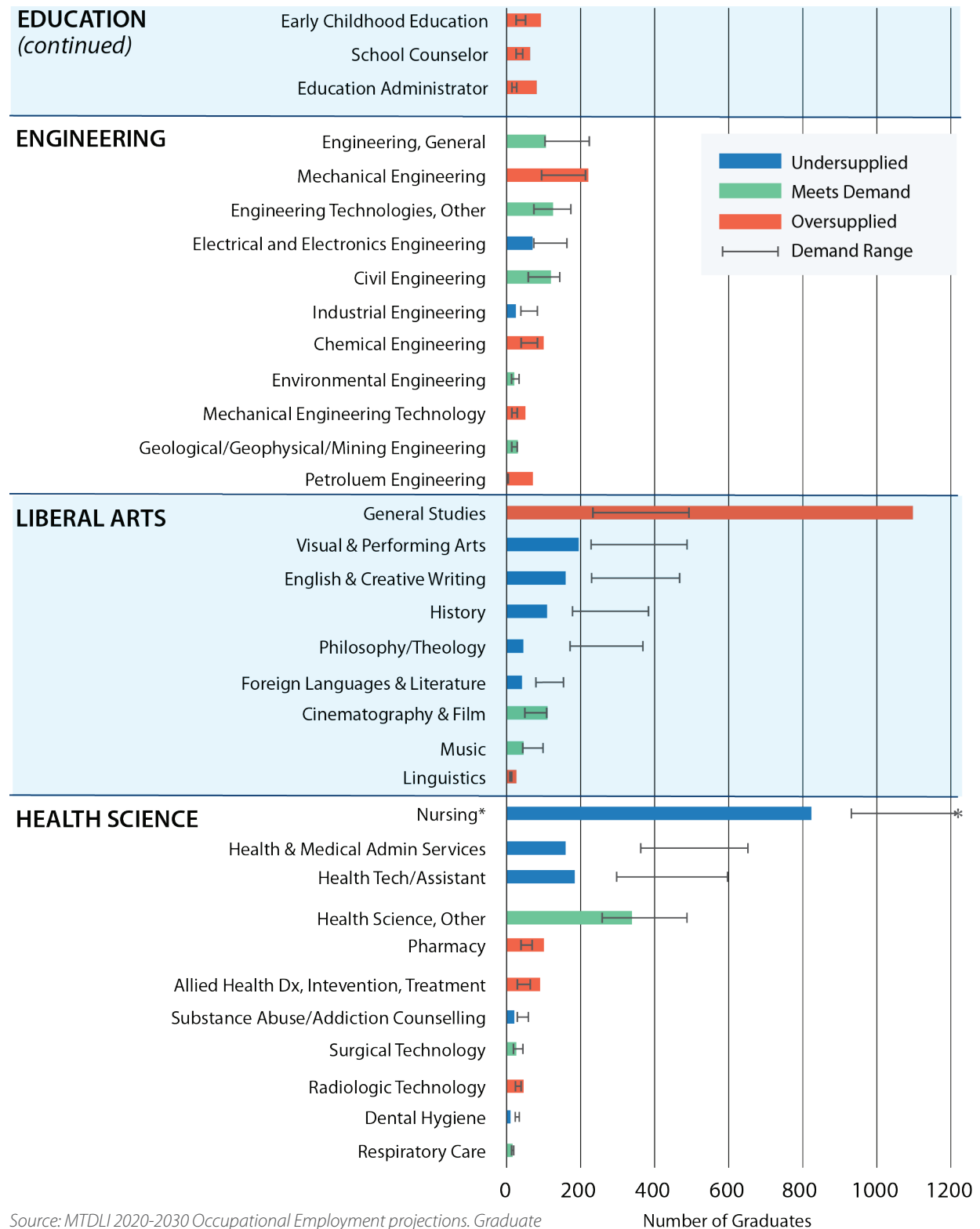


FIGURE 2.7**Supply and Demand Analysis by Program (All Occupations)**

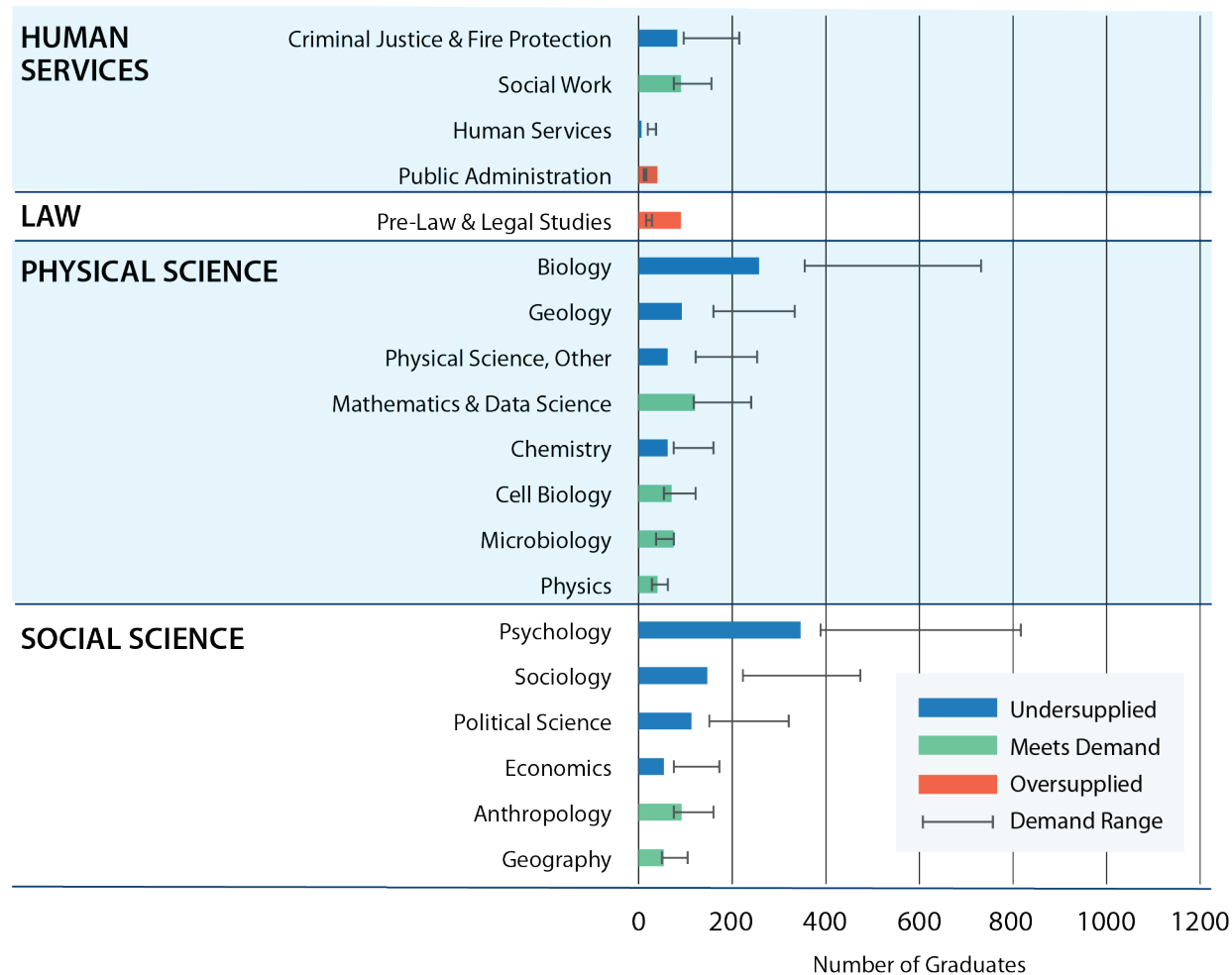
Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from IPEDS and RAPIDS. Demand is sum of occupation demand historically filled by graduates from the program according to 2015-2019 ACS IPUMS micro data. * Upper bound of demand exceeds 1,200.

(Figure continues on the next page.)

FIGURE 2.7**Supply and Demand Analysis by Program (All Occupations), Cont.**

Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from IPEDS and RAPIDS. Demand is sum of occupation demand historically filled by graduates from the program according to 2015-2019 ACS IPUMS micro data. * Upper bound of demand exceeds 1,200.

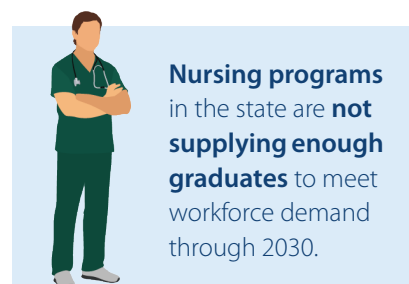
(Figure continues on the next page.)

FIGURE 2.7**Supply and Demand Analysis by Program (All Occupations), Cont.**

Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from IPEDS and RAPIDS. Demand is sum of occupation demand historically filled by graduates from the program according to 2015-2019 ACS IPUMS micro data. * Upper bound of demand exceeds 1,200.

2.2.1 Health Science Programs

Nursing is the third largest program among Montana post-secondary institutions, producing an average of 830 graduates per year. Most (90%) of these graduates come from registered nursing (RN) programs, while practical nursing (LPN) and nursing assistant (CNA) programs produce the remaining 10% of nursing graduates. Nursing graduates have historically worked in variety of occupations, including those outside of the healthcare field. Most of the demand for nursing graduates comes from the need to fill employment growth and retirement openings for registered nurses and nursing assistants, with 710 RN openings and 770 CNA openings per year.



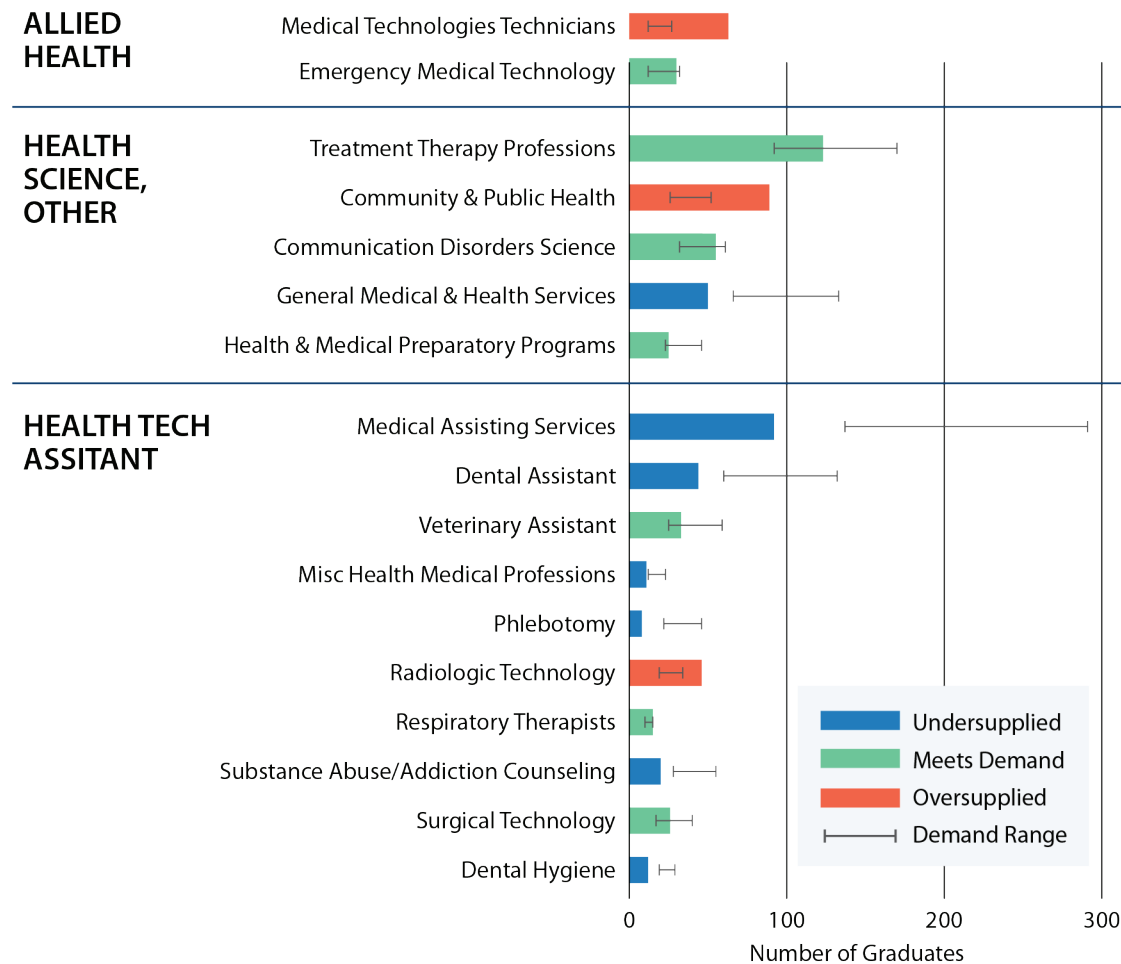
Total workforce demand for the nursing program is estimated to be between 900 and 1,550 graduates per year through 2030. The existing capacity at the state's post-secondary institutions falls below the lower bound of this estimate; therefore, the nursing program is categorized as undersupplied.

The general program entitled health science, other is the fifth largest program among Montana post-secondary institutions, producing an average of 340 graduates per year. About one-third (36%) of graduates from this program hold a degree in treatment therapy. **Figure 2.8** provides a supply and demand analysis for the detailed programs within health science.

FIGURE 2.8

Supply and Demand Analysis for Select Detailed Health Science Programs

(All Occupations)



Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from IPEDS and RAPIDS. Demand is sum of occupation demand historically filled by graduates from the program according to 2015-2019 ACS IPUMS micro data.

Treatment therapy professionals is the largest program within health science, other. The program produces over 120 graduates per year, which falls within the estimated demand of 100 and 180 workers per year. Most of the demand for treatment therapy professional comes from the demand for physical therapy. Between 60 and 90 physical therapy openings are projected each year through 2030. However, only an average of 44 student



graduate in with a Doctorate of Physical Therapy (DPT) each year, leaving the program undersupplied. The remaining programs within treatment therapy include mental health professions, such as mental health counselling, and marriage and family therapy.

The allied health diagnostic, intervention, and treatment (ALHT) program in **Figure 2.7** is also oversupplied. Montana post-secondary institutions produce an average of 90 ALHT graduates



EMT and Paramedic programs in the state are producing enough graduates to **meet workforce demand**.

annually, which exceeds the estimated workforce demand of between 30 to 60 graduates. Emergency medical technology (EMT/Paramedic) programs fall within this category and produce an average of

30 graduates per year. However, as shown in Figure 2, EMT graduates are not oversupplied. EMT programs in the state are producing enough graduates to meet and not exceed demand for EMTs and paramedics.

ALHT programs are categorized as oversupplied in **Figure 2.7** due to an oversupply of medical technologies and technician graduates. Medical technologies programs averages 63 graduates per year, including an average of 36 physician assistant (PA) graduates per year. MTLDI projects 67 annual openings for physician assistants per year through 2030. As many as 38 of these openings may need to be filled by PA graduates. Therefore, the physical assistant program is undersupplying estimated workforce demand.

Athletic training is also included in ALHT programs, averaging 18 graduates per year over the last four academic years. The average number of athletic training graduates exceeds estimated demand of seven job openings for athletic trainers per year.

The health tech and assistant program is the third largest health science program. Montana post-secondary institutions produce an average of 190 health tech and assistant graduates per year, but workforce demand is between 300 and 600 workers per year. The health tech/assistant program includes dental assistant, phlebotomy, veterinary assistant programs, and others. The supply and demand analysis for these detailed programs is found in **Figure 2.8**.

Most graduates within the health tech and assistant program graduate from medical assistant programs. Medical assistant programs average 90 graduates per year, which includes medical admin assistant (70), pharmacy technician (9), and physical therapy assistant (23) graduates. These programs are all undersupplied. The demand for medical admin assistant graduates is estimated to be between

Allied Health

- EMTs and Paramedics
- Physician Assistants
- Athletic Trainers

Health Science, Other

- Physical Therapy
- Public Health
- Speech Language Pathology
- Pre-Med

Health Tech/Assistant

- Medical Assistant
- Pharmacy Technician
- Physical Therapy Assistant
- Dental Assistant
- Veterinary Assistant
- Phlebotomy

Health & Medical Admin. Services

- Healthcare Office Management
- Healthcare Information Tech
- Medical Coding



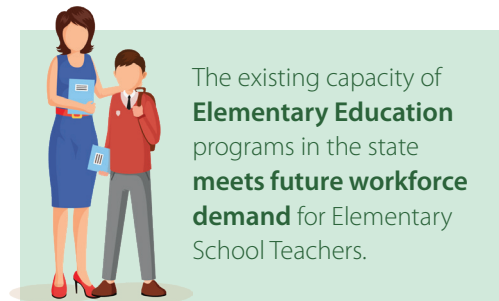
Medical Assistants, Pharmacy Technicians, and Physical Therapy Assistants are all **undersupplied** by Montana post-secondary institutions.

90 and 180 workers per year. MTDLI estimates 100 openings for pharmacy technicians and 70 physical therapy assistant per year through 2030, above the average number of graduates from these programs.

The health and medical administrative services program is the fourth largest health science program shown in **Figure 2.7**. Health and medical administrative services includes healthcare office management, health care information technology, and medical coding programs in the state. These programs have produced an average of 160 graduates per year over the last four academic years. Annual workforce demand for the health and medical administrative services program is estimated between 360 and 650, outstripping existing supply.

2.2.2 Education Programs

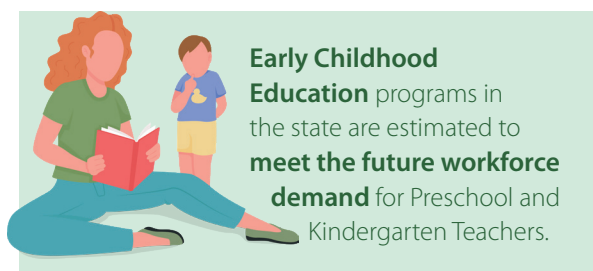
Montana post-secondary institutions graduate over 1,200 education students every year. Approximately 70% of these graduates are prepared to work in elementary or secondary education settings. Elementary education is the largest education program, averaging nearly 300 graduates annually, yet this program is not meeting workforce demand. Based on job projections and historical employment patterns, Montana's schools will need between 430 and 840 elementary education graduates every year to meet workforce demand. The results from this analysis are shown in **Figure 2.7**.



Part of the reason demand for elementary education graduates is so high relative to supply is because historically elementary education graduates have worked in a variety of occupations including preschool and kindergarten teachers, elementary and middle school teachers, high school teachers, librarians, teaching assistants, and special education teachers. Elementary education graduates also work outside of the education field as musicians, photographers, bartenders, fast food and counter workers, and waiters. A portion of estimated demand for all these occupations is attributed to the demand for elementary education graduates. For example, an estimated two percent of all fast food and counter workers hold a degree in elementary education. Therefore, two percent of the 2,400 annual job openings for fast food and counter workers is considered part of the demand for elementary education graduates.

While it is likely that a portion of elementary education graduates will continue to be hired in non-education related fields, perhaps due to changing career interests or inability to find employment in their preferred field, Montana post-secondary institutions are not expected to produce education graduates for the purposes of working in non-education related fields. **Figure 2.9** adjusts the demand for education programs to include only workforce demand stemming from education occupations that require some college education. The demand for elementary education graduates shown in **Figure 2.9** comes only from the estimated demand for elementary school teachers. According to this analysis, elementary ed programs in the state are producing enough graduates to meet future workforce demand for elementary school teachers.

