

Assessment of the Alignment between West Virginia's High School Career and Technical Education Programs and the Labor Market

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See the full report on the [Institute of Education Sciences](#) website.

Appendix A. About the study

This appendix includes additional information about the study of the alignment between West Virginia's high school career and technical education (CTE) programs and the labor market, including a richer discussion of the motivation behind the study, information about national CTE policies, and information about West Virginia's policy context.

Why this study?

There is broad agreement on the importance of education and training as critical factors shaping future employment and earnings (Carnevale, Garcia, & Gulish, 2017). There is also ample research supporting the benefits of a well-educated workforce to a state's economic productivity and growth (Berger & Fisher, 2013). Even for jobs that do not typically require postsecondary-level skills and knowledge, employers often give preference to applicants with some postsecondary education or training (Carnevale, Jayasundera & Gulish, 2016; Vedder, Denhart, & Robe, 2013). Employers might see some level of postsecondary experience as an indication that jobseekers have qualities that research has shown to be important to success in 21st century careers, including interpersonal, intrapersonal, and cognitive competencies (Pellegrino & Hilton, 2013); foundational knowledge and skills; self-regulation abilities; and mindsets and values (Nagaoka, Farrington, Ehrlich, & Heath, 2015; Shechtman, Cheng, Stites, & Yarnall, 2016).

To enable students to meet the needs of the 21st century economy, policymakers and educators recognize the importance of preparing all high school students for college and careers. Education leaders increasingly see some form of advanced academic and CTE or skills training as essential for productive employment. In 2012 the U.S. Department of Education released *Investing in America's Future: A Blueprint for Transforming Career and Technical Education*, which identified core principles for the future of high-quality CTE programs, including alignment between high-quality CTE programs and labor market needs (U.S. Department of Education, 2012). To support such alignment so that students can get jobs once they complete their education, the report argues that state and local leaders must work with employers to ensure that high school CTE programs offer a sequence of courses spanning high school and postsecondary education that lead to an industry certification or advanced postsecondary certificate or degree and that are responsive to labor market demands.

Despite the U.S. Department of Education’s call to action, little rigorous research exists on the alignment between high school CTE programs and regional labor markets (Hargis, 2011; U.S. Department of Education, 2012). Instead, research has focused on the association between students’ participation in a high school CTE program or career pathway and their academic attainment and labor market outcomes. For example, research suggests that career pathways and CTE programs can increase high school graduation rates (Dougherty, 2016; Warner & Caspary, 2017), postsecondary enrollment (Dougherty, 2016), and employment rates and earnings (Dougherty, 2016; Hollenbeck and Huang, 2017; Kemple, 2008). These positive findings highlight the promise of high school CTE programs, but they do not shed light on the regional alignment of CTE programs with high-demand occupations.

Some technical assistance is available to state leaders who are interested in using education and workforce data to better align high school CTE programs, postsecondary workforce training programs, and employers’ skill needs (National Skills Coalition, 2017). In 2014 the National Skills Coalition initiated the State Workforce and Education Alignment Project (SWEAP) to support state efforts by developing three types of data tools (National Skills Coalition, 2015):

- Data dashboards to track outcomes of workforce development programs (Prince, King, Wilson, & DeRenzis, 2015).
- Pathway evaluation tools to help determine which career pathway programs work best for which types of people (King, Prince, Wilson, & DeRenzis, 2015).
- Supply and demand reports to identify occupations with an inadequate number of skilled workers to fill employment openings and guide investments in workforce programs to fill those gaps (Wilson, 2014).

With or without technical assistance, many states are forging ahead on improving alignment between career pathway programs (including CTE programs at the high school and postsecondary levels) and regional labor markets (National Skills Coalition, 2017; Wilson, 2014). A 2015 report from the Education Commission of the States summarizes recent “significant legislative activity” in 13 states (not including West Virginia) aimed at improving alignment between high school and postsecondary CTE and developing career pathways that better prepare students for high-skill, high-demand jobs (Zinth, 2015, p. 1). States have adopted various approaches to improving alignment between CTE and workforce needs, including assigning responsibility for improving career pathways to a state-level entity; encouraging or requiring regional partnerships of K–12, postsecondary, and business/industry partners; and providing competitive grants or other financing for local or statewide alignment initiatives (Zinth, 2015).

CTE leaders at West Virginia’s Department of Education (WVDE) have not yet attempted to improve the alignment of high school CTE programs to regional labor markets, in part because they lack the basic information on the current state of alignment needed to inform their decisionmaking. This applied research study was designed to address that gap by providing WVDE’s CTE leaders with information on CTE infrastructure, projected labor market needs, and their alignment.

Specifically, for each region in West Virginia the study team calculated the percentage of projected employment openings in high-demand study occupations for which there are aligned high school CTE programs in the same region. The team also calculated the percentage of high school CTE programs that align with high-demand study occupations in each region. In contrast to initiatives like SWEAP, this study focused on infrastructure (the existence of high school CTE programs that align to high-demand occupations) rather than supply and demand (the number of CTE completers in a given CTE program relative to the number of projected employment openings in a related occupation) because student-level data were not available. This study represents a first step toward gauging the alignment of regional CTE programs to workforce needs in West Virginia; subsequent steps of interest to WVDE could include a comparison of student supply and labor market demand in occupations with numerous projected employment openings or an examination of CTE program alignment at the postsecondary level.

Policy background

National CTE policy. In 1983, *A Nation at Risk: The Imperative of Education Reform*, a report by the National Commission on Excellence in Education, argued that American schools were failing to prepare an economically competitive workforce (National Commission on Excellence in Education, 1983). The next year, Congress passed the Carl D. Perkins Vocational and Technical Education Act (Perkins I), which called for CTE programs to integrate vocational and academic skills to improve student career readiness. Congress subsequently reauthorized the Act in 1990 (Perkins II), 1998 (Perkins III), 2006 (Perkins IV), and 2018 (Perkins V). The 2006 reauthorization replaced the term “vocational” with “career and technical” (Carl D. Perkins Career and Technical Education Act, 2006). This reauthorization also eliminated a restriction on the use of federal funds for CTE programs that prepare students for careers requiring a bachelor’s or advanced degree. Perkins IV also introduced Tech Prep, which provided states with grants to strengthen links between secondary and postsecondary education programs (Klein et al., 2014).

The Perkins legislation describes required and permissible uses of federal funds to support CTE programs, as well as the compliance reporting expectations of all state and local secondary and postsecondary grant recipients. States receive Perkins funds under Title I (basic state grant) and Title II (Tech-Prep education). Title I grants are awarded to states through a formula based on the state’s populations of certain age groups and per capita income. Each state is required to distribute at least 85 percent of its Title I funds by formula to local education agencies, area vocational and technical schools, community colleges, and other nonprofit institutions that offer CTE programs. Each state determines the percentage of funds to be distributed at the secondary and postsecondary levels. On average, states spend 64 percent of funds at the secondary level and 36 percent at the postsecondary level (Klein et al., 2014).

The 2006 Perkins IV reauthorization shaped the CTE programs included in this study (conducted using data from the 2016/17 school year). Perkins IV required that all local recipients of Perkins funds offer one or more programs of study that (Carl D. Perkins Career and Technical Education Act, 2006, p. 35):

- Incorporate secondary education and postsecondary education elements.
- Include coherent and rigorous content aligned to challenging academic standards and relevant career and technical content in a coordinated, nonduplicative progression of courses that align secondary education with postsecondary education to adequately prepare students to succeed in postsecondary education.
- May include the opportunity for high school students to participate in dual or concurrent enrollment programs or other ways to acquire postsecondary education credits.
- Lead to an industry-recognized credential or certificate at the postsecondary level, an associate’s degree, or a bachelor’s degree.

Although local subgrantees were required to make CTE programs available, they were neither accountable for student performance in these programs nor asked to collect data on student participation or outcomes (Klein et al., 2014).

States may offer CTE programs in one or more of 16 career clusters recognized by the U.S. Department of Education Office of Career, Technical, and Adult Education and Advance CTE (box A1). These career clusters are occupational categories that have an industry-validated knowledge and skills definition that includes what students need to know and be able to do to succeed in that field. The career clusters are broken down into 79 career pathways that outline sequences of academic, career, and technical courses and training progressing from secondary through postsecondary education (for example, there is a “construction” career pathway within the “architecture and construction” career cluster).

Box A1. Career clusters recognized by the U.S. Department of Education Office of Career, Technical, and Adult Education and Advance CTE

- Agriculture, food, and natural resources.
- Architecture and construction.
- Arts, audio/video technology, and communications.
- Business, management, and administration.
- Education and training.
- Finance.
- Government and public administration.
- Health science.
- Hospitality and tourism.
- Human services.
- Information technology.
- Law, public safety, corrections, and security.
- Manufacturing.
- Marketing, sales, and service.
- Science, technology, engineering, and mathematics.
- Transportation, distribution, and logistics.

Source: Advance CTE, n.d.

The 2018 Perkins V reauthorization, which did not influence the 2016/17 CTE programs included in this study, signals an increasing emphasis on aligning CTE programs to “in-demand” industry sectors and occupations, although this is not a new requirement (Advance CTE & National Skills Coalition, 2018). Perkins V allows CTE programs that provide career exploration and career development activities, which might include “readily available career and labor market information, including information on occupational supply and demand; educational requirements; other information on careers aligned to State, local, or Tribal (as applicable) economic priorities; and employment sectors” (Strengthening Career and Technical Education for the 21st Century Act, 2018, p. 62). Recipients can use Perkins V funding to support professional development for school faculty, staff, and leaders to ensure that they use labor market information “to inform the programs, guidance, and advisement offered to students” (Strengthening Career and Technical Education for the 21st Century Act, 2018, p. 63). Finally, Perkins V requires states applying for federal CTE funding to complete a needs assessment that demonstrates CTE program alignment to in-demand industry and occupations, and it provides competitive grants for innovative strategies to align skills with workforce demand.

This new emphasis in Perkins V on aligning to labor market needs also creates an opportunity for states to coordinate their planning for Perkins-funded CTE programs of study and their employment training programs authorized under the 2014 Workforce Innovation and Opportunity Act (WIOA). WIOA requires each state to analyze and publicly report on the state’s economic conditions, employers’ needs, and the knowledge and skills required for relevant industries; submit to the U.S. Secretary of Labor a four-year workforce development strategy for the state’s workforce development system; and have local workforce development boards establish career pathways aligned to training, education, and supportive services to connect youth with in-demand career opportunities (Cushing, Therriault, & English, 2017). States will need to analyze very similar labor market information for both Perkins V and the WIOA state planning process and might benefit from conducting a joint analysis that identifies roles and responsibilities across systems and avoids gaps in service or duplication of efforts (Advance CTE & National Skills Coalition, 2018).

West Virginia’s CTE policy. WVDE designed its CTE standards to meet the standards of the Perkins Act. The goal behind WVDE’s standards is to prepare students for “a wide range of high-quality postsecondary opportunities within a Simulated Workplace environment” (West Virginia Department of Education, 2015). WVDE developed

standards for 100 CTE programs and 44 career pathways, which are all aligned to national standards (West Virginia Department of Education, 2015). To refine the skills and objectives of each state-approved CTE program and career pathway, WVDE convened local advisory councils of educators and representatives in local businesses and industries (West Virginia Department of Education, 2015). High schools are required to provide students with access to a CTE program for at least 6 of the 16 national career clusters (West Virginia Department of Education, 2015). In West Virginia, each of the 16 career clusters has at least one high school CTE program (West Virginia Department of Education, 2015).

