



GO VIRGINIA REGIONAL CAREER AND TECHNICAL EDUCATION STUDY

REPORT TO THE WESTERN VIRGINIA
WORKFORCE DEVELOPMENT BOARD

AUGUST 2020

GO Virginia Regional Career and Technical Education Study

Report to the Western Virginia Workforce Development Board

Report prepared by Shaffer Evaluation Group:

Patricia Moore Shaffer, Ph.D.

Jesse W. White

Noel Williams, Ph.D.

Arianna White-Levatich

John Calver

Marquita Hockaday, Ph.D.

August 2020

Abstract

Shaffer Evaluation Group (SEG) was contracted by the Western Virginia Workforce Development Board (WVWDB) to conduct a regional study of Career and Technical Education (CTE) in the Roanoke Valley and Alleghany Highlands region. This report presents findings and recommendations to the WVWDB following an assessment of current operations, future plans, demands, and needs of CTE programs being offered in the Roanoke Valley and Alleghany Highlands. The assessment focused on publicly-funded, K-12 career and technical education centers and community college workforce development programs within five key career clusters, prioritized by the WVWDB: 1) Architecture and Construction; 2) Health Sciences; 3) Information Technology; 4) Manufacturing; and 5) Transportation, Distribution, and Logistics.

Table of Contents

LIST OF ABBREVIATIONS.....	4
EXECUTIVE SUMMARY	6
INTRODUCTION.....	8
Purpose of Study.....	8
Study Phases	8
Methods.....	9
FINDINGS	10
1. Alignment of CTE/Workforce Programs with Business/Industry Needs	10
2. Effective Practices in CTE.....	17
3. Challenges and Opportunities.....	24
RECOMMENDATIONS.....	31
1. Implement Regional CTE Planning.....	32
2. Align Programs to Address Business/Industry Needs	33
3. Diversify Program Delivery	43
ACKNOWLEDGEMENTS	50

List of Abbreviations

Full Term or Title	Abbreviation
Approved Multi-division Online Providers	AMOP
Automotive Service Excellence	ASE
Botetourt Technical Center	BTEC
Bureau of Labor Statistics	BLS
Burton Center for Arts & Technology	BCAT
Career & Technical Education	CTE
Career Technical Education Student Organizations	CTSO
Certified Nursing Assistant	CNA
Commercial Driver's License	CDL
Dabney S. Lancaster Community College	DSLCC
Distributive Education Clubs of America	DECA
Dual Enrollment	DE
Educators Rising (formerly known as Future Educators Association)	FEA
English Language Learners	ELL
Environmental Protection Agency	EPA
Family, Career, & Community Leaders	FCCLA
Family and Consumer Sciences	FAC
Federal Aviation Administration	FAA
Flux-cored Arc Welding	FCAW
Franklin County Career Center	FCCC
Future Business Leaders of America	FBLA
Get Skilled, Get a Job, Give Back	G3
Gas Metal Arc Welding	GMAW
Health Occupations Students of America	HOSA
Heating, Ventilation, Air Conditioning & Refrigeration	HVAC-R
Information Technology	IT
Jackson River Technical Center	JRTC
Licensed Practical Nurse	LPN
Local Workforce Development Areas	LWDA
Medical Facilities of America	MFA
National Center for Construction Education and Research	NCCER
National Occupational Competency Testing Institute	NOCTI
Occupational Safety and Health Administration	OSHA
Roanoke County Public Schools	RCPS
Roanoke Technical Center	RoTEC
Salem City Schools	SCS
Salem High School	SHS
Shaffer Evaluation Group	SEG
Shielded Metal Arc Welding	SMAW
Science, Technology, Engineering, & Mathematics	STEM
Strengths, Weakness, Opportunities, and Threats	SWOT
Technology Student Association	TSA

Valley Career & Technical Center	VCTC
Virginia Board of Nursing	VBON
Virginia Community College System	VCCS
Virginia Department of Education	VDOE
Virginia Western Community College	VWCC
Western Virginia Workforce Development Board	WVWDB

Executive Summary

Shaffer Evaluation Group (SEG) was contracted by the Western Virginia Workforce Development Board (WVWDB) to conduct a regional study of Career and Technical Education (CTE) in the Roanoke Valley and Alleghany Highlands region (LWDA Region 3). This report presents findings and recommendations to the WVWDB following an assessment of current operations, future plans, demands, and needs of CTE programs being offered in the region. The assessment focused on publicly-funded, K-12 career and technical education centers and community college workforce development programs within five key career clusters, prioritized by the WVWDB: 1) Architecture and Construction; 2) Health Sciences; 3) Information Technology; 4) Manufacturing; and 5) Transportation, Distribution, and Logistics.

Based on a review of local CTE and workforce development programs and workforce needs and consultation with local elected officials, education leaders, and business/industry stakeholders in LWDA Region 3, the evaluation team identified existing effective practices and known gaps in meeting regional workforce needs. Three recommendations are offered to the WVWDB to improve local CTE and workforce development programs:

1. Implement Regional CTE Planning. Regional planning is recommended as an essential first step toward improving CTE in this region. Regional planning should be undertaken by a council or collaborative and address the findings and other recommendations raised in this report.

2. Align CTE Programs to Meet Business/Industry Needs. The workforce/program analysis yielded rich findings that suggest several programmatic gaps or duplications that should be addressed within the region.

- **Programs prioritized for development and/or expansion** are 1) certified nursing aide, 2) maintenance & repair worker, 3) landscaping & groundskeeping worker, 4) home health aide, 5) licensed practical nurse, 6) plumber, pipefitter & steamfitter, 7) carpenter, and 8) industrial machinery mechanic.
- **Only one program is proposed for possible reduction:** Veterinary technologists/technicians.

3. Diversify CTE Program Delivery. Limited K-12 facilities and the need to expand programs require new ways to deliver CTE programs in this region. Four options are proposed to diversify how CTE programs are offered:

- **CTE academies**, established in existing facilities in close collaboration with one or both of the region's community colleges, industry, and the school divisions, could strategically address gaps in regional workforce preparation while integrating academics for career preparation and meeting or exceeding graduation requirements.
- **Virtual programming, or online coursework**, could provide a new approach for offering prerequisite, introductory, or computer-based courses with low requirements for hand-on work, although recent experiences with virtual CTE courses during the COVID-19 pandemic suggest that more is possible with this delivery method.

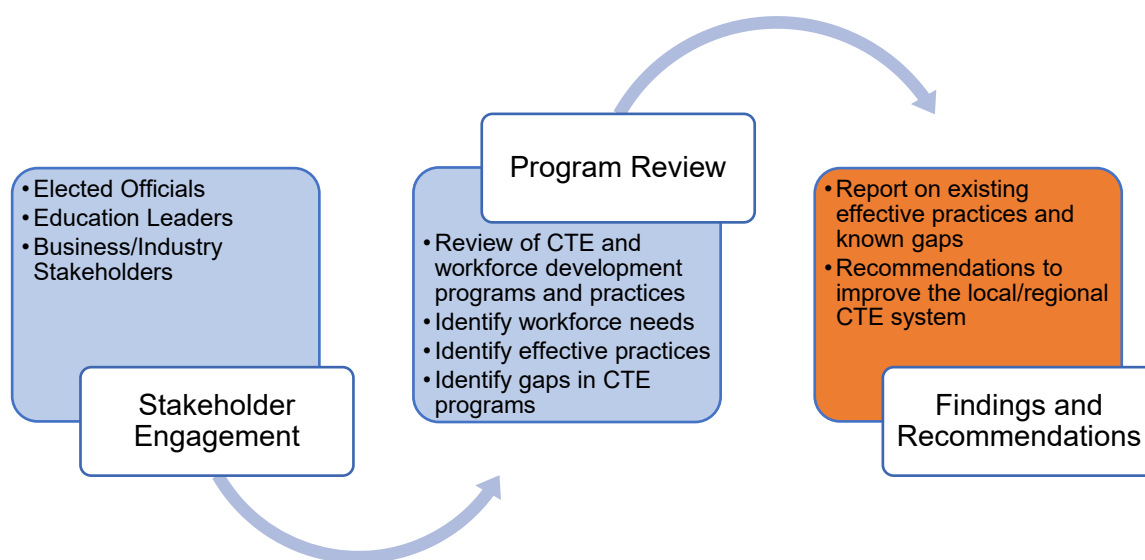
- A **regional career and technical center** could provide dedicated facilities and staff to expand CTE offerings while addressing the special educational requirements of high-need employment gaps, such as LPN and plumbing.
- **Mobile classrooms or labs** could allow regional schools to expand their instructional space temporarily and provide greater access to specialized equipment and courses to a larger number of students.

Introduction

Purpose of Study

Commissioned by the Western Virginia Workforce Development Board (WVWDB), the purpose of this study is to 1) conduct an assessment of the current operations, future plans, demands, and needs of career and technical education (CTE) and workforce development programs being offered in the Roanoke Valley and Alleghany Highlands region (LWDA Region 3); and 2) produce recommendations for a research-based direction for CTE programs that meet the business/industry needs of this community. The study focused on publicly-funded, K-12 career and technical centers and community college workforce development programs within five key career clusters prioritized by the WVWDB: 1) Architecture and Construction; 2) Health Sciences; 3) Information Technology; 4) Manufacturing; and 5) Transportation, Distribution, and Logistics. Analyses also considered the level of education required for occupations in these key clusters and focused on programs that lead to certifications or terminal associate's degrees (i.e., not on transferable credit programs issuing bachelor's or graduate degrees).

Study Phases



This report represents the final phase of this three-phase study:

1. Stakeholder Engagement with elected officials and other leaders from the education, business, and industry sectors.
2. Program Review, including identification of effective practices and programs, assessment of current CTE and workforce development programs, identification of workforce needs, and identification of gaps in CTE programs.
3. Findings and Recommendations, including the preparation of a report that highlights effective practices and known gaps and duplications in CTE and workforce development programs and

offers recommendations on sustaining and scaling effective practices, eliminating duplications, and introducing new programs to address known gaps to address labor market needs.

This report combines stakeholder engagement data with findings from a detailed program review in an effort to provide a complete summary of existing CTE practices. Paired with a robust understanding of the gaps and needs within the region, this final report (Phase 3) provides recommendations for improving the regional CTE system.