Montana post-secondary institutions have produced an average of 95 early childhood education graduates per year over the last four academic years. Early childhood education (ECE) graduates have historically worked in mostly education-related occupations, primarily as preschool and kindergarten teachers. Childcare workers and home health aides are the two most common occupations for ECE



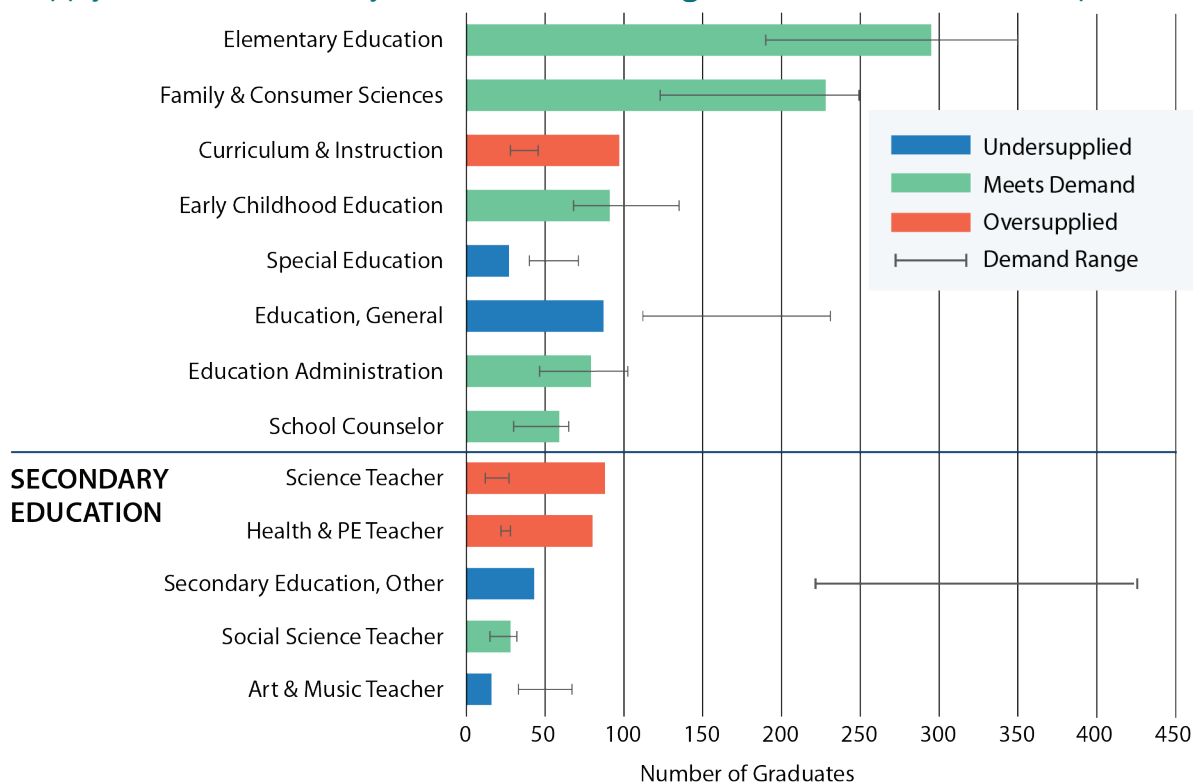
graduates outside of education fields. Even though many early childhood graduates work as preschool or kindergarten teachers, a higher percentage of preschool and kindergarten teachers report holding an elementary education degree than an ECE degree. As a result, a higher percentage of the demand for these teachers is attributed to elementary education than to the ECE program.

These factors contribute to a relatively low estimate of the demand for ECE graduates in **Figure 2.7** and a categorization of the ECE program as oversupplied.

Assuming instead that the early childhood education is the preferred training program for preschool and kindergarten teachers, **Figure 2.9** shows how the supply of ECE graduates compares to demand for these teaching occupations. MTDLI estimates there to be 135 annual job openings for preschool and kindergarten teachers through 2030. The demand on the post-secondary education system, specifically the ECE program, is between 70 and 135 graduates per year. Therefore, the existing capacity of ECE programs in Montana is estimated to meet the future workforce needs for Preschool and Kindergarten teachers in the state.

FIGURE 2.9

Supply and Demand Analysis for Education Programs from Education Occupations



Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from 2017 - 2020 IPEDS and RAPIDS.

Notes: Demand for School Counselor only coming from Education, guidance, career counselors and advisors (SOC 211012). Demand for Early Childhood Education only coming from Kindergarten and Preschool Teachers (SOC 252011 - 252012). Demand for Elementary Education only coming from Elementary School Teachers, except Special Ed (SOC 252021). Demand for Special Education only coming from Special Education Teachers (SOC 252051 - 252059). Demand for Education Administrators only coming from Education Administrator (SOC 119031 - 119039). Demand for remaining programs only includes occupations where graduates have historically worked that also requiring some college education.

Secondary education programs produce approximately 250 graduates per year, including art and music, science, social science, and health and physical education (PE) teachers. These graduates go on to work in a variety of different careers, many of which do not require a college degree or are not in an education-related field. To adjust for these discrepancies, **Figure 2.9** shows the estimated demand for these programs stemming only from occupations historically filled by secondary education graduates and requiring at least some college education.

Demand for secondary education programs is lower when non-college occupation demand is excluded. Despite the reduction in demand, art and music teachers are still categorized as undersupplied in **Figure 2.9**, as are graduates from secondary education, other. The demand for social science teachers falls enough to categorize the program as meeting workforce demand. However, health and PE teachers, and science teacher programs are oversupplying workforce demand when considering only demand from occupations requiring some college education.

The remaining oversupplied education program in **Figure 2.9** is curriculum and instruction. This program produces almost 100 graduates per year, many of whom work in occupations that do not require a college degree or in occupations outside of education. As a result, the demand for curriculum and instruction graduates presented in **Figure 2.7** includes demand from many occupations that do not require a college degree. The curriculum and Instruction program primarily trains graduates to work as instructional coordinators. There are only about 23 job openings per year for this occupation, well below the number of curriculum and instruction graduates. Therefore, the analysis presented in **Figure 2.9** categorizes the program as oversupplied.

Family and consumer science is the second largest education program among Montana post-secondary institutions, producing an average of 230 graduates per year over the last four academic years. Most graduates from the family and consumer science program hold a degree in health and human development, community health, or food and nutrition. Childcare provider apprenticeship completers are included in this program as well, although the childcare apprenticeship program has only averaged four completers per year over the last four years.

The demand for family and consumer science graduates is between 430 and 840 graduates per year, which is due in large part to the demand for childcare workers. A total of 720 annual job openings for childcare workers is expected through 2030. According to historical employment patterns, over 80% of childcare workers hold a family and consumer science degree. Assuming these employment patterns continue, the family and consumer science program is not estimated to meet workforce demand, as shown in **Figure 2.7**.

Family and consumer science graduates also work as marriage and family therapists, child, family, and school social workers, mental health counselors, education advisors and career counselors, librarians, and elementary and middle school teachers. **Figure 2.9** considers demand from only these occupations, and others requiring some college education.

Childcare workers do not require college and are excluded from the analysis in **Figure 2.9**. Demand for the family and consumer science program presented in **Figure 2.9** is estimated to be between 140

The Family & Consumer Science program is in high demand due to the high demand for childcare workers, many of whom hold a degree in family and consumer science. The program is **undersupplied** relative to workforce demand across all occupations, including **childcare workers**.



and 270 graduates per year. Therefore, the program is categorized as meeting workforce demand for occupations requiring some college education. However, to the extent that the family and consumer science program is also needed to help meet the demand for childcare workers, then the program may still be considered undersupplied.

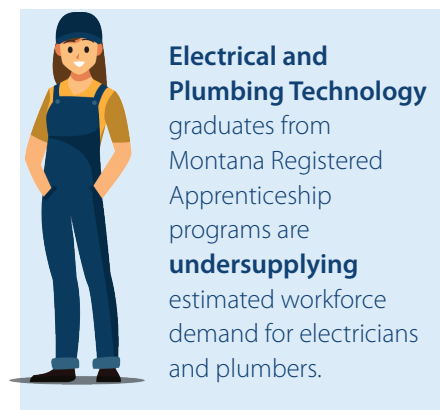
2.2.3 Construction, Mechanic, and Transportation Programs

Construction, mechanic, and transportation program graduates make up a smaller pool of students from Montana post-secondary institutions, graduating around 780 students per year. However, these programs provide an important source of workforce supply for several trade-related occupations. For example, electricians and plumbers are required to complete a registered apprenticeship to obtain a license. Therefore, Montana Registered Apprenticeship is the primary source of electricians and plumbers in the state.

The supply and demand analysis presented in [Figure 2.7](#) matches the supply of graduates from these programs to estimated workforce demand based on historical employment patterns of individuals holding a degree in construction, mechanic, and transportation programs. Graduates from these programs work as carpenters, construction managers, plumbers, electricians, pilots, machinists, automotive mechanics, and in other trades-related occupations. There are also a few graduates working in careers outside of their field of study, or in occupations that do not require a post-secondary education. For example, there is a small percentage of construction graduates working as construction laborers, construction and building inspectors, janitors, and retail salespersons, which does not require a post-secondary certificate or degree.

[Figure 2.10](#) provides an alternative measure of workforce demand for construction, mechanic, and transportation programs including only demand from occupations directly related to the program that require some post-secondary education. The supply and demand analysis presented in [Figure 2.10](#) also includes more detailed programs within transportation science and electrical, mechanical, and precision technology programs.

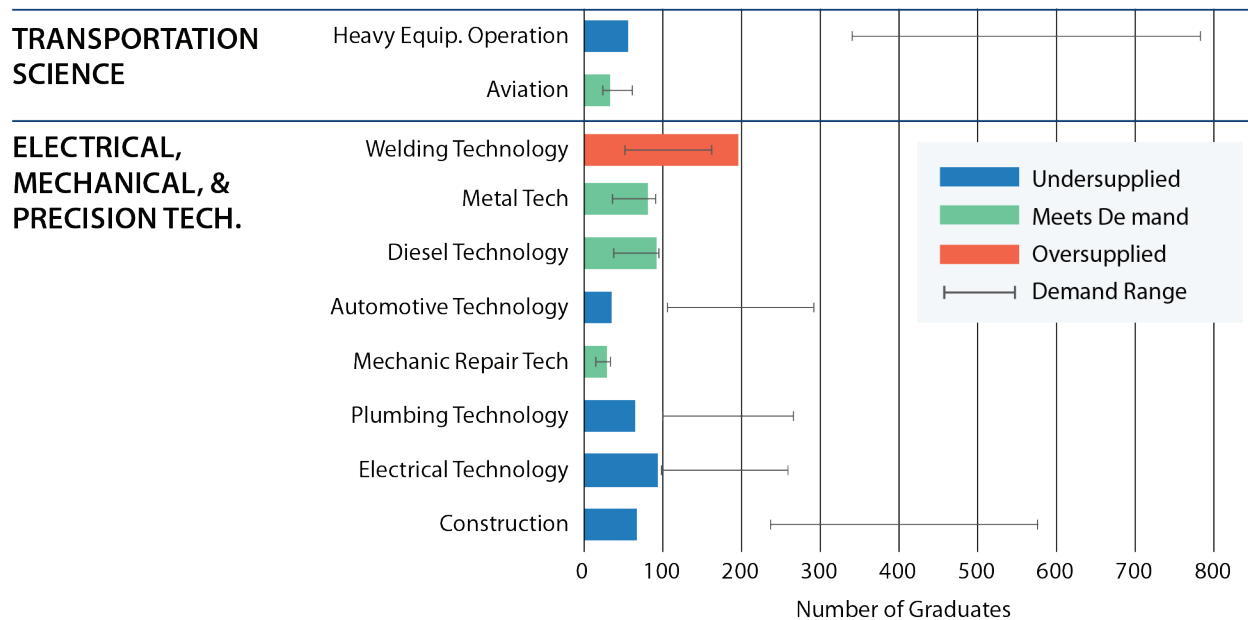
There have been an average of 88 electrical technology apprenticeship completers per year over the last four years. Additionally, the Montana Registered Apprenticeship program provides an average of 65 plumbing technology graduates per year. These programs are the largest among Montana Registered Apprenticeship and critical source of supply for electricians and plumbers in the state. MTDLI estimates between 110 and 290 apprenticeship completers are demanded in each program per year through 2030. Based on these projections, both the electrical technology and plumbing technology programs are undersupplying future workforce demand.



Construction is another undersupplied program offered by Montana post-secondary institutions. An average of 67 students per year graduate with a degree in construction. Most of these students find a career in carpentry, or in other construction-related occupations. The demand for construction graduate is generated primarily from the demand for carpenters. Roughly 90% of carpenters have some training in construction, and 670 carpenter job openings are expected each year. The demand for construction is estimated to be between 210 and 580 graduates per year, which is well above the average supply.

FIGURE 2.10

Supply and Demand Analysis for Detailed Construction Programs from Related Occupations



Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from 2017 - 2020 IPEDS and RAPIDS.

Notes: Automotive Technology demand comes from Automotive Service Technicians and Mechanics (49-3023). Diesel Technology demand comes from Bus and Truck Mechanics and Diesel Engine Specialists (49-3031). Aviation demand includes Airline Pilots (53-2011) and Aircraft Mechanics and Service Technicians (49-3011). Welding Technology demand comes only from Welding, Soldering and Brazing Workers (51-4120). Metal Tech demand comes from Sheet Metal Workers (47-2211) and Machinists (51-4041). Demand for Mechanic Repair Tech comes from Maintenance and Repair Workers (49-9071) and Other installation and repair workers (49-9000).

Welding technology is the largest trade-related program at Montana post-secondary institutions, averaging nearly 200 graduates per year. The analysis presented in [Figure 2.10](#) compare the supply and demand for for welders, soldering, and brazing workers in Montana. There is estimated to be about 170 job openings for welders annually through 2030. While most welders hold a degree in welding technology, not all of these openings are expected to be filled by programs in Montana. The demand for welding technology is estimated to be between 60 and 170 graduates per year. As a result, the welding technology program is categorized as oversupplied relative to estimated workforce demand.

The number of **Welding Technology** graduates surpasses estimated demand for Welders in Montana. Therefore, the program is categorized as **oversupplied**.



The demand for graduates from heavy equipment operation is the highest among all construction, mechanic, and transportation programs.¹⁹ Heavy equipment operators receive a Commercial Drivers License (CDL) as part of their program. A CDL is the primary education requirement for heavy tractor-trailer truck drivers, which is a very-high demand occupation in the state. Approximately 780 annual job openings for truck drivers are not adequately supplied by the 56 heavy equipment operation graduates per year. However, the supply of truck drivers is understated in this analysis because individuals can receive a CDL outside of the post-secondary education system.



Heavy Equipment Operation

programs undersupply demand for heavy tractor-trailer truck drivers. However, additional supply comes from outside the post-secondary education system.

Automotive technology is the final undersupplied construction, mechanic, and transportation program. Over the last four academic years, colleges have produced an average of 35 automotive technology graduates per year, much less than the 100 and 290 automotive service technicians needed each year. Existing program capacity falls well below estimated workforce demand.

The remaining programs in aviation, metal technology, diesel technology, and mechanic repair technology are all estimated to meet future workforce demand. Demand for these programs is generated from occupations directly related to the program, including pilots, machinists, sheet metal workers, diesel engine mechanics, and maintenance and repair workers. To the extent that graduates from these programs are needed to fill demand for additional occupations, then existing program capacity may be insufficient.

2.2.4 Science, Technology, Engineering, and Mathematics (STEM) Programs

Montana post-secondary institutions offer a wide variety of programs in science, technology, engineering, and mathematics (STEM). STEM programs focus on the development of technical skills and are often associated with work in a specific field. Approximately 2,700 students graduate from STEM programs at Montana post-secondary institutions every year, including graduates in agriculture, architecture, computer science, engineering, and physical sciences.

Graduates from these programs work in a variety of different occupations. For example, historical employment patterns suggest biology graduates work as biological life scientists and biological technicians, and in careers outside of biology as physicians, surgeons, and dentists. Graduates in mathematics and data science have gone on to pursue careers as computer programmers, accountants, insurance underwriters, and operations research analysts. Since graduates from these programs work in several different jobs, the demand for these programs comes from a variety of occupations. **Figure 2.11** shows the supply and demand analysis for all STEM occupations, considering demand generated by any occupation that has employed graduates from the programs.

All the programs in agriculture, architecture, physical science, and computer and information science are either meeting or undersupplying workforce demand. The largest program among these is the natural resource conservation and management program, which graduates 280 students per year. Demand for this program is approximately 190 and 440 students per year, suggesting existing capacity is sufficient to meet workforce demand. According to this analysis, the STEM programs that are the most significantly undersupplied include agriculture, biology, physical science, geology, and forestry. Only mechanical engineering, chemical engineering, and petroleum engineering programs are oversupplied.

FIGURE 2.11**Supply and Demand Analysis for STEM Programs (All Occupations)**

Category	Program	GAP Analysis	Grads	Min	Max
Ag, Natural Resource and Conservation	Agriculture	Under	176	193	408
	Plant Science	Under	41	58	136
	Natural Resource Conserv & Mgmt	Meets	282	190	438
	Forestry	Under	34	72	165
Architecture	Architecture	Under	70	77	171
Computer and Info Science	Computer and Information Systems	Meets	71	34	78
	Computer Science	Meets	161	84	195
	Network Technology	Meets	129	78	195
Engineering	Mechanical Engineering	Over	223	95	214
	Engineering, General	Meets	109	103	224
	Chemical Engineering	Over	103	39	83
	Civil Engineering	Meets	123	62	145
	Electrical and Electronics Engineering	Under	70	75	167
	Environmental Engineering	Meets	22	15	35
	Petroleum Engineering	Over	71	2	5
	Industrial Engineering	Under	29	38	83
	Geological/ Mining Engineering	Meets	30	13	31
	Engineering Technologies, Other	Meets	127	74	177
	Mechanical Engineering Technology	Over	51	14	31
Physical Science	Physical Science, Other	Under	62	121	255
	Biology	Under	258	356	733
	Cell Biology	Meets	71	52	121
	Microbiology	Meets	74	39	74
	Mathematics and Data Science	Meets	121	118	241
	Chemistry	Under	64	76	161
	Geology	Under	91	158	335
	Physics	Meets	42	29	64

Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from IPEDS and RAPIDS. Demand is sum of occupation demand historically filled by graduates from the program according to 2015-2019 ACS IPUMS micro data.

Excluding non-college occupations from demand causes the biggest drop in demand for programs where:

1. Graduates from the program often work in occupations that do not require a college education.

OR

2. The program trains graduates to work in college-level occupations that can be filled by graduates from a variety of different programs.

While many STEM program graduates work in occupations within their field of study, there are also some who are underemployed – working as janitors, bookkeepers, retail salespersons, or cashiers. To control for those working in lower skill fields, **Figure 2.12** provides a supply and demand analysis for STEM programs based only on the demand from occupations that require at least some post-secondary education. Comparing this analysis to the analysis across all occupations reveals notable differences. Most programs are estimated to be oversupplying workforce demand, and just one program remains undersupplied – computer and information systems.