Simulated Workplace. West Virginia delivers high school CTE through “Simulated Workplace” environments to promote high school completion and postsecondary readiness by providing students school-based workplace environments and opportunities to earn college credit and work toward industry certifications (West Virginia Department of Education, 2015). WVDE’s CTE division began piloting its Simulated Workplace in 2013 in approximately 80 classrooms in 20 schools, adding classrooms each year for three years. West Virginia Board of Education Policy 2510 of 2016 requires all state-approved high school CTE programs to shift the third and fourth required program courses (out of four) from a classroom environment to a Simulated Workplace environment.

Through a set of 12 protocols, Simulated Workplace environments integrate core academics with real-world experiences and expectations that prepare students for life after high school (West Virginia Department of Education, n.d.). The protocols are not a curriculum; they help create an environment where students learn real-world skills in job-like settings while still receiving the support of an instructor in the safety and convenience of a school. These protocols guide the cultural shift to more personalized learning and student-led instruction in Simulated Workplaces. The 12 protocols are shown in box A2.

Box A2. The 12 protocols of West Virginia’s Simulated Workplace

- Student-led companies.
- Application/interview structure.
- Formal attendance system.
- Drug-free work zone.
- “5S” environments (productive workplace environments).
- Safe work areas.
- Workplace teams.
- Project-based learning/student engagement.
- Company name and handbook.
- Company meetings.
- Onsite business reviews.
- Accountability (data review, report, and technical assessments).

Source: West Virginia Department of Education, n.d.

Planning districts. The West Virginia State Legislature identified eight community and technical college/career and technical education consortia planning districts to support the streamlining of students’ pathways from secondary school through postsecondary training and on to the workforce, coordinating regional education offerings and thereby expanding opportunities for economic development (West Virginia Code of State Rules, 2016). The planning districts can also improve the alignment between education and the workforce, the focus of the current study. Thus, planning districts define the county groupings that most substantively relate to this study’s goals.

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Appendix B. Methods

This appendix includes a detailed discussion of the study’s data sources, sample and selection criteria, and analysis plan.

Data sources

This study of the alignment of West Virginia’s high school career and technical education (CTE) programs and the labor market relied on data from multiple sources (table B1). The study team merged the data from these sources using standard occupational classification (SOC) codes, which derive from a Bureau of Labor Statistics system that classifies workers into 867 “detailed occupations,” each having an occupational definition and SOC code (U.S. Department of Labor, 2018c).

Table B1. Data sources for each research question and data component

Research question	Data component (source)				
	High school career and technical education (CTE) program offerings (WVDE)	Alignment between CTE programs and occupations (WVDE)	Projected employment openings (Workforce West Virginia)	Bright Outlook occupations (O*NET)	Occupational preparation requirements (O*NET)
1. What is the distribution of occupational preparation requirements across all projected employment openings from 2014 to 2024 by region in West Virginia?			X		X
2. To what extent do high school CTE programs align to high-demand occupations with moderate occupational preparation requirements in each region of West Virginia?	X	X	X		X
a. Within each region, what percentage of projected employment openings in these high-demand occupations are served by at least one high school CTE program?	X	X	X		X
b. Within each region, what percentage of high school CTE programs align to at least one of these high-demand occupations?	X	X	X		X
3. To what extent does the alignment between high school CTE programs and high-demand occupations with moderate occupational preparation requirements improve once high-demand occupations in other regions of the state or country are also considered?	X	X	X	X	X

WVDE is West Virginia Department of Education. O*NET is Occupational Information Network.

Note: The data sources are linked using standard occupational classification codes, as defined by the Department of Labor on the O*NET website, and CTE program names.

Source: Authors’ analysis of data from U.S. Department of Labor (2018a), West Virginia Department of Commerce (n.d.), and West Virginia Department of Education (n.d.).

West Virginia Department of Education data. The West Virginia Department of Education (WVDE) website provides data on CTE program offerings for each high school or career technical center in the state from 2010/11 through 2018/19, including program name, career cluster, high school/career technical center name, and county name (West Virginia Department of Education, n.d.). The study used data for the 2016/17 school year. The study team gathered data on the alignment of CTE programs to occupations that were previously available from the

WVDE CTE website, which included a list of occupations (with SOC codes) that align to each state-approved CTE program. The study team supplemented these data with data received from officials at WVDE, as the publicly available data were incomplete.

Workforce West Virginia data. The study used data on each region’s long-term occupational projections from 2014 to 2024, where regions were defined by workforce investment area (WIA), from the Workforce West Virginia website (West Virginia Department of Commerce, n.d.).¹ The data included occupation title, SOC code, and the number of long-term projected employment openings from 2014 to 2024 for each occupation in West Virginia.

*Occupational Information Network (O*NET) data.* The study used national data on the occupational preparation requirements for all of West Virginia’s occupations from the U.S. Department of Labor’s O*NET website, which was updated in 2018 (U.S. Department of Labor, 2018a). The study team also gathered data on national Bright Outlook occupations from the O*NET website, defined as occupations that are projected to have at least 100,000 employment openings nationally from 2016 to 2026 or to grow by 10 percent or more during that period (U.S. Department of Labor, 2018b). “New and emerging” occupations involve significantly different work than that performed by job incumbents of other occupations and are not adequately reflected by the existing O*NET structure. They must also be high-growth occupations (at least 21 percent growth over a decade) in high-growth industries identified under the High Growth Job Training Initiative (U.S. Department of Labor, 2006). Occupational preparation and Bright Outlook occupation data are based on national trends; they are not specific to any one state or region in the United States.

Sample and selection criteria

Regions in West Virginia. The grouping of counties in each region in the study is closely but not completely aligned to West Virginia’s eight planning districts (table B2). The CTE program data from WVDE are available at the county level and therefore could align to the county groupings of the planning districts. However, the long-term occupational projections from Workforce West Virginia were available only by WIA, so the county groupings within each WIA do not align perfectly with those of the planning districts. Because planning districts are substantively relevant to WVDE, the study team worked to align the regions in the study as closely as possible to the planning districts.

There are a few differences between planning districts and the regions in the study. First, in the Advantage Valley planning district, where counties were split across two WIAs, the team used the projected employment data of the WIA with the larger number of projected employment openings (WIA 3, which is home to the state capital). Second, the projected employment data for the Southern Mountains planning district included data for some of the counties that were included in the Advantage Valley planning district, as there is no way to exclude these counties from the data for WIA 2. Finally, the CTE program data for Shenandoah Valley and Potomac Highlands planning districts were combined into a single region for the study because they were included in a single WIA (WIA 7).

¹ The 2014–24 projections are no longer publicly available, as Workforce West Virginia recently replaced them with projections for 2016–26.

Table B2. Mapping of West Virginia counties to study regions, planning districts, and workforce investment areas, 2016/17

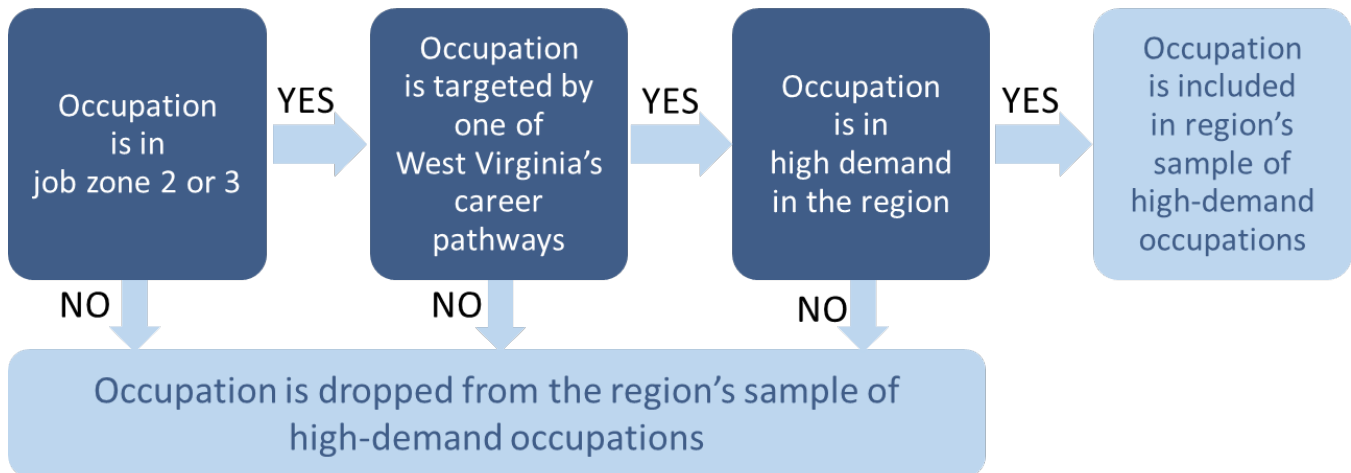
County	Study region	Planning district	Workforce investment area	County	Study regions	Planning districts	Workforce investment area
Webster	Southeastern	Southeastern	1	Hancock	Northern Panhandle	Northern Panhandle	5
Pocahontas				Brooke			
Nicholas				Ohio			
Greenbrier				Marshall			
Fayette				Wetzel			
Raleigh				Monongalia			
Summers				Marion			
Monroe				Taylor			
Mercer				Preston			
Boone				Southern Mountains			
Logan	Doddridge						
Mingo	Gilmer						
Lincoln	Lewis						
Wyoming	Braxton						
McDowell	Upshur						
Putnam	Barbour						
Cabell	Randolph						
Wayne	Calhoun						
Mason	Morgan	Potomac Highlands and Shenandoah Valley	4		Potomac Highlands	7	
Kanawha	Berkeley			Shenandoah Valley			
Pleasants	Jefferson						
Ritchie	Pendleton						
Wood	Grant						
Wirt	Hardy						
Jackson	Mineral						
Roane	Hampshire						
Tyler	Tucker						

Note: Table shows the relationship between the county groupings for the regions in the study and in the data sources.

Source: Authors' analysis using information from West Virginia Code of State Rules (2016) and West Virginia Department of Commerce (n.d.)

Occupations in the study. The study's occupations came from the population of occupations and include any that have long-term projected employment openings from 2014 to 2024 in West Virginia. To create a set of high-demand occupations for each region ("high-demand study occupations"), the study team followed a set of decision rules, which are described below and are summarized in figure B1.

Figure B1. Decision rule process for creating regional sets of high-demand study occupations



Note: The first two decision rules are applied to the statewide set of occupations. The third decision rule is applied separately by region to create a set of 20 high-demand occupations for each region.

Source: Authors' creation.

