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

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Assessing the Alignment Between West Virginia's High School Career and Technical Education Programs and the Labor Market

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To help students leave high school on a path toward success in the labor market, education policymakers and practitioners often focus on improving career and technical education (CTE) opportunities in high school. Understanding the alignment between high school CTE programs and the labor market is an important step in this process. To support CTE improvement efforts, this study quantitatively assessed the alignment between West Virginia's high school CTE programs and the labor market, with a focus on alignment to regional high-demand occupations that require moderate occupational preparation. These "high-demand study occupations" are the 20 occupations in each region of West Virginia with the largest number of long-term projected employment openings from 2014 to 2024 that require more than a high school diploma (for example, a license or work-related experience) but less than a bachelor's degree.

The study found that 70 percent of West Virginia's long-term projected employment openings typically require some occupational preparation beyond a high school diploma but less than a bachelor's degree. Further, 93 percent of the regional long-term projected employment openings in high-demand study occupations were served by at least one aligned CTE program in the same region. However, students in only 53 percent of the state's CTE programs were in a program that aligned to at least one high-demand study occupation within their region. West Virginia stakeholders can use the findings to improve their CTE system's alignment and better prepare students for a postsecondary career. This study also serves as an example for policymakers and practitioners in other states who are interested in quantifying their CTE system's alignment in order to make data-informed decisions.

Why this study?

The 21st century economy demands an educated workforce with advanced skills and knowledge (U.S. Chamber of Commerce, 2017). Education policymakers and practitioners across the United States have become increasingly focused on offering high-quality career and technical education (CTE) programs that prepare students for college and careers in current or emerging professions. During the 2016/17 school year 98 percent of the nation's public school districts offered CTE programs to high school students (Gray & Lewis, 2018).

State education agencies play a critical role in assessing the state's labor market needs and examining whether their high school CTE system is meeting these needs. In West Virginia, CTE is a critical component of the state's strategy for preparing college- and career-ready high school graduates. Leaders in the West Virginia Department of Education (WVDE) have prioritized improving the quality of CTE programs and streamlining the portfolio of programs to better align to the regional labor market. (See box 1 for definitions of key terms used in this study and appendix A for more information on the study's policy context.)

Leaders at WVDE's Division of Career and Technical Education and Governor's Economic Initiatives lacked a way to quantify how well their CTE programs aligned to the labor market, limiting the ability to make data-informed decisions. Without a way to quantify alignment, WVDE has relied on qualitative assessments, such as consulting with local advisory councils of educators and representatives from local businesses and industries. This study employs new methods to quantify the

For additional information, including background on the study, technical methods, and supporting analyses, access the report appendices at https://go.usa.gov/xv5eq.

Box 1. Key terms

Alignment between career and technical education (CTE) programs and occupations. The extent to which a CTE program prepares students with the knowledge, skills, and abilities to succeed in a given occupation.

Bright Outlook occupation. An occupation that the U.S. Department of Labor projects will have at least 100,000 employment openings nationally from 2016 to 2026 or is projected to grow by 10 percent or more during that period (U.S. Department of Labor, 2018b).

CTE program. "An approved sequence of four CTE courses which align to a CTE cluster and pathway, impact state economic labor market needs as verified by workforce data, and lead to an industry-recognized credential or certificate or opportunity for continuing into postsecondary level education" (West Virginia Department of Education, 2015, p. ix). The West Virginia Department of Education works with a local advisory council of "volunteers from business and industry, labor, postsecondary education, the non-profit sector and students," as required by the Carl D. Perkins Career and Technical Education Act of 2006 (Perkins IV) to determine which programs to approve (West Virginia Department of Education, 2015, p. vi). (See appendix A for more information on local advisory councils, career clusters and pathways, and the Perkins Act of 1984 and reauthorizations.)

Career clusters. Occupational fields recognized by the U.S. Department of Education Office of Career, Technical, and Adult Education and Advance CTE. Each field has an industry-validated knowledge and skills definition that includes what students need to know and be able to do to succeed in that field. West Virginia's career pathways align to these national career clusters and pathways.

Career pathways. Sequences of academic, career, and technical courses and training progressing from secondary through postsecondary education. Under the Perkins Act, states may offer CTE programs in one or more of 16 career clusters, which are broken down into 79 career pathways. All of West Virginia's CTE programs are aligned to Perkins Act career clusters and pathways—if there is no career pathway for an occupation, there is no CTE program.

Employment openings served. A status that indicates that an occupation and its employment openings are served by at least one aligned high school CTE program.

High-demand study occupations. Occupations included in the analysis based on a set of decision rules (see box 2 and figure B2 in appendix B). Regional high-demand study occupations include the 20 occupations in each region with the largest number of long-term projected employment openings from 2014 to 2024 that require moderate occupational preparation. National high-demand study occupations include all Bright Outlook occupations that require moderate occupational preparation. (Box 2 has more information on the data and on the study's occupations, tables C1b–C1h in appendix C list the regional high-demand study occupations, and table C2b in appendix C lists the national high demand study occupations.)

High-school CTE program. Includes CTE programs at both high schools and career technical centers (which also serve adults). Students may attend career technical centers for a portion of the school day, week, or year, or they may attend full time, receiving both academic and technical instruction.

Long-term projected employment openings. Employment openings from 2014 to 2024 projected by Workforce West Virginia, a division of the West Virginia Department of Commerce (West Virginia Department of Commerce, n.d.).