Methods

The detailed study plan is presented in the appendix (A.2). Methods utilized to gather the information presented in this document are highlighted below:

- Town hall meetings (2) with elected officials and other leaders from the education, business, and industry sectors, held in Roanoke, Virginia (February 20, 2020)
- Follow-up survey of elected officials and other leaders from the education, business, and industry sectors, administered immediately following the town hall meetings (February 24 – April 1, 2020)
- Visits with representatives of Carilion Clinic, F&S Building Innovations, Medical Facilities of America, PowerSchool, ProAmpac, Wabtec Corporation, and WestRock – Low Moor Converting Plant (March 9-13, 2020)
- Program and literature scan of effective practices (February 20–June 19, 2020)
- Follow-up conversations with school administrators and CTE leaders from Burton Center for Arts & Technology, Franklin County Career Center, and Salem High School (May 21–28, 2020)
- Telephone interviews with dual enrollment coordinators from Dabney S. Lancaster Community College and Virginia Western Community College (May 27–28, 2020)
- Review of local, state, and national effective practices in CTE (February 20–May 29, 2020)
- Facility site visits, held during the week of March 9, 2020:

Community Colleges	Dabney S. Lancaster Community College (DSLCC)	March 11, 2020
	Virginia Western Community College (VWCC)	March 10, 2020
CTE Centers	Botetourt Technical Education Center (BTEC)	March 12, 2020
	Burton Center for the Arts & Technology (BCAT)	March 9, 2020
	Franklin County Career Center (FCCC)	March 10, 2020
	Jackson River Technical Center (JRTC)	March 11, 2020
	Roanoke Technical Education Center (RoTEC)	March 13, 2020
High Schools	Salem High School (SHS)	March 9, 2020

Findings

Findings are presented in three sections: 1) workforce/program analysis, comparing workforce needs to existing CTE and workforce development programs in the region, highlighting gaps and duplications in workforce training identified; 2) effective CTE practices, programs, and initiatives in the LWDA Region 3, representing strengths and opportunities for further development; and 3) areas of concern in local/regional CTE practices and programs, representing challenges and potential opportunities for improvement.

1. Alignment of CTE/Workforce Programs with Business/Industry Needs

This section combines information regarding workforce needs with education data for the LWDA Region 3. This analysis will highlight training duplications, potentially underserved areas (i.e., gaps), and where future development efforts may be focused. This information is differentiated by five career clusters prioritized by the WVWDB: 1) Architecture & Construction; 2) Health Sciences; 3) Information Technology; 4) Manufacturing; and 5) Transportation, Distribution, & Logistics.¹

For this analysis, workforce projection data were drawn from Virginia Employment Commission occupational employment projections that have been aligned with the CTE Career Clusters framework.² Employer perspectives were collected through on-site interviews conducted during March 2020 to augment the workforce projection data. Data on CTE program enrollment are included in the analysis.

CTE programs included in the analysis are from Botetourt Technical Center (BTEC), the Burton Center for the Arts and Technology (BCAT), Dabney S. Lancaster Community College (DSLCC), Franklin County Career Center (FCCC), Jackson River Technical Center (JRTC), Roanoke Technical Center (RoTEC), Salem High School (SHS), and the Virginia Western Community College (WVCC). SEG analyzed CTE enrollment and sequences of courses in the CTE technical centers; these CTE programs are typically offered at the 11th and 12th grade level; some CTE program sequences may require pre- or co-requisite courses, which was beyond the scope of this study.³ Analysis was based on the most recent year of course enrollment data available, which—dependent on the school—might be 2018-19 or 2019-20.

¹ Four of these five career clusters were listed in the top five areas in which employers experience difficulty filling positions with qualified applicants in the *2017 Workforce Needs Survey: A Survey of Employers in the Roanoke Region of Virginia*, distributed by WVCC in collaboration with area school districts.
<https://www.virginiawestern.edu/cte/docs/2017WorkforceNeedsSurvey.pdf>

² Trailblazers: Career and Technical Education in Virginia, <http://ctetrailblazers.org/labor-market-data/>. This dataset is based on 2016 U.S. Bureau of Labor Statistics national employment projections for over 800 different occupations and is a national resource for workforce projections.

³ CTE course sequences may be started as early as 8th grade but typically start in 9th grade. For example, Introduction to Health Occupations may be offered to 9th grade students and Medical Terminology to 10th grade students as prerequisite courses for a CTE technical center's Health Science programs.

Although enrollment data were available from all secondary schools and both community colleges, few schools reported course wait-list counts (also known as denials).

Reference tables can be found in Appendix A1. Table 1 presents comprehensive reference data on LWDA Region 3 occupations, including training requirements, median salary (2017), projected number of jobs (2026), annual job openings, and projected growth (2016-2026). Table 2 in Appendix A1 summarizes CTE program enrollment by career pathway and occupation (as appropriate) within the five targeted career clusters. The third table provides more detailed data on occupations identified as gaps or duplications in the section below. *Program gaps* were identified for occupations that did not have at least a 1 to 1 ratio of enrolled students to annual job openings; had at least 50 projected annual job openings (for high-wage⁴ positions) or 100 annual job openings for low-wage positions in the LWDA 3 region; and had clear training requirements not exceeding an Associate's degree⁵ and associated certifications.⁶ *Program duplications* were identified as occupations that had an over 3 to 1 ratio of enrolled students to annual job openings and an over 1 to 1 ratio of graduates to annual job openings (if graduation data was available).

1.1.1 Architecture & Construction



- The workforce data suggest that there will be an average 5% increase in architecture and construction jobs by 2026, with 11,139 projected jobs in this region. Among the Architecture & Construction pathways, the *construction* pathway—which includes high-wage trade careers such as carpenters,

GAPS

Carpenters

Licensed plumbers,
pipefitters, & steamfitters

Landscaping &
groundskeeping workers

electricians, and plumbers—is expected to see 3% growth, with projected total of 7,327 jobs in 2026. The second largest pathway (*maintenance/operations*) anticipates 12% growth and anticipated total employment of 2,844; high-wage maintenance occupations include HVAC mechanics (see Appendix A.1, Table 1).

- RoTEC, JRTC, FCCC, BTEC, BCAT, and both community colleges have programs that address building trades, including carpentry, electrical, and masonry. These programs include introductory courses for the building trades (e.g., *Building Trades I* and *II*) that appear to be popular, with strong enrollment alongside higher denial numbers (reviewed when available). For example, FCCC enrolled 115 students in its building trades

courses in the 2018-19 year, while 96 students were denied seats; BCAT enrolled 17, while 24 were denied. This indicates that there are more students who would like to take these courses

⁴ In this report, a “high-wage” occupation is defined as an occupation with a median annual wage higher than the median annual wage for all U.S. occupations.

⁵ For this study, occupations of interest are those with the following training requirements: high school or less; training/certification; and associate degree or some college. Occupations requiring at least a bachelor's degree were not included in the analysis.

⁶ Production Workers, Laborers and Freight, Stock, and Material Movers, Light Truck or Delivery Services Drivers, and Industrial Truck and Tractor Operators were excluded from this list since these might not be occupations with associated certifications or might have only a subset of jobs within the occupation that requires certifications.

than are able to enroll at this time. Of the occupations in the *construction* pathway, carpentry and plumbing program enrollment is lower than desirable (see A.1, Table 2).

- No regional programs were identified that prepare licensed plumbers, pipefitters, and steamfitters, nor were there programs focused on the “operation engineer and other construction equipment operator” occupation. These gaps point to an opportunity to expand offerings in these occupations, particularly in the higher-demand plumbing occupation.
- Only two schools offered courses aimed at architectural drawing or design (SHS and BCAT). It was noted in the employer interviews that employees who can read a technical manual, specifications, blueprints, or plans were highly desirable. In fact, construction managers rely on these skills, and this well-compensated occupation is expected to grow 5% between 2016 and 2026. It may be important to focus education and training on administrative or project management skills associated with the construction industry in future CTE to prepare students for future management positions.
- Another area of high growth according to the labor data is in the *maintenance/operations* career pathway within the construction cluster. These jobs, such as “electrical power line installers and repairers” or “HVAC installers and repairers” are expected to see growth of up to 15% between 2016 and 2026, although neither occupation met this study’s threshold to recommend for program investment.
- Although not a high-wage occupation, there is relatively strong demand (projected 1,520 jobs in 2026) and projected strong growth (+13%) for “landscaping and groundskeeping workers,” but few CTE programs in LWDA Region 3 support this training. Only FCCC appeared to offer a “horticulture operations” course, which enrolled 19 students in the 2018-19 year. It is important to note that schools may offer horticulture classes, like FCCC, through an Agriculture program rather than Architecture and Construction.

1.1.2 Health Sciences



- Among the five career clusters, the health sciences field is expected to grow the most (average +17% between 2016 and 2026) and generate the highest employment number (over 19,000). This career cluster should be considered the priority for future investments. Growth is expected across all career pathways, with the high-wage *diagnostic services* and *therapeutic services* pathways seeing the most significant increases. Three health occupations (“registered nurses,” “nursing assistants,” and “licensed practical and licensed vocational nurses”) offer the highest number of jobs in this career cluster—almost 10,000 projected employed in 2026.

GAPS

Nursing assistants

Licensed practical &
vocational nurses

Home health aides

DUPLICATIONS

Veterinary technologists

- Most schools offer health sciences courses, mostly focused on nursing assistant training. However, student and employer demand for these programs remains unmet. For example, FCCC enrolled 189 students in 2018-19 but denied 383. The employer interviews revealed that this region is in strong need of high quality, reliable, and committed medical assistants, certified nursing assistants, and licensed practical nurses.
- Another therapeutic occupation of interest for program development is “home health aide.” While the region expects to have 889 home health aide jobs by 2026, there are no training or certification programs offered in support of this need. Though this is a low-wage occupation, this gap could be particularly salient given the country’s growing need for elder care, particularly home-based care.⁷
- While all schools (except SHS) offer some kind of training for medical aide careers, three schools also offered programs designed to support Emergency Medical Technician training. This career is classified under the Law, Public Safety, Corrections, & Security career cluster, not Health Sciences, and is outside of the scope of this study. However, its projected low annual job (33) openings and low median salary (\$33,110) would not warrant its inclusion as a recommended program at this time.
- Overall, the career and employment projections show that there will be many available jobs in the healthcare sector within the next several years. Qualitative reports from employers indicate there are areas for development or improvement in instructional quality for nursing and that employment demand exceeds the number of students earning certification or licensure. Although there are many other career pathways within the health sciences career cluster that appear to be underserved by the existing CTE programs (e.g., health informatics, dental hygiene, physical therapy, or pharmaceutical specialty areas), the overwhelming need for nursing support should drive new program development or expansion.

⁷ L. Konish, “Pandemic will drive major changes to the nursing home industry, CNBC, May 24, 2020, <https://www.cnbc.com/2020/05/24/how-coronavirus-pandemic-drive-major-changes-in-nursing-homes.html>

1.1.3 Information Technology



- The high-wage information technology (IT) career cluster in this region is expected to see, on average, 10% growth between 2016 and 2026 across career pathways, with a projected total of 3,000 jobs by 2026. The *network systems* and the *programming & software development* pathways appear to be in higher demand comparatively with the *information & support services* pathway. Of note, no affiliated occupation in this career cluster has more than 50 vacancies per year in this region.
- Given the relatively low number of annual vacancies (214) in this career cluster, IT programs are over-represented in existing CTE programs compared to regional workforce needs. All schools included in the current analyses offer more than one course in the IT field, and all offer *Basic Computer Systems Technology I* and *II* courses. Programming skills are embedded in many occupations, suggesting that IT programs support more than just the IT career cluster and pathways.