Decision rule 1: Keep occupations in job zones 2 and 3. The analysis of high school CTE program alignment to the labor market focused on O*NET job zones 2 and 3 for three reasons:

- Occupations in job zone 2 usually require at least a high school diploma and are usually attached to some core certifications in the O*NET database, and occupations in job zone 3 usually require a high school diploma plus training in an accredited vocational school, related on-the-job experience, or an associate's degree. These are the occupations that high school and community college CTE programs typically target.
- Occupations in job zone 1 only sometimes require a high school diploma and usually require little or no previous work-related skill, knowledge, or experience. These are not occupations to which most CTE pathways would logically lead. Including job zone 1 could produce false positives because the occupation has no preparation requirements (for example, a labor market need for baristas being "met" by the education system) and false negatives because a program does not purposefully prepare students for the occupation (for example, a CTE program being potentially labeled "misaligned" because it does not specifically prepare students for work as a barista).
- Occupations in job zone 4 usually require a bachelor's degree, and occupations in job zone 5 usually require an advanced degree (such as a master's or doctoral degree). The data on high school CTE program alignment to occupations did not identify alignment if the occupation required education beyond the CTE program. Therefore, the study excluded occupations in job zones 4 and 5. However, only 1 of the top 20 occupations in West Virginia (as measured by projected employment openings) is in job zone 4, and none is in job zone 5 (West Virginia Department of Commerce, n.d.).

Decision rule 2: Keep occupations targeted by West Virginia's career pathways. After the study team reduced the list of occupations to those in job zone 2 or 3, the list included many occupations that do not require any formal training (for example, retail salespersons) because job zone 2 includes many occupations that require only a high school diploma or some work-related experience or knowledge. To limit the set of occupations to relevant occupations (occupations that need some type of formal training), the study team used data that identified occupations that were targeted by West Virginia's career pathways. This decision rule excluded mostly service and labor occupations. For example, occupations such as janitors, retail salespersons, stock clerks, and construction laborers were among the high-demand occupations in several regions, but these types of occupations do not

typically require any specialized training beyond on-the-job training. The study team acknowledges that this decision rule might exclude some relevant occupations, but the goal was to have a decision rule that could weed out irrelevant occupations, without using judgment calls, so that the study could be replicated.

Decision rule 3: Keep high-demand occupations. West Virginia’s workforce data included 584 different O*NET occupations, with projected employment openings ranging from 32 (for compensation and benefits managers) to more than 29,000 (for office clerks). To create the regional sets of high-demand occupations, the study focused on the top 20 occupations in each region with the highest number of projected employment openings from 2014 to 2024. This made the results easier to present and interpret and focused WVDE’s attention on CTE program alignment to occupations that are in high demand, as alignment to these occupations will have greater impact. Thus, after reducing the set of occupations within each region using decision rules 1 and 2, the study team further restricted the set to the top 20 occupations (as measured by projected employment openings from 2014 to 2024) in job zones 2 and 3. This rule excluded some occupations, but not those in high demand: statewide, there were 337 occupations in job zone 2 or 3 with any projected employment openings from 2014 to 2024, and the top 20 occupations accounted for about 50 percent of total projected employment openings.

To create the set of national high-demand occupations, the study team applied only the first two decision rules because data were not available for the third decision rule (data on projected employment openings were not available to rank the occupations). Thus, the set of national high-demand occupations included all Bright Outlook occupations that were not excluded by decision rule 1 or 2. Though the third decision rule is not applied, these occupations would be projected to be in high-demand or to experience high-growth if they were considered a Bright Outlook occupation.

CTE programs in the study. The study included CTE programs from every high school and career technical center in West Virginia. For simplicity, this report uses the term “high school CTE program” to refer to CTE programs in both high schools and career technical centers in the state. Career technical centers serve both high school students and adults; students may attend these centers for only a portion of the school day, week, or year, or they may attend full time, receiving both academic and technical instruction at the center. Adult CTE programs of study were excluded from the study.

Analysis plan

Research question 1. Answering research question 1 required calculating the percentage of projected employment offerings in each job zone, by region (equation B1), to provide WVDE with a basic summary of each regional labor market’s projected occupational preparation needs:

$$B1 \quad P1_{jd} = \frac{N_{jd}}{N_d}$$

where $P1_{jd}$ is the percentage of long-term projected employment openings from 2014 to 2024 accounted for by job zone j ($j = 1, \dots, 5$) in region d ($d = 1, \dots, 7$). The percentage is calculated as the number of projected employment openings in job zone j in region d (N_{jd}) divided by the total number of projected employment openings in region d (N_d).

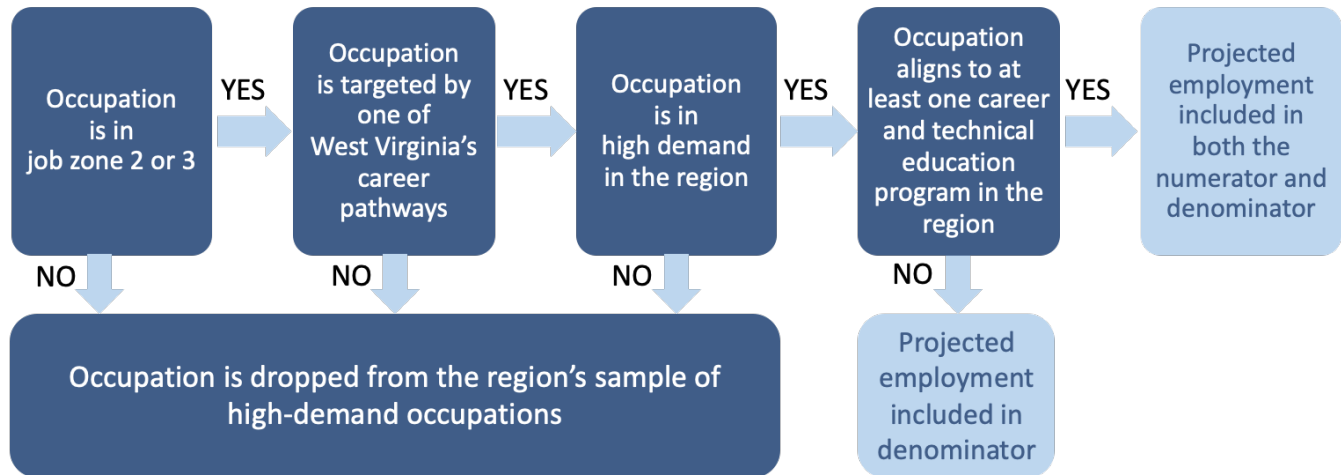
Research question 2a. Addressing research question 2a required calculating the percentage of employment openings served for each region (equation B2):

$$B2 \quad P2A_d = \frac{N_{emp_openings_served,d}}{N_{emp_openings,d}}$$

where $P2A_d$ is the percentage of long-term projected employment openings from 2014 to 2024 in high-demand study occupations in region d that are served by at least one high school CTE program in region d (employment openings served). The numerator is the subset of projected employment openings in region d that are served by

at least one CTE program in the region, even if eligibility for those employment openings requires further preparation. The denominator is the total number of long-term projected employment openings from 2014 to 2024 in high-demand study occupations in region d . Figure B2 depicts the process for arriving at the percentage of employment openings served for each region.

Figure B2. Process for calculating projected employment openings served



Note: The figure depicts the calculations for answering research question 2a.
Source: Authors' creation.

Research question 2b. Answering research question 2b required calculating the percentage of high school CTE programs aligned for each region (equation B3) to show WVDE the extent to which each region's high school CTE programs aligned to the high-demand study occupations in the region:

$$B3 \quad P2B_d = \frac{N_{aligned_programs,d}}{N_{programs,d}}$$

where $P2B_d$ is the percentage of high school CTE programs in region d that align to at least one of the region's high-demand occupations (percentage of "programs aligned"). The numerator is the subset of high school CTE programs in region d that align to at least one high-demand study occupation in region d . The denominator is the total number of high school CTE programs in region d . The total number includes multiple instances of identical programs of study in separate high schools (for example, if the allied health CTE program is offered in two high schools in region d , it is counted twice in the denominator, not once).

Note that the employment openings served and the programs aligned statistics do not measure the same thing. One can imagine a region where high-demand study occupations are fully served (employment openings served = 100 percent) but where many additional high school CTE programs are offered, targeting niche occupations that are not in high demand (programs aligned < 100 percent). One can also imagine a region where all high school CTE program offerings align to a few high-demand study occupations (programs aligned = 100 percent) but where at least some high-demand study occupations are not served by any high school CTE programs in the same region (employment openings served < 100 percent).

Research question 3. Addressing research question 3 required calculating CTE program alignment to high-demand study occupations outside each region. There may be good reason to invest in CTE programs that align to a high-demand study occupation in other regions of West Virginia. Therefore, for each region, the study team calculated percentages for CTE programs that aligned to a high-demand study occupation in other regions of West Virginia (equation B4).

$$B4 \quad P3WV_d = \frac{N_{any_region_aligned,d}}{N_{programs,d}}$$

where $P3WV_d$ is the percentage of high school CTE programs in region d that align to at least one high-demand study occupation in any West Virginia region (within-region alignment plus across-region alignment). The numerator is the subset of high school CTE programs that aligned to at least one high-demand study occupation in any region of West Virginia. The denominator is the total number of high school CTE programs in region d .

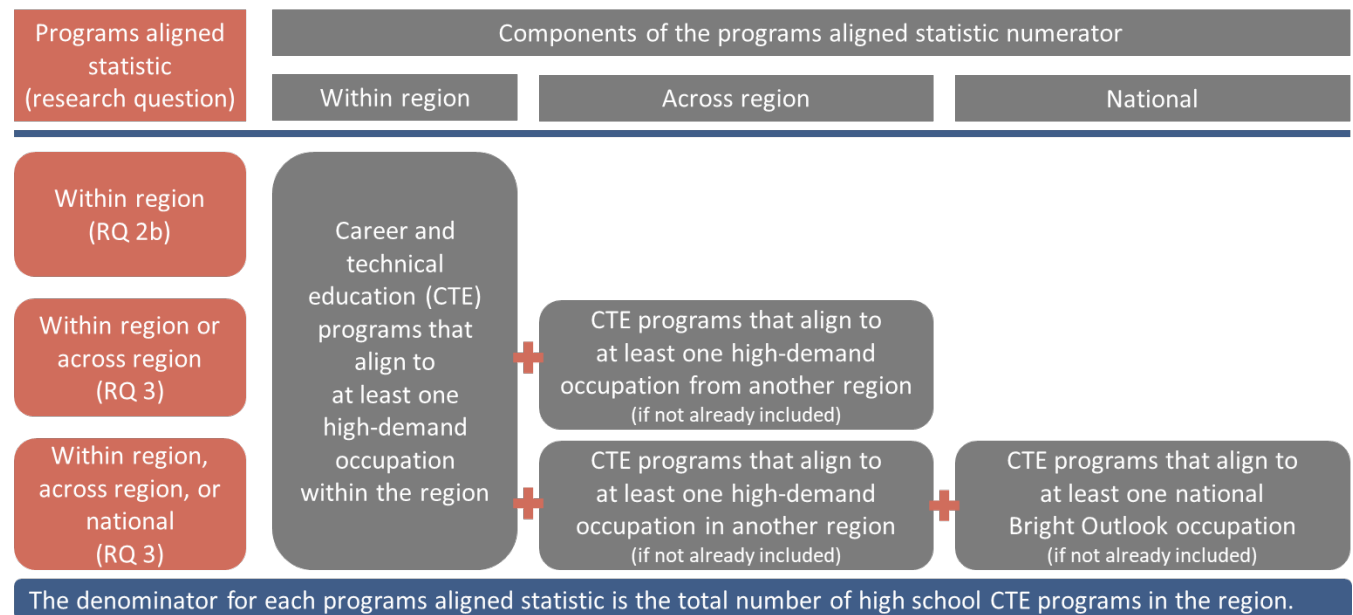
National high-demand occupations may also be relevant, as students can leave the state to seek employment. For each region, the study team also calculated the percentage of regional high school CTE programs that aligned to any regional or national high-demand study occupation (equation B5):

$$B5 \quad P3US_d = \frac{N_{region_nation_aligned,d}}{N_{programs,d}}$$

where $P3US_d$ is the percentage of high school CTE programs in region d that align to at least one high-demand study occupation in any West Virginia region or to a national high-demand study occupation (within-region alignment plus across-region alignment plus national alignment). The numerator is the subset of high school CTE programs that align to at least one high-demand study occupation in any region of West Virginia or nationally. The denominator is the total number of high school CTE programs in region d .