Moderate occupational preparation. More than a high school diploma (for example, a license or work-related experience) but less than a bachelor's degree.

Occupational preparation requirements. The amount of time and training (education and workplace experience) a typical worker requires to acquire the knowledge and skills to perform at an average level in a specific occupation (U.S. Department of Labor, 1991). The Occupational Information Network (O*NET), sponsored by the U.S. Department of Labor, is the primary source of information on occupations and preparation requirements (U.S. Department of Labor, 2018a). Five O*NET job zones categorize occupations according to typical levels of occupational preparation required (U.S. Department of Labor, 2019):

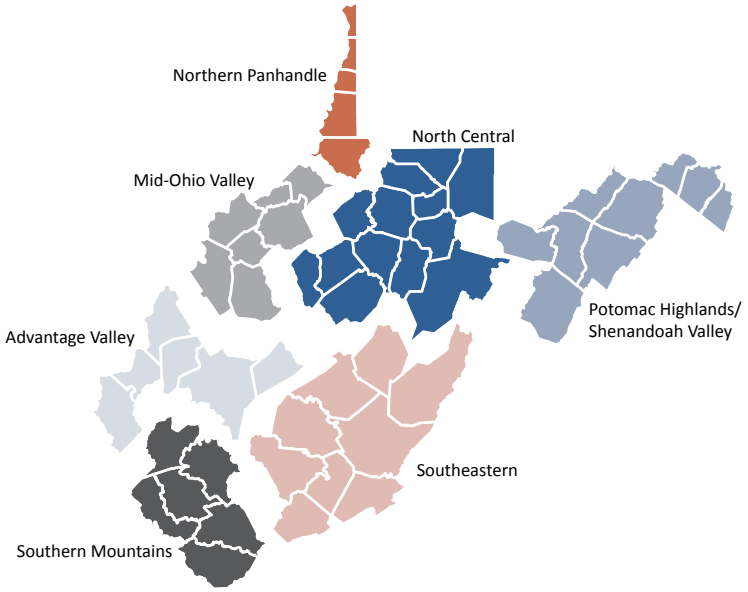
- *Job zone 1:* Little or no preparation needed. Occupations sometimes require a high school diploma or General Educational Development (GED) certificate and little or no work-related experience or knowledge.

Box 1. Key terms *(continued)*

- *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.

Region. An area in West Virginia that is closely aligned to the state's regional planning districts and that was established to provide regional support for developing pathways to college and career readiness and improve the alignment between regional education opportunities and the workforce (West Virginia Code of State Rules, 2016). This study used a modified version of the planning district regions to accommodate differences in the county groupings for each region in West Virginia's data on projected employment openings. Specifically, the county groupings in the data differ slightly from those of the planning districts in two regions (Southern Mountains and Advantage Valley), and the data combine two planning districts into a single region (Potomac Highlands and Shenandoah Valley). The study's seven regions are shown in the map.

West Virginia regions and county groupings used for the study



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

alignment between West Virginia's CTE program offerings at the system level and the labor market. It provides WVDE with quantitative data that its leaders can use along with their qualitative measures to assess the portfolio of CTE programs and to make informed programming decisions (for example, creating new CTE programs that target unmet labor market needs or refining programs to increase alignment).

West Virginia leaders are not alone in prioritizing the alignment of high school CTE programs to projected labor market needs. A 2015 report from the Education Commission of the States identified "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 occupations (Zinth, 2015, p. 1). Nationally, the 2018 reauthorization of the Perkins Act emphasized alignment, requiring states and districts applying for federal CTE funding to complete a needs assessment that demonstrates how CTE programs are aligned to in-demand industries and occupations (Strengthening Career and Technical Education for the 21st Century Act, 2018).

The limited mobility of students motivated a regional focus in this study. The typical adult lives only 18 miles from his or her mother, and for students attending a public postsecondary institution, the median distance between their permanent home and their postsecondary institution is only 11 miles (Bui & Miller, 2015; Hillman, 2016; Molloy, Smith, & Wozniak, 2011). As of 2015 one-third of young adults ages 18–35 in West Virginia still lived with

their parents (Vespa, 2017). That many young adults do not move far from their hometowns highlights the importance of preparing them for success in their own or nearby communities.

Despite the increased attention to alignment in both state and national policy, little research has documented the system-level alignment of high school CTE programs to projected labor market needs. For the most part, research has focused on the association between students' participation in a CTE program and their academic attainment and labor market outcomes. For example, research suggests that CTE programs can boost high school graduation rates (Dougherty, 2016; Warner & Caspary, 2017), postsecondary enrollment (Dougherty, 2016), employment rates, and earnings (Dougherty, 2016; Hollenbeck & Huang, 2017; Kemple, 2008). However, two recent studies found that, nationally, many high school students' CTE concentrations and credentials were not well aligned to labor market needs (ExcelinED & Burning Glass Technologies, 2019; Sublett & Griffith, 2019). For example, only an estimated 19 percent of credentials that K–12 students earned in the United States met employers' demands (ExcelinED & Burning Glass Technologies, 2019). Although these studies did not measure system-level alignment between CTE program offerings and the labor market, a lack of alignment could be a contributing factor to findings that CTE programs do not meet employers' needs.

The current applied research study adds to the limited research on CTE program alignment by delivering a data-driven look at the extent to which West Virginia's high school CTE programs align to the labor market. The study is a first step toward quantitatively gauging alignment between CTE programs and the labor market in West Virginia and can inform WVDE decisions on CTE program offerings.