NO CHANGE

- Three schools offer advanced programming courses (FCCC, BCAT, and RoTEC). Employers in the IT field who spoke to the research team felt that hiring programmers is difficult. According to these employers, qualified programmers attending 4-year colleges are often committed to employment offers by their second or third years of school, and thus hiring must be very proactive. This indicates high need for these positions and that more students might choose to pursue these careers in the future (especially given that programming is one of the more profitable careers in IT). However, these careers typically require a bachelor's degree or more, and it might not be possible for CTE to fulfill these requirements. Students in high school Information Technology cluster programs learn the basics of computer systems, programming, IT fundamentals, and earn industry certifications as early as 9th grade. These programs may be considered part of early career pathway training and experiences that lead into a 4-year program.
- Enrollment data again indicate that introductory IT courses (e.g., *Computer Information Technology I & II*) issue more denials to students (30) than admissions (11). While student demand and IT workforce needs elsewhere in Virginia reinforce the need for IT program offerings, regional workforce needs suggest that further expansion of IT programs should not be prioritized. No changes and no new investments are recommended.

1.1.4 Manufacturing



- Separating from other career clusters in industry, the manufacturing cluster is expected to experience a 2% decline between 2016 and 2026. However, this career cluster is projected to remain a high-volume jobs sector, with an expected 13,000 jobs in this cluster in 2026. The *maintenance, installation & repair* (~400 job openings/year) and *production* (~880 job openings/year) pathways expect to offer the highest number of jobs in this career cluster, although of these two pathways only the high-wage *maintenance* pathway anticipates positive job growth (overall +7%).

- Within the *maintenance, installation & repair* and *production* pathways, there are four high-demand occupations, three of which offer high wages: “maintenance & repair workers,” “industrial machinery mechanics,” and “welders, cutters, solderers, and brazers,” and “machinists.” The

GAPS

Maintenance & repair
workers

Industrial machinery
mechanics

maintenance & repair worker occupation is not well-represented among existing CTE programs except in mechatronics programs, despite the fact that it represents the sixth largest job availability group in the region with an expected total of 1,870 jobs by 2026. The industrial machinery mechanic occupation is also not well-represented among CTE programs. While the number of students enrolled in welding courses far exceeds anticipated annual job openings (99), the number of welding program graduates (68) also suggests that the labor supply does not meet the regional workforce need.

- Interviews with employers in the manufacturing industry indicated that they seek employees with a strong work ethic and who work safely, have team skills, are reliable, and can process information accurately. Specifically, some employers mentioned that employees who understand the process with which they are working and can engage in problem-solving are most valuable, because they are able to engage with managers in process improvement or troubleshooting. Employers also noted that attention to protocols and safety procedures is highly necessary for these positions. The kind of general manufacturing education classes that might cover some of these skill areas do not appear to be reflected in the CTE curriculum included in the current analyses; only two schools (BCAT and SHS) offer a general manufacturing systems course. Other schools offer courses specific to individual careers, such as *Introductory Welding* or *Robotics*.
- Some areas within the manufacturing industry are expected to experience significant growth before 2026. As mentioned previously, the “maintenance and repair worker” occupation has an average of 187 annual job openings and is expected to grow by 8% between 2016 and 2026. While some maintenance and repair skills may be embedded in courses such as precision machining or mechatronics, the maintenance and repair worker occupation is not strongly reflected in local programs. Employers also mentioned the need for maintenance technicians. Given that this area is expected to grow, this may be an opportunity for CTE program development. Other pathways of interest are *production* and *quality assurance*; the industry expects to have over 8,100 production jobs and 879 quality assurance jobs by 2026.
- Employers highlighted that on-the-job training is available at their companies, with new hires learning additional skills gradually. For example, one manufacturer described how most employees learn to drive forklifts during their time with the company, as this is a necessary aspect of the industry. Being able to operate this (or other types) of machinery is not necessarily a pre-hire qualification requirement but may be learned once a new employee comes on board. These general operational skills acquired post-hire are transferrable across positions or companies.

1.1.5 Transportation, Distribution & Logistics



- This career cluster is expected to grow in this region (+9% between 2016–2026), totaling over 14,000 jobs by 2026. Most of this growth is expected to be in *transportation operations* (10,963), which includes jobs such as “heavy and tractor-trailer drivers” or “industrial truck and tractor operators.” Other pathways include *facility and mobile equipment maintenance* (e.g., “diesel engine specialists,” “automotive service technicians and mechanics,” and “automotive body and related repairers”), *logistics planning & management services*, as well as *sales & service*, although fewer jobs are expected to exist in these areas in comparison to transportation operations (2,684, 365, and 822 respectively).
- Importantly, the jobs in the high-growth *transportation operations* pathway require, on average, a high school degree (or less), and some training or certification, but offer wages for non-management jobs ranging from \$35,000–\$50,000. Labor data suggest that there are 372 annual job openings for high-wage heavy and tractor-trailer truck drivers in this region. Both DSLCC and VWCC offer a Commercial Driver's License Program and enrolled 56 and 333 students, respectively, according to 2018-20 enrollment data. This training also supports similar jobs within the *transportation operations* pathway, such as “bus drivers (school or special client)” or “light truck/delivery services drivers.” These jobs are expected to experience growth by 2026 (+11% and +10% respectively).
- All technical centers and VWCC offered auto body repair or service, which fall under the *facility and mobile equipment maintenance* pathway. At first glance, this pathway appears to be over-represented in regional CTE programs given the number of students enrolled compared to actual annual job availability. These courses are popular with students and tend to be oversubscribed; that is, more students are seeking to enroll than available seats in that course. However, the number of graduates in these programs is considerably smaller than enrolled counts, with local school divisions reporting 43 graduates in Automotive Service and 24 in Autobody in the 2019-20 school year. Training in diesel engine repair was represented at one facility only, however, this could be a potential area for growth given the importance of freight movements on I-81 and other neighboring U.S. highways. (Current annual job opening estimates, however, do not support a strong need for this type of training). Training to support “mobile heavy equipment mechanic” positions was also noticeably missing among local CTE offerings. Given that the annual job hires for “mobile heavy equipment mechanics” and “diesel engine specialists” are under 50 each, however, investment in training programs might not be warranted.

NO CHANGE

2. Effective Practices in CTE

This section highlights effective practices, programs, and initiatives in CTE within LWDA 3. This summary draws upon information shared by local leaders at two Town Hall Meetings and through a follow-up survey, interviews with local education administrators, and site observations by the evaluation team. These effective practices reflect both areas of strengths and potential opportunities for further growth.

2.1 Work-based Learning

Virginia adopted legislation in 2016 to require the Board of Education to develop the Profile of a Virginia Graduate, which articulated the skills and competencies the state expects all high school graduates to have.⁸ In support of this effort, Virginia provided guidance promoting work-based learning,⁹ defined by the state as “school-coordinated workplace experiences that are related to students’ career goals and/or interests, are integrated with instruction, and are performed in partnership with local businesses and organizations.” State guidance describes 11 different work-based learning methods of instruction currently practiced in Virginia—job shadowing, mentorship, service learning, externship, school-based enterprise, internship, entrepreneurship, clinical experience, cooperative education, youth registered apprenticeship, and registered apprenticeship. As students participate in work-based learning experiences, their various paths can be grouped into three categories: career awareness, career exploration, or career preparation.

During school facility site visits, stakeholder town halls, and follow-up discussions, three LWDA Region 3 school divisions shared similar approaches to work-based learning. While work-based learning opportunities remain somewhat under-developed (see next section), there are strong and emerging examples of effective practices in the region already, as illustrated below.

- Roanoke County Public Schools (RCPS) has played a critical leadership role in establishing a regional registered apprenticeship initiative. A registered apprenticeship involves mentoring (and paying) a student through company-specific training to become a highly-trained and credentialed employee within a local or regional company or industry. Soon after Virginia launched its work-



⁸ Profile of a Virginia Graduate, <http://www.doe.virginia.gov/instruction/graduation/profile-grad/index.shtml>

⁹ CTE Work-Based Learning Guide, <http://cteresource.org/verso/titles/career-and-technical-education-work-based-learning-guide-219>

based learning initiative, RCPS introduced this apprenticeship initiative with industry partner Western Virginia Water Authority. The program began small, with five student placements 3 years ago, and has expanded to place 30 students in 10 different companies during the 2019-20 school year. Apprenticeships are flexible so that industry partners can work directly with the Virginia Department of Labor and Industry to determine the related technical instruction that is part of the apprenticeship requirements instead of limiting instruction to specific CTE classes at BCAT.

RCPS invited Salem City Schools and Roanoke City Public Schools to join the initiative; an RCPS representative noted that other school systems “are on the verge” of joining the initiative. A regional business group, led by the Water Authority and F&S Building Innovations, assists with the branding and marketing of the apprenticeship to fellow businesses. This initiative has outstanding potential to expand across the region, thereby opening up more possibilities for regional collaboration.

- When this study was conducted, at least two school divisions (RCPS and SCS) reported that they planned to hire a workforce coordinator to assist with work-based learning. However, due to budget cuts caused by the COVID-19 pandemic, hiring for this position has been put on hold.
- In addition to their involvement with RCPS’s apprenticeship initiative, Salem City Schools offers multi-tiered work-based learning experiences. Salem High School offers apprenticeships and mentoring activities facilitated by local business and industry representatives, and each fall every senior is given 4 days to shadow an employer’s job. Internships, externships, school-based enterprise, and cooperative education are other pathways Salem uses for work-based learning.

2.2 Programs Meeting Local Needs

The assessment of local CTE programs revealed program examples at each campus that uniquely met local needs and demonstrated effective practices. This list is not exhaustive, but is intended to be illustrative of best practices while demonstrating a range of program examples across the regional centers engaged in this study.

- *Automotive program and Diesel Equipment Technology course at SHS.* This high school offers a robust series of automotive courses, including sequences of four automotive body repair courses, four automotive service courses, and a Diesel Equipment Technology course. In the diesel course, students receive instruction in general maintenance of medium- and heavy-duty trucks and equipment while learning the theory and operation of diesel engines, brakes, suspension and steering systems, and electrical/electronic systems. This course was the only one of its kind in LWDA Region 3, despite a small but measurable need for training in diesel engine repair. The

automotive program overall demonstrates many effective practices, including the organization of classes similar to a “fictitious” company, in which students fulfill operational and management roles. Students completing certain course sequences are eligible to take the Automotive Service Excellence (ASE) student certification examination.

- *Carpentry at JRTC and RoTEC.* Training in carpentry is provided at JRTC and RoTEC through a 3-course sequence. A distinguishing feature of the JRTC Carpentry program is the opportunity it provides students to study many aspects of home building, ranging from cabinetmaking, installation of windows and doors, and interior trim work. At RoTEC, carpentry instruction is also centered on residential construction practices from foundation to complete building. Students build sheds (which are sometimes sold) and remodel existing structures on the school’s campus.
- *Certified Nursing Aide (CNA) programs.* CNAs are in high demand, and CNA programs, which are approved by the Virginia Department of Health Professions Board of Nursing, can be found in several LWDA Region 3 educational facilities: BCAT, BTEC, DSLCC, JRTC, RoTEC, and VWCC. Among the effective practices observed during K-12 site visits, it is worth noting that BTEC’s program offers a dual enrollment opportunity through DSLCC for coursework; and RoTEC reported that Spring Tree Health and Rehab, a Medical Facilities of America (MFA) facility, business partner, and advisor, offers employment to any student who passes the CNA licensure exam. Both college programs are distinguished by high-quality facilities and state-of-the-art equipment.
- *Commercial Driver’s License programs at DSLCC and VWCC.* Both community colleges offer Commercial Driver’s License courses—critical for training the workforce needed for driving commercial trucks. VWCC’s Workforce Solutions department has partnered with CDS Tractor Trailer Training Company to offer this course; this partnership has enabled a strong hands-on approach and connects students to trucking company recruiters. DSLCC offers courses leading to both a Class A and Class B commercial driver’s license. Both colleges make this training available through their FastForward10-11-12 program (see sidebar for more information about FastForward).