Figure B3 depicts the process for arriving at the percentage of regional high school CTE programs that align to at least one high-demand occupation within the region, across regions, and nationally.

Figure B3. Process for calculating the career and technical education programs aligned statistics



Note: The figure depicts the calculations for answering research questions 2b and 3. For both the numerator and the denominator of each statistic, CTE programs are counted at the high school level and the statistic is calculated separately by region.
Source: Authors' creation.

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Appendix C. Supporting analyses

This appendix provides additional analyses that support the main analyses, including information about regional projected employment openings and occupational preparation requirements, about served and unserved high-demand study occupations in each region, and about the alignment of each career and technical education (CTE) program in each region.

Supplemental information about regional projected employment openings and occupational preparation requirements

Table C1a shows the number and percentage of long-term projected employment openings from 2014 to 2024 by job zone and West Virginia region. The U.S. Department of Labor’s Occupational Information Network (O*NET) is the primary source of information on occupations and preparation requirements (U.S. Department of Labor, 2019b). Five O*NET job zones categorize occupations according to the typical levels of occupational preparation required of employees (U.S. Department of Labor, 2019a):

- *Job zone 1:* Little or no preparation needed. Occupations sometimes require a high school diploma or General Educational Development (GED) certificate and little or no work-related experience or knowledge.
- *Job zone 2:* Some preparation needed. Occupations usually require a high school diploma and some work-related experience or knowledge.
- *Job zone 3:* Medium preparation needed. Most occupations require vocational training, on-the-job experience, or an associate’s degree, and some require licenses to practice.
- *Job zone 4:* Considerable preparation needed. Most occupations require a bachelor’s degree and a considerable amount of work-related skill, knowledge, or experience.
- *Job zone 5:* Extensive preparation needed. Most occupations require a graduate degree and extensive skills, knowledge, and experience.

Tables C1b–C1h show the projected employment openings and degree attainment rates for the top 20 high-demand occupations by region in West Virginia in 2016/17.

Table C1a. Number and percentage of long-term projected employment openings in West Virginia from 2014 to 2024, by job zone and region

Region	Job zone										Total	
	1: Little or no preparation		2: Some preparation		3: Medium preparation		4: Considerable preparation		5: Extensive preparation			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Advantage Valley	9,447	10	39,668	41	28,206	29	13,839	14	6,039	6	97,199	100
Mid-Ohio Valley	7,762	14	27,587	48	11,747	21	7,395	13	2,436	4	56,927	100
North Central	17,264	12	64,579	44	38,259	26	17,107	12	10,625	7	147,834	100
Northern Panhandle	6,779	11	28,456	48	14,563	24	7,279	12	2,625	4	59,702	100
Potomac Highlands & Shenandoah Valley	7,702	12	29,626	47	13,652	22	8,347	13	3,064	5	62,391	100
Southeastern	12,654	12	48,275	46	26,249	25	12,469	12	5,023	5	104,670	100
Southern Mountains	10,763	11	45,957	46	24,305	24	13,509	14	4,709	5	99,243	100
West Virginia	81,416	11	329,525	45	183,296	25	98,085	13	42,323	6	734,645	100

Note: Percentages may not sum to 100 because of rounding. Job zones are defined in the Occupational Information Network (O*NET). Preparation needed for each job zone refers to degrees, related experience, and on-the-job training. Although preparation needed increases as the job zone number increases, correspondence between job zones and preparation requirements is not perfect (for example, most job zone 4 occupations require a bachelor's degree, but some do not). For additional information on education requirements, related experience, job training, and example occupations for each O*NET job zone, see U.S. Department of Labor (2018a).

Source: Authors' analysis of data from U.S. Department of Labor (2018a) and West Virginia Department of Commerce (n.d.).

Table C1b. Projected employment openings from 2014 to 2024 and reported degree attainment for the top 20 high-demand occupations in the Advantage Valley region of West Virginia in 2016/17

High-demand occupation	Projected employment openings (number)	Reported degree attainment (percent)					
		Bachelor's degree or higher	Associate's degree	Postsecondary certificate	Some college	High school diploma	Less than high school diploma
Office clerks, general	4,510	0	36	0	15	41	0
Registered nurses	4,249	23	66	0	11	0	0
Retail salespersons	3,886	0	10	0	0	63	19
Combined food preparation and serving workers	3,233	0	0	0	14	29	57
General and operations managers	2,414	29	0	0	19	15	0
Cashiers	2,259	0	0	1	0	68	30
Customer service representatives	2,219	16	0	0	6	67	0
Secretaries and administrative assistants, except legal, medical, and executive	2,146	0	37	0	14	39	0
Personal care aides	2,024	0	0	0	17	54	17
First-line supervisors of office and administrative support	1,846	45	0	0	20	23	0
Maintenance and repair workers, general	1,715	0	0	30	0	37	15
Waiters and waitresses	1,577	7	0	0	0	57	28
Bookkeeping, accounting, and auditing clerks	1,557	12	0	21	0	41	0
Laborers and freight, stock, and material movers, hand	1,530	0	0	0	5	70	19
Janitors and cleaners, except maids and housekeeping cleaners	1,508	7	0	0	0	72	19
Heavy and tractor-trailer truck drivers	1,434	0	0	15	0	56	19
Security guards	1,329	0	0	1	9	89	0
First-line supervisors of retail sales workers	1,209	0	19	0	0	52	14
Stock clerks and order fillers	1,199	0	0	0	0	56	44
Accountants and auditors	1,165	42	14	0	39	0	0

Note: The U.S. Department of Labor collects degree attainment data through nationally representative surveys of employees and occupational experts. The data do not necessarily reflect what is required for the occupation, and national data might not accurately reflect occupational requirements in West Virginia. Values for reported degree attainment by occupation may not sum to 100 percent because the numbers were derived from surveys that did not have a 100 percent response rate.

Source: Authors' analysis of data from U.S. Department of Labor (2018a) and West Virginia Department of Commerce (n.d.).

Table C1c. Projected employment openings from 2014 to 2024 and reported degree attainment for the top 20 high-demand occupations in the Mid-Ohio Valley region of West Virginia in 2016/17

High-demand occupation	Projected employment openings (number)	Reported degree attainment (percent)					
		Bachelor's degree or higher	Associate's degree	Postsecondary certificate	Some college	High school diploma	Less than high school diploma
Retail salespersons	2,786	0	10	0	0	63	19
Combined food preparation and serving workers	2,515	0	0	0	14	29	57
Office clerks, general	2,408	0	36	0	15	41	0
Cashiers	2,358	0	0	1	0	68	30
Construction laborers	1,847	0	0	6	0	70	6
Registered nurses	1,441	23	66	0	11	0	0
Personal care aides	1,441	0	0	0	17	54	17
General and operations managers	1,227	29	0	0	19	15	0
Waiters and waitresses	1,165	7	0	0	0	57	28
Secretaries and administrative assistants, except legal, medical, and executive	1,016	0	37	0	14	39	0
Laborers and freight, stock, and material movers, hand	1,004	0	0	0	5	70	19
Customer service representatives	990	16	0	0	6	67	0
Heavy and tractor-trailer truck drivers	964	0	0	15	0	56	19
Home health aides	951	0	9	21	0	63	0
First-line supervisors of retail sales workers	937	0	19	0	0	52	14
Elementary school teachers, except special education	929	95	0	0	0	0	0
Maintenance and repair workers, general	920	0	0	30	0	37	15
Stock clerks and order fillers	863	0	0	0	0	56	44
Nursing assistants	848	0	0	25	8	60	0
Bookkeeping, accounting, and auditing clerks	823	12	0	21	0	41	0

Note: The U.S. Department of Labor collects degree attainment data through nationally representative surveys of employees and occupational experts. The data do not necessarily reflect what is required for the occupation, and national data might not accurately reflect occupational requirements in West Virginia. Values for reported degree attainment by occupation may not sum to 100 percent because the numbers were derived from surveys that did not have a 100 percent response rate.

Source: Authors' analysis of data from U.S. Department of Labor (2018a) and West Virginia Department of Commerce (n.d.).

Table C1d. Projected employment openings from 2014 to 2024 and reported degree attainment for the top 20 high-demand occupations in the North Central region of West Virginia in 2016/17

High-demand occupation	Projected employment openings (number)	Reported degree attainment (percent)					
		Bachelor's degree or higher	Associate's degree	Postsecondary certificate	Some college	High school diploma	Less than high school diploma
Registered nurses	6,060	23	66	0	11	0	0
Office clerks, general	5,930	0	36	0	15	41	0
Combined food preparation and serving workers	5,403	0	0	0	14	29	57
Retail salespersons	4,957	0	10	0	0	63	19
Cashiers	4,255	0	0	1	0	68	30
Personal care aides	3,217	0	0	0	17	54	17
Heavy and tractor-trailer truck drivers	2,875	0	0	15	0	56	19
Waiters and waitresses	2,867	7	0	0	0	57	28
Construction laborers	2,717	0	0	6	0	70	6
Maintenance and repair workers, general	2,706	0	0	30	0	37	15
Laborers and freight, stock, and material movers, hand	2,670	0	0	0	5	70	19
Secretaries and administrative assistants, except legal, medical, and executive	2,266	0	37	0	14	39	0
General and operations managers	2,230	29	0	0	19	15	0
Customer service representatives	2,188	16	0	0	6	67	0
Maids and housekeeping cleaners	2,175	1	0	0	0	64	35
First-line supervisors of retail sales workers	2,160	0	19	0	0	52	14
Home health aides	1,952	0	9	21	0	63	0
Janitors and cleaners, except maids and housekeeping cleaners	1,611	7	0	0	0	72	19
Stock clerks and order fillers	1,600	0	0	0	0	56	44
Licensed practical and licensed vocational nurses	1,558	0	20	43	35	0	0

Note: The U.S. Department of Labor collects degree attainment data through nationally representative surveys of employees and occupational experts. The data do not necessarily reflect what is required for the occupation, and national data might not accurately reflect occupational requirements in West Virginia. Values for reported degree attainment by occupation may not sum to 100 percent because the numbers were derived from surveys that did not have a 100 percent response rate.