To quantify alignment, this study relied on WVDE's documentation of the occupations for which each CTE program is designed to prepare students. This documentation was limited to occupations with education requirements that high school CTE programs can satisfy. (See box 2 and appendix B for more information about the study's data and occupations.) Because students can satisfy many occupational preparation requirements, such as a certificate, license, or associate's degree, through a high school CTE program, this study focused on the segment of the labor market that requires moderate occupational preparation—occupations that require some preparation beyond a high school diploma but less than a bachelor's degree.

This study quantified the extent to which regional high-demand occupations (referred to as high-demand study occupations) have at least one aligned high school CTE program in the region and the extent to which high school CTE program offerings aligned to high-demand study occupations in each region of the state. In addition to regional alignment, the study also analyzed state and national alignment by calculating the extent to which West Virginia CTE program offerings aligned to high-demand occupations in other regions of the state or nationally.

WVDE leaders could combine the quantitative results from this system-level analysis with qualitative measures and a quantitative analysis of supply and demand (comparing the number of students in the CTE programs with the number of employment openings) to enhance their decisionmaking. Ultimately, this information could help WVDE improve the alignment between CTE programs and the labor market and better prepare high school graduates for postsecondary careers. This study also serves as an example for policymakers and practitioners in other states.

Research questions

This study addressed the following research questions:

1. What is the distribution of occupational preparation requirements across all projected employment openings from 2014 to 2024 by region in West Virginia?

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?
   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?
   b. Within each region, what percentage of high school CTE programs align to at least one of these high-demand occupations?

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?

The answer to research question 1 provides context for understanding the occupational preparation requirements (education, experience, and training) of the labor market in each region of West Virginia before statistics are presented for research questions 2 and 3 on alignment between regional CTE programs and high-demand occupations with moderate occupational preparation requirements.

Box 2. Data sources, sample, and methods

Data sources. This study relied on data from multiple sources (see appendix B for a more detailed description of the data, including a summary of data sources by research question):

- *High school career and technical education (CTE) program offerings.* The data from the West Virginia Department of Education's (WVDE) Division of Career and Technical Education and Governor's Initiatives website identified all available high school CTE programs in each region of West Virginia during the 2016/17 school year (see table; West Virginia Department of Education, n.d.).
- *Alignment between CTE programs and occupations.* For each CTE program, WVDE provided a list of occupations for which the program is designed to prepare students. The list included only the occupations that have education requirements that high school CTE programs can satisfy.
- *Projected employment openings.* Data from the West Virginia Department of Commerce, Workforce West Virginia, website identified the number of projected employment openings in each occupation from 2014 to 2024 in West Virginia by region (West Virginia Department of Commerce, n.d.).[1]
- *Bright Outlook occupations.* Data from the U.S. Department of Labor's Occupational Information Network (O*NET) website identified all 2016 national Bright Outlook occupations, based on the Bureau of Labor Statistics' national employment projections from 2016 to 2026 (U.S. Department of Labor, 2018a).
- *Occupational preparation requirements.* Data from the U.S. Department of Labor's O*NET website identified the typical preparation requirements for each occupation (U.S. Department of Labor, 2018a). Because the data come from national surveys of employers, the occupational preparation requirements represent national averages and might not accurately reflect requirements in West Virginia.

CTE programs in the study. The study included all of the CTE programs from every high school and career technical center in each region that were available to high school students (see table). West Virginia's high schools and career technical centers offered 95 unique types of CTE programs to high school students during the 2016/17 school year. Many of these programs were available in multiple schools within a region. The total number of available CTE programs across all of the regions was 1,149.

Occupations in the study. The set of occupations examined varied across research questions. To capture the distribution of occupational preparation requirements for all of West Virginia's projected employment openings from 2014 to 2024 (research question 1), the analysis included all West Virginia occupations with any amount of long-term projected employment openings, by region.

The statistics on alignment between high school CTE programs and occupations (research questions 2 and 3) relied on a set of high-demand occupations for each region, identified using three decision rules (see appendix B for more information about the decision rules): keep only occupations in job zones 2 and 3, occupations targeted by West Virginia's career pathways (see below and appendix A), and the 20 occupations in each region with the largest number of projected employment openings.

High-demand occupations for job zone 1 were excluded because they require no education beyond a high school diploma and usually require little or no work-related skills, knowledge, or experience (thus, most CTE pathways would not logically lead to

zone 1 occupations). High-demand occupations for job zones 4 and 5 (occupations that typically require a bachelor's degree or higher) were excluded because WVDE's documentation of CTE program alignment to occupations included only occupations with education requirements that high school CTE programs can satisfy. (Only 1 of the top 20 occupations in West Virginia was in job zone 4, and none was in job zone 5.)

The second decision rule limited the regional sets of occupations to those targeted by West Virginia's career pathways (occupations for which a CTE program is designed to prepare students), which outline sequences of courses and training from secondary through postsecondary education and align to national standards (see box 1 and appendix A for more information on career pathways). This decision rule eliminates occupations from job zone 2 that high school CTE programs are not meant to serve because they do not require any education or training beyond a high school diploma or on-the-job training (for example, retail salesperson and janitor).

The third decision rule limited the regional sets of occupations to the 20 in each region with the highest number of projected employment openings from 2014 to 2024 to make the results easier to present and interpret. Some 337 occupations in West Virginia were in job zones 2 and 3. The top 20 occupations accounted for about half the projected employment openings in the state. The study also used these regional sets of high-demand occupations to determine the extent to which alignment improves once high-demand occupations in other regions of the state are also considered (research question 3).