Technology and Engineering

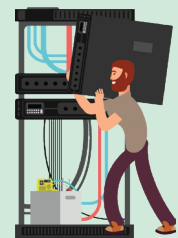


Computer and Information Systems programs in Montana are **undersupplying** estimated demand for computer user support specialists.

An average of 70 computer and information system students graduate per year from Montana colleges, compared to between 80 and 200 job openings for computer user support specialists. Assuming computer and information system graduates are best suited to fill these openings, the program is estimated to be undersupplying workforce demand.

The demand for computer and information science programs in **Figure 2.12** comes only from the estimated number of job openings in computer and mathematical occupations, which includes computer programmers, database administrators, computer network support specialists, and software developers. The computer science program is still estimated to meet and not exceed workforce demand when it is limited to these occupations. However, network technology is categorized as oversupplied. The program averages about 130 graduates per year, compared to demand of 100 openings from network and computer systems administrators, computer network architects, and computer network support specialists.

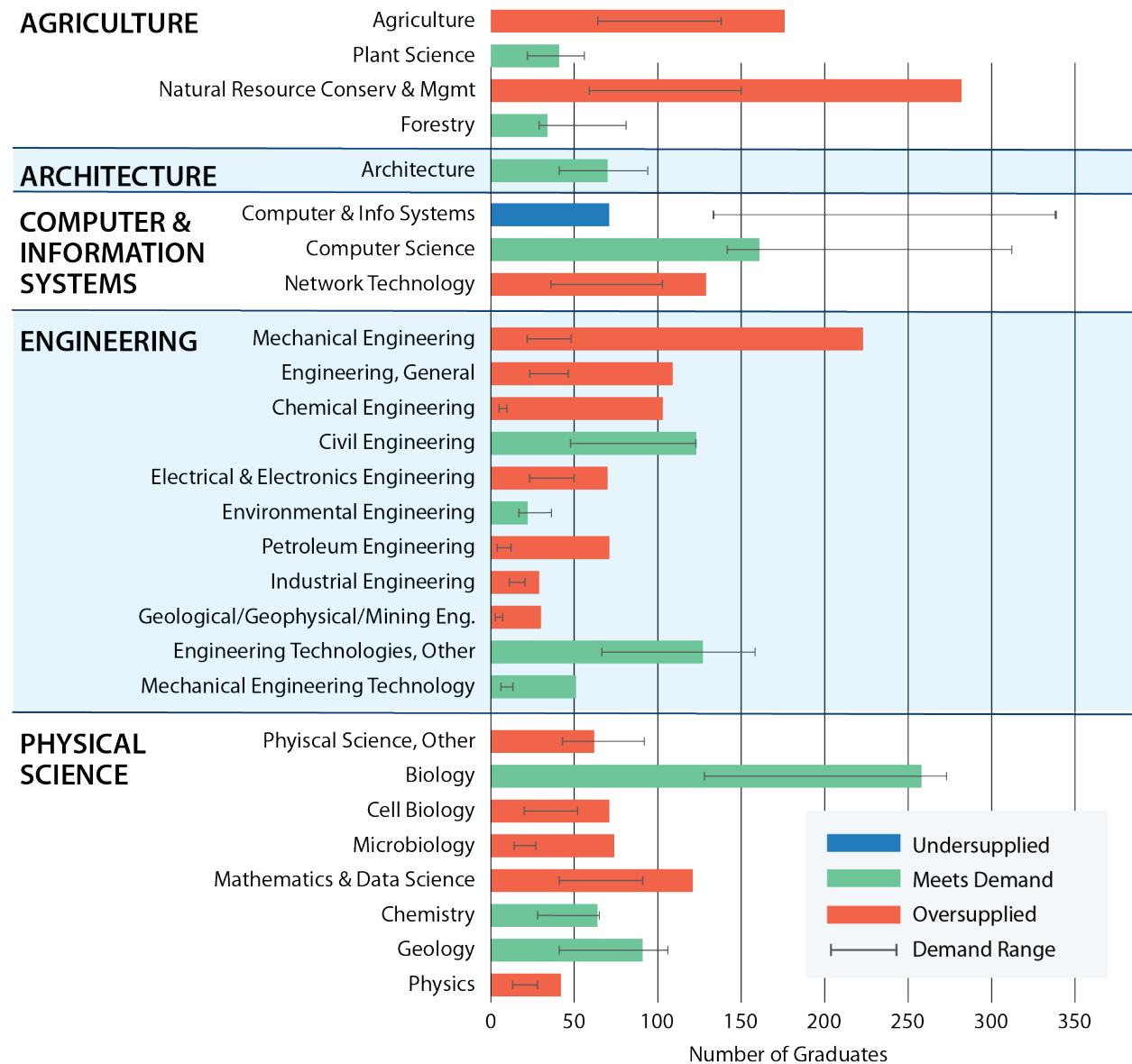
Computer Science programs in Montana are **meeting demand** for computer programmers, software developers, and other computer and mathematical occupations.



Engineering programs are estimated to either **meet** or **exceed** estimated workforce demand for engineers in Montana.

Engineering programs in Montana produce about 960 graduates per year in a variety of fields. While engineering graduates work in several occupations, some programs train students to work in a particular occupation. Chemical, Civil, Environmental, Industrial, Petroleum, Mechanical, Geological, and Industrial engineering programs train graduates to work in those specific fields. **Figure 2.12**

considers only job openings from those engineering occupations as part of the demand for graduates from the programs. While engineering graduates are ultimately hired in a variety of jobs, this analysis determines whether the programs are producing enough graduates in each field to meet the demand from the occupations the programs were designed to fill.

FIGURE 2.12**Supply and Demand Analysis for STEM programs (College Occupations)**

Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from 2017 - 2020 IPEDS and RAPIDS.

Notes: Program demand is derived from the demand for occupations requiring a college education that have also been held by graduates from the program. Demand for computer and information systems graduates comes from Computer and Mathematical occupations (SOC 15). The demand for chemical engineering graduates comes only from the demand for Chemical Engineers (17-2041). The demand for civil engineering graduates comes from the demand for Civil Engineers (17-2051). Electrical and Electronics Engineering graduate demand comes from projected job openings for Electrical (17-2071) and Electronics Engineers (17-2072). Petroleum, environment, and industrial engineering graduate demand is estimated as the demand for petroleum (17-2171), environmental (17-2081), and industrial (17-2112) engineers, respectively. Mining and Geological Engineers (17-2151) drives demand for geological engineering graduates.

All engineering programs in Montana are estimated to meet or exceed demand for engineers. Civil engineering is the program with the largest demand, with 123 annual job openings for civil engineers each year through 2030. Engineering technology programs are also in high demand, averaging between 70 and 160 job openings per year. Montana post-secondary institution capacity is estimated to meet this demand, producing 123 civil engineering and 127 engineering technology graduates per year.

Architecture is another STEM program that trains graduates to work in a specific occupation. Between 40 and 95 annual job openings for architects need to be filled, with roughly 70 architecture graduates per year. Therefore, the architecture program is estimated to meet workforce demand.

Science and Mathematics

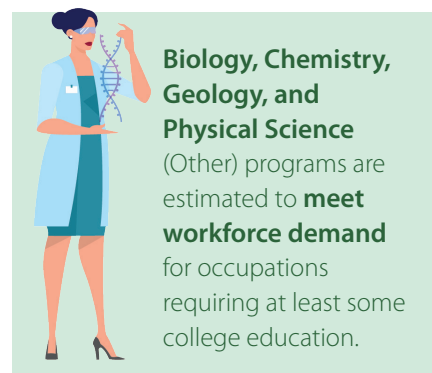
The Montana post-secondary education system graduates 1,300 science and mathematics graduates per year in a variety of programs, including biology, statistics, agriculture, forestry, geology, plant and animal science, and chemistry. Most of these programs provide graduates with a foundational



understanding of scientific and mathematic principles, which can be applied to a variety of different careers. For example, graduates from agriculture and natural resource programs work as conservation scientists, foresters, fish and game wardens, and agricultural and food scientists. Biology graduates often work as biologists and in healthcare occupations. Many mathematics students go on to work in finance, accounting, or technology-related fields.

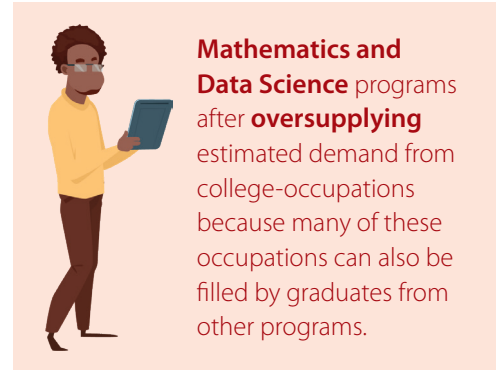
The supply and demand analysis for these programs changes slightly when considering only occupation requiring a college education as a part of demand. All science and mathematics programs are either meeting or exceeding demand in **Figure 2.12**. The most significantly oversupplied program is the natural resource conservation and management program. The demand for this program falls from 440 graduates per year to approximately 160 when considering only demand from occupations requiring college degrees. A drop in demand can occur because graduates from the program have historically been underemployed, or the programs leads to college occupations that can be filled by graduates from a variety of different programs. In the case of agriculture and natural resource, the demand for these occupations fell due to a high percentage of graduates working in occupations that have not required a college education.

Biology, chemistry, geology, and other physical science programs meet estimated workforce demand from occupations requiring a college education. However, they are undersupplying graduates when the demand from all occupations is considered. Depending on the assumed responsibility of the post-secondary education system to train graduates for occupations that do not require a college degree, these programs can either be seen as undersupplied or meeting workforce demand. Despite the undersupplied categorization in **Figure 2.12**, these programs are not identified as candidates for expansion because the demand



for non-college level occupation can presumably be filled most efficiently by training institutions outside of the post-secondary education system.

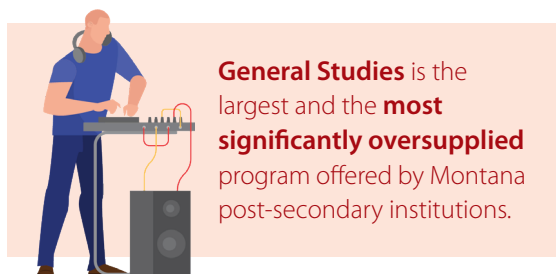
Mathematics and data science programs are categorized as oversupplied in the college-occupation analysis. Workforce demand for mathematics and data sciences programs is between 50 and 100 graduates annually from occupations that require at least some college. The drop in demand for this program between the supply and demand analysis across all occupations and only college-occupations is largely due to the types of college-level occupations mathematics and data science graduates have historically filled. Most graduates from these programs work in occupations requiring some level of college education. However, these occupations can also be filled by graduates from a variety of other programs. For example, mathematics graduates have worked as accountants and computer programs, which is demand that can also be filled by graduates from accounting and computer science programs.



2.2.5 Humanities Programs

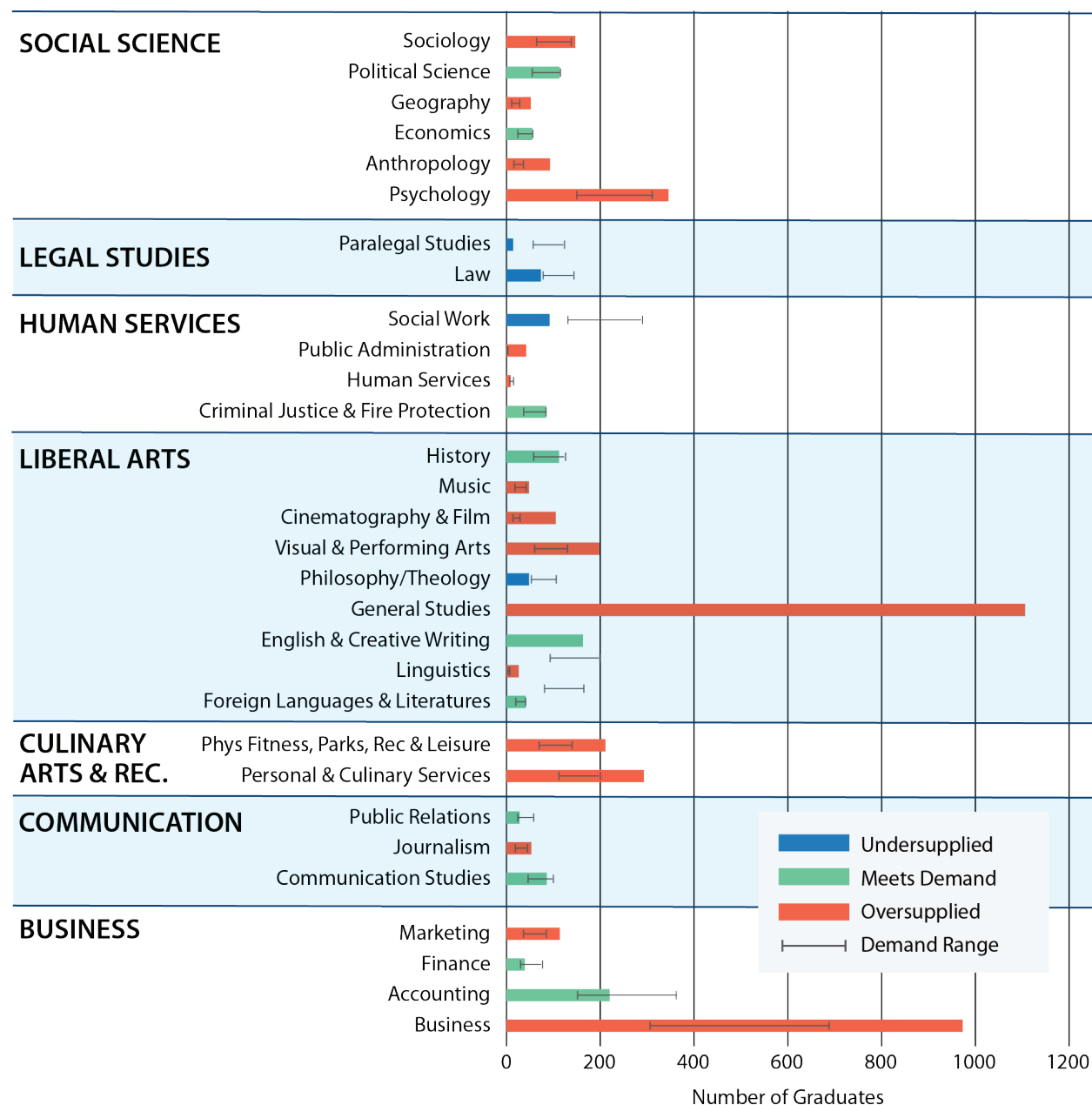
Approximately 5,000 people graduate from humanities programs each year, comprising 42% of all graduates from Montana post-secondary institutions. These graduates earn degrees in business, communications, liberal arts, legal professions, human services, and social science. Humanities programs prepare graduates to work in a variety of occupations, including lawyers, accountants, social workers, financial analysts, journalists, and economists.

The largest humanities program is general studies, which graduates approximately 1,100 students per year. This program provides a general education and offers many students the opportunity to graduate with a degree who have not met the requirements for a specific degree program. At two-year colleges, a degree in general studies can also serve as a transfer degree for students going on to pursue a bachelor's degree at a four-year college or university. Forty-one percent of general studies graduates with an associate degree go on to pursue higher education. While the program



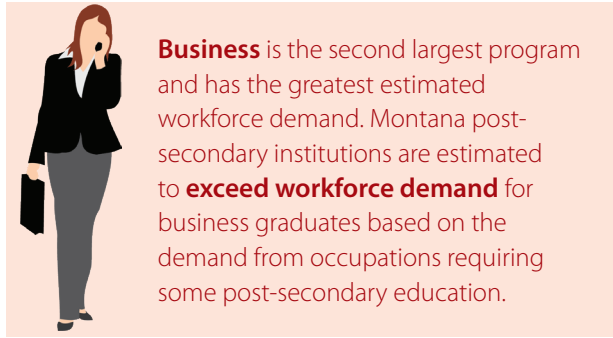
is not necessarily designed for direct entry into the workforce, there are most graduates from the program who do not continue their education and enter the labor market. Workforce demand for these graduates is relatively low compared to the size of the program. The general studies program is the most significantly oversupplied program among Montana post-secondary institutions.

Figure 2.13 shows the demand for humanities program graduates stemming from occupations requiring some college education compared to the number of graduates by program. The demand for general studies graduates ranges between 100 and 200 graduates per year from occupations requiring some post-secondary education.

FIGURE 2.13**Supply and Demand Analysis for Humanities Programs (College Occupations)**

Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from 2017 - 2020 IPEDS and RAPIDS.

Notes: Program demand is derived from the demand for occupations requiring a college education that have also been held by graduates from the program. Demand for Law comes from the demand for Lawyers (23-1011). Demand for paralegal studies comes from demand for paralegals (23-2011). Demand for personal and culinary services graduates comes from the demand for barbers (39-5011), hairdressers (39-5292), manicurists (39-5092), and skincare specialists (39-5094). Public Relations demand comes from demand for PR managers (11-2030) and specialists (27-3031). Criminal justice and fire protection demand comes from demand for firefighters (33-2011), fire inspectors (33-2021), and supervisors of firefighting and prevention workers (33-1021). Accounting demand comes from the demand for accountants (13-2011). Social Work demand comes from demand for child, family, and school (21-1021), healthcare (21-1022), mental health and substance abuse (21-1023), and other social workers (21-1029).



Business is the second largest program among graduates, with nearly 1,000 per year. Graduates from this program are work in a variety of occupations, including as tax examiners, credit analysts, personal financial advisors, insurance sales advisors, and others. Between 50% and 60% of the occupations held by business graduates require some type of college education. Demand from these occupations is estimated to be between 330 and 720 business graduates per

year. The existing capacity at the state's post-secondary institutions exceeds the upper bound of this estimate; therefore, the business program is categorized as oversupplying workforce demand across college-level occupations.

The most significantly undersupplied humanities program is social work. The total estimated demand for social workers ranges from 130 to 290 workers per year, which includes healthcare, mental health and substance abuse, child, family, and school social workers. An average of 92 people earn a degree in social work every year. Many of these graduates become social workers. However, there are also a number who work in other fields, perhaps due to low wages or changing interests. Assuming these employment patterns continue, the demand for social work graduates increases to between 180 and 400 students per year across all occupations. Existing capacity falls below the lower bound of demand; therefore, the social work program is categorized as undersupplied.



Law and paralegal studies are also categorized as undersupplied based on the demand for lawyers, and paralegals and legal assistants. The supply and demand analysis presented in [Figure 2.13](#) assumes that graduates in legal studies are best suited to fill the demand for these occupations, and therefore



considers all projected job openings for lawyers and paralegals as part of demand for legal studies. An average of 73 graduates earn a juris doctorate (JD) each year, compared to an estimated 80 to 140 job openings for lawyers per year. An additional 14 students graduate in paralegal studies per year, which falls below estimated demand of 60 to 120 paralegals annually.