Source: Authors' analysis of data from U.S. Department of Labor (2018a) and West Virginia Department of Commerce (n.d.).

Table C1e. Projected employment openings from 2014 to 2024 and reported degree attainment for the top 20 high-demand occupations in the Northern Panhandle region of West Virginia in 2016/17

High-demand occupation	Projected employment openings (number)	Reported degree attainment (percent)					
		Bachelor's degree or higher	Associate's degree	Postsecondary certificate	Some college	High school diploma	Less than high school diploma
Office clerks, general	3,183	0	36	0	15	41	0
Registered nurses	2,164	23	66	0	11	0	0
Retail salespersons	2,018	0	10	0	0	63	19
Cashiers	1,961	0	0	1	0	68	30
Combined food preparation and serving workers	1,554	0	0	0	14	29	57
Personal care aides	1,446	0	0	0	17	54	17
Laborers and freight, stock, and material movers, hand	1,339	0	0	0	5	70	19
Maintenance and repair workers, general	1,337	0	0	30	0	37	15
General and operations managers	1,244	29	0	0	19	15	0
Waiters and waitresses	1,115	7	0	0	0	57	28
Janitors and cleaners, except maids and housekeeping cleaners	1,115	7	0	0	0	72	19
Maids and housekeeping cleaners	1,005	1	0	0	0	64	35
First-line supervisors of office and administrative support	973	45	0	0	20	23	0
Nursing assistants	944	0	0	25	8	60	0
Secretaries and administrative assistants, except legal, medical, and executive	926	0	37	0	14	39	0
Bartenders	885	0	0	0	16	43	37
First-line supervisors of retail sales workers	801	0	19	0	0	52	14
Bookkeeping, accounting, and auditing clerks	769	12	0	21	0	41	0
Heavy and tractor-trailer truck drivers	756	0	0	15	0	56	19
Customer service representatives	721	16	0	0	6	67	0

Note: The U.S. Department of Labor collects degree attainment data through nationally representative surveys of employees and occupational experts. The data do not necessarily reflect what is required for the occupation, and national data might not accurately reflect occupational requirements in West Virginia. Values for reported degree attainment by occupation may not sum to 100 percent because the numbers were derived from surveys that did not have a 100 percent response rate.

Source: Authors' analysis of data from U.S. Department of Labor (2018a) and West Virginia Department of Commerce (n.d.).

Table C1f. Projected employment openings from 2014 to 2024 and reported degree attainment for the top 20 high-demand occupations in the Potomac Highlands and Shenandoah Valley region of West Virginia in 2016/17

High-demand occupation	Projected employment openings (number)	Reported degree attainment (percent)					
		Bachelor's degree or higher	Associate's degree	Postsecondary certificate	Some college	High school diploma	Less than high school diploma
Office clerks, general	2,539	0	36	0	15	41	0
Cashiers	2,313	0	0	1	0	68	30
Combined food preparation and serving workers	2,278	0	0	0	14	29	57
Registered nurses	2,120	23	66	0	11	0	0
Retail salespersons	1,989	0	10	0	0	63	19
Personal care aides	1,671	0	0	0	17	54	17
Laborers and freight, stock, and material movers, hand	1,569	0	0	0	5	70	19
Customer service representatives	1,556	16	0	0	6	67	0
Waiters and waitresses	1,323	7	0	0	0	57	28
Elementary school teachers, except special education	1,271	95	0	0	0	0	0
Stock clerks and order fillers	1,036	0	0	0	0	56	44
Secretaries and administrative assistants, except legal, medical, and executive	1,019	0	37	0	14	39	0
Janitors and cleaners, except maids and housekeeping cleaners	1,019	7	0	0	0	72	19
First-line supervisors of retail sales workers	1,013	0	19	0	0	52	14
Maintenance and repair workers, general	1,000	0	0	30	0	37	15
Heavy and tractor-trailer truck drivers	996	0	0	15	0	56	19
General and operations managers	990	29	0	0	19	15	0
Bus drivers, school or special client	979	7	0	0	0	71	21
Nursing assistants	905	0	0	25	8	60	0
Childcare workers	818	0	23	0	0	23	14

Note: The U.S. Department of Labor collects degree attainment data through nationally representative surveys of employees and occupational experts. The data do not necessarily reflect what is required for the occupation, and national data might not accurately reflect occupational requirements in West Virginia. Values for reported degree attainment by occupation may not sum to 100 percent because the numbers were derived from surveys that did not have a 100 percent response rate.

Source: Authors' analysis of data from U.S. Department of Labor (2018a) and West Virginia Department of Commerce (n.d.).

Table C1g. Projected employment openings from 2014 to 2024 and reported degree attainment for the top 20 high-demand occupations in the Southeastern region of West Virginia in 2016/17

High-demand occupation	Projected employment openings (number)	Reported degree attainment (percent)					
		Bachelor's degree or higher	Associate's degree	Postsecondary certificate	Some college	High school diploma	Less than high school diploma
Office clerks, general	4,705	0	36	0	15	41	0
Cashiers	3,902	0	0	1	0	68	30
Combined food preparation and serving workers	3,858	0	0	0	14	29	57
Retail salespersons	3,849	0	10	0	0	63	19
Personal care aides	3,700	0	0	0	17	54	17
Registered nurses	3,037	23	66	0	11	0	0
General and operations managers	1,998	29	0	0	19	15	0
First-line supervisors of retail sales workers	1,942	0	19	0	0	52	14
Secretaries and administrative assistants, except legal, medical, and executive	1,770	0	37	0	14	39	0
Waiters and waitresses	1,733	7	0	0	0	57	28
Licensed practical and licensed vocational nurses	1,733	0	20	43	35	0	0
Heavy and tractor-trailer truck drivers	1,678	0	0	15	0	56	19
Laborers and freight, stock, and material movers, hand	1,579	0	0	0	5	70	19
Nursing assistants	1,543	0	0	25	8	60	0
Maintenance and repair workers, general	1,508	0	0	30	0	37	15
Maids and housekeeping cleaners	1,464	1	0	0	0	64	35
First-line supervisors of office and administrative support	1,458	45	0	0	20	23	0
Janitors and cleaners, except maids and housekeeping cleaners	1,426	7	0	0	0	72	19
Elementary school teachers, except special education	1,406	95	0	0	0	0	0
Stock clerks and order fillers	1,301	0	0	0	0	56	44

Note: The U.S. Department of Labor collects degree attainment data through nationally representative surveys of employees and occupational experts. The data do not necessarily reflect what is required for the occupation and national data might not accurately reflect occupational requirements in West Virginia. Values for reported degree attainment by occupation may not sum to 100 percent because the numbers were derived from surveys that did not have a 100 percent response rate.

Source: Authors' analysis of data from U.S. Department of Labor (2018a) and West Virginia Department of Commerce (n.d.).

Table C1h. Projected employment openings from 2014 to 2024 and reported degree attainment for the top 20 high-demand occupations in the Southern Mountains region of West Virginia in 2016/17

High-demand occupation	Projected employment openings (number)	Reported degree attainment (percent)					
		Bachelor's degree or higher	Associate's degree	Postsecondary certificate	Some college	High school diploma	Less than high school diploma
Office clerks, general	4,726	0	36	0	15	41	0
Registered nurses	3,942	23	66	0	11	0	0
Personal care aides	3,726	0	0	0	17	54	17
Retail salespersons	3,702	0	10	0	0	63	19
Cashiers	3,436	0	0	1	0	68	30
Combined food preparation and serving workers	3,268	0	0	0	14	29	57
Customer service representatives	2,140	16	0	0	6	67	0
General and operations managers	1,982	29		0	19	15	0
Heavy and tractor-trailer truck drivers	1,938	0	0	15	0	56	19
Laborers and freight, stock, and material movers, hand	1,719	0	0	0	5	70	19
Secretaries and administrative assistants, except legal, medical, and executive	1,603	0	37	0	14	39	0
Maintenance and repair workers, general	1,488	0	0	30	0	37	15
Waiters and waitresses	1,416	7	0	0	0	57	28
First-line supervisors of retail sales workers	1,397	0	19	0	0	52	14
Substitute teachers	1,338	—	—	—	—	—	—
Janitors and cleaners, except maids and housekeeping cleaners	1,302	7	0	0	0	72	19
Construction laborers	1,290	0	0	6	0	70	6
Licensed practical and licensed vocational nurses	1,235	0	20	43	35	0	0
Nursing assistants	1,183	0	0	25	8	60	0
Maids and housekeeping cleaners	1,180	1	0	0	0	64	35

— is not available.

Note: The U.S. Department of Labor collects degree attainment data through nationally representative surveys of employees and occupational experts. The data do not necessarily reflect what is required for the occupation, and national data might not accurately reflect occupational requirements in West Virginia. Values for reported degree attainment by occupation may not sum to 100 percent because the numbers were derived from surveys that did not have a 100 percent response rate.

Source: Authors' analysis of data from U.S. Department of Labor (2018a) and West Virginia Department of Commerce (n.d.).

Supplemental information about served and unserved high-demand study occupations

This section provides information on regional (table C2a) and national (table C2b) long-term projected employment openings in high-demand study occupations and whether the occupation was served or unserved by high school CTE programs within each region in 2016/17.

Table C2a. Number of regional long-term projected employment openings in high-demand study occupations from 2014 to 2024 that were served and unserved (shaded) by a career and technical education program in each region in West Virginia in 2016/17

High-demand study occupation	Advantage Valley	Mid-Ohio Valley	North Central	Northern Panhandle	Potomac Highlands & Shenandoah Valley	Southeastern	Southern Mountains
Automotive service technicians and mechanics	801	603	842	340	549	924	625
Bookkeeping, accounting, and auditing clerks	1,557	823	1,520	769	544	1,007	1,041
Carpenters	674	272	1,101	289	366	858	766
Cooks, restaurant	735	454	1,483	577	664	1,018	784
Correctional officers and jailers	na	na	1,080	na	235	874	na
Court, municipal, and license clerks	na	na	na	510	na	na	na
Electricians	482	552	813	369	302	722	720
Executive secretaries and executive administrative assistants	362	na	na	na	na	na	na
First-line supervisors of construction trades and extraction	631	340	1,493	336	200	762	857
First-line supervisors of food preparation and serving workers	784	na	1,287	583	565	817	721
Fitness trainers and aerobics instructors	na	na	na	na	200	na	na
Food service managers	na	210	na	na	291	na	na
Hairdressers, hairstylists, and cosmetologists	397	na	599	326	na	393	na
Heating, air conditioning, and refrigeration mechanics and installation	na	141	na	na	na	na	na
Industrial machinery mechanics	436	260	662	348	na	na	916
Machinists	na	na	na	na	na	556	502
Maintenance and repair workers, general	1,715	920	2,706	1,337	1,000	1,508	1,488
Mobile heavy equipment mechanics, except engines	na	na	na	na	na	478	357
Nursing assistants	890	848	1,550	944	905	1,543	1,183
Office clerks, general	4,510	2,408	5,930	3,183	2,539	4,705	4,726
Paralegals and legal assistants	575	na	na	na	240	na	na
Pharmacy technicians	328	221	801	241	278	474	825

High-demand study occupation	Advantage Valley	Mid-Ohio Valley	North Central	Northern Panhandle	Potomac Highlands & Shenandoah Valley	Southeastern	Southern Mountains
Plumbers, pipefitters, and steamfitters	360	na	na	232	287	na	na
Police and sheriff's patrol officers	819	251	958	520	352	640	396
Psychiatric aides	na	na	na	na	na	na	452
Psychiatric technicians	na	na	721	na	na	na	na
Secretaries and administrative assistants, except legal, medical, and executive	2,146	1,016	2,266	926	1,019	1,770	1,603
Security guards	1,329	301	804	408	436	889	716
Teacher assistants	360	208	745	232	601	749	347
Tire repairers and changers	na	155	na	na	na	na	na
Welders, cutters, solderers, and brazers	na	260	615	237	na	526	683
Wellhead pumpers	na	207	na	na	na	na	na

na is not applicable (occupations are not in high demand in the region).