Number of career and technical education providers and programs in West Virginia, by region, 2016/17

Region	Providers		Programs[b]
	High schools	Career technical centers[a]	
Advantage Valley	20	6	200
Mid-Ohio Valley	11	4	118
North Central	22	8	269
Northern Panhandle	10	1	90
Potomac Highlands and Shenandoah Valley	14	3	177
Southeastern	9	3	182
Southern Mountains	6	5	113
Total	92	30	1,149

a. High school students may attend career technical centers (which also serve adults) for a portion of the school day, week, or year, or they may attend full time, receiving both academic and technical instruction.

b. Reflects the number of programs offered, not the number of unique program offerings (that is, different high schools and career technical centers in the same region may offer programs of the same type). There were 95 unique program types across all providers.

Source: Authors' calculations using data from the West Virginia Department of Education (n.d.).

Finally, to examine the extent to which alignment improves once national (as well as regional) high-demand occupations are considered (research question 3), the study team created a set of national high-demand occupations. This set followed the first two decision rules, but because the data that identify national high-demand (Bright Outlook) occupations did not include exact employment projections, the third decision rule could not be applied. This final set of occupations included all 37 national Bright Outlook occupations in job zones 2 and 3 that WVDE targeted with one of its approved career pathways.

Methodology. The study team calculated a set of descriptive statistics on the number and percentage of projected employment openings in each job zone, by region. In addition, to describe the alignment between high school CTE programs and regional and national sets of high-demand occupations, the study team calculated four CTE program–occupation alignment statistics for each region:

- *Long-term employment openings served.* The percentage of the region's long-term projected employment openings from 2014 to 2024 for the region's high-demand occupations that are served by at least one aligned high school CTE program within the region.
- *Programs aligned, within-region alignment.* The percentage of a region's high school CTE program offerings that align to at least one of the region's high-demand occupations.
- *Programs aligned, within- or across-region alignment.* The percentage of a region's high school CTE program offerings that align to at least one of the region's high-demand occupations or one high-demand occupation in another region in West Virginia.
- *Programs aligned, within-region, across-region, or national alignment.* The percentage of the region's high school CTE program offerings that align to at least one regional or national high-demand study occupation.

See appendix B for a detailed description of the methods, and figure B3 in appendix B for detailed descriptions of the alignment statistics.

Note

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

Findings

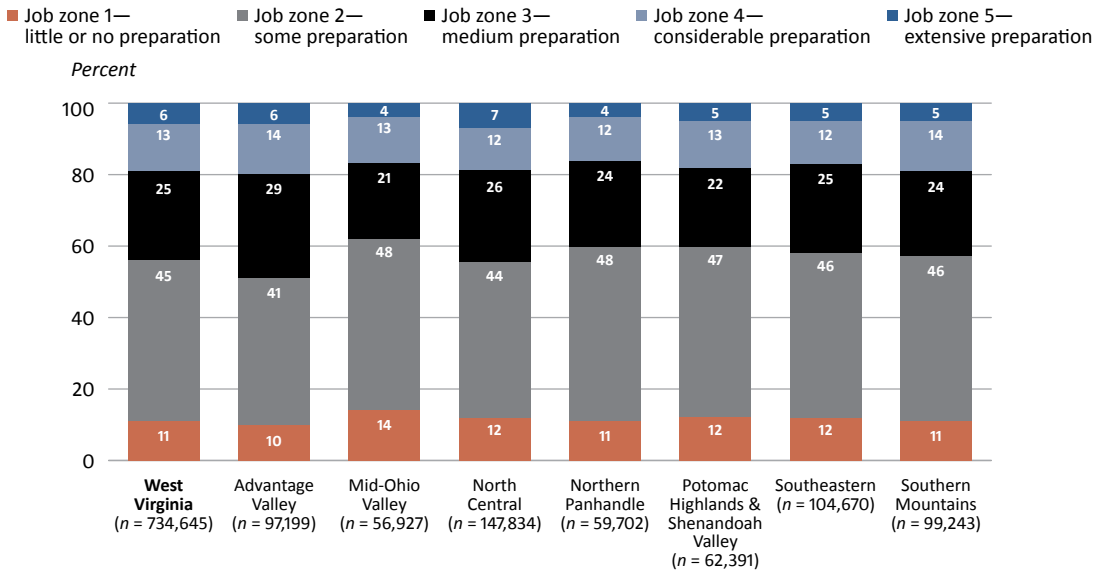
Seventy percent of West Virginia's long-term projected employment openings typically require some occupational preparation beyond a high school diploma but less than a bachelor's degree

Most West Virginia students will likely need some occupational preparation beyond a high school diploma (figure 1). On average, 70 percent of projected openings were in job zone 2 or 3; those zones include occupations with requirements that go beyond completing high school, such as work-related experience, training in vocational schools, an associate's degree, or a license. Some 19 percent of projected openings were in job zone 4 or 5; those zones include occupations that require more extensive preparation, including a bachelor's or graduate degree and considerable work-related skills, knowledge, or experience. And 11 percent were in job zone 1, requiring little or no occupational preparation. (See table C1a in appendix C for employment openings by region and job zone and tables C1b–C1h for the typical degrees earned by workers in each region's high-demand occupations with moderate occupational preparation requirements.)