2.3 Supply and Demand Analysis by Region

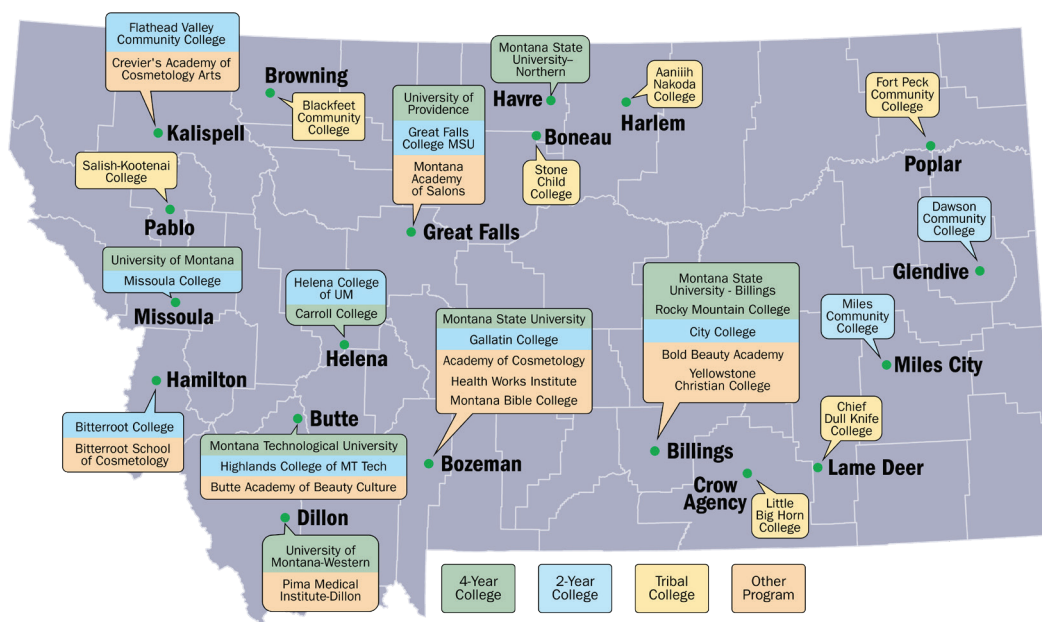
As a large state with a dispersed population, Montana's workforce development efforts must focus on ensuring our training system can produce enough workers to meet business needs in each region of the state. Montana's postsecondary education system has the capacity to meet statewide demand for several occupations requiring a college degree. However, there may still be areas of the state where it is difficult for employers to find qualified workers. Mismatches in the geographical distribution of the supply and demand of workers create labor market frictions, which can cause the unemployment rate to rise and hamper business productivity.

The geographical distribution of graduates will not perfectly match the distribution of workforce demand because businesses' workforce needs are always evolving, and colleges often develop specializations that lead to the concentration of programs in a particular region. However, identifying and resolving distribution mismatches that persist over time can be effective in improving the efficiency of the Montana labor market. The final research question of this report seeks to understand the contribution of colleges to their local region, to identify regional differences in the supply and demand of graduates, and to determine how graduate migration patterns help to fill those gaps.

2.3.1 Graduate Contribution to Regional Workforce

The post-secondary institutions included in this study are in every region of the state, as shown in **Figure 2.14**. The western regions produce the most graduates, primarily from the state's flagship universities in Missoula and Bozeman. The Southwest and Northwest regions are also projected to have the largest demand for workers. Employment in these regions is estimated to grow at 1.2% and 1.1%, respectively. South Central and North Central regions are both estimated to experience 1.0% employment growth over the next ten years. Employment in the Eastern region is estimated to grow the slowest, average 0.6% growth per year through 2030.

FIGURE 2.14
Montana Post-Secondary Institutions by Region



Post-secondary institutions in each region provide an important source of labor for local employers. Employers tend to hire workers from nearby institutions, and graduates tend to work in the region where they graduated. This is particularly true in the western regions, where employers have access to a large pool of local graduates from the state's flagship universities. Eighty-five percent of graduates working in the Southwest graduated in that region, and 79% of graduates working in the Northwest graduated from institutions in the region. The other regions of the state have a smaller local pool of graduates; therefore, more of their graduate workforce comes from other regions. **Figure 2.15** shows where graduates working in each region went to college.

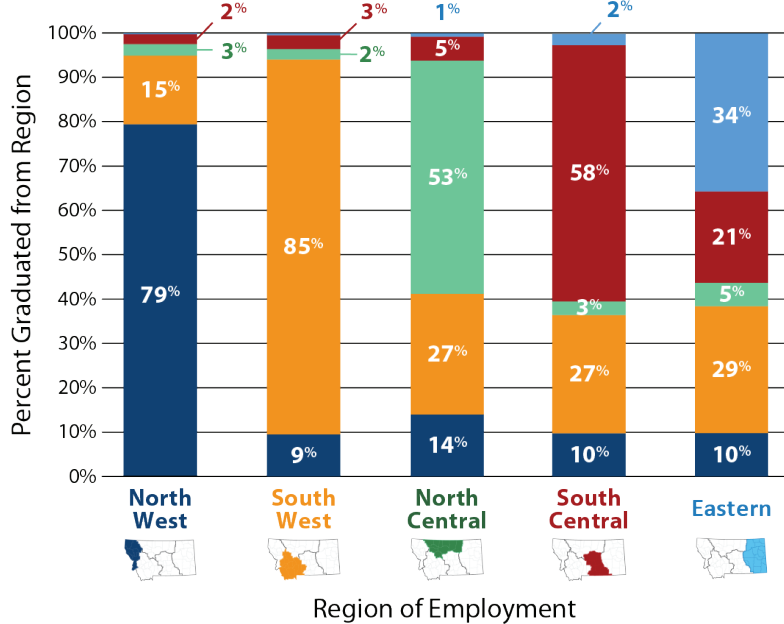
Most graduates who work in Montana find employment in the region where they graduated. **Figure 2.16** shows the migration of graduates by region one year after graduation. Higher retention of graduates in the local region suggests the colleges in that region meet local business needs.

The South Central region, where Billings is located, has the highest graduate retention. Forty-eight percent of graduates from that region remain there to work one year after graduation, and 78% remain in the state. The highest percentage of out-migration occurs in the Eastern region. Nearly a third of graduates from the Eastern region work there a year after graduation. An additional 10% of graduates move to the Billings area for work, and another 8% move to the other three regions of the state. Less than half of graduates from the Eastern region work for a Montana employer a year after graduation.

FIGURE 2.15

Where Did Graduates Working in Each Region Attend Training?

By Region of Employment One-Year after Graduation, 2010-2020

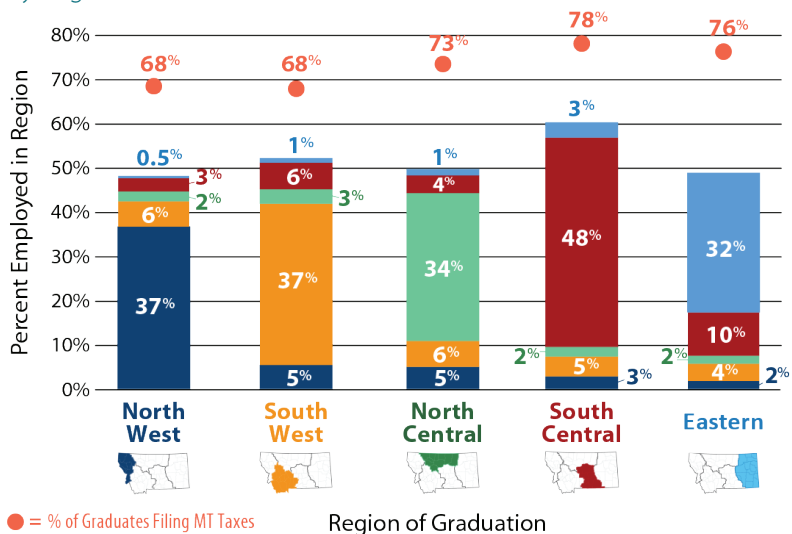


Source: MTDLI, OCHE, RMC, CC, UP, and apprenticeship graduate data wage match. Region 5 data not available before 2010.

FIGURE 2.16

Where Do Graduates Move One Year After Graduation?

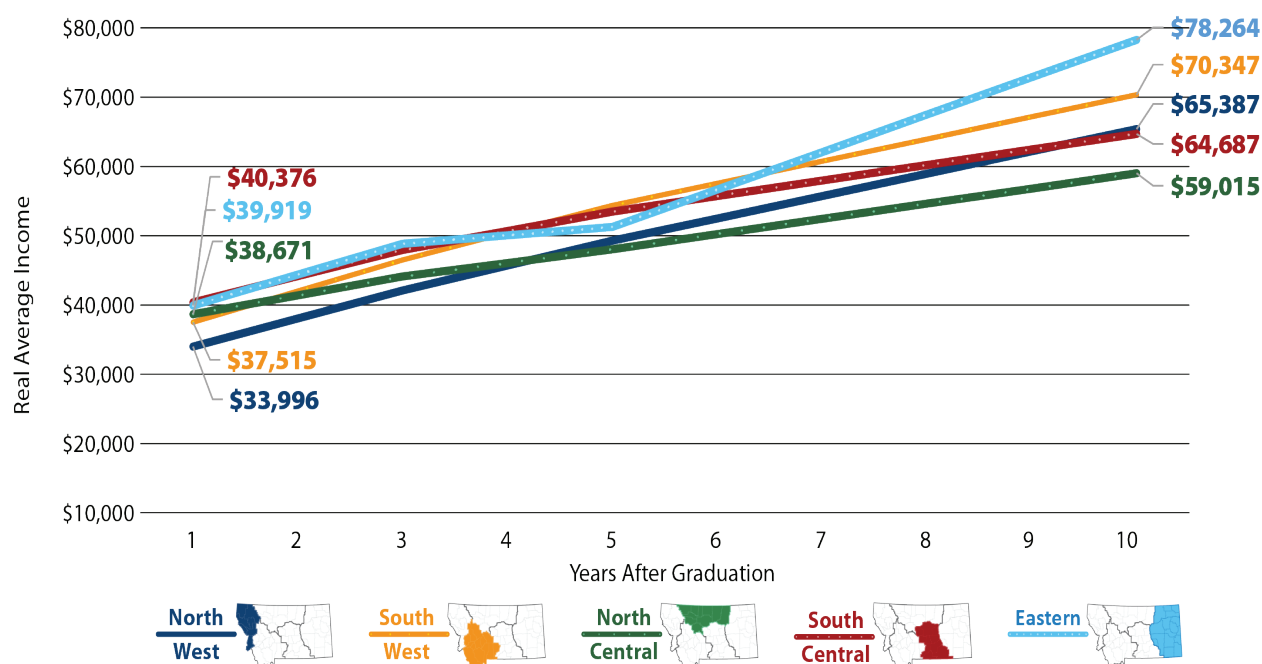
By Region of Graduation, 2001-2020



Source: MTDLI, OCHE, RMC, CC, UP, and apprenticeship graduate data wage match. Does not add to 100% because not all graduates enter the Montana workforce, and not all employers record their location. Region 5 data not available before 2010.

However, many are still living in Montana but self-employed or working for employers in other states. Seventy-six percent of graduates from the Eastern region file income taxes in Montana a year after graduation, which is the second highest retention rate among regions. Over half of graduates from every region remain in the state for work after graduation.

Graduates from the Eastern and North Central region report the highest income levels in the first few years after graduation. Income growth continues to accelerate for graduates from the Eastern region, reaching \$78,000 ten years after graduation. Southwest region graduates, primarily from Montana State University, report the next highest income levels in the long run. Ten years after graduation students from institutions in the Southwest region report an average income of \$70,000. Figure 2.17 shows the average income reported by graduates from each region in the ten years after graduation.

FIGURE 2.17**Real Average Income by Region**

Source: DOR, OCHE, RMC, CC, UP, and apprenticeship income data match summarized by MTDLI. Real income reported in 2021 dollars using the CPI-U.



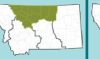


2.3.2 Regional Supply and Demand Analysis by Program

While colleges provide an important source of labor for local employers, the rural regions in Montana are less likely to have the necessary workforce to meet employer's needs. Figure 2.18 shows the supply and demand analysis by program in each of the five regions. Programs colored blue are undersupplying regional demand, green indicates the program meets regional demand, orange means over-supplied, and white indicates the program is not offered at colleges in the region. Program supply includes only graduates from post-secondary institutions in the region, and demand is measured using regional employment projections.

While Montana colleges have the capacity to meet statewide demand for most programs, there is more **significant unmet demand in the state's rural regions.**

The Northwest and Southwest regions have the greatest number of over-supplied programs because the state's flagship universities are in those regions, and the programs are designed to fill statewide demand. Nearly all programs offered at Montana post-secondary institutions are available in the western regions. Institutions in the South Central and North Central region also offer over half of all the post-secondary programs available in Montana. However, institutions in the rural Eastern region have more limited program offerings. Only 40% of programs are offered in East. Of these programs, only 22% are supplying enough graduates to meet regional employer demand. Employers in the Eastern will need to recruit workers from other regions of the state to fill their estimated workforce needs.

FIGURE 2.18**Regional Supply and Demand Analysis by Program**

Program Category	Program	North West 	South West 	North Central 	South Central 	Eastern 
Agriculture, Natural Resource and Conservation	Agriculture	Under	Meets	Meets	Under	Under
	Plant Science		Meets		Under	Under
	Natural Resource Conservation and Mgmt	Over	Meets	Under	Under	Under
	Forestry	Meets				
Architecture	Architecture		Over			
Business	Business	Meets	Meets	Under	Meets	Under
	Accounting	Meets	Meets	Meets	Under	Under
	Finance	Under	Under			
	Marketing	Meets	Meets		Under	Under
Communication	Communication Studies	Meets	Under		Under	
	Journalism	Over				
	Public Relations		Under		Over	
Computer and Info Science	Computer and Information Systems	Over	Under	Over	Under	Under
	Computer Science	Under	Over	Meets	Meets	Meets
	Network Technology	Over	Under	Under	Under	Under
Construction, Mechanic and Transportation	Construction	Under	Under	Under	Under	Under
	Electrical Technology	Under	Under	Under	Under	Under
	Plumbing Technology	Under	Under	Meets	Under	Under
	Electrical, Mechanical, and Precision Tech	Under	Meets	Meets	Under	Under
	Welding Technology	Meets	Over	Over	Meets	Under
Culinary Arts and Recreation	Transportation Sciences and Technologies	Over	Meets	Under	Over	Over
	Personal and Culinary Services	Over	Meets	Over	Over	
	Physical Fitness, Parks, Rec & Leisure	Meets	Under	Under	Meets	

Over

Oversupplied

Meets

Meets Demand

Under






Undersupplied

Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from IPEDS and RAPIDS. Demand is sum of occupation demand historically filled by graduates from the program according to 2015-2019 ACS IPUMS micro data.

Only graduates from institutions located in the region are included in supply.

(Table continues on the next page.)

FIGURE 2.18**Regional Supply and Demand Analysis by Program, Cont.**

Program Category	Program	North West 	South West 	North Central 	South Central 	Eastern 
Education	Education, General	Under	Under	Under	Under	Under
	Curriculum and Instruction	Over	Meets	Meets	Meets	Under
	Education Administration	Over	Over		Over	
	Special Education			Under	Over	
	School Counselor	Over	Under	Over	Over	
	Elementary Education	Under	Meets	Under	Under	Under
	Early Childhood Education	Meets	Over	Meets	Under	Meets
	Family and Consumer Science	Under	Over	Under	Under	Under
	Secondary Education, Other	Under	Under	Under	Under	
	Art and Music Teacher		Under		Under	
	Health and PE Teacher	Over	Under	Under	Under	
	Science Teacher		Over	Under	Under	
	Social Science Teacher		Meets		Under	
Engineering	Mechanical Engineering					
	Engineering, General	Under	Over	Under	Under	Under
	Chemical Engineering		Over			
	Civil Engineering		Over			
	Electrical and Electronics Engineering		Over			
	Environmental Engineering		Over			
	Petroleum Engineering		Over			
	Industrial Engineering		Over			
	Geological/Geophysical/Mining Engineering		Over			
	Engineering Technologies, Other	Under	Meets	Over	Meets	Meets
	Mechanical Engineering Technology		Over			
Liberal Arts	Foreign Languages and Literatures	Meets	Under		Under	Under
	Linguistics	Meets	Over			
	English and Creative Writing	Meets	Under	Under	Under	
	General Studies	Over	Over	Over	Over	Over
	Philosophy/Theology	Under	Under	Under	Under	
	Visual and Performing Arts	Meets	Meets	Under	Under	Under
	Cinematography and Film	Over	Over			
	Music	Over	Under		Under	Under
	History	Under	Under	Under	Under	

Over

Oversupplied

Meets

Meets Demand






Under

Undersupplied

Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from IPEDS and RAPIDS. Demand is sum of occupation demand historically filled by graduates from the program according to 2015-2019 ACS IPUMS micro data. Only graduates from institutions located in the region are included in supply.

(Table continues on the next page.)

FIGURE 2.18**Regional Supply and Demand Analysis by Program, Cont.**

Program Category	Program	North West 	South West 	North Central 	South Central 	Eastern 
Health Professions	Health Science, Other	Meets	Over	Under	Under	Under
	Treatment Therapy Professionals	Over	Under	Under	Over	
	Dental Hygiene			Over		
	Health and Medical Administrative Services	Under	Under	Meets	Under	Under
	Allied Health Dx, Intervention, Treatment	Over			Over	
	Emergency Medical Technology	Under		Over	Over	
	Respiratory Care	Over		Over		
	Surgical Technology	Over		Over		
	Radiologic Technology	Over	Over		Over	
	Health Tech/ Assistant	Under	Under	Over	Under	Under
	Phlebotomy			Meets		Over
	Dental Assistant	Meets		Meets		
	Veterinary Assistant		Over			
	Substance Abuse/Addiction Counseling	Under		Meets	Under	Over
	Pharmacy	Over	Over			
	Nursing	Under	Over	Over	Under	Under
Human Services	Criminal Justice and Fire Protection	Under	Under	Over	Meets	Under
	Human Services	Under		Meets	Meets	Meets
	Public Administration	Over	Over		Under	
	Social Work	Over		Under		Under
Legal Professions	Law	Over				
	Paralegal Studies	Under		Meets		
Physical Science	Physical Science, Other	Under	Under	Under	Under	
	Biology	Under	Meets	Under	Under	Under
	Cell Biology	Under	Over	Under		
	Microbiology	Under	Over		Under	
	Mathematics and Data Science	Under	Meets	Under	Under	
	Chemistry	Under	Meets	Under	Under	
	Geology	Under	Meets	Under	Under	
Social Science	Physics	Meets	Over		Under	
	Psychology	Meets	Meets	Under	Under	Under
	Anthropology	Over	Under			
	Economics	Under	Meets			
	Geography	Over		Under	Under	
	Political Science	Meets	Meets		Under	
	Sociology	Under	Under	Under	Under	

Over

Oversupplied

Meets

Meets Demand

Under

Undersupplied

Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from IPEDS and RAPIDS. Demand is sum of occupation demand historically filled by graduates from the program according to 2015-2019 ACS IPUMS micro data. Only graduates from institutions located in the region are included in supply.