Note: Cell shading indicates that the occupation is unserved.

Source: Authors' analysis of data from U.S. Department of Labor (2018a) and West Virginia Department of Commerce (n.d.).

Table C2b. National high-demand study occupations served or unserved (shaded) by a career and technical education program, by West Virginia region, 2016/17

High demand study occupation	Advantage Valley	Mid-Ohio Valley	North Central	Northern Panhandle	Potomac Highlands & Shenandoah Valley	Southeastern	Southern Mountains
Animal trainers	Yes	Yes	Yes	No	Yes	Yes	Yes
Bookkeeping, accounting and auditing clerks	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chefs and head cooks	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Construction carpenters	Yes	Yes	Yes	Yes	Yes	Yes	No
Cooks, restaurant	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Energy auditors	Yes	Yes	Yes	No	Yes	Yes	No
Fence erectors	Yes	Yes	Yes	Yes	Yes	Yes	No
First-line supervisors of food preparation and serving workers	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fitness trainers and aerobics instructors	Yes	Yes	Yes	No	No	No	No
Hairdressers, hairstylists	Yes	Yes	Yes	No	Yes	No	Yes
Helpers—carpenters	Yes	Yes	Yes	Yes	Yes	Yes	No
Helpers—electricians	Yes	Yes	Yes	Yes	Yes	Yes	No
Helpers—extraction workers	Yes	Yes	Yes	No	No	No	No
Helpers—pipelayers, plumbers, pipefitters, and steamfitters	Yes	Yes	Yes	Yes	Yes	Yes	No
Maintenance and repair workers, general	Yes	No	Yes	No	Yes	No	Yes
Mapping technicians	No	Yes	Yes	No	Yes	Yes	No
Medical records and health information technicians	Yes	No	No	No	Yes	No	No
Millwrights	Yes	No	Yes	Yes	Yes	Yes	Yes
Nail technician	No	Yes	No	No	Yes	Yes	Yes
Office clerks, general	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Outdoor power equipment and other small engine mechanics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Paralegals and legal assistants	No	No	Yes	No	No	No	No
Pipefitters and steamfitters	Yes	Yes	Yes	Yes	Yes	Yes	No
Plumbers	Yes	Yes	Yes	Yes	Yes	Yes	No
Rough carpenters	Yes	Yes	Yes	Yes	Yes	Yes	No

High demand study occupation	Advantage Valley	Mid-Ohio Valley	North Central	Northern Panhandle	Potomac Highlands & Shenandoah Valley	Southeastern	Southern Mountains
Secretaries & administrative assistants, except legal, medical, and executive	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Security guards	Yes	Yes	Yes	No	Yes	Yes	Yes
Service unit operators, oil, gas, and mining	Yes	Yes	Yes	No	No	No	No
Skincare specialists	No	Yes	No	No	Yes	Yes	Yes
Solar energy installation managers	Yes	Yes	Yes	No	Yes	Yes	No
Surveying technicians	No	Yes	Yes	No	Yes	Yes	No
Tax preparers	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Teacher assistants	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tour guides and escorts	Yes	No	Yes	No	Yes	Yes	Yes
Web developers	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wellhead pumpers	Yes	Yes	Yes	No	No	No	No
Occupations served (number)	31	31	34	20	31	28	19

Note: Cell shading indicates that the occupation is unserved. The list of occupations includes all 37 national high-demand occupations (Bright Outlook occupations) in job zone 2 or 3 that West Virginia Department of Education targets with one of its approved career pathways.

Source: Authors' analysis of data from U.S. Department of Labor (2018a) and West Virginia Department of Commerce (n.d.).

High school career and technical education program alignment by West Virginia region

Tables C3a–C9b report on the number of projected employment openings from 2014 to 2024 in high-demand study occupations and on the alignment of high school CTE programs and high-demand study occupations by region in West Virginia in 2016/17.

Table C3a. Number of projected employment openings from 2014 to 2024 in high-demand study occupations and alignment between high school career and technical education programs and high-demand study occupations in the Advantage Valley region of West Virginia in 2016/17

Number of projected employment openings from 2014 to 2024	High-demand study occupation	Aligned high school career and technical education (CTE) program in 2016/17	Number of schools with aligned CTE programs ^a
4,510	Office clerks, general	Information management ^b Management and administrative support ^b	14 12
2,146	Secretaries and administrative assistants, except legal, medical, and executive	Information management ^b Management and administrative support ^b	14 12
1,715	Maintenance and repair workers, general	Industrial equipment maintenance ^b	1
1,557	Bookkeeping, accounting, and auditing clerks	Accounting	12
1,329	Security guards	Law and public safety ^b	4
890	Nursing assistants	Therapeutic services	8
819	Police and sheriff's patrol officers	Law and public safety ^b	4
801	Automotive service technicians and mechanics	Automotive technology	7
784	First-line supervisors of food prep and serving workers	Pro-Start restaurant management ^b	8
735	Cooks, restaurant	Pro-Start restaurant management ^b	8
674	Carpenters	Carpentry Power, structural and technical systems ^b	7 3
631	First-line supervisors of construction trades and extraction	Energy, power and engineered systems	2
575	Paralegals and legal assistants	None	na
482	Electricians	Electrical technician Power, structural and technical systems ^b	4 3
436	Industrial machinery mechanics	Industrial equipment maintenance ^b	1
397	Hairdressers, hairstylists, and cosmetologists	Hairstylist	1
362	Executive secretaries and executive administrative assistant	Information management ^b Management and administrative support ^b	14 12
360	Teacher assistants	Careers in education Early childhood education	3 5
360	Plumbers, pipefitters, and steamfitters	Plumbing Power, structural and technical systems ^b	2 3
328	Pharmacy technicians	Allied health	4

na is not applicable (no CTE program offered).

Note: Shading indicates that the occupation is not served by any of the region's high school CTE programs.

a. Includes career technical centers.

b. CTE program is aligned to more than one high-demand occupation.

Source: Authors' analysis of data from U.S. Department of Labor (2018a), West Virginia Department of Commerce (n.d.), and West Virginia Department of Education (n.d.).

Table C3b. Across-region and national alignment of high school career and technical education programs in the Advantage Valley region of West Virginia that are not aligned to high-demand study occupations within that region, 2016/17

High school career and technical education (CTE) program unaligned within region	Across-region alignment ^a	National alignment ^b	Number of schools with CTE program ^c
Advanced manufacturing	No	No	1
Agribusiness systems	Yes	Yes	6
Animal Systems	No	Yes	2
Barbering	No	No	1
Career and work skills training	No	No	5
Chemical energy and mechanical technologies	No	Yes	1
CISCO Networking Academy	No	No	2
Coding, app and game design	No	Yes	6
Computer systems repair technology	No	No	2
Diagnostics services	No	No	1
Diesel equipment technology	No	No	2
Drafting	No	No	4
Emergency/firefighting management services	No	No	2
Food science and nutrition	No	No	2
Graphic communications	No	No	1
Graphic design	No	No	3
Health informatics	No	Yes	3
Heating, ventilation, and air conditioning (HVAC) technician	Yes	No	6
Hospitality and tourism concentration	No	Yes	1
Hydraulic and pneumatic troubleshooting	No	No	1
Industrial electrical control systems	No	No	1
Junior Reserve Officers' Training Corps (JROTC)	No	No	12
Machine tool technology	Yes	Yes	3
Marketing management	Yes	No	7
Masonry	No	No	1
Metals technology	Yes	No	1
Microsoft computer applications specialist	No	No	2
Millwork and cabinetmaking	No	No	1
Personal fitness and wellness training	Yes	Yes	1
Pet grooming	No	Yes	2
Plant systems	No	No	4
Pre-engineering – Project Lead the Way	No	No	6
Rehabilitation specialist	No	No	1
Robotics	No	No	1
Simulation and game development virtual	No	No	1
Welding	Yes	No	8

a. Whether a CTE program aligns to a high-demand study occupation in a different region.

b. Whether a CTE program aligns to a high-demand study occupation anywhere else in the country.

c. Includes career technical centers.

Source: Authors' analysis of data from U.S. Department of Labor (2018a), West Virginia Department of Commerce (n.d.), and West Virginia Department of Education (n.d.).

Table C4a. Number of projected employment openings from 2014 to 2024 in high-demand study occupations and alignment between high school career and technical education programs and high-demand study occupations in the Mid-Ohio Valley region of West Virginia in 2016/17

Number of projected employment openings from 2014 to 2024	High-demand study occupation	Aligned high school career and technical education (CTE) program in 2016/17	Number of schools with aligned CTE program ^a
2,408	Office clerks, general	Information management ^b	8
		Management and administrative support ^b	7
1,016	Secretaries and administrative assistants, except legal, medical, and executive	Information management ^b	8
		Management and administrative support ^b	7
920	Maintenance and repair workers, general	None	na
848	Nursing assistants	Therapeutic services	3
823	Bookkeeping, accounting, and auditing clerks	Accounting	4
603	Automotive service technicians and mechanics	Automotive technology	3
552	Electricians	Electrical technician	2
		Power, structural and technical systems ^b	4
454	Cooks, restaurant	Pro-Start restaurant management ^b	2
340	First-line supervisors of construction trades and extraction	Energy, power and engineered systems	1
301	Security guards	Law and public safety ^b	2
272	Carpenters	Carpentry	4
		Power, structural and technical systems ^b	4
260	Industrial machinery mechanics	None	na
260	Welders, cutters, solderers, and brazers	Agribusiness systems	7
		Power, structural and technical systems ^b	4
		Welding	4
251	Police and sheriff's patrol officers	Law and public safety ^b	2
221	Pharmacy technicians	Allied Health	1
210	Food service managers	Pro-Start restaurant management ^b	2
		Careers in education	3
208	Teacher assistants	Early childhood education	2
207	Wellhead pumpers	Chemical energy and mechanical technologies	1
155	Tire repairers and changers	Automotive technology	3
141	Heating, air conditioning, and refrigeration mechanics I	None	na

na is not applicable (no CTE program offered).

Note: Shading indicates that the occupation is not served by any of the region's high school CTE programs.

a. Includes career technical centers.

b. CTE program is aligned to more than one high-demand occupation.