FastForward Program

FastForward programs, available at DSLCC and VWCC, are fast-track training programs that prepare students for work in high-demand jobs. Most FastForward programs are between six and twelve weeks in duration, and offer credential training for forty high-demand careers.

For example, DSLCC offers FastForward programs for jobs such as commercial driver, phlebotomy technician, and manufacturing technician. VWCC’s FastForward programs also include a commercial driver’s class, as well as certification courses for welders and nurse aides.

The programs are available through the state-funded **FastForward Grant**, which aims to increase the number of Virginians who have an in-demand industry credential. According to the Virginia Community College System, residents with workforce credentials are twice as likely to be hired over applicants with no credentials, and credentials typically earn workers over 25% increased take-home pay. FastForward provides funds for two-thirds of the cost of training upon completion of a class and related credentialing exam.

¹⁰ Virginia’s FastForward Grant: <https://www.fastforwardva.org/program-details/>

¹¹ DSLCC FastForward program: <https://www.dslcc.edu/fastforward-makes-training-affordable-dslcc>.

¹² VWCC FastForward program: <https://www.virginiawestern.edu/cct/career-training/financial-assistance/fastforward/>

- *General Maintenance at FCCC.* Jobs associated with the “maintenance and repair worker” occupation are prevalent in LWDA Region 3, yet underrepresented among CTE programs, with only FCCC offering coursework aligned with this occupation. Its *General Maintenance I* course equips students with general custodial and measuring skills, as well as basic electrical, plumbing, and carpentry skills. Recently, *General Maintenance I* students worked on community projects benefiting the Ronald McDonald House in Roanoke, helping students to connect their work with community engagement. VWCC has a similar program—*Maintenance Technology*—offered as an 18-credit-hour career studies certificate program, but they did not report any enrollment in the program.
- *Industrial Maintenance Mechanic program at DSLCC.* Industrial Maintenance Mechanics are in high demand in LWDA Region 3. DSLCC offers a 4-level Industrial Maintenance Mechanic program, designed by the National Center for Construction Education and Research. This is a unique program offering in LWDA Region 3 and is offered through the FastForward program.
- *Phlebotomy Technician program at DSLCC.* DSLCC offers a Certified Phlebotomy Technician program, which trains students to perform clinical tasks in hospital laboratories, medical offices, and healthcare clinics. Phlebotomists collect blood specimens from clients for laboratory analysis and are in growing demand according to employers. The program is offered through the college’s FastForward program.
- *Precision Machining.* The Precision Machining program was launched a few years ago at RoTEC in response to local job demands and is a unique K-12 program in this region. During their site visit to RoTEC, the evaluation team observed modern industry equipment and an instructional space that allowed for excellent product throughput (input, process, output). Other schools are pursuing partnerships with local community colleges to expand their offerings in precision machining: In 2020-21, SHS is introducing a *Precision Machining I* course in partnership with VWCC; RoTEC shared that it is investigating a similar partnership to offer precision machining.
- *Mechatronics programs.* Mechatronics is a growing occupational area within manufacturing that focuses on the engineering of both electrical and mechanical systems and includes a combination of robotics, electronics, computer, telecommunications, integrated systems, process control, and product engineering. VWCC offers an associate degree and Career Studies certificate in Mechatronics Systems Engineering Technology that is well-respected in this region. RoTEC’s Mechatronics program is linked to VWCC (see Section 2.4). BCAT’s program is part of the Roanoke County Governor’s STEM Academy; the organization of their classroom space was commended by site visitors as a “best practice.” Mechatronics instruction is provided on other campuses, too, including BTEC, SHS, and DSLCC.
- *VWCC Regional Academy.* The VWCC Regional Academy allows high school students to explore postsecondary specialized programs of study in high demand career fields. In this dual credit model program, student cohorts from across the region meet daily on the VWCC campus to complete coursework that meets the foundational requirements for degree programs, often while completing a VWCC career studies certificate or industry credential. Programs offered to regional high school students include heating, ventilation, air conditioning & refrigeration (HVAC-R), engineering, pharmacy technician, medical billing/pharmacy technician, mechatronics, health

science, nurse aide, and pre-health. Tuition assistance has been available for health programs through the Claude Moore Charitable Foundation.

2.3 Industry/Business Partnerships

Business and industry partnerships have long been recognized as essential to CTE program quality. The Strengthening CTE for the 21st Century Act (Perkins V¹³), signed into law by President Trump in 2018, requires data-driven decision making, builds on current success, and pushes toward more systemic partnership with business and industry, incorporating labor market alignment into the definition of programs of study and requiring extensive stakeholder engagement on the local level. Under Title I of the Workforce Innovation and Opportunity Act of 2014,¹⁴ state and local boards are encouraged to promote use of industry and sector partnerships to address the workforce needs of multiple employers within an industry. The recognition of the value of career readiness within the ‘Every Student Succeeds Act’ (ESSA¹⁵) and in Virginia’s Profile of a Virginia Graduate, also have contributed to stronger commitment to cross-agency cooperation on the local level.

It was evident during facility site visits and the stakeholder Town Hall Meetings that local industry partners and businesses had been engaged by the technical centers and community colleges through several mechanisms, including advisory councils, craft committees, apprenticeships, mentorships, and guidance for curriculum and instruction. Several strong examples of business/industry engagement with education stand out and are briefly discussed below.

- RoTEC teachers demonstrated close working relationships with local businesses. Business and industry partners support RoTEC programs through equipment donations, providing teachers with timely information about new technologies or changes in their industry, speaking with students about their industries, supporting Career and Technical Education Student Organizations (CTSOs), and employing students. Carilion Clinic supports

Key Terms

A **career pathway** represents a common set of skills and knowledge, both academic and technical, necessary to pursue a full range of career opportunities, ranging from entry level to management, including technical and professional careers.

A **CTE completer** is a student who has met the requirements for a CTE concentration (sequence) and all requirements for high school graduation, or an approved alternative education program.

A **concentration** is a coherent sequence of state-approved courses as identified in the course listings within Virginia’s web-based Administrative Planning Guide (APG).

A **specialization** is a student’s choice to take additional courses beyond a minimum completer course sequence in a specific career cluster area related to his/her career pathway.

Certifications/licensure assessments, including industry certifications, state licenses, and/or occupational competency skills certifications, can be taken by students after completion of certain skill sets and coursework. Students are required to earn a Board-approved CTE credential to graduate with a Standard Diploma.

¹³ Perkins V: http://www.doe.virginia.gov/instruction/career_technical/administration/index.shtml
<http://www.cteresource.org/attachments/atb/2019-2020%20Perkins%20Local%20Plan%20Application%20and%20Budget%20Template.xlsm>

¹⁴ WIOA: https://wdr.doleta.gov/directives/attach/TEGL/TEGL_21-16.pdf
<https://www.dol.gov/agencies/eta/performance/performance-indicators#WIOA%20PIP>

¹⁵ ESSA: <https://careertech.org/resource/mapping-career-readiness-essa-full>

the RoTEC health program by providing equipment and work-based learning opportunities enabled through a formal partnership agreement. Of note is a Ford dealer who donated a new Ford Fiesta for students to study and learn the components of new cars.

- In addition to the division's CTE advisory council, FCCC's CTE programs are required to have advisors from external industries. There was evidence of employer involvement at all levels of the FCCC, including curriculum, apprenticeships, and career fairs. The level of business and industry involvement varies according to program. The autobody and automotive technology programs in particular demonstrate considerable commitment from the industry. Employers, especially PPG Paint and Nelson Collision, provide equipment and materials, and the instructor has cultivated strong relations with Snap-On and Maaco. One notable partner, Lincoln Tech, has directly recruited from the class.
- In addition to the school division's General Advisory Committee, each BCAT trade program has its own individual Advisory Committee. These committees consist of at least two business industry representatives, the teacher(s) in charge of the program, and at least one parent. Of note, Carilion Clinic supports the Introduction to Nursing program by providing equipment, work-based learning opportunities, and a formal partnership agreement that includes provision of a teacher. Roanoke County Fire and Rescue supports the EMT program with donations and staff for practice and clinical ride-alongs.
- DSLCC works very closely with industry partners to provide training needs assessment, job analysis, and training plan development in addition to course delivery. The college has designed entirely new programs that address specific training criteria or customized courses from one of their current offerings. DSLCC industry partners include WestRock, SchaeferRolls, Garten Trucking, Easy Pass, Agri Feed, Munters Corporation, Carilion Clinic, Everbrite, Modine Manufacturing, and Love's, all of which require training for their employees.
- VWCC's healthcare programs prepare students for careers in nursing, dental hygiene, radiography, radiation oncology, medical laboratory technician, and phlebotomy. Although most of the classroom activity is at the main campus, the old community hospital is used as a training site with partners from Carilion Clinic and Radford University.

2.4 High-Quality Community College Facilities and Capacity

The community college facilities were distinguished by new or serviceable, industry-relevant equipment to support a variety of career pathways; both colleges also appeared to have ample facility space. VWCC facilities in particular were of very high quality:

- The Nursing lab had patient rooms with computerized patients that can simulate emesis and a live birth. The instructor can observe patient care in a separate room through one-way mirrored glass.
- The radiography lab had simulators that appear to be replicas of those used in medical providers' labs (without radiation). Students use this equipment to model all skills required of a radiography technician ready to enter employment with minimal on-the-job training.

- The medical technology lab is set up like a hospital lab, where blood is analyzed, genes are modified, and lab tests are conducted. The lab offers a nearly real-life setting for learning.
- In the Dental Hygiene program, students participate in a simulated dentist's office with clearly labeled workspaces, safety messages, and organized workspaces. Patients come in from the community to have simple dental exams and teeth cleaning free of charge. This system adds value to the program's students who learn to interact with real patients while providing a needed service to the region's citizens.
- The FabLab is a brand-new makerspace and contains several pieces of equipment and inventor resources (e.g., 3D printing) that can be employed to innovate and prototype new products.

2.5 Vertical Program Alignment

Ideally, CTE programs of study require a sequence of courses and/or competencies extending across secondary and postsecondary education that incorporate technical, academic, and employability knowledge and skills. Late elementary and middle school recruitment efforts and CTE middle school exploration courses support strong enrollment in high school. Content and standards within the high school CTE concentration should be non-duplicative, relevant, and vertically aligned to prepare students to transition seamlessly to the next level of education and lead to a specialization or one or more recognized post-secondary credentials, including industry certifications, licenses, apprenticeship certificates, post-secondary certificates, and degrees.