Several programs are only offered in a few regions. Nearly all engineering and architecture graduates come from the Southwest region, primarily from Montana State University. Similarly, all law and physical therapy graduates come from the University of Montana in the Northwest region. The North Central region is home to the only Dental Hygiene program in the state. Centralized programs are designed to fill statewide workforce demand, and therefore should not be compared to regional demand as shown in **Figure 2.18**. However, the regional analysis is still useful for centralized programs because it highlights the geographical distribution mismatch in supply and demand. Graduates from centralized programs must be willing to move to other areas of the state to meet workforce demand in those areas.

While Montana post-secondary institutions have the capacity to meet statewide demand for most programs, there are geographic mismatches in supply and demand that make it difficult for employers to find graduates. For example, Montana colleges have the capacity to meet projected demand for nurses, but the regional analysis shows the Northwest, South Central, and Eastern regions are undersupplied. Nursing graduates from colleges in the Southwest and North Central regions will need to move to the undersupplied regions so that healthcare providers across Montana have access to the nursing workforce they need.

The general studies program is the only program that is consistently oversupplied in every region of the state. Colleges across the Montana may need to consider whether existing capacity for the general studies program is appropriate given employer demand levels.

The regional supply and demand analysis also helps identify the most appropriate location for program expansion among those programs identified as undersupplied at the state-level. For example, electrical technology and plumbing technology programs are undersupplied. The regional analysis suggests Montana Registered Apprenticeship may focus on expanding electrical and plumbing apprenticeship opportunities in the Northwest, South Central, and Eastern regions where the programs are the most significantly undersupplied. Construction program graduates are also undersupplied and could be expanded in every region of the state.

Social work is another statewide expansion candidate. Ninety-three percent of graduates in social work programs come from post-secondary institutions located in the Northwest region. These graduates are oversupplying regional demand but fall short of fulfilling statewide demand. Expansion of social work programs may look to focus on areas outside the Northwest to ensure Montana's in every region of the state have access to the services they need.

2.3.3 Regional Supply and Demand Analysis by Occupation

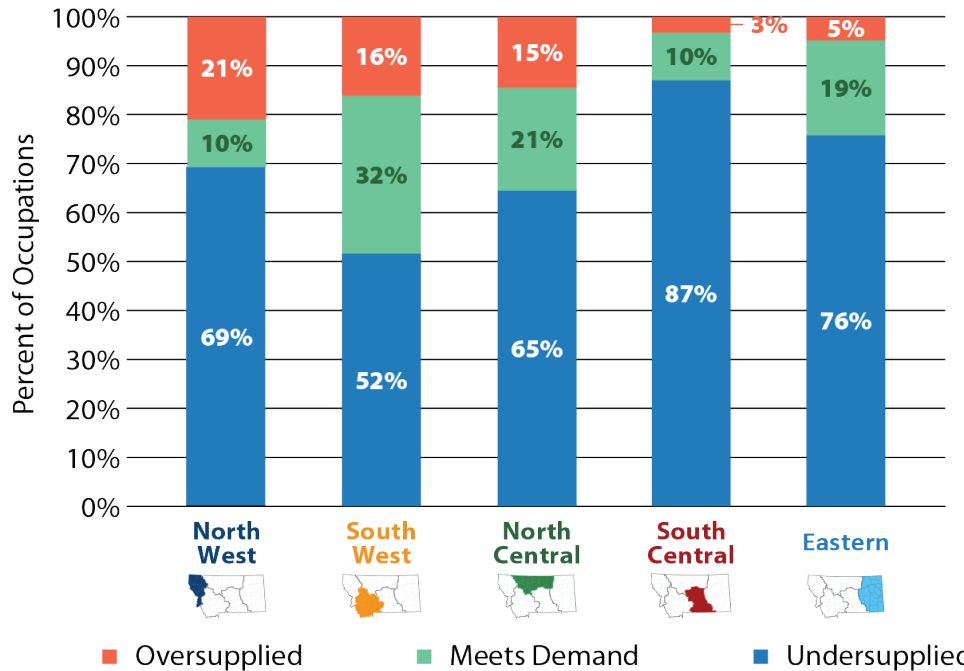
The occupational supply and demand analysis by region compares the supply of graduates from colleges in each region to the estimated worker demand in the region. The analysis focuses on high-demand occupations requiring post-secondary education, defined as the occupations in the top 25th percentile for total openings across the state. Supply is calculated as the number of graduates from colleges in each region who are trained to work in the occupation.

While 62% of high-demand occupations are undersupplied at the statewide level, the regional analysis by occupation shows post-secondary institutions meeting more workforce demand in the western and northern regions of the state. Institutions in the Eastern and South Central regions are undersupplying more than three-quarters of high-demand occupations in their regions. Approximately 76% of the

high-demand occupations in the Eastern region and 87% of high-demand occupations in the South Central region are undersupplied by post-secondary institutions in area. **Figure 2.19** shows the percentage of high-demand occupations that fall into each supply and demand category by region.

FIGURE 2.19

High-Demand Occupational Supply and Demand Analysis by Region



Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from 2017 - 2020 IPEDS and RAPIDS.






While most of the unmet demand is in the east and central regions of Montana, the regional supply of post-secondary graduates is insufficient in every region to meet all the workforce demand. Institutions in the Southwest have the most capacity, meeting demand for 48% of high-demand occupations. However, it should not be expected that colleges in each region would be able to produce the exact number of graduates needed by local businesses every year. Colleges can more efficiently serve the state economy by developing specializations. If employers can attract graduates from other regions to help fill demand, then post-secondary institutions should not be expected to meet demand for every occupation in their region. The mobility of the graduate workforce is critical to ensuring employers in all regions of the state have access to the workforce they need.

The mobility of the graduate workforce is critical to ensuring employers in all regions of the state have access to the workforce they need.

Despite a significant number of undersupplied high-demand occupation in every region, not all of these occupations require institutions in the region to develop new programs or expand existing programs to meet workforce demand. **Figure 2.20** shows a list of high-demand occupations requiring some post-secondary education that are consistently undersupplied across the state. To be listed in

Figure 2.20 the occupation must be undersupplied at the statewide level and statewide demand must exceed one hundred graduates per year. The figure also denotes the regions where the occupation is undersupplied and where regional demand for the occupation exceeds ten graduates per year. Post-secondary institutions in these regions may consider developing a new program or expanding an existing program to meet local workforce demand. If they do not, then employers may need to rely on graduates from outside the region to help fill demand.

FIGURE 2.20**Top Undersupplied Occupations by Region**

Occupation		Education	North West 	South West 	North Central 	South Central 	Eastern 
Very-High Demand	Bookkeeping, Accounting, & Auditing Clerks	SC ND	X	X	X	X	X
	Nursing Assistants	PS ND	X			X	X
	Carpenters	Apprenticeship	X	X	X	X	X
	General & Operations Managers	Bachelor's	X	X	X	X	
	Project Mgmt & Business Operations Specialists	Bachelor's	X	X	X	X	
	Electricians	Apprenticeship	X		X	X	
	Plumbers, Pipefitters, and Steamfitters	Apprenticeship	X	X		X	
	Coaches and Scouts	Bachelor's	X	X	X	X	
	Substance Abuse, Behavioral Disorder, and Mental Health Counselors	Bachelor's	X	X	X	X	
	Market Research Analysts	Bachelor's	X	X		X	
	Medical and Health Services Managers	Bachelor's			X	X	X
	Paralegals and Legal Assistants	Associate	X			X	
High Demand	LPN and LVN nurses	PS ND	X	X	X	X	
	Medical Assistants	PS ND	X	X		X	
	Dental Assistants	PS ND		X		X	
	Heating, AC, & Refrigeration Mechanics	PS ND		X			
	Buyers and Purchasing Agents	Bachelor's	X	X			
	Child, Family, and School Social Workers	Bachelor's	X	X		X	
	Construction Managers	Bachelor's	X			X	

Source: MTDLI 2020-2030 Occupational Employment projections. Graduate data from 2017 - 2020 IPEDS and RAPIDS. Occupations undersupplied in region and statewide. X denotes the occupation is undersupplied in the region and employer demand exceeds ten graduates per year over the next ten years. SC ND= some college, no degree. PS ND= Post-secondary non-degree award.

Bookkeepers and carpenters are two undersupplied occupations with significant demand in every region of the state to justify program development or expansion at post-secondary institutions. Workforce training for these occupations can be achieved through a Montana Registered Apprenticeship program or with some college education, but neither requires a college degree.

Program development or expansion may also be warranted in four of the state's five regions to train general operations managers, project managers, coaches, licensed practical nurses (LPNs), and substance abuse and mental health counselors. Apart from LPNs, all these occupations typically require a bachelor's degree.

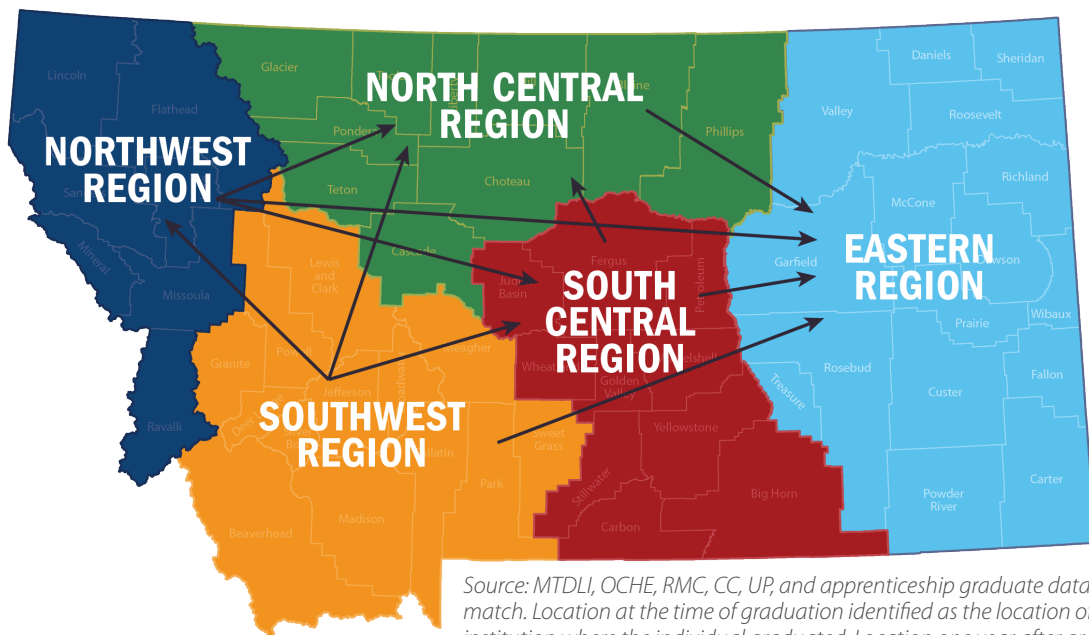
Understanding which regions have the greatest unmet demand for an occupation can assist post-secondary institutions in identifying areas for new program development or expansion. However, institutions should also seek feedback from employers in their community to confirm estimated demand and to determine whether in-migration has helped alleviate the workforce shortage for a particular occupation.

2.3.4 Graduate Migrations Helps Fill Regional Gaps in Supply and Demand

Graduate migration helps alleviate some of the regional discrepancies in worker supply and demand. The eastern and central regions of the state have more significant unmet demand than the western regions. Employers in the North Central, South Central, and Eastern regions rely on graduates from the west to help fill demand. As a result, students migrate after graduation from the more populated western regions into the areas where there is unmet demand. **Figure 2.21** illustrates the migration patterns of graduates a year after graduation. The Northwest and Southwest regions are net exporters of graduates, and the North Central, South Central, and Eastern regions are net importers.

FIGURE 2.21

Regional Net Migration of Graduates a Year after Graduation from 2010-2020

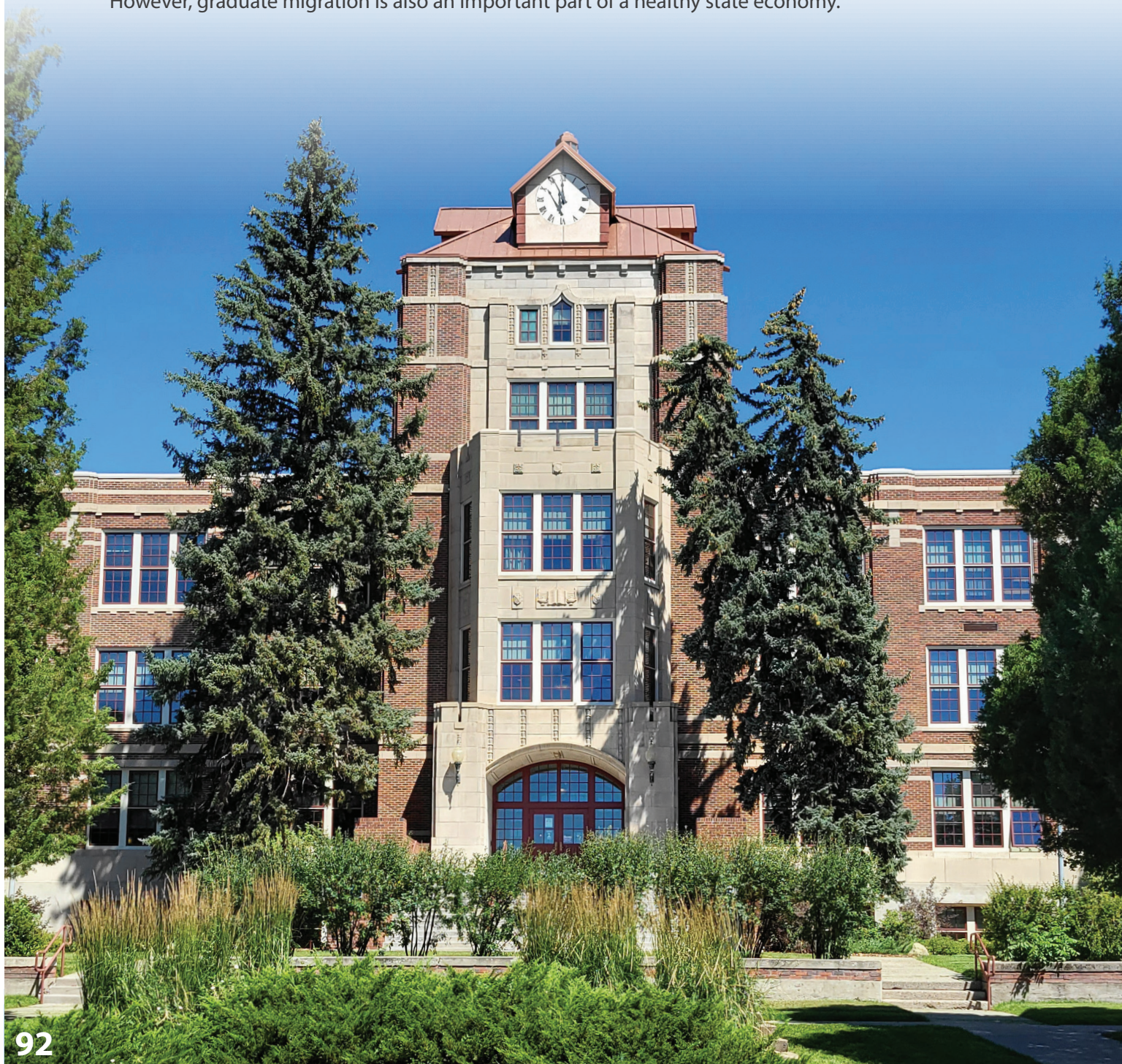


Source: MTDLI, OCHE, RMC, CC, UP, and apprenticeship graduate data wage match. Location at the time of graduation identified as the location of institution where the individual graduated. Location one year after graduation identified by the location of the graduate's primary employer. Arrow shows net migration between regions.

Despite the large number of workers demanded by employers in the west, the Southwest and Northwest regions are net exporters of graduates, meaning more graduates leave the region after graduation than come from other regions to work. The other three regions of Montana are net importers of graduates. These regions do not produce as many graduates, and graduates from the west migrate into these regions after graduation to help fill demand.

Of the net importing regions, the Eastern region appears to have the most unmet demand because employers in that region import graduates from every other region. The North Central region exports graduates to the Eastern region, but imports from the other three regions. The South Central region has the largest population base of all the net importing regions and seems to have the least unmet demand because the region exports graduates to both the North Central and Eastern regions.

Migration patterns provide insight into areas with unmet demand, as graduates are drawn to areas where employment opportunities are most attractive. In areas with substantial unmet demand, natural market forces should attract students into the region as limited worker supply puts upward pressure on wages. Graduates appear to be responding to these forces and moving to the areas with the greatest need. Post-secondary institutions are an important source of labor for local employers. However, graduate migration is also an important part of a healthy state economy.



Conclusion

The Montana post-secondary education system plays a key role in addressing the state's ongoing workforce shortage. Over 11,700 students graduate from 36 Montana post-secondary institutions per year, providing a critical source of labor supply to fill the state's estimated 16,800 annual job openings requiring some post-secondary education. After graduation, most students work in the state in their field of study, thus contributing to the Montana economy. On average, 69% of graduates were working in Montana making above the state entry-level wage one year after graduation. Graduates who worked year-round earned above the median wage after one year. Graduates work in every county in Montana, illustrating the importance of post-secondary education in workforce development efforts throughout the state.

Graduates from certificate, associate, and apprenticeship programs, and those with prior work experience are mostly likely to remain in the state after graduation. Programs with shorter training times and strong connections to the Montana labor market have the greatest retention rates of graduates within the state's labor market.

Graduates with higher education have higher income levels on average. The largest difference in income between degree types occurs between bachelor's and graduate degrees. There are minimal differences in earnings between bachelor's and associate degree holders in Montana immediately after graduation, but the returns to education vary by program. Bachelor's degree graduates have a greater long-run income potential – surpassing associate degree income three years after graduation.

Montana post-secondary institutions are undersupplying most of the high-demand occupations requiring post-secondary education, many of which are occupations in education, healthcare, and construction. Preschool, kindergarten, and secondary school teachers are in short supply. A limited supply of teachers at all levels of education has also impacted the available pool of substitute teachers. Expansion of early childhood education programs through secondary education may be needed to meet the state's need for high-quality educators in the state.

Expansion of programs to train high-level healthcare professionals may also be needed to meet future workforce demand. Physical therapy, physician assistant, nurse practitioner, and mental health social work programs are all candidates for expansion at Montana four-year post-secondary institutions. Social work and mental health providers are the most significantly undersupplied graduate-level professions. At two-year colleges, expansion candidates include a variety of healthcare programs – such as dental hygiene, nursing, and medical assisting programs. Construction programs are also undersupplied by two-year colleges and Montana Registered Apprenticeship. The workforce outcomes show students from these programs find employment quickly in Montana, supporting the conclusion that the programs are undersupplied and may be good candidates for expansion.

About 20% of programs were identified as over-supplied at the statewide level. The over-supplied programs in liberal arts, business, social science and physical science also have below average workforce outcomes, confirming the analysis. The most significantly over-supplied program in Montana is general studies. Despite minimal demand, colleges in Montana have produced an average of 1,100 general studies graduates over the last four academic years, making general studies the largest program among graduates. While the general studies program is designed as a transfer program and may meet demand from students who are unsure of their career interests, only 41% of students who graduate with an associate in general studies achieve a bachelor's degree or higher. Furthermore, only the general studies program is consistently oversupplying graduates in every region of the state. Colleges across Montana may need to consider whether existing capacity for the general studies program is appropriate given employer demand levels.