The occupational preparation requirements of projected employment openings are fairly consistent across regions

The regional distributions of occupational preparation requirements are mostly within 2 percentage points of the statewide average (see figure 1). Occupations in the Advantage Valley region, home of the state capital, require slightly higher than average levels of preparation, with fewer jobs in zones 1 and 2 and more in job zones 3 and 4. Students seeking employment in this region will require more occupational preparation. Occupations in the Mid-Ohio Valley region require slightly lower than average levels of preparation, with more occupations in job zones 1 and 2 and fewer in job zones 3 and 5.

Figure 1. Seventy percent of West Virginia's long-term projected employment openings typically require at least some occupational preparation but not considerable or extensive preparation, 2016/17



Note: The extent of preparation needed for each job zone refers to the degrees, related experience, and on-the-job training required for occupations in each job zone. Although the preparation needed increases with the job zone number, correspondence between job zones and preparation levels is not perfect. *Little or no preparation* means that occupations require little or no work-related experience or knowledge and only sometimes require a high school diploma. *Some preparation* means that occupations usually require a high school diploma and some work-related experience or knowledge. *Medium preparation* means that occupations usually require vocational training, on-the-job experience, or an associate's degree, and some require a license to practice. *Considerable preparation* means that occupations usually require a bachelor's degree and considerable work-related experience or knowledge. *Extensive preparation* means that occupations usually require a graduate degree and extensive work-related experience or knowledge.

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

Regional career and technical education programs served, on average, 93 percent of the regional projected employment openings in high-demand study occupations

In all but two regions (Mid-Ohio Valley and Northern Panhandle) at least 90 percent of projected employment openings in high-demand study occupations were served by at least one CTE program in the same region (map 1).

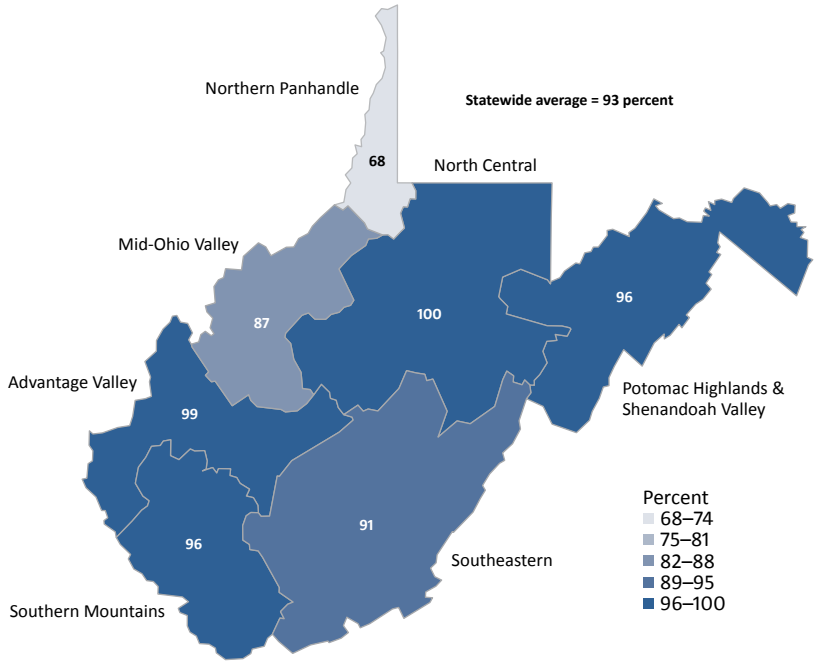
Regional variation in the percentage of long-term projected employment openings served highlights a potential need for improvement in the Northern Panhandle region

Although the percentage of statewide employment openings served by at least one CTE program is high (93 percent), differences exist across regions (see map 1). In the Northern Central region all of the region's high-demand study occupations were served by at least one CTE program, while in the Northern Panhandle region only 68 percent were (which is 25 percentage points below the statewide average). Therefore, students in the Northern Panhandle region had fewer opportunities than students in other regions to prepare for their region's labor market through a high school CTE program.

In one or more regions in which they were in high demand, 11 high-demand study occupations were not served by an aligned high school career and technical education program

Though most high-demand study occupations were served by at least one aligned CTE program in their region, 11 high-demand study occupations were not served by an aligned CTE program within their region (table 1). Further, 5 of the 11 occupations were unserved in more than one region in which they were in high demand (first-line supervisors of construction trades and extraction; hairdressers, hairstylists, and cosmetologists; industrial machinery mechanics; maintenance and repair workers; and paralegals and legal assistants). This gap in alignment indicates that these occupations might lack the requisite skilled labor to fill long-term projected employment openings.

Map 1. Regional career and technical education programs in West Virginia served a majority of regional long-term projected employment openings in high-demand study occupations, 2016/17



Note: Percentages reflect each region's long-term projected employment openings from 2014 to 2024 for high-demand occupations that were served by at least one aligned high school career and technical education program within the region (the "employment openings served" statistic).