During site visits and review of documentation, evaluators paid close attention to evidence of vertical program alignment. Although this area offers the opportunity for improvement (discussed later in this report), RoTEC shared a few clear examples of vertical alignment worth highlighting:

- RoTEC reported strong existing recruitment programs. RoTEC offers its 5-5-5 summer institute for students that includes 5 days spent exploring five industries for students in Grade 5. In the area of automotive technology, children learn to change tires and oil, operate the car lift, and experience some of the workday events of a service technician. There is also a middle school career explorations course in Grades 6 and 8 and the RoTEC Extravaganza event. The Extravaganza serves as a fundraiser for the local CTE foundation and allows RoTEC to feature students' work and inform community leaders of the value of their programs. In Grade 7, students work with school counselors, parents, and staff to develop a college and career plan required for graduation, although a recent local government audit found that RCPS middle school students did not complete Academic Career Plans in accordance with VDOE Regulations and School Board policy.¹⁶
- RoTEC, through a partnership with VWCC, offers a good model of a vertical course of study spanning high school and college. Through its Manufacturing course cluster, RoTEC students can earn 3 or 4 college credits that articulate to the Mechatronics program at VWCC. While the credits are non-transferable to other colleges or degree programs, they can be applied to complete a program at VWCC. For students who do not continue their studies at VWCC, they are

¹⁶ City of Roanoke (December 2019), CTE Audit, <https://roanokeva.gov/AgendaCenter/ViewFile/Item/767?fileID=11640>

able to earn SolidWorks Associate certification (CSWA) used in Computer Numeric Control (CNC) machining, the same certification that can be earned after 2 years at VWCC.

3. Challenges and Opportunities

This section highlights areas of challenge for CTE in LWDA Region 3, drawing upon information shared by local leaders at the Town Hall Meetings and through the follow-up survey, interviews with local education administrators, and site observations by the evaluation team. These challenges represent areas of weakness and potential opportunities for growth.

3.1 Cramped K-12 Classroom Facilities

With few exceptions, the evaluation team observed K-12 classroom facilities that were too small to support the learning activities taking place. This issue was especially evident at BTEC, BCAT, FCCC, and SHS. Automotive, carpentry, and masonry programs were most affected by these space restrictions. This limitation impacts students' abilities to learn the skills of the trade effectively and restricts the number of students that can fully and safely participate in class activities. Crowded spaces can give students false impressions of the industry and increase the likelihood that safety violations or incidents may occur. A few examples are described below from the site visits held in March 2020.

- The BTEC autobody, auto service, and masonry classroom spaces were small and lacked sufficient storage space.
- The BCAT automotive shop and carpentry room need more space for instruction and more storage space. The automotive shop had inadequate restroom facilities and electrical panels at capacity in several areas of the facility.
- FCCC has high enrollment for its CTE program but is hampered by the facility's space limitations. The FCCC representative described their CTE programs as "busting at the seams, undersized,



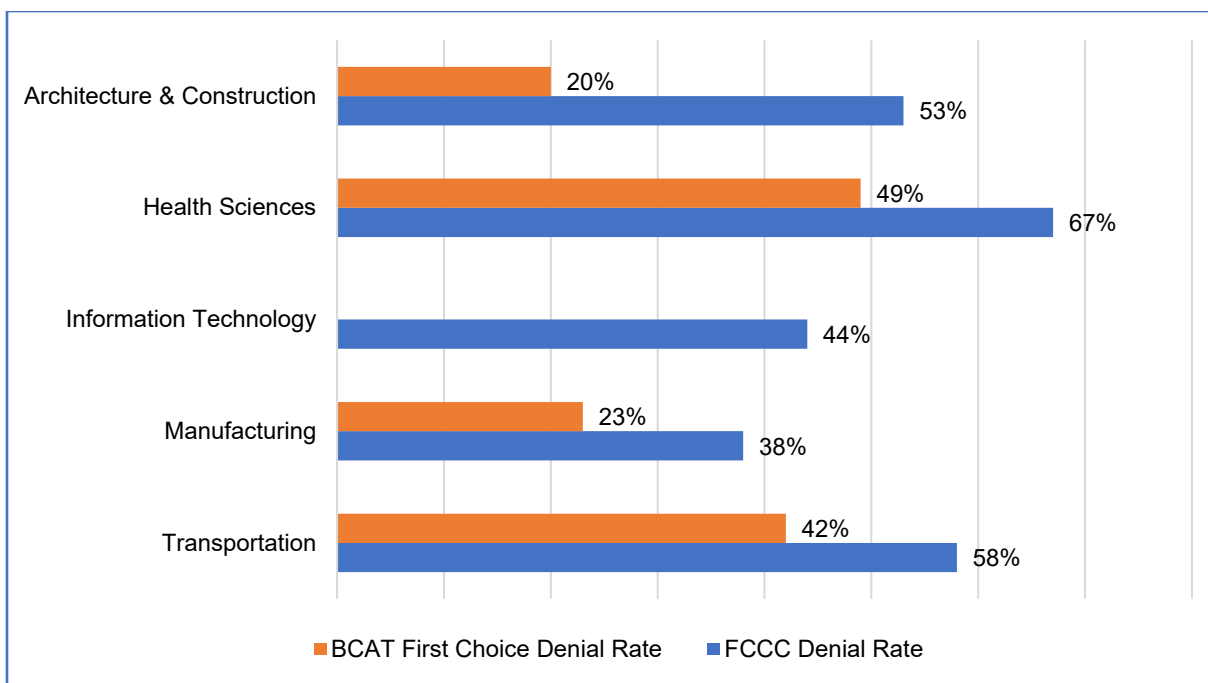
and understaffed.” The masonry instructional space was small; the evaluation team observed that it was “a very difficult and small environment” for instruction. The autobody and auto repair shops were also small and lacked sufficient storage space.

- The automotive classroom at SHS is compact and, at the time of the site visit, was crowded with vehicles for projects to the point that projects were overflowing into the parking lot. The welding shop was also crowded.

3.2 Oversubscribed K-12 Programs

The evaluation team heard concerns about oversubscribed CTE programs that had more students wishing to enroll in courses than there were available seats. BTEC, for example, shared that popular courses such as *Aerospace Technology* or *Computer Systems* were at or above capacity and other programs were below capacity. However, BTEC, similar to other technical centers, does not maintain waiting lists, which made it challenging to analyze objective evidence of student demand for courses. The community colleges did not report any concerns with oversubscription, with both campuses indicating that they had capacity to take more students.

Two technical centers—FCCC and BCAT—did maintain waitlist data and offered evidence of student demand for coursework. On average, the denial rate for FCCC CTE courses in the five targeted career clusters was 58%. BCAT collects data on first, second, and third choice application acceptances to programs; for this analysis, the number of first choice applications compared to course seats was used to generate a proxy denial rate for clusters. The BCAT first choice denial rate for courses in the five targeted career clusters was 26%. The denial rates by career cluster are provided in the graph below. While the rates differ between the two schools, due in part to the differences in approaches to collecting denials data, the pattern of high demand is similar: denial rates are highest in the Health Sciences, followed by Transportation.



There was high variance in denial rates within the career clusters. In BCAT's Architecture and Construction cluster, Building Trades had a denial rate of 31%, compared to 4% for Masonry; Welding in Manufacturing had a 46% denial rate, compared to Mechatronics, which was undersubscribed; and in the IT cluster, Networking was undersubscribed while Game Design had a 33% denial rate. Variation was also seen at FCCC in the Architecture and Construction cluster although with different effects: *Masonry I* (74%), *Electricity II* (67%), and *HVAC I* (66%) had higher denial rates compared to *Building Trades I* (47%). Similar to BCAT, the denial rate for Game Design (45%) was high while Networking was undersubscribed. Student demand could be affected by personal interest (e.g., Game Design), level of difficulty, and program reputations at the school level.

3.3 Challenges with Student Transportation for Work-Based Learning

Given the importance of work-based learning, the transportation concerns voiced by some school divisions and technical centers pose a challenge for student employment and preparation as well as attendance at VWCC programs, clinical hours at medical facilities, cooperative education, and other work based-learning opportunities. Transportation challenges are well known in this region; an earlier economic analysis pointed out that all forms of transportation—commuter, passenger rail, ground freight, and intermodal—are lacking.¹⁷

- At RoTEC, the CTE Director reported there are not enough school buses to get students to school, so adding drop-offs and pick-ups for work-based learning is not an option. Committed school staff often take students home in their cars at night when students have no other way to get home if they participate in work-based learning. Despite this challenge, there were 15 RoTEC Co-op students, 189 students in service learning, and 30 students gaining clinical experience during the 2019-20 school year.
- FCCC staff confirmed in a follow-up interview that transportation to work-based learning sites is a “significant issue for students living in a large rural county.” Students must provide their own transportation to have a work-based learning placement. From the staff's perspective, there is no viable solution to the transportation issue, other than direct funding to pay for students' gas consumption if they have a car. Transportation is less problematic for students attending VWCC Regional Academies, since students can ride the bus with the Roanoke Valley Governor's School students (the facilities are 2 miles apart).

3.4 Challenges with Dual Enrollment

In this region, both DSLCC and VWCC offer dual enrollment for high school students. Dual enrollment allows students to earn high school and transferable college credit at the same time and in the same classroom and may eliminate duplication of courses taken in high school and college. While lowering the cost of a post-secondary education and combining it with a CTE program, dual enrollment also decreases the time to attain a college diploma and increases on-time graduation rates for

¹⁷ N. Gansneder & J. Thomas, Final Report: Economic Analyses and Conversations with Business Leaders in the Roanoke and New River Valleys, 2016, https://www.roanoke.com/opinion/editorials/final-report-economic-analyses-and-conversations-with-business-leaders-in-the-roanoke-and-new-river/pdf_71356c61-1ece-5efb-95a0-bb24cdbf5bb5.html

underserved and disadvantaged learners.¹⁸ Research has found that students who acquire college credits while still in high school are more likely to enroll and persist in post-secondary education.¹⁹

Most of the technical centers under study offered dual enrollment courses in CTE and other academic areas through DSLCC and/or VWCC. Dual enrollment courses are offered on high school campuses and are expected to be of the same quality and rigor as courses offered on campus. High school teachers teaching college courses must meet the same academic requirements as college faculty and may be required to receive training in course delivery. Similarly, enrolled students are held to the same standards of achievement as college students. High school students can also enroll in on-campus courses (e.g., VWCC academy programs), which provide focused instruction for HVAC-R, medical billing, pharmacy technician, health science, and nurse aide occupations. Students can apply dual enrollment credit toward a general studies associate degree concurrent with their high school graduation. Students may also transfer CTE credits earned toward a certification or associate degree program at a participating Virginia community college.

Although most technical center staff spoke highly of dual enrollment courses offered on campus and at high schools, some concerns were raised that could be hindering the success of dual enrollment.