Source: Authors' analysis of data from U.S. Department of Labor (2018a), West Virginia Department of Commerce (n.d.), and West Virginia Department of Education (n.d.).

Table C4b. Across-region and national alignment of high school career and technical education programs in the Mid-Ohio Valley region of West Virginia that are not aligned to high-demand study occupations within that region, 2016/17

High school career and technical education (CTE) program unaligned within region	Across-region alignment ^a	National alignment ^b	Number of schools with CTE program ^c
Aesthetics	No	No	1
Animal processing	No	No	1
Animal systems	No	Yes	3
Broadcasting technology	No	No	1
Career and work skills training	No	No	3
Coding, app and game design	No	Yes	1
Collision repair technology	No	No	2
Computer systems repair technology	No	No	3
Diesel equipment technology	No	No	1
Drafting	No	No	3
Emergency/firefighting management services	No	No	1
Food science and nutrition	No	No	4
Forest industry	No	No	1
Hairstylist	Yes	Yes	1
Junior Reserve Officers' Training Corps (JROTC)	No	No	3
Medical office	No	No	2
Microsoft computer applications specialist	No	No	1
Millwork and cabinetmaking	No	No	2
Nail technology	Yes	Yes	1
Natural resources management	No	Yes	1
Performing arts	No	No	3
Personal fitness and wellness training	Yes	Yes	1
Plant systems	No	No	6
Prevention support specialist	No	No	1
Robotics	No	No	1
Science, technology, engineering, and math (STEM)	No	No	4
Simulation and game development virtual	No	No	3
Turf and landscape systems	No	No	1
Visual arts	No	No	3

a. Whether a CTE program aligns to a high-demand study occupation in a different region.

b. Whether a CTE program aligns to a high-demand study occupation anywhere else in the country.

c. Includes career technical centers.

Source: Authors' analysis of data from U.S. Department of Labor (2018a), West Virginia Department of Commerce (n.d.), and West Virginia Department of Education (n.d.).

Table C5a. Number of projected employment openings from 2014 to 2024 in high-demand study occupations and alignment between high school career and technical education programs and high-demand study occupations in the North Central region of West Virginia in 2016/17

Number of projected employment openings from 2014 to 2024	High-demand study occupation	Aligned high school career and technical education (CTE) program in 2016/17	Number of schools with aligned CTE program ^a
5,930	Office clerks, general	Information management ^b	16
		Management and administrative support ^b	18
2,706	Maintenance and repair workers, general	Building maintenance and operations	2
		Industrial equipment maintenance	1
2,266	Secretaries and administrative assistants, except legal, medical, and executive	Information management ^b	16
		Management and administrative support ^b	18
1,550	Nursing assistants	Therapeutic services	9
1,520	Bookkeeping, accounting, and auditing clerks	Accounting	14
1,493	First-line supervisors of construction trades and extraction	Energy, power and engineered systems	6
1,483	Cooks, restaurant	Pro-Start restaurant management ^b	9
1,287	First-line supervisors of food preparation and serving workers	Pro-Start restaurant management ^b	9
1,101	Carpenters	Carpentry	9
		Power, structural and technical systems ^b	5
1,080	Correctional officers and jailers	Law and public safety ^b	6
958	Police and sheriff's patrol officers	Law and public safety ^b	6
842	Automotive service technicians and mechanics	Automotive technology	7
813	Electricians	Electrical technician	8
		Power equipment systems	2
		Power, structural and technical systems ^b	5
804	Security guards	Law and public safety ^b	6
801	Pharmacy technicians	Allied health	3
745	Teacher assistants	Careers in education	8
		Early childhood education	5
721	Psychiatric technicians	Prevention support specialist	3
		Social services assistant	1
662	Industrial machinery mechanics	Industrial equipment maintenance	1
615	Welders, cutters, solderers, and brazers	Agribusiness systems	14
		Metals technology	2
		Power, structural and technical systems ^b	5
		Welding	6
599	Hairdressers, hairstylists, and cosmetologists	Hairstylist	2

a. Includes career technical centers.

b. CTE program is aligned to more than one high-demand occupation.

Source: Authors' analysis of data from U.S. Department of Labor (2018a), West Virginia Department of Commerce (n.d.), and West Virginia Department of Education (n.d.).

Table C5b. Across-region and national alignment of high school career and technical education programs in the North Central region of West Virginia that are not aligned to high-demand study occupations within that region, 2016/17

High school career and technical education (CTE) program unaligned within region	Across-region alignment ^a	National alignment ^b	Number of schools with CTE program ^c
Animal processing	No	No	1
Animal systems	No	Yes	4
Baking and pastry	No	No	2
Broadcast journalism	No	No	3
Broadcasting technology	No	No	1
Career and work skills training	No	No	2
CASE animal science	No	No	2
Chemical energy and mechanical technologies	Yes	Yes	1
CISCO networking academy	No	No	2
Coding, app and game design	No	Yes	8
Collision repair technology	No	No	5
Computer systems repair technology	No	No	5
Diesel equipment technology	No	No	1
Drafting	No	No	2
Food science and nutrition	No	No	3
Graphic design	No	No	1
Health and safety leadership	No	No	1
Heating, ventilation, and air conditioning (HVAC) technician	Yes	No	1
Hospitality and tourism concentration	No	Yes	1
Junior Reserve Officers' Training Corps (JROTC)	No	No	5
Machine tool technology	Yes	Yes	2
Marketing management	Yes	No	5
Masonry	No	No	2
Medical office	No	No	1
Microsoft computer applications specialist	No	No	2
Millwork and cabinetmaking	No	No	1
Natural resources management	No	Yes	7
Paralegal assistant	Yes	Yes	1
Performing arts	No	No	6
Personal fitness and wellness training	Yes	Yes	1
Pet grooming	No	Yes	1
Plant systems	No	No	13
Pre-engineering – Project Lead the Way	No	No	2
Rehabilitation specialists	No	No	1
Robotics	No	No	1
Science, technology, engineering, and math (STEM)	No	No	5
Simulation and game development virtual	No	No	3
Virtual childcare	No	No	1
Visual arts	No	No	7

a. Whether a CTE program aligns to a high-demand study occupation in a different region.

b. Whether a CTE program aligns to a high-demand study occupation anywhere else in the country.

c. Includes career technical centers.

Source: Authors' analysis of data from U.S. Department of Labor (2018a), West Virginia Department of Commerce (n.d.), and West Virginia Department of Education (n.d.).

Table C6a. Number of projected employment openings from 2014 to 2024 in high-demand study occupations and alignment between high school career and technical education programs and high-demand study occupations in the Northern Panhandle region of West Virginia in 2016/17

Number of projected employment openings from 2014 to 2024	High-demand study occupation	Aligned high school career and technical education (CTE) program in 2016/17	Number of schools with aligned CTE program ^a
3,183	Office clerks, general	Information management ^b	3
		Management and administrative support ^b	8
1,337	Maintenance and repair workers, general	None	na
944	Nursing assistants	Therapeutic services	4
926	Secretaries and administrative assistants, except legal, medical, and executive	Information management ^b	3
		Management and administrative support ^b	8
769	Bookkeeping, accounting, and auditing clerks	Accounting	7
583	First-line supervisors of food preparation and serving workers	Pro-Start restaurant management ^b	4
577	Cooks, restaurant	Pro-Start restaurant management ^b	4
520	Police and sheriff's patrol officers	None	na
510	Court, municipal, and license clerks	None	na
408	Security guards	None	na
369	Electricians	Power equipment systems	1
		Power, structural and technical systems ^b	1
348	Industrial machinery mechanics	None	na
340	Automotive service technicians and mechanics	Automotive technology	4
336	First-line supervisors of construction trades and extraction	None	na
326	Hairdressers, hairstylists, and cosmetologists	None	na
289	Carpenters	Carpentry	3
		Power, structural and technical systems ^b	1
241	Pharmacy technicians	None	na
237	Welders, cutters, solderers, and brazers	Agribusiness systems	4
		Power, structural and technical systems ^b	1
		Welding	4
232	Teacher assistants	Careers in education	3
		Early childhood education	2
232	Plumbers, pipefitters, and steamfitters	Power, structural and technical systems ^b	1

na is not applicable (no CTE program offered).

Note: Shading indicates that the occupation is not served by any of the region's high school CTE programs.

a. Includes career technical centers.

b. CTE program is aligned to more than one high-demand occupation.

Source: Authors' analysis of data from U.S. Department of Labor (2018a), West Virginia Department of Commerce (n.d.), and West Virginia Department of Education (n.d.).

Table C6b. Across-region and national alignment of high school career and technical education programs in the Northern Panhandle region of West Virginia that are not aligned to high-demand study occupations within that region, 2016/17

High school career and technical education (CTE) program unaligned within region	Across-region alignment ^a	National alignment ^b	Number of schools with CTE program ^c
Broadcast journalism	No	No	1
Broadcasting technology	No	No	3
Coding, app and game design	No	Yes	2
Collision repair technology	No	No	4
Computer systems repair technology	No	No	3
Diesel equipment technology	No	No	1
Drafting	No	No	1
Electronics technician	No	No	2
Food science and nutrition	No	No	7
Graphic communications	No	No	1
Graphic design	No	No	1
Machine tool technology	Yes	Yes	3
Marketing management	Yes	No	2
Mining extraction	No	No	1
Plant systems	No	No	4
Pre-engineering – Project Lead the Way	No	No	1
Science, technology, engineering, and math (STEM)	No	No	4
Social services assistant	Yes	No	1

a. Whether a CTE program aligns to a high-demand study occupation in a different region.

b. Whether a CTE program aligns to a high-demand study occupation anywhere else in the country.

c. Includes career technical centers.

Source: Authors' analysis of data from U.S. Department of Labor (2018a), West Virginia Department of Commerce (n.d.), and West Virginia Department of Education (n.d.).

Table C7a. Number of projected employment openings from 2014 to 2024 in high-demand study occupations and alignment between high school career and technical education programs and high-demand study occupations in the Potomac Highlands and Shenandoah Valley region of West Virginia in 2016/17

Number of projected employment openings from 2014 to 2024	High-demand study occupation	Aligned high school career and technical education (CTE) program in 2016/17	Number of schools with aligned CTE program ^a
2,539	Office clerks, general	Information management ^b	10
		Management and administrative support ^b	10
1,019	Secretaries and administrative assistants, except legal, medical, and executive	Information management ^b	10
		Management and administrative support ^b	10
1,000	Maintenance and repair workers, general	Industrial equipment maintenance	1
905	Nursing assistants	Therapeutic services	5
664	Cooks, restaurant	Pro-Start restaurant management ^b	7
601	Teacher assistants	Careers in education	4
		Early childhood education	2
565	First-line supervisors of food preparation and serving workers	Pro-Start restaurant management ^b	7
549	Automotive service technicians and mechanics	Automotive technology	5
544	Bookkeeping, accounting, and auditing clerks	Accounting	10
436	Security guards	Law and public safety ^b	2
366	Carpenters	Carpentry	5
		Power, structural and technical systems ^b	12
352	Police and sheriff's patrol officers	Law and public safety ^b	2
302	Electricians	Electrical technician	1
		Power, structural and technical systems ^b	12
291	Food service managers	Marketing management	6
		Pro-Start restaurant management ^b	7
287	Plumbers, pipefitters, and steamfitters	Power, structural and technical systems ^b	12
278	Pharmacy technicians	Allied health	1
240	Paralegals and legal assistants	None	na
235	Correctional officers and jailers	Law and public safety ^b	2
200	First-line supervisors of construction trades and extraction	Energy, power and engineered systems	1
200	Fitness trainers and aerobics instructors	None	na

na is not applicable (no CTE programs offered).