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 1. Regional long-term projected employment openings in high-demand study occupations from 2014 to 2024 that were unserved by a career and technical education program in one or more regions in West Virginia in which they were in high demand, by region, 2016/17

High-demand study occupation (number of regions without an aligned CTE program)	Total number of unserved projected employment openings	Number of projected employment openings served and unserved (shaded) by region						
		Advantage Valley	Mid-Ohio Valley	North Central	Northern Panhandle	Potomac Highlands & Shenandoah Valley	Southeastern	Southern Mountains
Maintenance and repair workers, general (3)	3,765	1,715	920	2,706	1,337	1,000	1,508	1,488
First-line supervisors of construction trades and extraction (2)	1,193	631	340	1,493	336	200	762	857
Paralegals and legal assistants (2)	815	575	na	na	na	240	na	na
Hairdressers, hairstylists, and cosmetologists (2)	719	397	na	599	326	na	393	na
Industrial machinery mechanics (2)	608	436	260	662	348	na	na	916
Police and sheriff's patrol officers (1)	520	819	251	958	520	352	640	396
Court, municipal, and license clerks (1)	510	na	na	na	510	na	na	na
Security guards (1)	408	1,329	301	804	408	436	889	716
Pharmacy technicians (1)	241	328	221	801	241	278	474	825
Fitness trainers and aerobics instructors (1)	200	na	na	na	na	200	na	na
Heating, air conditioning, and refrigeration mechanics and installation (1)	141	na	141	na	na	na	na	na

CTE is career and technical education; na is not applicable (occupation is not in high demand in the region).

Note: Shading indicates that the projected employment openings were not served by an aligned CTE program in the region. The table includes only regional high-demand occupations that were not served by an aligned CTE program in one or more regions. See table C2a in appendix C for a complete list of regional long-term projected employment openings in high-demand occupations that were served and unserved in each region of West Virginia and table C2b for a summary of national high-demand study occupations that were served and unserved in each region of West Virginia.

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.).

In addition, 5 of the 11 high-demand study occupations were in high demand in every region but were unserved in at least one region (first-line supervisors of construction trades and extraction, maintenance and repair workers, pharmacy technicians, police and sheriff's patrol officers, and security guards; see table 1). Students in regions with unserved high-demand study occupations will be at a disadvantage in their region's labor market and in the statewide labor market.

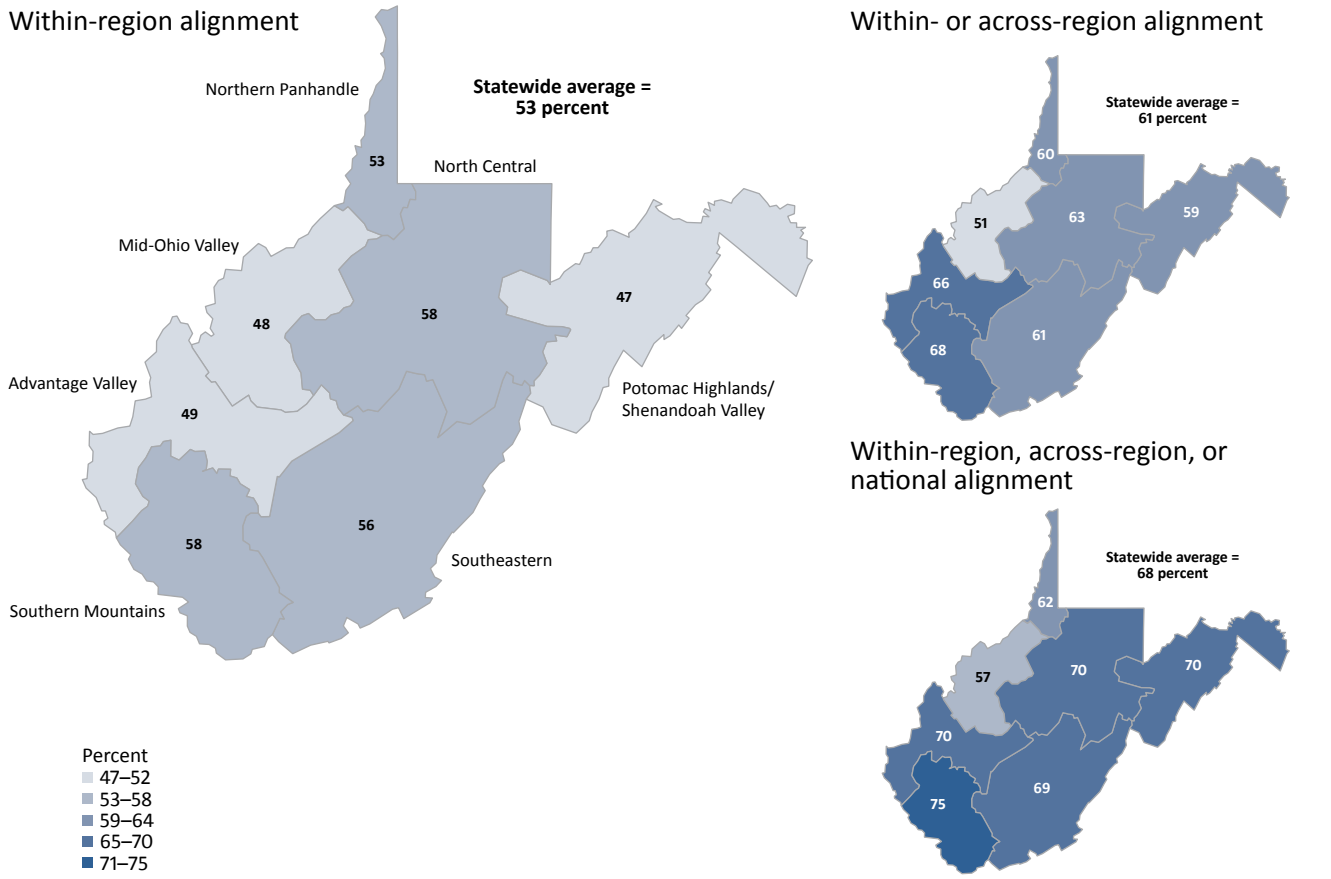
The maintenance and repair workers occupation is a particular concern, as it was a high-demand occupation in every region and had some of the highest projected employment openings among the high-demand study occupations, but it lacked an aligned CTE program in three regions (see table 1). The Northern Panhandle region also raises concerns because 8 of its 20 high-demand study occupations were not served by a CTE program in the region. The high number of projected employment openings for maintenance and repair workers in the Northern Panhandle region suggests that the percentage of employment openings served in the region would increase by 10.5 percentage points if the region offered a CTE program aligned to this occupation, which has the second highest projected openings in the region (after office clerks; see table C2a in appendix C).