The regional supply and demand analysis shows more significant unmet demand in the south central and eastern regions. Institutions in the Eastern and South Central regions are undersupplying more than three-quarters of high-demand occupations in their regions. Most graduates come from the western regions and migrate into the rural areas with more unmet demand, helping to alleviate discrepancies between supply and demand in those regions. Labor force mobility is a critical element of ensuring all employers have access to a well-trained workforce. Graduate mobility allows for program specialization among colleges and improves the efficiency of post-secondary education in Montana.

As Montana faces a worker shortage, the post-secondary education system provides an important source of workforce supply. The information provided in this report indicates that Montana colleges are successful in meeting both student and employer needs but improvements could always be made. With insights provided in this report, the education and training systems in the state are better prepared to plan for the future and design strategies for continual improvement.



Appendix A: Methodology

A.1 Workforce Outcomes Methodology

To understand workforce outcomes for graduates of Montana's educational institutions, graduate data was matched to wage records collected through the mandatory reporting of payroll wages by employers to the Montana Department of Labor and Industry (MTDLI) for Unemployment Insurance (UI) program purposes. This research was governed by the security requirements outlined in the Memorandum of Understanding (MOU) between the MTDLI and the Office of the Commissioner of Higher Education (OCHE) to protect the confidentiality of the UI wage files and the privacy of graduates.

Additionally, individual graduate data was also matched to income tax records maintained by the Montana Department of Revenue (DOR) to capture additional sources of income besides wages. This match was governed by the security requirements outlined in the MOU between MTDLI and DOR to protect the confidentiality of income tax data and graduate information. Using both income tax data and wage records allowed for a more comprehensive understanding of the workforce outcomes of graduates. The data and methodology for the matches is outlined in the sections below.

A.1.1 Description of the Graduate Data

The data in this study considers graduates from all fifteen Montana University System (MUS) schools, as well as graduates from the state's three private four-year institutions – Carroll College, University of Providence, and Rocky Mountain College. Montana Registered Apprenticeship program completers are also included. The study includes 143,673 graduates over 19 academic years from 2001-02 to 2019-20. An academic year is from summer of a given year through spring of the following year. On average, there were approximately 8,620 graduates and 8,870 degrees awarded per year. **Figure A.1** highlights summary information on the graduate data.

FIGURE A.1

Summary Stats for Graduate Data

Number of Graduates	143,673
Average Graduates Per Year	8,620
Number of Degrees	168,536
Average Degrees Per Year	8,870
Number of Institutions	19
Number of Academic Years	19
Timeframe Provided	2001-02 to 2019-20
Percent Single Degree Holders	85%

Figure A.2 shows the number of graduates by educational institution. Montana's two flagship universities have the most graduates, with over 40,000 at each school over the last nineteen years. There are a total of nine four-year universities and nine two-year colleges included in these data. Most colleges are located in Montana's major cities – Billings, Missoula, Great Falls, Bozeman, Helena, Butte, and Kalispell. However, Dawson Community College, MSU-Northern, and UM-Western are located in more rural areas of the state.

The final educational institution considered in this report is Montana Registered Apprenticeship. There have been over 3,200 apprenticeship completers since 2001, averaging roughly 250 completers per year, similar to the number of graduates from Helena or City College. The registered apprenticeship program incorporates formal education with on-the-job training to prepare completers to work in a variety of occupations. Instead of providing training in a centralized building, apprentices are trained at employer sponsor locations throughout the state. Since 2000, 54 out of Montana's 56 counties have had at least one apprenticeship participant.²⁰

FIGURE A.2

Graduates by Educational Institution

Institution	Total Number of Graduates	3-Yr Annual Avg Number of Grads	First Academic Year of Grads	Type of College	Location
Apprenticeship	3,207	251	2001-02	NA	Statewide
Carroll College	4,898	284	2001-02	4-Year	Helena
City College	3,735	228	2001-02	2-Year	Billings
Dawson CC	605	62	2010-11	2-Year	Glendive
Flathead Valley CC	5,507	330	2001-02	2-Year	Kalispell
Gallatin College	841	158	2013-14	2-Year	Bozeman
Great Falls College	4,361	318	2001-02	2-Year	Great Falls
Helena College	3,305	216	2001-02	2-Year	Helena
Highlands College	1,628	97	2001-02	2-Year	Butte
MSU-Billings	11,009	546	2001-02	4-Year	Billings
MSU-Bozeman	43,128	3,032	2001-02	4-Year	Bozeman
MSU-Northern	4,764	225	2001-02	4-Year	Havre
MT-Tech	6,230	417	2001-02	4-Year	Butte
Miles CC	975	106	2010-11	2-Year	Miles City
Missoula College	5,648	361	2001-02	2-Year	Missoula
Providence	3,959	347	2001-02	4-Year	Great Falls
Rocky Mountain	3,771	233	2001-02	4-Year	Billings
UM-Missoula	40,261	2,117	2001-02	4-Year	Missoula
UM-Western	4,161	388	2001-02	4-Year	Dillon

Notes: Missoula College graduates include Bitterroot College. Total number of graduates at each college do not add up to total number of graduates because one graduate can earn degrees from multiple schools.

Not every educational institution in the state is included in the graduate workforce outcomes. There are some colleges that choose not to participate. Montana's seven tribal colleges are not included, as well as some private training institutions. Additionally, data limitations prevent Montana high school graduates from inclusion in the report. While the graduate data does not include every educational institution, the data does provide a good representation of the state's workforce training capacity.

A.1.2 Program Categorization

There were nearly 2,500 different programs recorded since 2001 by the 19 institutions in the study. Most of the programs are distinct only due to coding and naming inconsistencies between colleges and changes over time. The 2,500 programs were grouped together to generate a manageable list of 209 unique programs. Each of the two thousand programs were categorized individually based on the following factors:

1. Classification of Instructional Program (CIP) Code recorded by the college
2. Standard Occupational Classification (SOC) Code recorded by the apprenticeship program
3. Feedback from program heads at the colleges on the history of the program and the types of jobs people graduating from the program have filled
4. CIP to SOC code crosswalk published by the U.S. Department of Education and U.S. Department of Labor, which matches educational programs with occupations an individual is qualified to fill after completing the program

The 209 programs are a result of combining similar programs across institutions and programs within a college that have changed over time with slightly different names or coding. Occupational codes identifying different apprenticeship training programs were converted into CIP codes according to the CIP to SOC crosswalk provided by the U.S. Department of Education and U.S. Department of Labor. Significant effort was made to update old CIP codes and ensure program codes accurately represented the programs at each institution. Programs with the same CIP code at two different institutions were combined, as were programs that led to the same occupations based on the CIP to SOC crosswalk. Although two institutions may teach the same program differently, this study treats programs as the same across institutions. **Figure A.3** shows which institutions are producing graduates in each of the resulting 209 programs.

FIGURE A.3**Programs by Educational Institution**

Program Description	CIP	Apprenticeship	Carroll	City C	Dawson	FVCC	Gallatin	Great Falls C	Helena C	Highlands	Miles CC	Missoula C	MSU-Billings	MSU-Bozeman	MSU-Northern	MT-Tech	Providence	Rocky Mtn	UM-Missoula	UM-Western
Agricultural Business and Management ¹	010101				A						X			A	A					
Agricultural Mechanics Technology	010205				X				X						A					
Agricultural Production ²	010301										A									
Sustainable Food and Bioenergy	010308					A								A						
Equestrian Studies	010507										A							A		A
Animal Science	010901				A						X			A						
Food Science	011001			X		A														
Plant Science	011101													A						
Range Science and Management	011106										A			A						
Natural Resource Conservation and Management	030101					A								A					A	
Environmental Science ³	030103		A										A	A				A	A	A
Land Use Planning and Management	030206													A						
Natural Resources Management & Policy	030299																		A	
Forestry ⁴	030501																	A	A	
Fish and Wildlife Management	030601										A			A					A	
Architecture	040401													A						
Ethnic, Cultural Minority, Gender, and Group Studies	050299													A					A	
Communication Studies	090101		A										A	X	X		X	A	A	
Journalism	090401																		A	
Radio and Television	090701																		X	
Public Relations	090902		A										A							
Information Technology	110103					A		A				A						X		
Computer Programming & Application Development	110201			A		A		A	A											
Computer Information Systems	110501		A												X					
Computer Science	110701		A											A		A	A	A	A	
Web Technology	110801					A				X	A					A				
Network Technology ⁵	110901			A			A	A		X	A					A			A	
Computer Support Specialist	111006	X										A								
Culinary Arts	120503					A	A					A								
Food Service Management	120504											A								

A = Active. More than one graduate average over the last three academic years.

X = Program existed but is not currently active. One or fewer average graduates per year over the last three academic years.

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FIGURE A.3**Programs by Educational Institution** *(continued)*

Program Description	CIP	Apprenticeship	Carroll	City C	Dawson	FVCC	Gallatin	Great Falls C	Helena C	Highlands	Miles CC	Missoula C	MSU-Billings	MSU-Bozeman	MSU-Northern	MT-Tech	Providence	Rocky Mtn	UM-Missoula	UM-Western
Meat Cutting/Meat Cutter	120506	X																		
Education, General	130101										X		A	A			X		A	
Curriculum and Instruction	130301												A	A					A	
Education Administration	130401													A				A	A	
Higher Education Administration	130406													A						
Learning Development	130607														A					
Special Education	131001												A							
School Counselor	131101												A	A	A				A	
Elementary Education	131202		A					X			X		A	A	A		A	A	A	A
Secondary Education	131205							X						X			A		X	X
Early Childhood Education	131210				A	A							X	A					A	A
Agricultural Teacher	131301													A						
Art and Music Teacher	131302												A	A				A		A
Business Teacher	131303														X					X
English Teacher	131305		A										A		X			A		A
Industrial Technology Teacher	131309													A	X					X
Mathematics Teacher	131311		X										A		X			X	A	X
Health and Physical Education Teacher	131314		X								X		A	A	X			A		A
Science Teacher	131316												X	A	A			X		X
Social Science Teacher ⁶	131317		A										A	A	X			A		A
Biology Teacher	131322		X										X					X		X
Chemistry Teacher	131323		X										X							
History Teacher	131328		X										A					X		A
Spanish Teacher K-12	131330		X										X							
School Librarian	131334													A						
English Second Language (ESL) Teacher	131401		X											A					A	
Teachers Assistant	131501																			A
General Engineering	140101		A		X									A		A				
Chemical Engineering	140701													A						
Civil Engineering	140801		A											A		A				
Computer Engineering	140901													A						

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X = Program existed but is not currently active. One or fewer average graduates per year over the last three academic years.

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FIGURE A.3Programs by Educational Institution *(continued)*

Program Description	CIP	Apprenticeship	Carroll	City C	Dawson	FVCC	Gallatin	Great Falls C	Helena C	Highlands	Miles CC	Missoula C	MSU-Billings	MSU-Bozeman	MSU-Northern	MT-Tech	Providence	Rocky Mtn	UM-Missoula	UM-Western
Software Engineering	140903															A				
Electrical and Electronics Engineering	141001													A		A				
Environmental Engineering	141401													A		A				
Mechanical Engineering	141901													A		A				
Metallurgical Engineering	142001															A				
Petroleum Engineering	142501															A				
Industrial Engineering	143501													A						
Geological/Geophysical/Mining Engineering ⁷	143901															A				
Civil Engineering Technology	150201									A					A	X				
Electronics Technology	150303	X					A					A		X	A					
Process Plant Technology	150499			A																
Water Quality and Treatment Mgmt	150506								X						X					
Environmental Engineering Technology	150507			A				X		X		A			X					
Industrial Technology	150612	X			A			A							X					
Nondestructive Testing	150799					X														
Mechanical Engineering Technology	150805													A						
Stationary Engineering Technology ⁸	150999	A																		
Construction Engineering Technology	151001								X					A	X					
Surveying	151102					A														
Computer System Technology	151202			A																
Drafting and Design Technology ⁹	151301	A		X			A	X		A		A		X	X	X				
Engineering Management	151501													X						
Power Plant Technology	151702	X																		
Foreign Languages and Literatures ¹⁰	160101		A										A	A					A	
Linguistics ¹¹	160102		X																A	
Family and Consumer Science	190101													A					X	
Food and Nutrition	190501													A						
Child Care Provider/Assistant	190709	A																		
Law ¹²	220101																		A	
Paralegal Studies	220302							X				A					A			

A = Active. More than one graduate average over the last three academic years.

X = Program existed but is not currently active. One or fewer average graduates per year over the last three academic years.

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FIGURE A.3**Programs by Educational Institution** *(continued)*

Program Description	CIP	Apprenticeship	Carroll	City C	Dawson	FVCC	Gallatin	Great Falls C	Helena C	Highlands	Miles CC	Missoula C	MSU-Billings	MSU-Bozeman	MSU-Northern	MT-Tech	Providence	Rocky Mtn	UM-Missoula	UM-Western
English and Creative Writing ¹³	231301		A										A	A		A	A	A	A	A
General Studies ¹⁴	240102		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Biology	260101		A										A	A	A	A	A	A	A	A
Biochemistry	260202		A											A				X	A	
Molecular Biology	260204													A						
Cell Biology	260401													A						
Microbiology	260502												A	A					A	
Entomology	260702													A						
Toxicology	261004																		A	
Biotechnology	261201													A						
Ecology	261301																		A	A
Epidemiology	261309																A		A	
Neuroscience	261501													X					A	
Mathematics and Data Science ¹⁵	270101		A										A	A	X	A	A	A	A	A
Statistics	270501													A		X				
Recreation Management	310399																		A	
Health and Physical Education/ Fitness	310501		X			X							A	A	A		X	A	A	A
Kinesiology and Exercise Science	310505													A			A	A		
Philosophy	380101		A											A				A	A	
Theology	390601		A														X			
Chemistry	400501		A										A	A		A	A	A	A	
Geology	400601													A		A		A	A	
Physics	400801		A											A					A	
Psychology	420101		A										A	A			A	A	A	A
School Psychology	422805																		A	
Criminal Justice	430104			A	A	A			X				A		A		A			
Fire and Rescue ¹⁶	430203	X		A				X	A											
Human Services	440000					X						X	A		A		X			
Public Administration	440401		X										X	A					A	
Social Work	440701																		A	
Anthropology	450201													A					A	
Economics	450601													A				X	A	

A = Active. More than one graduate average over the last three academic years.

X = Program existed but is not currently active. One or fewer average graduates per year over the last three academic years.

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FIGURE A.3**Programs by Educational Institution (continued)**

Program Description	CIP	Apprenticeship	Carroll	City C	Dawson	FVCC	Gallatin	Great Falls C	Helena C	Highlands	Miles CC	Missoula C	MSU-Billings	MSU-Bozeman	MSU-Northern	MT-Tech	Providence	Rocky Mtn	UM-Missoula	UM-Western
Geography	450701																		A	
Geographic Information Systems	450702					A				X						X			A	
Political Science17	451001		A										A	A			X		A	X
Sociology	451101		A										A	A			A	A	A	A
Masonry	460101	A																		
Carpentry	460201	A		A		X	X	X	X	A	X	A				A				
Electrical Technology	460302	A				A														
Lineworker	460303	A								A										
Building Maintenance	460401	X										A								
Concrete Finishing	460402	X																		
Roofer	460410	X																		
Metal Building Assembly	460411	A																		
Plumbing Technology	460503	A													A					
Communications Systems Installation	470103	A																		
Electronics Technician	470105					A			X											
Security System Installation	470110	X																		
Heating, Ventilation and Refrigeration Maintenance	470201	A		X		X						A								
Heavy Equipment Maintenance Tech	470302	A																		
Industrial Mechanics and Maintenance	470303	A																		
Firearms Technologies	470402					A														
Auto Collision Repair & Refinishing	470603	X		A		X		X								X				
Automotive Technology	470604	A		A					A	A	A					A	X			
Diesel Technology	470605			A	X				A			A				A				
Recreational Power Equipment	470606											X								
Aviation Maintenance Tech	470607								A											
Motorcycle Maintenance and Repair	470611	X																		
Machining Technology	480501	X								A		A								
Sheet Metal Technology	480506	A																		
Welding Technology	480508			A	A	A	A	A	A	A		A		X	A					
CNC Machinist Technology	480510					A	A		A					X						
Metal Fabricator	480511								A	A										

A = Active. More than one graduate average over the last three academic years.

X = Program existed but is not currently active. One or fewer average graduates per year over the last three academic years.

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FIGURE A.3**Programs by Educational Institution (continued)**

Program Description	CIP	Apprenticeship	Carroll	City C	Dawson	FVCC	Gallatin	Great Falls C	Helena C	Highlands	Miles CC	Missoula C	MSU-Billings	MSU-Bozeman	MSU-Northern	MT-Tech	Providence	Rocky Mtn	UM-Missoula	UM-Western
Boilermaker	480801	A																		
Aviation	490102					A	X							A				A		
Heavy Equipment Operation	490202	A				A					A	A								
Visual and Performing Arts	500101												A	A			X	A	A	A
Dance	500301																		A	
Interior Design	500408						A	X	A					A						
Graphic Design	500409					A		X							X					
Theatre	500501		X										X					X	A	
Cinematography and Film	500602													A					A	
Goldsmithing & Jewelry Design	500713					A														
Music	500903				X								A	A			X	X	A	
Speech Language Pathology	510204																		A	
Dental Assistant	510601							A												
Dental Hygiene	510602							A												
Health Care Office Management ¹⁸	510701					A		A				A	A				A		A	
Health Information Technology ¹⁹	510707	A				X		A		X		X		X		A	A			
Medical Transcription	510708					X		X			X									
Medical Coding	510713			A		A	A	A			X									
Medical Admin Assistant ²⁰	510716	A		X		A	A	A	A	A	X	A		X		X	A			
Pharmacy Technician	510805			X		X		X			X	A					A			
Physical Therapist Assistant	510806					A		A												
Paramedic	510904			A		A		A												
Respiratory Care	510908							A				A								
Surgical Technology	510909					A		A				A								
Ultrasound Technology	510910			X																
Radiologic Technology	510911			A		A		X		A		A				X				
Physician Assistant	510912																	A		
Athletic Training	510913												A					X	A	
Medical Laboratory Technology	511004					A						X							A	
Phlebotomy Technician	511009							A			A									
Health Sciences	511102		A			X					X			A						
Pre-Pharmacy	511103								A											

A = Active. More than one graduate average over the last three academic years.

X = Program existed but is not currently active. One or fewer average graduates per year over the last three academic years.

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FIGURE A.3

Programs by Educational Institution (continued)

Program Description	CIP	Apprenticeship	Carroll	City C	Dawson	FVCC	Gallatin	Great Falls C	Helena C	Highlands	Miles CC	Missoula C	MSU-Billings	MSU-Bozeman	MSU-Northern	MT-Tech	Providence	Rocky Mtn	UM-Missoula	UM-Western
Substance Abuse/Addiction Counseling ²¹	511501				A	A							A	A			A			
Community Health Services	511504																		A	
Pharmacy ²²	512001																		A	
Public Health ²³	512201		A			A								A					A	
Occupational Health & Industrial Hygiene	512206															A				
Physical Therapy	512308																		A	
Anthrozoology	512313		A																	
Dietetic Technician	513103							X												
Registered Nursing	513801		A	A		A		A	A		A	A	A	A	A	A	A			
Nursing Practice	513808													A						
Practical Nursing	513901	X		A	X	A		A	A	X		X				X				
Nursing Assistant	513902	A								A										
Business ²⁴	520101		A	A	A	A	A	A			A	A	A	A	A	A	A	A	A	A
Accounting	520301		A										A	A			A	A	A	
Accounting Technology	520302	A		A		A	A	A	A	A	A	A		X		X				
Administrative Assistant ²⁵	520401			X	X	X		X	A	A	X	A				X				
Customer Relations	520406										A	A								
Entrepreneurship ²⁶	520701					A		X	A		A								A	
Finance	520801		A										A	A					A	
Human Resources	521001			A																
Marketing	521401					X					X	A	A				X		A	
Tourism and Travel Services	521905	X																		
History	540101		A										A	A			A	A	A	A

A = Active. More than one graduate average over the last three academic years.