Note: Shading indicates that the occupation is not served by any of the region's high school CTE programs.

a. Includes career technical centers.

b. CTE program is aligned to more than one high-demand occupation.

Source: Authors' analysis of data from U.S. Department of Labor (2018a), West Virginia Department of Commerce (n.d.), and West Virginia Department of Education (n.d.).

Table C7b. Across-region and national alignment of high school career and technical education programs in the Potomac Highlands and Shenandoah Valley region of West Virginia that are not aligned to high-demand study occupations within that region, 2016/17

High school career and technical education (CTE) program unaligned within region	Across-region alignment ^a	National alignment ^b	Number of schools with CTE program ^c
Aesthetics	No	Yes	1
Agribusiness systems	Yes	Yes	13
Animal processing	No	No	1
Animal systems	No	Yes	10
Applied design	No	No	3
Broadcasting technology	No	No	1
Career and work skills training	No	No	2
Curriculum for Agricultural Science Education plant science	No	No	1
Certified Internet webmaster	No	No	1
CISCO networking academy	No	No	1
Coding, app and game design	No	Yes	4
Collision repair technology	No	No	2
Computer systems repair technology	No	No	3
Diesel equipment technology	No	No	1
Drafting	No	No	1
Emergency/firefighting management services	No	No	1
Food science and nutrition	No	No	5
General management	No	No	1
Graphic communications	No	No	1
Graphic design	No	No	1
Hairstylist	Yes	Yes	1
Health informatics	No	Yes	1
Heating, ventilation, and air conditioning (HVAC) technician	Yes	No	1
Informatics	No	No	1
Junior Reserve Officers' Training Corps (JROTC)	No	No	5
Machine tool technology	Yes	Yes	2
Masonry	No	No	1
Microsoft computer applications specialist	No	No	2
Millwork and cabinetmaking	No	No	3
Multimedia publishing	No	No	1
Nail technology	Yes	Yes	1
Natural resources management	No	No	4
Plant systems	No	No	7
Pre-engineering – Project Lead the Way	No	No	2
Robotics	No	No	2
Science, technology, engineering, and math (STEM)	No	No	1
Simulation and game development virtual	No	No	2
Welding	No	No	3

a. Whether a CTE program aligns to a high-demand study occupation in a different region.

b. Whether a CTE program aligns to a high-demand study occupation anywhere else in the country.

c. Includes career technical centers.

Source: Authors' analysis of data from U.S. Department of Labor (2018a), West Virginia Department of Commerce (n.d.), and West Virginia Department of Education (n.d.).

Table C8a. Number of projected employment openings from 2014 to 2024 in high-demand study occupations and alignment between high school career and technical education programs and high-demand study occupations in the Southeastern region of West Virginia in 2016/17

Number of projected employment openings from 2014 to 2024	High-demand study occupation	Aligned high school career and technical education (CTE) program in 2016/17	Number of schools with aligned CTE program ^a
4,705	Office clerks, general	Information management ^b	8
		Management and administrative support ^b	13
1,770	Secretaries and administrative assistants, except legal, medical, and executive	Information management ^b	8
		Management and administrative support ^b	13
1,543	Nursing assistants	Therapeutic services	9
1,508	Maintenance and repair workers, general	None	na
1,018	Cooks, restaurant	Pro-Start restaurant management ^b	7
1,007	Bookkeeping, accounting, and auditing clerks	Accounting	9
924	Automotive service technicians and mechanics	Automotive technology	5
889	Security guards	Law and public safety ^b	4
874	Correctional officers and jailers	Law and public safety ^b	4
858	Carpenters	Carpentry	10
		Power, structural and technical systems ^b	3
817	First-line supervisors of food preparation and serving workers	Pro-Start restaurant management ^b	7
762	First-line supervisors of construction trades and extraction	Energy, power and engineered systems	1
749	Teacher assistants	Careers in education	4
		Early childhood education	5
722	Electricians	Electrical technician	4
		Power, structural and technical systems ^b	3
640	Police and sheriff's patrol officers	Law and public safety ^b	4
556	Machinists	Machine tool technology	1
526	Welders, cutters, solderers, and brazers	Agribusiness systems	7
		Power, structural and technical systems ^b	3
		Welding	7
478	Mobile heavy equipment mechanics, except engines	Power, structural and technical systems ^b	3
474	Pharmacy technicians	Allied health	5
393	Hairdressers, hairstylists, and cosmetologists	None	na

na is not applicable (no CTE programs offered).

Note: Shading indicates that the occupation is not served by any of the region's high school CTE programs.

a. Includes career technical centers.

b. CTE program is aligned to more than one high-demand occupation.

Source: Authors' analysis of data from U.S. Department of Labor (2018a), West Virginia Department of Commerce (n.d.), and West Virginia Department of Education (n.d.).

Table C8b. Across-region and national alignment of high school career and technical education programs in the Southeastern region of West Virginia that are not aligned to high-demand study occupations within that region, 2016/17

High school career and technical education (CTE) program unaligned within region	Across-region alignment ^a	National alignment ^b	Number of schools with CTE program ^c
Aerospace engineering	No	No	1
Aesthetics	No	Yes	1
Animal processing	No	No	2
Animal systems	No	Yes	5
Baking and pastry	No	No	1
Business finance	No	No	1
Coding, app and game design	No	Yes	3
Collision repair technology	No	No	4
Computer integrated manufacturing	No	No	1
Computer systems repair technology	No	No	4
Diesel equipment technology	No	No	1
Drafting	No	No	3
Food science and nutrition	No	No	3
Forest industry	No	No	1
Graphic design	No	No	1
Health and safety leadership	No	No	1
Heating, ventilation, and air conditioning (HVAC) technician	Yes	No	2
Hospitality and tourism concentration	No	Yes	2
Junior Reserve Officers' Training Corps (JROTC)	No	No	11
Lodging management program	No	No	1
Marketing management	Yes	No	3
Masonry	No	No	3
Microsoft computer applications specialist	No	No	1
Nail technology	Yes	Yes	1
Natural resources management	No	Yes	3
Performing arts	No	No	2
Plant systems	No	No	4
Plumbing	Yes	No	1
Pre-engineering – Project Lead the Way	No	No	5
Prevention support specialist	Yes	No	2
Science, technology, engineering, and math (STEM)	No	No	1
Visual arts	No	No	2

a. Whether a CTE program aligns to a high-demand study occupation in a different region.

b. Whether a CTE program aligns to a high-demand study occupation anywhere else in the country.

c. Includes career technical centers.

Source: Authors' analysis of data from U.S. Department of Labor (2018a), West Virginia Department of Commerce (n.d.), and West Virginia Department of Education (n.d.).

Table C9a. Number of projected employment openings from 2014 to 2024 in high-demand study occupations and alignment between high school career and technical education programs and high-demand study occupations in the Southern Mountains region of West Virginia in 2016/17

Number of projected employment openings from 2014 to 2024	High-demand study occupation	Aligned high school career and technical education (CTE) program in 2016/17	Number of schools with aligned CTE program ^a
4,726	Office clerks, general	Information management ^b	3
		Management and administrative support ^b	2
1,603	Secretaries and administrative assistants, except legal, medical, and executive	Information management ^b	3
		Management and administrative support ^b	2
1,488	Maintenance and repair workers, general	Building maintenance and operations	2
		Industrial equipment maintenance ^b	2
1,183	Nursing assistants	Therapeutic services	8
1,041	Bookkeeping, accounting, and auditing clerks	Accounting	5
916	Industrial machinery mechanics	Industrial equipment maintenance ^b	2
857	First-line supervisors of construction trades and extraction	None	na
825	Pharmacy technicians	Allied health	1
784	Cooks, restaurant	Pro-Start restaurant management ^b	6
766	Carpenters	Carpentry	4
721	First-line supervisors of food preparation and serving workers	Pro-Start restaurant management ^b	6
720	Electricians	Electrical technician	3
		Power equipment systems	2
716	Security guards	Law and public safety ^b	2
683	Welders, cutters, solderers, and brazers	Agribusiness systems	1
		Welding	6
625	Automotive service technicians and mechanics	Automotive technology	6
502	Machinists	Machine tool technology	2
452	Psychiatric Aides	Prevention support specialist	1
		Social services assistant	1
396	Police and sheriff's patrol officers	Law and public safety ^b	2
357	Mobile heavy equipment mechanics, except engines	Industrial equipment maintenance ^b	2
347	Teacher assistants	Careers in education	6
		Early childhood education	2

na is not applicable (no CTE programs offered).

Note: Shading indicates that the occupation is not served by any of the region's high school CTE programs.

a. Includes career technical centers.

b. CTE program is aligned to more than one high-demand occupation.

Source: Authors' analysis of data from U.S. Department of Labor (2018a), West Virginia Department of Commerce (n.d.), and West Virginia Department of Education (n.d.).

Table C9b. Across-region and national alignment of high school career and technical education programs in the Southern Mountains region of West Virginia that are not aligned to high-demand study occupations within that region, 2016/17

High school career and technical education (CTE) program unaligned within region	Across-region alignment ^a	National alignment ^b	Number of schools with CTE program ^c
Advanced manufacturing	No	No	1
Aesthetics	No	Yes	2
Animal systems	No	Yes	1
Business finance	No	No	3
Certified Internet webmaster (CIW) 1	No	No	1
Coding, app and game design	No	Yes	3
Collision repair technology	No	No	1
Computer science (Project Lead the Way)	No	No	1
Computer systems repair technology	No	No	2
Diagnostics services	No	No	1
Diesel equipment technology	No	No	1
Drafting	No	No	4
Electronics technician	No	No	2
Entrepreneurship	No	No	1
Graphic communications	No	No	1
Graphic design	No	No	2
Hairstylist	Yes	Yes	2
Heating, ventilation, and air conditioning (HVAC) technician	No	No	2
High School of Business	No	No	1
Hospitality and tourism concentration	No	Yes	1
Junior Reserve Officers' Training Corps (JROTC)	No	No	2
Masonry	No	No	1
Medical office	No	No	1
Nail technology	No	Yes	2
Plant systems	No	No	2
Plumbing	Yes	No	1
Pre-engineering – Project Lead the Way	No	No	1
Robotics	No	No	3
Simulation and game development virtual	No	No	2

a. Whether a CTE program aligns to a high-demand study occupation in a different region.

b. Whether a CTE program aligns to a high-demand study occupation anywhere else in the country.

c. Includes career technical centers.

Source: Authors' analysis of data from U.S. Department of Labor (2018a), West Virginia Department of Commerce (n.d.), and West Virginia Department of Education (n.d.).

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