- **Costs.** Some school divisions cited the high costs of dual enrollment as a significant deterrent for students and their families. In most LWDA Region 3 school divisions, tuition costs for dual enrollment courses offered within high schools are passed directly to the enrolled students and their families, although one school division has subsidized the tuition fee for economically disadvantaged students. For VWCC dual enrollment courses taught at high schools, the tuition cost has been as high as \$55 per credit hour, yet still significantly lower than the cost of a college course. The VWCC college representative interviewed for this study explained that all dual enrollment courses are offered at full tuition, but the cost is reduced to \$55/hour given offsets of in-kind services provided by the school divisions (e.g., provision of instructors). Of note, the DSLCC dual enrollment coordinator quoted a much lower tuition fee of \$5/credit hour for their campus's dual enrollment courses. During the evaluation team's March 2020 site visit to BTEC, the technical center had stopped most dual enrollment due to the additional costs borne by families but planned to add back some dual enrollment classes, at no cost to students, through DSLCC.

Dual enrollment courses offered on campus, including the VWCC Regional Academies, are more expensive—offered at the full tuition rate of \$178.49 per credit hour. For the 2-year Health Science regional academy, this tuition cost is approximately \$7,497, or about \$1,875 per semester. Students are also responsible for their own transportation to and from campus and to clinical sites; programs are scheduled up to 5 days per week for 2 academic years. Some school division representatives indicated that cost and transportation were not deterrents for their students, but for other school divisions, the costs of dual enrollment courses were too high for some students and their families. One CTE director mentioned that when he taught in a county

¹⁸ J. D. Zinth, CTE Dual Enrollment: A Strategy for College Completion and Workforce Investment, 2014, <https://www.ecs.org/clearinghouse/01/11/50/11150.pdf>

¹⁹ J. Swanson, An Analysis of the Impact of High School Dual Enrollment Course Participation on Postsecondary Academic Success, Persistence, and Degree Completion, 2008, http://nacep.org/wp-content/uploads/2010/02/2008_joni_swanson_summary.pdf

high school, many students “*came from families that didn’t have any money, so for them to pay full tuition to go to Virginia Western was totally not doable.*”

- **Communication of Program Pathway from High School to College.** One of the colleges’ dual enrollment coordinators offered the observation that although most dual enrollment courses are now embedded in a program of study, most students and parents (and even some teachers) think of them as single courses. As a result, students were not taking full advantage of programs of study that could lead to certification and, ultimately, an associate degree. The Virginia Community College System (VCCS) also documented this concern statewide: a 2016 VCCS document stated that “most dual enrollment students (95%) are not program-placed in a pathway leading to a credential, and 75% of students take ‘random general education courses.’”²⁰ The dual enrollment coordinator recommended that communications to parents and students emphasize the full CTE program pathway (“stackable program pathway”) that leads to completion of a credential while still in high school and/or an associate degree at the community college following high school graduation.

In discussing certification and credit topics with the evaluation team, K-12 staff voiced their concerns with program continuity between technical centers and community colleges, particularly related to how certification and credit transferred from the high school to the college level. One staff member was concerned that students were not being provided with the same certification for a completed dual enrollment course that would have been offered for the equivalent course on campus. The team also heard concerns about students going to community college to earn a certification (e.g., AWS Welder) who did not receive college credit for the same certification earned in high school. In discussing these issues, a dual enrollment coordinator spoke to the complexity of regulations for credit transfer. Although CTE courses might not transfer to 4-year institutions, CTE course credits earned through dual enrollment generally should transfer to other Virginia community colleges—but there are exceptions. For example, a course affiliated with a locally designed program might not transfer to another community college. There are also different external certifications offered at the high school and college levels for similar programs. These conversations supported the idea that improved communications and planning between K-12 and community college administrators would help meet the goal of increasing student participation in CTE program pathways.

3.5 Stigmatization of CTE

During the Town Hall Meetings, stakeholders expressed concerns about lack of interest in CTE and careers in certain industries, such as construction and manufacturing. Stakeholders believed that some parents and students held pre-existing stereotypes that CTE programs are “too easy” and not intended for students on a college track. Some stakeholders believed that “perceptions of the industry are negative.” Others stated that “some parents prefer the ‘better’ diploma,” “students [are] directed to college away from the trades,” and that the “public perception of CTE is less than college bound.”

There was discussion during the Town Hall Meetings about reaching out to parents with children in earlier grades (e.g., 5th) to educate them about the value of CTE. These early “marketing” initiatives

²⁰ S. Morrissey, *Dual Enrollment in the VCCS*, 2016, http://sfc.virginia.gov/pdf/retreat/2016%20Blacksburg/111616_No2b_Dual%20Enrollment%20in%20the%20VCCS.pdf

are critical to introduce and create positive associations with CTE. Site visits indicated there were very few technical centers with existing marketing plans to engage elementary students and their parents. Although there is a lot more that can be done in this area, some school divisions and industry partners are making these investments already; selected local examples are provided below.

- F&S Building Innovations sponsors the [Build Smart Institute](#), a summer program providing instruction based on the Home Builders Institute Pre-Apprenticeship Certification Training (PACT) program. The primary objective of this new institute is to educate, train, and place career-ready candidates into functioning construction trade positions. The program, offered in two 3-week sessions, is open to youth aged 11–15 years. The listed price for the 2020 camp is \$1,050.
- As a recruiting strategy, BCAT sends a school counselor to elementary schools to provide information about their programs. The center also invites 8th graders to tour BCAT in the fall and invites them to an Open House. Information about the online application is sent out to families in a variety of ways, such as postcards, robocalls, and school announcements. BCAT staff members also attend middle and high schools to follow up directly with interested students.
- As mentioned earlier, RoTEC offers its 5-5-5 summer institute for students that includes 5 days spent exploring five industries for students in Grade 5. There is also a middle school career explorations course offered in Grades 6 and 8.

3.6 Barriers to Regional Collaboration

During the initial Town Hall Meetings supporting this project, the evaluation team heard concerns about regional collaboration, including a lack of willingness to collaborate on CTE program planning, with stakeholders commenting on the need to “get out of county/city silos and collaborate with one another,” the “lack of interest among local officials about collaborating,” perceived competition in this area between colleges and school divisions, and limiting industry engagement to preferred partners while “ignoring others.” Other significant concerns addressed the geographic challenges to collaboration, with stakeholders commenting that the spread of programs limited interaction and funding for current CTE programs. It takes approximately two hours to drive across through the region from the northwest to the southeast – a significant factor that must be considered when discussing accessibility of CTE programs.

While the community colleges and industry partners were more likely to speak positively about regional collaboration, school divisions saw potential challenges in pursuing a new regional center. A rural school division representative stated that the regional center concept “doesn’t work,” although later added that a regional center or program that offers specialized programs not possible to house at the local level—such as heavy equipment operator—might work. An urban school division representative shared a similar suggestion: a regional center or program should be used to support specialty programs that might not have sufficient enrollment to sustain them at the local level.

“[We’ve been discussing] where can we collaborate on areas that may not be in such high demand, and that we don’t currently have. It doesn’t make sense to regionalize...a nursing program, because there’s too many students to fill a regional program. But, is there an opportunity to teach new things, pharmacy tech or some of the health informatics, phlebotomy, those kind of classes that we don’t currently offer. That may be an opportunity to expand a little

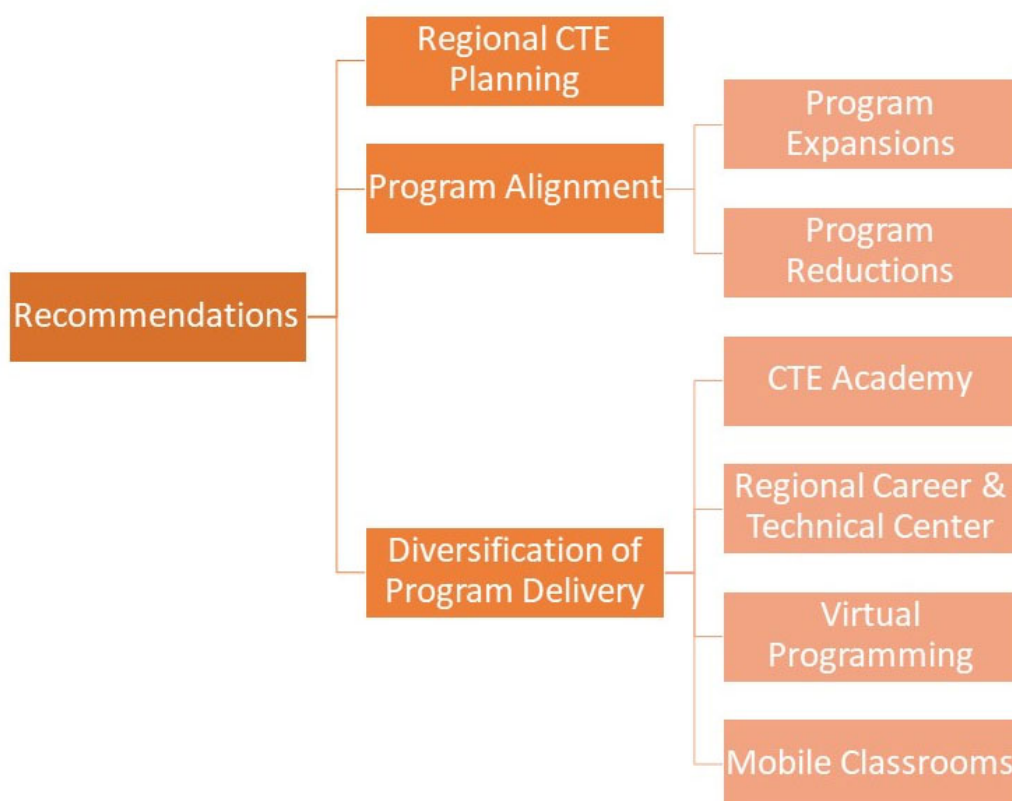
bit regionally to where maybe we only have 5 or 10 kids that are interested in taking it, that's not enough for us to run a program, but if we combined our efforts between all the school divisions, then we'd have enough to move a program forward."

Other significant hindrances to collaboration include:

- Differences in course titles and descriptions across regional school divisions are problematic for regional planning. Localities may modify standardized course titles to stimulate interest in courses or for other reasons. Upon review of CTE course descriptions and offerings, the evaluation team found that, from an outsider's point of view, it is difficult to compare one course with the same title or course code in one school with that in another. For example, in one school, *Automotive Service Technology* is offered, while in another, the same course is titled *Automotive Technology*. Inconsistent titling can be detrimental to students, who might move from one school or division to another with the same academic and career plan; students should be able to complete a CTE completer or concentrator sequence and continue to post-secondary education and training without restarting a new or different program.
- Scheduling conflicts among school divisions, which maintain different school calendars, class length schedules, and use block vs. 7-period schedules, among other cross-division differences.
- Financial ramifications of funding a regional center or program, including reallocating the school division's Perkins, state, and local funding, budgeting for physical plant and industry-relevant equipment costs, transportation costs, raising sufficient revenue for community college involvement to offset tuition costs, and managing funds from participating school divisions.
- Establishing governance/oversight/decision-making for a regional center that is perceived as fair and is agreed upon by all participating partners.