Students in 53 percent of West Virginia's career and technical education programs were in a program that aligned to at least one high-demand study occupation within their region

On average, 53 percent of the CTE programs in each region aligned to a high-demand study occupation within the region, potentially leaving students in 47 percent of the CTE programs receiving high school occupational preparation that did not align to their region's labor market. The Potomac Highlands and Shenandoah Valley region had the lowest percentage of CTE programs aligned within the region (47 percent), and the Southern Mountains and North Central regions had the highest percentage (58 percent; map 2).

About 83 percent of high school CTE programs that did not align to a high-demand study occupation within their region also did not align to high-demand study occupations across West Virginia (449 CTE programs did not align to any regional high-demand occupation). Because students might leave their region after high school or might work in another region without relocating, aligning CTE programs to high-demand study occupations in other regions can be valuable. The statewide average proportion of CTE programs aligned increases from 53 percent within the region to 61 percent when alignment to a high-demand study occupation in another region or regions in West Virginia is included (across-region alignment).

Map 2. Students in about half of West Virginia's career and technical education programs were in a program that aligned to at least one high-demand study occupation within their region, 2016/17



Note: The three maps show the percentage of each region's career and technical education programs that aligned to at least one high-demand study occupation within the same region (within-region alignment), in any region in West Virginia (within-or across-region alignment), and in any region in West Virginia or the country (within-region, across-region, or national alignment). See box 2 for definitions of alignment statistics.

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.).

After across-region alignment of CTE programs to a high-demand study occupation was included, regional variation in CTE program alignment widened. Alignment ranged from 51 percent (Mid-Ohio Valley region) to 68 percent (Southern Mountains region), up from a range of 47 percent (Potomac Highlands and Shenandoah Valley) to 58 percent (Southern Mountains and North Central regions) for within-region alignment alone (see map 2). The Mid-Ohio Valley region, already below average for within-region alignment, experienced the smallest increase in aligned programs (3 percentage points) once across-region alignment was included. The Southern Mountains region, which along with the North Central region had the highest within-region alignment, had a larger than average increase of 10 percentage points when across-region alignment was included. The Potomac Highlands and Shenandoah Valley region also experienced a larger than average increase of 12 percentage points when across-region alignment was included, while the Advantage Valley region experienced the largest increase, of 17 percentage points. This suggests that students in these two regions might have been less likely than other students to receive high school occupational preparation that aligned to their region's labor market, but that they had similar opportunities as other students if they pursued work in other regions of West Virginia.

Students in 68 percent of West Virginia's career and technical education programs were in a program that aligned to at least one regional or national high-demand study occupation

Looking at alignment of high school CTE programs beyond West Virginia's labor market is also relevant, as students may decide to leave the state or work in a neighboring state without relocating. National employment trends may also point to changes that might occur in West Virginia's labor market.

When all regional and national high-demand study occupations were considered, 68 percent of West Virginia's high school CTE programs aligned to a high-demand occupation. That means that students in almost a third of the CTE programs received occupational preparation that might not have aligned to the labor market for high-demand study occupations. Regional variation in alignment was quite large, from 57 percent in the Mid-Ohio Valley region to 75 percent in the Southern Mountains region. Students in 43 percent of the Mid-Ohio Valley region's CTE programs received occupational preparation that might not have aligned to any of the study's high-demand occupations, compared with only 25 percent in the Southern Mountains region. Therefore, students in some regions had more opportunities than students in other regions to receive training that aligned to a high-demand study occupation.

Even though alignment improves greatly when high-demand study occupations across West Virginia and the country are considered, alignment within a student's own region is the most relevant to WVDE and students since most students remain close to home after graduation (Bui & Miller, 2015; Hillman, 2016; Molloy et al., 2011; Vespa, 2017). In particular, national alignment is less meaningful for both WVDE and its students.

Limitations

High school CTE programs identified as unaligned might nonetheless prepare students for occupations that align to the labor market in some way, for several reasons related to the study design. First, because this study examined only the top 20 occupations in number of projected employment openings, CTE programs identified as unaligned might align to occupations outside the top 20. However, there are, by definition, fewer employment opportunities in those occupations.