X = Program existed but is not currently active. One or fewer average graduates per year over the last three academic years.

Notes on Specific Program Classifications:

1. *Agricultural Business and Management (010101) and Agricultural Technology (010102) tie to the same two occupations. MSU-N Ag Tech program is coded as 010101.*
2. *Agricultural Production (010301) and Livestock Management (010906) tie to the same occupations. Both are coded under Ag Production.*
3. *Environmental Science (030103) and Environmental Studies (030104) lead to the same occupations. They are both coded as Environmental Science.*
4. *Forestry (030501) and Natural Resource Management Policy (030201) lead to the same occupations. Both are coded as Forestry. Rocky Mountain program 030201 coded as forestry.*
5. *Network Technology (110901) includes Network and System Administrators (111001), Management Information Systems (521201), and Computer and Information Systems Security (111003).*
6. *Social Science Teacher (131317) includes Reading Teacher (131315), Social Studies Teacher (131318) and Computer Teacher (131312).*
7. *Geological Engineering (143901) and Mining Engineering (142101) tie to the same occupations. Both are coded as 143901.*
8. *Stationary Engineering Technology (150999) represents the Stationary Engineers and Boiler Operators (SOC 51-8021) apprenticeship program sponsored by Talon Energy in Colstrip.*
9. *Drafting Design Technology (151301) and Computer Aided Design (151302) tie to the exact same occupations so they are both coded as 151301.*
10. *Foreign Languages and Literatures (160101) also includes Classical Language from Carroll because they tied to the same occupations. Foreign Languages and Literatures (160101), French (160901), Spanish (160905) and Latin (161203) lead to the same occupations. All are coded as 160101.*
11. *Classics (161200), Linguistics (160102), Russian (160402), Japanese (160302), and German (160501) all lead to the same occupations. All are coded as 160102.*
12. *Law (220101) includes Energy, Environmental, and Natural Resources Law (220207) because only projected job tied to 220207 is Lawyers.*
13. *English (230101), English Writing (231301), Creative Writing (231302), English Literature (231401), and Professional and Technical Writing (231303) lead to the same occupations. All are coded as English/Creative Writing.*
14. *General Studies (240102) and Liberal Studies (240101) tie to the same occupations. 240102 code is used. Multidisciplinary Major (309999) is grouped with General Studies as well because it does not tie to any occupations.*
15. *Mathematics and Data Science (270101) includes Information Science (110401) and Engineering Mathematics (270301).*
16. *Fire Science (430201) links to the same jobs as 430203 but 430203 has one extra occupation so that is the code used.*
17. *Political Science (451001) and International Relations (450901) lead to the same occupations. They are both coded under Political Science.*
18. *Healthcare Office Management (510701) and Medical Information Technology (510706) tie to the same occupation. Coded as 510701.*
19. *Health Information Technology (510707) also includes Health Information Technology (512706). These appear to be the same types of programs. Both are in healthcare, but 512706 doesn't tie to any healthcare occupations.*
20. *Medical Admin Assistant (510716), Medical Reception (510801) and Medical Assistant (510712) all tie to Medical Assistant occupation. 510716 also ties to Medical Secretary, so this code is used.*
21. *Substance Abuse and Addiction Counseling (511501) also includes the code 512399 at MSU-Billings because the program seems to be about mental health and substance abuse counseling.*
22. *Pharmacy (512001) includes Pharmaceuticals, Drug Design/Medicinal Chemistry (512003) because the only projected job tied to 512003 is Pharmacists.*
23. *Public Health, General (512201) includes Public Health (512207) and Community Health (511504). 512201 includes Medical and Health Service Managers, and Health Science teachers, postsecondary.*
24. *Business Admin (520201) and Business General (520101) tie to the exact same occupations so they are grouped together. Organizational Communication (090901) at MSU Billings doesn't have any occupations tied to it, so it is grouped with business based on the program description.*
25. *Administrative Assistant (520401) includes Office Technology (520407) and Legal Support Specialists (220301).*
26. *Small Business Management (520703) is included in Entrepreneurship (520701).*

A.1.3 Timeframes Used to Match Wages

Graduates completed their programs in either the 2nd quarter (May), 3rd quarter (July), or 4th quarter (December) of each year. Graduation dates were determined based on the term of graduation. The date an individual is awarded their degree may not be at the end of their last term if, for example, the student had outstanding fees. No graduation term fell within the 1st quarter. The graduates' wages were compared five years prior to graduation through ten years after graduation. Graduates were matched to the wage files to determine total wages for the following time periods:

- the first four quarters before and after graduation,
- quarters 9 through 12 (three years) before and after graduation,
- quarters 17 through 20 (five years) before and after graduation,
- quarters 37 through 40 (ten years) after graduation.

The wage summaries are based on quarters before and after graduation to equally compare individuals across quarters. For example, a graduate in the second quarter of 2019 would have two quarters to find a job before 2020, but a graduate in the fourth quarter of 2019 would not have any time to find a job before the start of 2020. If all graduates from 2019 were pooled together, then these two candidates would both be evaluated on whether they were employed in 2020, even though they had different amounts of time to find a job and earn higher wages. Instead, this analysis uses the quarters after graduation to calculate total wages in the four quarters after graduation. A 2019 second quarter graduate is evaluated on the four quarters after graduation of 2019Q3 through 2020Q2. A 2019 fourth quarter graduate is also compared on four quarters after graduation of 2020Q1 through 2020Q4. This distinction places the same evaluation time frame on graduates with different quarters.

A.1.4 Wage Data Background

The wage data used in the match comes from the mandatory reporting of payroll wages by employers to the MTDLI for UI program purposes. The wages reported are the total amount of wages earned by a worker in a quarter. The wages reported cannot be used to assume an hourly or annual rate of pay because there is no information on the number of hours or months worked by the graduate; therefore, the wages reported are better interpreted as wage earnings. Some workers will have higher wages due to overtime hours worked, while other workers will have low wages because they only worked a few hours or only part of a quarter. The presence of wages only suggests that the worker earned some wages from an employer.

For most of the data provided in this report (except for the match to employer location and industry), wages earned from all employers were summed into total earnings for the graduate. For example, if a graduate held two jobs, each earning \$3,000 per quarter, their wages reflect the total \$6,000 earned per quarter. Annual wages are the sum of quarterly wage earnings from all employers.

Not all wage earnings are reported to MTDLI. Some payroll workers, such as migrant agriculture workers and railroad workers, do not pay into the UI system. Some federal agencies report their payroll wages nationally instead of to each state. Self-employed workers or independent contractors are not payroll workers and are not required to pay into the UI system (although self-employed workers can opt into the system). These workers could be earning income in Montana that is not reported to the UI system and therefore will not show up in the matched wage data but will show up in the income tax data.

A.1.5 Income Tax Data

The income data used in this report comes from the mandatory reporting of personal income to the Montana Department of Revenue (DOR) to calculate state income tax liability. Individuals report their income annually based on a tax year that typically is also the calendar year. Total income reported in this study is the sum of all income types shown in **Figure A.4** by individual. The income types are limited to earned income, with the exception of rental property income in line 17. Earned income provides the most accurate measure of an individual's earning capacity. This study excludes passive income and income transfers, such as capital gains, unemployment benefits, and social security benefits.

FIGURE A.4
Income Types Included by Line Item on Tax Return

Line Item	Description	Example
7	Wages, salaries, tips, etc.	Wage Income
12	Business income or (loss)	Sole-Proprietor Income
17	Rental real estate, royalties, partnerships, S corporations, trusts	Partnership Income
18	Farm income or (loss)	Sole-Proprietor Farm Income

The income tax data captures self-employment and business earnings that the wage data is unable to measure. The income tax data is also able to better identify whether graduates remain in the state after graduation. If the individual does not appear in the wage data, then they may have moved out of Montana, are self-employed, or are working for Montana employer not paying UI taxes. The income data better identifies a graduate's location. An individual is a resident if they filed income taxes as a Montana resident.

An individual can file as single, married filing jointly, head-of-household, or married filing separately on the same or separate forms. If an individual filed as single, head-of-household or married filing separately on different forms, then all of the income listed on the return is attributed to the individual. For the purposes of this study, all individuals who filed their income tax returns as married filing jointly have all the income listed in columns A and B of their return attributed to them even though the income was earned between two individuals. There is no way to correctly identify one individual's income from the others on a joint return, so the total is attributed to both people. Lastly, for those who filed as married filing separately on the same return, the total income is split out between the two people based on the income reported in column A and B. In this study, if an individual filed as married filing separately on the same return, only the income reported in the column associated with their social security number is attributed to them.

A.1.6 Matching Income Tax and Graduate Data

Montana income tax data from 2002 to 2020 was matched to the graduate data to determine graduates' income one-year, three-years, five-years, and ten-years after graduation. The time frame used to match income data was determined based on the calendar year of graduation. For example, graduates in the spring, summer and fall of 2001 matched to income tax data from 2002 to determine their income one year after graduation. These graduates also matched to income data from 2004, 2006 and 2011 to determine their income three, five, and ten years after graduation, respectively. Matching based on calendar year of graduation allows individuals graduating in the spring longer to generate income after graduation than fall graduates. However, because individuals only report their income to DOR annually, the match had to be done by calendar year.

Income data ten-years after graduation was available for individuals graduating in 2001 to 2010. Data five-years after graduation was available for graduates in 2001 to 2016, and data one-year after graduation was available for graduates in 2001 to 2019. No income tax data was available for individuals graduating in 2020.

The graduate data used in the match was uniquely identified by degree and program of study. If an individual graduated from multiple institutions or received multiple degrees, their income was counted once for each degree earned. Only 15% of individuals in the graduate data received multiple degrees ([Figure A.1](#)). Most graduates only earned one degree, and therefore only appear once in the data. Income was assessed directly after graduation, even if the individual remained in school. Therefore, degrees or programs where it is common for graduates to pursue higher education may have lower reported income levels in their first year after graduation.

Montana income tax data confidentiality requirements restrict the DOR from releasing individual records. Therefore, DOR conducted the individual-level match and released aggregate data to MTDLI by calendar year, as outlined in the MOU between MTDLI and DOR. Aggregate data provided included tax data for matched graduates by institution, region, degree, program, and program and degree combinations. Any aggregation in a calendar year that matched to less than ten individual income tax records was suppressed to protect individual tax information.

For each releasable aggregation, DOR provided the following summary statistics one year, three years, five, and ten years after graduation:

- Percent filing in tax year
- Average total earned income
- 25th and 75th percentile of total earned income
- Median total earned income

After receiving the aggregated income tax data, MTDLI adjusted the income in each calendar year to reflect 2021 dollars using the annual Consumer Price Index for Urban Consumers (CPI-U) was used to measure inflation.²¹ MTDLI used the real income tax data to generate summary statistics across all years.

A.1.7 Program Categorization for Income Data Match

Based on the ten-person threshold, only income data for 73 of the 209 programs were releasable in the program-level match. To increase the amount of releasable data, MTDLI condensed the remaining 136 programs into 34 program categories shown in **Figure A.5**. **Figure A.5** lists the programs from **Figure A.3** included in each category. In total, 107 unique programs were identified in the income data match.

FIGURE A.5

Program Categories for Income Data Match

Program Category	CIP Code	Programs Included (from Figure A.3)
Agriculture	010000	010101, 010205, 010301, 010308, 010507
Animal Science	010901	010901, 011001
Plant Science	011101	011101, 011106
Nat Resource Conserv & Mgmt	030000	030101, 030206, 030299
Communication Studies	090101	090101, 090701
Computer/Info Science	110000	110501, 110801, 111006, 470103, 470110
Personal & Culinary Services	120000	120503, 120504, 120506
Education, General	130000	130101, 130607
Education Administration	130401	130401, 130406
School Counselor	131101	131101, 422805
Early Childhood Education	131210	131210, 190709
Secondary Education, Other	131300	131205, 131301, 131303, 131305, 131309, 131311, 131328, 131330, 131334, 131401, 131501, 190101
Science Teacher	131316	131316, 131322, 131323
Mechanical Engineering	140000	141901, 142001
Engineering, General	140101	140101, 140901, 140903
Engineering Technologies	150000	150201, 150303, 150499, 150506, 150507, 150612, 150799, 150999, 151102, 151202, 151501, 151702
General Studies	240102	050299, 240102
Physical Science	260000	260202, 260204, 260702, 261004, 261201, 261301, 261309, 261501
Mathematics & Data Science	270101	270101, 270501
Philosophy/Theology	380000	380101, 390601
Geography	450701	450701, 450702
Construction	460000	460101, 460201, 460303, 460401, 460402, 460410, 460411
Mechanic Repair Tech	470000	470105, 470201, 470303, 470402, 470606, 470607, 470611
Automotive Technology	470600	470603, 470604
Metal Tech	480000	480501, 480506, 480510, 480511, 480801
Heavy Equipment Operation	490202	470302, 490202
Visual and Performing Arts	500000	500101, 500301, 500408, 500409, 500501, 500713
Health Science, Other	510000	190501, 510204, 511102, 511103, 511504, 512201, 512206, 512313
HIT and Medical Coding	510700	510707, 510708, 510713
Allied Health Diagnostic, Intervention, Treatment	510900	510904, 510910, 510913
Health Tech/ Assistant	511000	510601, 510805, 510806, 511004, 511009, 513103, 513902
Registered Nursing	513801	513801, 513808
Business	520101	520101, 520701, 521001, 521905
Administrative Assistant	520400	520401, 520406

NOTES: The "programs included" column lists program CIP codes from Figure A.3. The seventy-three programs from Figure A.3 that are not listed above were also included in the match but were not combined with any other program.

DOR was able to generate releasable aggregations for most of the 107 in every year from 2001 to 2019. However, there are 42 programs missing at least one year of income tax data. **Figure A.6** lists these programs along with the graduation years that the program didn't meet income data confidentiality requirements. Twenty-seven program (64%) are only missing income data for 2001. The aggregate income data for these programs only include graduates from 2002 to 2019.

FIGURE A.6

Programs Missing at least One Year of Graduate Data

CIP	Program Category	Missing Years	CIP	Program Category	Missing Years
90902	Public Relations	2001	460000	Construction	2001
110000	Computer/Info Science, Other	2001	460302	Electrical Technology	2001
110901	Network Technology	2001, 2003	460503	Plumbing Technology	2001, 2002, 2003
120000	Personal and Culinary Services	2001, 2003, 2005	470000	Mechanic Repair Tech	2001
131210	Early Childhood Education	2001	470600	Automotive Technology	2001
131302	Art and Music Teacher	2001	480000	Metal Tech	2001
140701	Chemical Engineering	2001	480508	Welding Technology	2001
141401	Environmental Engineering	2001, 2005	490102	Aviation	2001
142501	Petroleum Engineering	2001, 2003, 2005, 2007	490202	Heavy Equipment Operation	2001
143501	Industrial Engineering	2001, 2013	510602	Dental Hygiene	2001 – 2004
143901	Geological/Geophysical/Mining Engineering	2004	510700	HIT and Medical Coding	2001
150805	Mechanical Engineering Technology	2001	510701	Health Care Office Management	2001
151301	Drafting and Design Technology	2001	510716	Medical Admin Assistant	2001
160102	Linguistics	2001, 2004	510900	Allied Health Diagnostic, Intervention, Treatment	2001, 2004
220100	Law	2001	510908	Respiratory Care	2001
220302	Paralegal Studies	2001	510909	Surgical Technology	2001
260401	Cell Biology	2001, 2002	510911	Radiologic Technology	2001, 2002, 2003
380000	Philosophy/Theology	2001	510912	Physician Assistant	2001
430203	Fire and Rescue	2001, 2002	511501	Substance Abuse/Addiction Counseling	2001
440401	Public Administration	2001, 2002	520801	Finance	2004
450701	Geography	2001	521401	Marketing	2001

A.2 Supply and Demand Methodology

The supply and demand analysis conducted in this report is often referred to a gap analysis because it identifies gaps in the supply of workers meeting business needs. The purpose of the gap analysis is to determine if there are enough graduates produced by Montana educational institutions to meet estimated workforce demand. The gap analysis uses the MTDLI 2020-2030 employment projections data as an estimate of workforce demand. Worker supply is estimated based on graduate counts by program reported in the Integrated Postsecondary Education Data System (IPEDS) database, and data from Montana Registered Apprenticeship programs maintained by MTDLI. Worker supply data includes 36 educational institutions, averaging approximately 11,700 degrees and certificates per year over the last four academic years from 2016-17 to 2019-20.

The gap analysis is presented from two different perspectives – by occupation and program of study. Each analysis categorizes the occupation or program as undersupplied, meets demand, or over-supplied by Montana post-secondary institutions. The results from these analyses are then compared to graduate workforce outcomes by program to confirm or refute the prior conclusions. Presenting gap analysis from three different perspectives is necessary to overcome flaws inherent with this type of analysis and provide greater confidence in research conclusions.

A.2.1 Supply – Postsecondary Education and Apprenticeship Data

The supply of graduates from Montana's postsecondary education system is measured using data from the Integrated Postsecondary Education Data System (IPEDS). IPEDS is a system of interrelated surveys conducted annually by the U.S. Department of Education's National Center for Education Statistics (NCES). IPEDS gathers information from every college, university, and technical and vocational institution that participates in the federal student financial aid programs. The Higher Education Act of 1965, as amended, requires that institutions that participate in federal student aid programs report data on enrollments, program completions, graduation rates, faculty and staff, finances, institutional prices, and student financial aid.²²

IPEDS collects data on the number of students who complete a postsecondary education program by type of program and level of award (certificate or degree) at 32 different institutions in Montana, including the tribal colleges. The institutions are listed in [Figure A.7](#). Graduates from Missoula College, Gallatin College, and City College are also included in the IPEDS database but are not considered separate institutions. Instead, graduates from these colleges are included in the count of graduates at the University of Montana, Montana State University, and Montana State University Billings, respectively.

Montana Registered Apprenticeship program completers are the final educational institution considered apart of workforce supply. Data on apprentices in Montana is housed in the Registered Apprenticeship Partners Information Management Data System (RAPIDS) and is maintained by MTDLI.