Recommendations

Three primary recommendations are offered based on the workforce/program alignment analysis and the review of local practices. The three recommendations – regional CTE planning, program alignment, including program expansions and reductions, and diversification of program delivery – are summarized in the chart below and discussed in the following section. These recommendations are informed by regional, state, and/or national models and practices; selected models or practices are discussed alongside the recommendations, while published discussions of exemplary models and practices are highlighted in the literature scan in the report appendix (A.3).



1. Implement Regional CTE Planning

Normal business practice for school divisions and community colleges tends to favor division- or college-level planning in consultation with business and industry and other community partners; cross-district or regional planning is not frequently implemented. However, effective planning at the regional level could address several issues raised in this report and create a CTE program that meets regional workforce needs. Thus, regional planning is recommended as an essential first step toward improving CTE in this region. Primary tasks to address through regional planning include:

- “Right-size” regional CTE program offerings to align with workforce needs, including reducing selected program offerings and reallocating space and funding to higher-need occupations. (Specific programmatic recommendations are presented in the next section.)
- Develop and update annually an inventory of LWDA Region 3 CTE and workforce programs and courses; inventory should include:
 - Standardized program and course titling based on Virginia’s 17 career clusters and associated pathways²¹ and course titling guidance provided through the state’s CTE Resource Center
 - Program and course enrollment data
 - Program completion data
 - Course denial or wait list data
 - Industry-relevant certifications and licensures available and earned
- Implement an annual or biannual review process that checks for alignment between program offerings and seat counts with workforce projections and adjusts the regional plan to account for the changing landscape of business and industry.
- Create integrated program pathways among high schools, industry partners, and community colleges in LWDA Region 3 by linking K-12 CTE concentrations in high-need occupations

Model Strategies for Regional Coordination

The **Education Commission of the States** describes six steps for regional coordination: 1) Develop a single, clear definition for all CTE experiences that enables stakeholders to have a clear understanding of each type of experience; 2) develop a CTE strategic plan that includes regional priorities that align with high-demand jobs and employer priorities; 3) identify a designated entity or entities to be a part of coordination efforts (e.g., local board of education); 4) establish regional intermediaries that provide the link between districts and employers; 5) develop effective employer outreach and support strategies; and 6) communicate clearly on critical employer logistics.

The **Staunton-Augusta-Waynesboro (VA) region** produced a ten-year CTE Strategic Plan that is in its third year of implementation. Regional strategies include creating “Affinity Groups” for teachers in each career cluster, across the three jurisdictions, to enable curricula sharing and work toward a general, standardized curriculum for the same classes offered at different schools; and creating a centralized three-jurisdiction career and technical education middle school that operates during the summer months.

²¹ Virginia Department of Education, *Career Clusters: Pathways to College & Career Readiness*, http://www.doe.virginia.gov/instruction/career_technical/career_clusters/index.shtml

with prerequisite courses (including middle school CTE electives), post-secondary programs, apprenticeships, licensures, dual credit, and stackable and transferable credentials.²²

- Develop and implement a regional educational outreach/communications plan to positively engage late elementary students and their parents in CTE, including regional events and resource materials that promote and illustrate high-need career pathways available in the region.
- Identify and implement solutions to transportation issues that hinder student access to work-based learning.
- Expand apprenticeships to more businesses and industries through a coordinated regional effort.

Regional planning should be undertaken by a council or collaborative composed of representatives. The constituency of this council is proposed below:

- At least two business/industry representatives from each career pathway of interest (e.g., Construction, Therapeutic Services)
- Up to two representatives representing CTE (e.g., CTE director, principal of a technical center) from each school division
- Up to two career guidance and academic counseling professionals representing a school division and a community college
- Up to two representatives from each community college representing workforce development and dual enrollment
- At least two representatives from the WVVDB
- At least two experts in educational program evaluation, research, and assessment; ideally a research or assessment director from a local school division and community college
- At least one special education representative from a school division

2. Align Programs to Address Business/Industry Needs

The workforce/program analysis yielded rich findings that suggest several programmatic gaps or duplications that should be addressed within LWDA Region 3. The recommendations below, presented in priority order for program development or reduction, are presented to guide decisions about future CTE program investments. In identifying occupational programs for development and growth, priority was given to high-wage occupations with at least 50 annual job openings and low-wage occupations with at









²² Stackable and transferable credentials are a series of ascending credentials that allow a student to progress for an associate level certification at the secondary level to a postsecondary credential (e.g., Associate's degree).

least 100 annual job openings that also had clear training requirements and associated certifications.²³ These occupations also had a low ratio of enrolled students to annual job openings (<1:1). Occupational programs recommended for downsizing had at least a 3:1 ratio of enrolled students to annual job openings.

It is important to note that while these recommendations are data-driven, they are based in part on workforce projection estimates. Other factors should be considered in making programmatic decisions, including local stakeholder needs and interests.

2.1 Develop or Expand Programs or Courses

Recommendations for program development or expansion are listed below in priority order based on the ratio of course enrollment to annual job openings. Training and certification details for each occupation are described beneath the chart.

	Occupation	High School	Community College	Recent Year Enrollment	Annual Job Openings
	Certified Nursing Aides	✓	✓	130	398
	Maintenance & Repair Workers		✓	14	187
	Landscaping & Groundskeeping Workers	✓		19	186
	Home Health Aide	✓		0	112
	Licensed Practical Nurses	✓	✓	16	110
	Plumbers, Pipefitters & Steamfitters	✓	✓	0	67
	Carpenters	✓	✓	98	130
	Industrial Machinery Mechanics	✓	✓	34	54

²³ Production Workers, Laborers and Freight, Stock, and Material Movers, Light Truck or Delivery Services Drivers, and Industrial Truck and Tractor Operators were excluded from this list because these might not be occupations with associated certifications or only a subset of jobs within the occupation requires certifications.

Nursing Assistants/Certified Nursing Aides

- Certified nursing assistants provide basic patient care under direction of nursing staff. They perform duties such as feeding, bathing, dressing, grooming, or moving patients, or changing linens. Job titles for this occupation include “nursing care attendants,” “nursing aides,” and “nursing attendants.”
- The VDOE lists a 2-course sequence for nurse aides: *Nurse Aide I* (8360) and *Nurse Aide II* (8362). CNA may be used as a prerequisite to a career in nursing²⁴.
- Current state-approved certified nurse aide programs serving residents in the LWDA Region 3 are offered at BCAT, BTEC, DSLCC, Excel Nurse Aide Training, Fast Track Health Care Education, JRTC, Paul D. Camp Community College, Roanoke Valley Nurse Aide Training, RoTEC, Total Action Against Poverty/This Valley Works, and VWCC. It is not known how many CNA students are enrolled annually for institutions not engaged by this study.
- Core and specialty certifications are available from the National Council of State Boards of Nursing, the National Health Career Association, and the National Center for Competency Testing, among others. The National Council of State Boards of Nursing offers a National Nurse Aide Assessment Program that requires the completion of a state-approved nurse aide education program but does not require education or training after high school or 2 years of work experience.

Maintenance & Repair Workers, General

- Maintenance and repair workers perform work requiring the skills of two or more maintenance or craft occupations to keep machines, mechanical equipment, or the structure of an establishment in repair. Duties involve pipe fitting; boiler making; insulating; welding; machining; carpentry; repairing electrical or mechanical equipment; installing, aligning, and balancing new equipment; and repairing buildings, floors, or stairs.
- Although FCCC offers a course in general maintenance, building/property maintenance programs at community colleges typically provide training in this occupation. Programs usually lead to certification or an associate degree. Tidewater Technical College (Norfolk, VA) offers a Building Maintenance and Repair diploma program that includes building skills related to structural, mechanical, and electrical applications and knowledge of building codes.²⁵ An exemplary certificate program is Fairfax County Public Schools’ Property Maintenance Technician Certificate Program, which is offered through their adult education program; required courses include drywall, painting, and waterproofing; HVAC systems; electrical workshop; plumbing workshop;

²⁴ VDOE plan of study for LPN: Under “Therapeutic Services,”
http://www.doe.virginia.gov/instruction/career_technical/career_clusters/plans_of_study/index.shtml

²⁵ Tidewater Tech, Building Maintenance and Repair Diploma Program,
<http://www.tidewatertechtrades.edu/programs/building-maintenance-and-repair/index.html>

door locks workshop; and appliance repair.²⁶

- There are core certifications affiliated with this occupation, including the Certified Apartment Maintenance Technician (National Apartment Association), Certified Maintenance and Reliability Technician (Society for Maintenance & Reliability Professionals), Certified Building Operator (Building Operators Certification), and Certified Maintenance Employee (American Hotel and Lodging Association Educational Institute). Most of these certifications require 2 years of education following high school.

Landscaping & Groundskeeping Workers

- This occupation landscapes or maintains grounds of property using hand or power tools or equipment. Workers typically perform a variety of tasks, which can include any combination of the following: sod laying, mowing, trimming, planting, watering, fertilizing, digging, raking, sprinkler installation, and installation of mortar-less segmental concrete masonry wall units. Job titles include “groundskeeper,” “grounds maintenance worker,” “landscape technician,” and “gardener.”
- The VDOE lists several CTE courses through the CTE Resource Center under the Agriculture, Food, and Natural Resources career cluster that are aligned with this occupation, including *Horticulture Sciences* (8034), *Landscaping I* (8036), *Landscaping II* (8039), *Turf Grass Management* (8051), and *Turf Grass Management, Advanced* (8054).
- There are core and specialty certifications available from the National Association of Landscape Professionals, Professional Grounds Management Society, the National Institute for Certification in Engineering Technologies, and the Environmental Protection Agency. The Professional Grounds Management Society offers a Certified Grounds Technician certification that requires two years of job experience and a high school diploma but no education or training after high school. Irrigation in particular offers a series of certifications for system design, auditing, installation, and maintenance.
- The VDOE features the Hanover County Public Schools’ Turf Science Program as an exemplary program on its website.²⁷
- Local CTE directors expressed concern with adding landscaping to regional K-12 offerings, citing a lack of student interest as a major consideration for program expansion. It was reported that Roanoke County Public Schools dismantled their Agricultural Program a few years ago (Landscaping Design and Floral Design) due in large part to lack of student interest.

Home Health Aide

- This occupation provides routine individualized healthcare, such as changing bandages, dressing wounds, and applying topical medications to the elderly, convalescents, or persons with

²⁶ Fairfax County Public Schools, ACE: Property Maintenance Technician Certificate Program, <https://www.fcps.edu/academics/adult-education-academics/apprenticeship-trade-industrial/property-maintenance-technician>

²⁷ Virginia Department of Education, Hanover Turf Science Program, <https://www.youtube.com/watch?v=O2xOrg9tKf4&feature=youtu.be>

disabilities at the patient's home or in a care facility. Home health aides monitor or report changes in health status and provide personal care such as bathing, dressing, and grooming of patients.