Second, the study's decision rules narrowed the occupations included to those that West Virginia's high school CTE programs can directly serve and that do not require additional education beyond the high school CTE program. (See box 2 and appendix B for more information on the study's decision rules.) The sets of occupations did not include occupations in job zones 1, 4, and 5 or occupations that WVDE does not target in one of its approved career clusters. Though there were strong substantive justifications for the decision rules (data availability and exclusion of occupations for which high school CTE programs are not designed to prepare students), limiting

the study occupations in these ways might have excluded some relevant occupations from the analysis. Some of the CTE programs found to be unaligned to their region's high-demand occupations might, in fact, be aligned to an excluded occupation or might partly serve one of the regions' high-demand occupations (they might require additional education, for example). However, since occupations in job zones 2 and 3 covered 70 percent of West Virginia's projected employment openings (see figure 1), these two job zones included most of the relevant occupations from the regional sets of high-demand study occupations. Further, excluding occupations that require considerable postsecondary preparation (job zones 4 and 5) is less of a limitation in West Virginia because most students in West Virginia do not obtain the required level of preparation for occupations in those job zones: Most high school CTE graduates do not go on to college, and only 20 percent of the state's population receives a bachelor's degree or higher by age 25 (U.S. Census Bureau, 2017).

Third, though a high school CTE program might not have been designed to prepare students for a specific occupation, it might still provide skills that are useful in that occupation. However, the study data were not detailed enough to make that determination. For example, a baking and pastry program might help prepare students for an occupation as a cook. Similarly, the career and work skills CTE program, which WVDE says focuses on teaching general entry-level skills rather than being tailored (aligned) to a specific occupation or set of occupations, could be relevant to numerous occupations and could therefore still be beneficial.

Beyond the study design, data constraints led to several limitations. First, data on student credentials and postsecondary training were not available. Having such information could have enabled analysis of how well West Virginia's full CTE system, including its credential and postsecondary offerings, aligns to the labor market. Second, data on labor market projections were not available at the county level, and the regions in the dataset used for the study did not align perfectly with the regions in the other data sources. The study used a data-merging strategy that minimized these differences, but it still resulted in imperfect labor market projections in two of the study's regions (Advantage Valley and Southern Mountains). Third, the data indicating the preparation levels of occupations (job zones) were not available at the state level and came instead from a national source. The national data might not accurately reflect the required preparation for these occupations in West Virginia. Finally, because student-level data were not available at the time the study was conducted, it is unclear whether the labor supply aligns with labor demand; the study considered employment openings as served if a CTE program was available, regardless of the number of students completing the program.

Implications

This study points to several important implications for WVDE and directions for future research.

The West Virginia Department of Education could use the findings on alignment of career and technical education programs to help districts address unserved, high-demand occupations

WVDE might consider developing new high school CTE programs aligned to high-demand occupations in each region. WVDE could start by focusing on occupations that lack alignment in multiple regions. WVDE leaders might also want to focus on regions that are below average in alignment. In the Northern Panhandle region, for example, 8 of the 20 projected high-demand occupations are not served by CTE programs within the region. These alignment gaps can inform WVDE's decisions about CTE program offerings. Additional information that can inform decisions about CTE program offerings is presented in tables C3–C9 in appendix C, which detail the alignment status of each region's CTE programs and high-demand study occupations.

The West Virginia Department of Education might want to consider restructuring programs that do not align to high-demand occupations or conduct additional analyses on whether programs align to other occupations in the region or around the state

WVDE could use this study's detailed identification of unaligned high school CTE programs (in tables C3–C9 in appendix C) to take a deeper look at the value of these programs to students. The two northwestern regions of the state (Mid-Ohio Valley and Northern Panhandle) have the highest percentages of unaligned programs (see map 2). Regions with low alignment or weaker labor markets might want to consider aligning CTE programs to state or national high-demand occupations, particularly occupations that can be performed remotely. WVDE could also use the information on unaligned programs to inform conversations between education and workforce development leaders. If a region is preparing students for occupations that are not available in the region, these leaders might want to consider whether there is an opportunity to attract new industries to the region that would align to these CTE programs and thus would have a well-prepared potential workforce.

The West Virginia Department of Education might want to conduct additional analyses that build on the findings of this study, which was a first step toward measuring the alignment between the state's high school career and technical education programs and the labor market

Additional data and quantitative analyses could improve WVDE's capacity for making informed decisions about CTE program offerings. This study sought to examine the availability of CTE programs (a decision that WVDE can control) rather than students' enrollment in or completion of these programs. Thus, occupations in a region were classified as served if there was at least one aligned high school CTE program in the same region, regardless of the number of students who completed the program. As WVDE leaders continue to improve the alignment of the system of CTE programs to the state labor market, comparing the number of projected CTE graduates to the number of projected employment openings in aligned occupations could provide useful information about whether the supply of graduates is meeting the demand.

Beyond conducting a supply and demand analysis, this study could be extended in several other ways that could improve WVDE's decisionmaking capacity:

- Calculate statistics on aligned CTE programs by high school rather than by region to address the possibility that the study's regional focus masks important differences in high school CTE program availability.
- Include occupations in each region beyond the top 20 or include occupations that require additional postsecondary education.
- Include data on high school CTE programs and occupations in neighboring states. For example, the concentration of unserved openings in the Northern Panhandle implies questions about its unique geography, as this region borders both Ohio and Pennsylvania. Before creating new CTE programs in the Northern Panhandle, WVDE leaders could identify the occupations for which CTE programs in neighboring states are training their students. Similarly, before dropping unaligned CTE programs, WVDE could assess whether the programs prepare students for high-demand occupations in neighboring states.
- Assess whether the unaligned high school CTE programs identified in this study align to occupations that require additional postsecondary education and determine the extent to which students in unaligned programs go on to postsecondary education.
- Analyze the alignment between high school CTE programs and postsecondary education and projected employment openings to determine the coherence of regional CTE pipelines in preparing students for high-demand occupations. Building a state data system that can track such alignment would enable the identification of more informed cross-sector solutions to address any gaps in alignment.

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