FIGURE A.7**Educational Institutions Included in Graduate Supply**

Type	Institution	4-Yr Annual Avg Number of Grads	Location
4-Year	Carroll College	293	Helena
	Montana State University - Billings	818	Billings
	Montana State University	3,312	Bozeman
	Montana State University - Northern	291	Havre
	Montana Technological University	504	Butte
	Rocky Mountain College	240	Billings
	University of Providence	328	Great Falls
	University of Montana	3,118	Missoula
	University of Montana-Western	460	Dillon
2-Year	Dawson Community College	65	Glendive
	Flathead Valley Community College	363	Kalispell
	Great Falls College MSU	409	Great Falls
	Helena College UM	253	Helena
	Highlands College of Montana Tech	127	Butte
	Miles Community College	130	Miles City
Tribal	Aaniiih Nakoda College	38	Harlem
	Blackfeet Community College	85	Browning
	Chief Dull Knife College	21	Lame Deer
	Fort Peck Community College	41	Poplar
	Little Big Horn College	42	Crow Agency
	Salish Kootenai College	172	Pablo
	Stone Child College	38	Boneau
Other	Academy of Cosmetology	18	Bozeman
	Apprenticeship	231	Statewide
	Bitterroot School of Cosmetology	20	Hamilton
	Bold Beauty Academy	64	Billings
	Butte Academy of Beauty Culture	21	Butte
	Crevier's Academy of Cosmetology Arts	79	Kalispell
	Health Works Institute	34	Bozeman
	Montana Academy of Salons	68	Great Falls
	Montana Bible College	17	Bozeman
	Pima Medical Institute-Dillon	33	Dillon
	Yellowstone Christian College	10	Billings

Notes: Missoula College and Bitterroot College graduates are included in University of Montana total. Gallatin College graduates are included in Montana State University total. City College graduates are included in graduate count for Montana State University – Billings. Total number of graduates at each college do not add up to total number of graduates because one graduate can earn degrees from multiple schools.

Apprenticeship programs are identified in RAPIDS by Standard Occupational Classification (SOC) code. However, to merge these data with the graduate counts by program of study and degree, the SOC codes were translated into Classification of Instructional Program (CIP) Codes used in the IPEDS database. The occupation codes were translated based on the 2018 SOC to 2020 CIP code crosswalk provided by the U.S. Department of Labor and the U.S. Department of Education. The resulting program CIP codes can be found in **Figure A.3** for the apprenticeship programs.

Apprenticeship programs were also categorized by degree level based on time-to-completion for apprentices since 2001. Apprenticeship programs that took four or more years to complete on average are considered equivalent to bachelor's degree programs at Montana colleges. Programs taking between two and four years to complete are considered associate degree programs. Programs taking between one and two years to complete are identified as certificate program. Programs taking less than a year to complete are considered short-term certificate programs (<1 year). The resulting degree and program categorizations can be found in **Figure A.8** for the twenty-three apprenticeship programs averaging at least one completer a year over the last four years.

FIGURE A.8
Apprenticeship Degree and Program Categories

Degree Description	CIP Code	Program Description	4-Yr Annual Avg Number of Grads
Postsecondary Certificate >1<2 yr	513902	Nursing Assistant	24
	190709	Child Care Provider/Assistant	4
	490202	Heavy Equipment Operation	2
	520302	Accounting Technology	2
	510716	Medical Admin Assistant	1
Associate Degree	460302	Electrical Technology	77
	460503	Plumbing Technology	57
	480506	Sheet Metal Technology	10
	460303	Line worker	7
	470303	Industrial Mechanics and Maintenance	6
	150999	Stationary Engineering Technology*	5
	460411	Metal Building Assembly	5
	480801	Boilermaker	5
	460201	Carpentry	4
	470604	Automotive Technology	3
	470103	Communications Systems Installation	2
	430203	Fire and Rescue	2
	460101	Masonry	2
	470201	Heating, Ventilation & Refrigeration Maintenance	2
	470302	Heavy Equipment Maintenance Technology	1
	510707	Health Information Technology	1
	151702	Power Plant Technology	1
	480501	Machining Technology	1

Notes: *Stationary Engineering Technology (150999) represents the Stationary Engineers and Boiler Operators (SOC 51-8021) apprenticeship program sponsored by Talon Energy in Colstrip.

A.2.2 Demand – Employment Projections Data

Every year, the Montana Department of Labor and Industry (MTDLI) produces employment forecasts for the state of Montana in conjunction with the U.S. Department of Labor. The employment forecasts are produced over a two-year and ten-year time frame, by industry and occupation, and either statewide or geographically by region. The projections are based on historic employment data from January 1990 to December 2019. Employment data from 2020 is excluded in the estimate of demand to mute the impacts of the pandemic recession shock on long-term employment forecasts. The primary data source for the Montana industry employment projections is the Quarterly Census of Employment and Wages (QCEW), which is published jointly by the Bureau of Labor Statistics and the MTDLI.

The employment forecasts are an estimate of the future demand for workers based on historical employment data, coupled with knowledge that is available at the time of the forecast. Because the economy is constantly changing, the forecasts are not going to be exactly right. Instead, the employment forecasts should be seen as the most likely employment growth outcome of all possible outcomes, given the current knowledge and information about the economy.

Occupations are classified as either high demand, or very-high demand occupations based on the total projected openings. Very-high demand occupations are occupations with total annual openings in the 90th percentile within an education level. Similarly, occupations with total annual openings in the 75th percentile within an educational level are considered high demand occupations. **Figure A.9** summarizes the threshold for very-high and high demand occupations for each education level. For example, occupations in Montana requiring an associate's degree were considered in very-high demand if the projected total annual openings for the occupation are at or above 58 openings. If an occupation is projected to have at least 32 but less than 58 total annual openings, then the occupation is categorized as high demand in Montana among occupations requiring an associate's degree.

FIGURE A.9
Threshold for High-Demand Occupations by Education

Education Value	Very-High Demand	High Demand
Some college, no degree	951	396
Postsecondary non-degree award	182	70
Associate's degree	58	32
Bachelor's degree	123	53
Master's degree	65	33
Doctoral or professional degree	36	17

Source: MTDLI 2020-2030 employment projections. Very high-demand represents 90th percentile of total annual openings, high-demand represents the 75th percentile.

A.2.3 Supply and Demand Analysis using Employment Patterns

The first methodology presented to match the supply of graduates by program with employment demand by occupation uses historical employment patterns of graduates in the Montana economy. Data from the American Community Survey (ACS) estimates the educational attainment and field of study of Montana's workforce by occupation. Using these data, graduates from a program are allocated into occupations based on the actual employment patterns of graduates from that program. Similarly, employment demand by occupation is allocated to various programs of study based on the percentage of workers within the occupation who hold a degree in that field.

The resulting supply and demand analysis determines whether there are enough graduates in the right fields to meet the state's future workforce needs based on historical employment patterns of students after graduation and on the educational attainment of the existing workforce by occupation.

A.2.3.1 American Community Survey (ACS) Employment Patterns

The American Community Survey is a nationwide survey conducted by the U.S. Census Bureau that collects and produces information on social, economic, housing, and demographic characteristics of the nation's population every year. As a part of this survey, Montana households are surveyed by the Census Bureau annually about their employment status and education attainment. Micro data for the 2015-2019 ACS 5-year estimates were accessed through the Integrated Public Use Microdata Series (IPUMS) to estimate the educational attainment of Montana's workforce by occupation.

The data extracted from the ACS IPUMS data include the employment status, occupation, educational attainment, and field of degree reported for each Montana respondent to the survey. Employment status refers to whether an individual is employed, unemployed, or not in the labor force. An occupation is recorded for individuals who reports they are employed. The occupational categories used by the U.S. Census Bureau in the ACS data differ slightly from the Standard Occupational Classification (SOC) codes used by the U.S. Bureau of Labor Statistics. A crosswalk provided by the U.S. Census Bureau was used to convert the ACS occupation codes into SOC codes.

Educational attainment is also recorded for each survey respondent, which reflects the highest level of education achieved. A field of degree (FOD) is also recorded for individual's earning a bachelor's degree or higher. The FOD recorded in the ACS data is more general than the Classification of Instructional Program (CIP) Codes used in the IPEDS database. A crosswalk provided by the U.S. Census Bureau was used to map CIP codes used in the IPEDS database into FOD categories to generate a supply of graduates from Montana post-secondary institutions by FOD.

FOD data was imputed for associate degree holders based on the distribution within the occupation for those holding a bachelor's degree or higher. For occupations employing associate and bachelor's degree holders, the FOD distribution within the occupation was applied to associate degree holders. For example, if two-thirds of accountants holding a bachelor's degree or higher have a degree in accounting and one-third hold a degree in finance, then two-thirds of associate degree holders working as accountants would be assigned an accounting degree field and one-third would be assigned a finance degree field. There were seventeen occupations employing only associate degree earners or less, and therefore, did not have any FOD values within the occupation. All associate degree holders within these occupations were assigned to general studies.

A.2.3.2 Occupation (SOC) and Field of Degree (FOD) Crosswalk

The 2015-2019 ACS 5-year micro data by occupation, educational attainment, and degree field were used to generate a crosswalk that matched graduate supply by FOD to occupational demand by SOC code. The first step in generating this crosswalk was to estimate number of people in Montana who are employed by FOD within every occupation, where degree field represents only those holding post-secondary degrees (associate or higher). The frequency calculated in this step reflects the actual distribution of college graduates into occupations and allows for graduates to work in occupations that do not require a college degree.

An alternative count of individuals by occupation and degree field was also generated based on the assumption that college graduates are not underemployed and only work in occupations that typically require some college education. Workers with a FOD (i) who are employed in occupations not requiring a college degree were redistributed into occupations requiring some college education based on the distribution of workers within the degree field (i) who work in college-level occupations. The resulting frequency estimates the number of workers by FOD within only occupations requiring at least some college education (some college, no degree or higher).

A.2.3.3 Supply of Graduates by Occupation

The counts of individuals by occupation and field of degree generated from the ACS data are then used to translate the supply of graduates by FOD into the supply by occupation. To make this conversion, the count of workers by occupation and degree field is used to calculate the percentage of graduates holding a degree in field (i) who work in occupation (j). This percentage is multiplied by the average annual number of graduates in the FOD (i) from Montana post-secondary institutions, which yields the number of graduates from FOD (i) who are filling demand for occupation (j). This calculation is repeated for all field of degrees held by someone working in occupation (j). The supply for occupation (j) coming from each field of degree (i) is then summed across all fields that fill demand for the occupation, which yields the total supply of graduates for occupation (j). The calculation of graduate supply by occupation is expressed in the equation 1.1.

Supply of Graduates by Occupation

$$Grads_j = \sum_{i=1}^n Grads_i \times \frac{Emp_{j,i}}{Emp_i}$$

Where,

$Grads_j$ = Annual average number of graduates filling demand for occupation (j)

$Grads_i$ = Annual average graduate supply in field of degree (i) from IPEDS and Apprenticeship

$Emp_{(j,i)}$ = Number of people working in occupation (j) that hold degree in FOD (F) from ACS

Emp_i = Total number of people holding degree in field of degree (i) from ACS

n = Number of degree fields held by people working in occupation (j) from ACS

The calculation of graduate supply by occupation is made using actual employment patterns of graduates by occupation, allowing graduates to contribute to the supply of occupations that do not require a college education. An alternative calculation of graduate supply by occupation is also provided where college graduates are only considered a part of supply for occupations requiring some college education. This alternative measure of graduate supply by occupation increases the number of graduates supplied to occupations requiring a college education and does not supply any graduates to occupations requiring a high school diploma or less.

A.2.3.4 Demand for Graduates by Field of Degree

The ACS crosswalk matching field of degree to occupation is also used to convert employment demand by occupation into demand for post-secondary education graduates by field of degree. To make this conversion, the count of workers by occupation and degree field is used to calculate the percentage of workers in occupation (j) holding a post-secondary degree in field (i). This percentage is then multiplied by the employment demand for occupation (j) to yield the demand for degree field (i) stemming from occupation (j). This calculation is repeated across all occupations employing individuals holding a degree in field (i). The total demand for graduates from field (i) in occupation (j) is then summed across all occupations employing individuals in field (i) to calculate the total demand for graduates from field (i). The calculation of demand by field of degree is expressed in equation 1.2.

Demand for Graduates by Field of Degree

$$JO_i = \sum_{j=1}^n JO_j \times \frac{Emp_{j,i}}{Emp_j}$$

Where,

JO_i = Annual projected job openings for graduates from field of degree (i)

JO_j = Annual projected job openings for occupation (j) from MTDLI employment projections

$Emp_{(j,i)}$ = Number of people working in occupation (j) that hold degree in field (i) from ACS

Emp_j = Total number of people working in occupation (j) from ACS

n = Number of occupations employing individuals with a degree in field (i) from ACS

The calculation of employment demand by field of degree is made using actual employment patterns of graduates by occupation, allowing employment projections for occupations that do not require a post-secondary education to contribute to the demand for graduates. An alternative calculation of demand by field of degree is also provided where only demand for occupations requiring some post-secondary education are considered a part of the demand for graduates from Montana's post-secondary institutions. This alternative measure decreases demand by field of degree for fields where a high percentage of graduates are underemployed, meaning they work in occupations that do not require a post-secondary education.

A.2.4 Supply and Demand Analysis using Employment Possibilities

The second methodology presented to match the supply of graduates by program to employment demand by occupation considers all possible employment opportunities for graduates from Montana's post-secondary institutions. The list of possible employment opportunities for graduates from a program are defined by the program and occupational crosswalk provided by the U.S. Department of Education and the U.S. Department of Labor. This crosswalk provides a list of all occupations graduates from a particular program are qualified to fill.

Using the program and occupation crosswalk, graduates from a program are considered a part of the supply for all occupations they are qualified to hold. Similarly, employment demand by occupation is considered a part of demand for all programs training graduates to work in the occupation. The resulting supply and demand analysis determines whether Montana post-secondary institutions are producing enough graduates in the right fields to meeting the state's workforce needs by considering all possible employment opportunities for students after graduation.

A.2.4.1 Programs (CIP) and Occupations (SOC) Crosswalk

To match college programs with their corresponding occupations, the U.S. Department of Labor and the U.S. Department of Education provide a crosswalk between the standard occupational classification (SOC) codes and the classification of instructional programs (CIP) codes. The crosswalk used in this report matches 2018 SOC codes with the 2020 CIP codes. The crosswalk matches each program with the entire list of occupations an individual may be prepared to fill upon obtaining a degree in the program. Similarly, for each occupational code the crosswalk provides a list of programs that may train an individual to work in the occupation. The match is not one-to-one, meaning that a program may prepare a student for multiple occupations, and an occupation may be filled by students holding degrees from many different programs. For example, a student graduating with a practical nursing degree matches directly to the practical nursing occupation. However, a culinary arts graduate matches to five different occupations.

There were 386 academic programs at Montana colleges and 36 Registered Apprenticeship programs. The unique 418 programs are categorized into 107 programs, as described in section A.1.7. The programs at Montana colleges train graduates to fill 429 occupations, with about 69% requiring some college education. The other 31% of the occupations typically only require a high school diploma or less, although having more than the required education improves wage outcomes. About 29% of the occupations trained by programs at Montana colleges are in high-demand.

A.2.4.2 Calculation of Supply by Occupation and Demand by Program

The supply of graduates by occupation is calculated as the sum of graduates from all programs that are connected to the occupation. The graduates are counted once in each occupation their program serves. Graduates can be counted multiple times across different occupations. However, an individual can only choose one occupation upon graduation, and then they are no longer available for the other occupations except as a potential future worker. As a result, the actual supply of students for each occupation may be less than presented in this report. This concern is mitigated by focusing the analysis on high-wage, high-demand occupations because we can assume students will pursue careers that are most profitable.

The demand for graduates from each program of study is calculated as the sum of the projected job openings for each occupation a student graduating from the program is qualified to fill. In cases where multiple programs can prepare students for the same occupation, the demand for that occupation is counted once under each associated program. The total demand for college programs does not equal the sum of the demand for each program because occupations linking to more than one program will be counted more than once.

Endnotes

- 1 *Earned income is defined as the sum of lines 7,12,17, and 18 on Montana's income tax return. It includes wages and business income but excludes unearned income such as capital gains and social security. More information about the income data used in this report is available in the workforce methodology section of the appendix.*
- 2 *Average annual real personal income growth reported by the U.S. Bureau of Economic Analysis from 2010 to 2020 in MT.*
- 3 *Registered Apprenticeship program completers are categorized into degree types based on the average time to completion. Most apprenticeships are categorized as associate degree programs, including electrician and plumbing apprenticeships.*
- 4 *More information on the workforce outcomes of graduates from these programs is available in section 1.6.*
- 5 *2020 Occupational Outlook Handbook, U.S. Bureau of Labor Statistics. Educational attainment and training requirements reported for Airline and Commercial Pilots (SOC 53-2011, 53-2012).*
- 6 *Watson et al. 2020. "The Status of the Nursing Workforce in Montana." Published by the Montana Department of Labor and Industry. Available at lmi.mt.gov/_docs/Publications/LMI-Pubs/Special-Reports-and-Studies/Nursing-Report.pdf.*
- 7 *Montana has a more condensed pay distribution than nationally according to 2020 Occupational Employment and Wage Statistics, MTDLI and the US BLS. More information found at <https://lmi.mt.gov/montana-wages>.*
- 8 *Registered apprenticeship programs averaging between two and four years to complete are considered equivalent to associate degree programs. Electrician and plumbing apprenticeships are included in associate degree workforce outcomes.*
- 9 *Fall 2021 enrollment demographics reported by the Montana University System: mus.edu/data/dashboards/headcount.html.*
- 10 *Fall 2021 enrollment data reported by the Montana University System.*
- 11 *The percentage of graduates earning a higher degree excludes recent cohorts of graduates who have not had at least four-years after graduation to complete a bachelor's degree.*
- 12 *Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, Kindergarten and Elementary School Teachers (SOC 25-2012, 25-2021), and Secondary School Teachers (SOC 25-2031).*
- 13 *Watson, Amy. "How Healthy is Montana's Healthcare Industry?" April 2022. Montana Department of Labor and Industry, Economy at a Glance. https://lmi.mt.gov/_docs/Publications/EAG-Articles/0222-HealthcareMT.pdf*
- 14 *Watson, Amy. "Impacts of Child Care on the Montana Workforce." November 2020. Montana Department of Labor and Industry. https://lmi.mt.gov/_docs/Publications/LMI-Pubs/Special-Reports-and-Studies/ChildcareReport2020.pdf*
- 15 *More information about these institutions can be found in section A.2.1 of the appendix.*
- 16 *More information about the employment projections can be found in the methodology section and at lmi.mt.gov.*
- 17 *Information on WWAMI program available at <https://www.montana.edu/wwami/>*
- 18 *Rehabilitation job description provided by O*NET. <https://www.onetcodeconnector.org/ccreport/21-1015.00>*
- 19 *Heavy tractor-trailer truck drivers is not included in the demand for transportation science in Figure 2.7 because the historical employment patterns of graduates do not connect the program with that occupation. The demand for truck drivers is included in Figure 2.10 because it is considered a related occupation to heavy equipment operation.*
- 20 *Registered Apprenticeship Program Data Report. Montana Department of Labor and Industry. October 21, 2020. https://lmi.mt.gov/_docs/Publications/LMI-Pubs/Special-Reports-and-Studies/Apprenticeship-Data-Report-2020.pdf.*
- 21 *The CPI-U stands for the Consumer Price Index for All Urban Consumers. U.S. Bureau of Labor statistics publishes the CPI-U as a measure that examines the changes in price of a basket of goods and services purchased by urban consumers. The index measures national changes in prices and does not capture price changes specific to Montana.*
- 22 *More information available here: <https://nces.ed.gov/ipeds/about-ipeds>*

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