- In the state of Virginia, home health aides are required to register for a CNA course in order to work for long-term care establishments and in-home health care; there is no distinctive career pathway for home health aides beyond the certified nursing aide pathway. VDOE lists one CTE course—*Home Health Aide* (8364)—that is aligned with this occupation; this course can be incorporated into a nursing aide career pathway.
- Several certifications associated with this occupation are available from the National Health Career Association, the National Certification Council for Activity Professionals, and the National Center for Competency Testing, among others. The Home Care Certification available through the National Certification Council for Activity Professionals does not require work experience or training after high school.

Licensed Practical & Vocational Nurses (high-wage)

- This licensed occupation provides care for ill, injured, or convalescing patients or persons with disabilities in hospitals, nursing homes, clinics, private homes, group homes, and similar institutions.
- There are currently no K-12 facilities offering LPN training in this region. Current state-approved practical nursing programs serving residents in the LWDA Region 3 are offered by DSLCC, VWCC, and ECPI University–Roanoke. It is not known how many LPN certifications are produced annually by institutions not engaged by this study.
- The VDOE lists a 3-course sequence for Practical Nursing: *Practical Nursing I* (8357), *Practical Nursing II* (8358), and *Practical Nursing III* (8359). The Virginia CTE Resource lists the courses as equivalent to 2 double blocked 18-week courses (I, II) and 1 double blocked 36-week course plus clinical time (III); see table below. The courses follow specific state laws and regulations from a governing medical board or agency.
- The Virginia Department of Health Professions Board of Nursing provides LPN certification. To become qualified as an LPN in Virginia, the applicant must have completed 2 years of high school or its equivalent, meet the requirement of good character as established by the Board, complete an approved practical nursing program, and pass a written examination. There is no requirement that education must occur in a post-secondary setting, but applicants must be at least 18 years of age to take the license exam.

Course Code	Duration	Title
8357	18 weeks, 280 hours	Practical Nursing I
8358	18 weeks, 280 hours	Practical Nursing II
8359	36 weeks, 420 hours	Practical Nursing III

- Establishing an LPN program involves a slightly more rigorous process compared to developing other CTE programs. It is estimated that planning, implementing, and sustaining an LPN program takes approximately 1–2 years.²⁸ Potential barriers to creating a secondary LPN program include finding qualified instructors, equipping the classrooms, potential change in school board policy, scheduling clinical work experience, meeting success requirements over time, and program costs.
- A collaborative approach to planning could be an effective method for developing an LPN program and reduce the workload. This collaboration could include a working relationship with business and industry by establishing a clear memorandum of agreement with roles identified to assure high quality and compliance. LPN programs require consistent quality of assurance measures. These are identified by the percentage of students passing the LPN exam, total number of clinical hours, and the percentage of students hired and retained in local facilities. Working with business partners (e.g., Carilion Clinic and MFA) and postsecondary (e.g., VWCC, DSLCC or ECPI) could provide supervision for the program which could reduce the costs to the school division while meeting requirements. These and other partners could help offset costs and the workload by integrating the LPN program into their employee recruitment while assuring a flow of employees. The return on investment may be in their own staffing and accreditation or regulatory compliance as well as a reduction in cost of recruiting, attaining, and retaining qualified staff.
- Establishing a successful LPN program is possible and has been accomplished in other K-12 school divisions in other parts of Virginia, including Chesapeake Public Schools, Fairfax County Public Schools, Prince William County Public Schools, and Virginia Beach City Public Schools. For example, Massanutten Technical Center (MTC) located in Harrisonburg, Virginia provides affordable and quality nurse training for high school seniors and adults. The center works in close coordination with industry that helps their program remain updated and ahead of competition. MTC offers an 18-month program that is approved by the Virginia Board of Nursing. First year students spend a half day at the center in pre-clinical instruction, where students learn about the basic concepts of nursing, health, nutrition, and pharmacology. The second phase of training is 36-week phase of instruction that includes 15 hours per week of classroom instruction and 14 hours per week providing nursing care to clients under teacher supervision. In the second year of study, a regular schedule of full-time classes and clinical sessions are followed. Graduates are eligible to apply for the State Board examination leading to LPN licensure. In 2018, the NCLEX pass rate for their graduates was 100%.

²⁸ Licensed Practical Nurse guidance documents include:

<https://www.dhp.virginia.gov/Boards/Nursing/PractitionerResources/LawsRegulations/>
<https://www.dhp.virginia.gov/media/dhpweb/docs/nursing/leg/NursingEducationPrograms09202018.pdf>
<https://www.dhp.virginia.gov/Boards/Nursing/AbouttheBoard/EstablishingMaintainingEducationPrograms/>
<https://law.lis.virginia.gov/vacode/title54.1/chapter30/section54.1-3040.3/>

Steps to Establishing an LPN Program in Virginia

1. Engage Stakeholders: Get school leaders on board including the superintendent and curriculum and instructional leadership; make a case for the program's need and present to the school board. Identify and engage with business/industry partners and postsecondary partners, such as community colleges, universities, and/or accredited proprietary schools.

2. Develop Plan of Study: Initiate program planning by submitting the VDOE's "Application for New Career and Technical Education Program/Course." Develop a plan of study by working with partners to identify budget requirements, teaching space(s), courses, instructor(s), CTSO activity, and postsecondary matriculation. VDOE recommends a three-course sequence for Practical Nursing: *Practical Nursing I* (8357), *Practical Nursing II* (8358), and *Practical Nursing III* (8359).

3. Attain Initial VBON Approval. The Virginia Board of Nursing approves nursing education programs to operate in the Commonwealth of Virginia. Prior to submitting an application and fee to establish a nursing education program, the program director must attend a half-day VBON orientation on establishing nursing programs. The next VBON orientation session will be held on Oct. 7, 2020, in Henrico.

After attending an information session, the application packet can be submitted for review. The application review process by the VBON will take 60-90 business days, and the program will be notified in writing of the results of the application review. Once the VBON has deemed the program has submitted a completed application and required documents, a site visit will be conducted to ensure that the classroom(s), skills lab, and student resources are appropriate and available. The program will be given the opportunity to correct cited deficiencies during the 12 months the application is active.

Once the program is granted initial approval and is authorized to admit students, the program will submit quarterly reports to the Board to show progress toward full approval. Quarterly reports will continue until the program is granted full approval by the Board.

4. Attain Full VBON Approval. Full approval of the nursing program may be granted once the program has achieved a rate of not less than 80% for the program's first-time test takers taking the NCLEX based on at least 20 graduates within a two-year period; and a satisfactory survey visit has been made verifying compliance with all requirements for program approval. The program is responsible for completing a comprehensive self-evaluation report (the format is prescribed by the Board) and submitting a survey visit fee.

Once the program has been granted full approval, Board of Nursing regulations require an onsite survey of programs every five years if the nursing program is not accredited and every ten years if the nursing program has programmatic accreditation.

For more details on establishing a LPN program in Virginia, please see the Commonwealth of Virginia's Regulations for Nursing Education Programs.
(<https://www.dhp.virginia.gov/media/dhpweb/docs/nursing/leg/NursingEducationPrograms09202018.pdf>).

Plumbers, Pipefitters, and Steamfitters (high-wage)

- This occupation group assembles, installs, alters, and repairs pipelines or pipe systems that carry water, steam, air, or other liquids or gases. They install heating and cooling equipment and mechanical control systems. In addition to plumbers, pipefitters, and steamfitters, this group includes sprinklerfitters.
- VDOE lists two CTE courses through the CTE Resource Center under Trade and Industrial Education that are aligned with this occupation: *Plumbing I* (8551) and *Plumbing II* (8552).
- Massanutten Technical Center offers a Plumbing diploma program consisting of 14 courses, including *Basic Technical Math*, *Advanced Technical Math*, *Architectural Print Reading and Project Estimation*, *Industrial Maintenance Welding*, *Plumbing Practices I-IV*, *Plumbing Code*, *OSHA 10 & Industrial Health and Safety*, *Introduction to Computers*, *Human Relation Skills*, *Communication Skills*, and *Supervisory Skills*. Students who are also enrolled as apprentices can receive a certificate of completion for Apprenticeship-Related Instruction.²⁹
- Core and advanced certifications in plumbing and pipefitting/steamfitting are available from the National Inspection, Testing, and Certification Corporation, the International Association of Plumbing and Mechanical Officials, and the International Code Council. Journey-level certification from the National Inspection, Testing and Certification Corporation requires more than 2 years of work experience, but no education or training after high school.
- In Virginia, plumber licensure³⁰ is available through the Department of Professional and Occupational Regulation Board for Contractors Tradesman; the applicant must be at least 18 years old and provide evidence of 4 years of practical experience in the trade and 240 hours of formal vocational training, an associate degree, or certificate of completion from at least a 2-year program at a technical school or accredited community college, a bachelor's degree, or 10 years of experience in the trade.

Carpenters (high-wage)

- This occupation is responsible for constructing, erecting, installing, or repairing structures and fixtures made of wood, such as concrete forms; building frameworks, including partitions, joists, studding, and rafters; and wood stairways, window and door frames, and hardwood floors. Job titles used to describe this occupation are “construction carpenter” and “rough carpenter.”
- The VDOE lists three courses through the CTE Resource Center aligned with this occupation: Carpentry I (8601), Carpentry II (8602), and Carpentry III (8603).
- JRTC offers a three-course sequence of Carpentry courses that offers a strong model for potential replication at other sites. JRTC's Carpentry I is a 1-credit, 1-semester course designed to introduce students to the principles of carpentry as they relate to construction. Carpentry II is a 2-credit, 1-year course designed to give students more emphasis on carpentry principles;

²⁹ Massanutten Technical Center, Plumbing, <https://www.mtcva.com/plumbing>

³⁰ Plumber licensure: <http://www.dpor.virginia.gov/uploadedFiles/MainSite/Content/Boards/Tradesmen/A501-27TRADEREGS.pdf>

students are involved in construction of a house, cabinetmaking, and other carpentry work. Carpentry III is a 2-credit, 1-year course designed to give students advanced emphasis on carpentry. In this course students receive classroom and lab instruction in safety, installation of windows and doors, drywall construction, ceiling finishing, interior trim work, blueprint reading and drawing, and the construction of a house.

- In addition to several specialized certifications (e.g., Fenestration Master), core certifications aligned with this occupation include Certified Graduate Associate (National Association of Home Builders) and Certified Lead Carpenter (National Association of the Remodeling Industry), the latter of which does not require 2 years of education past high school.

Industrial Machinery Mechanics (high-wage)


- This occupation is responsible for repairing, installing, or maintaining industrial production and processing machinery or refinery and pipeline distribution systems. Job titles used to describe this occupation are “industrial mechanic,” “maintenance mechanic,” “maintenance technician,” and “master mechanic.”
- The VDOE lists two courses through the CTE Resource Center aligned with this occupation: *Industrial Maintenance Technology I* (8575) and *Industrial Maintenance Technology II* (8576).
- Locally, DSLCC offers an Industrial Maintenance Mechanic program with 4 levels of training. The program was designed by the National Center for Construction Education and Research and complies with Department of Labor time-based standards for apprenticeship. This hybrid program includes a combination of convenient online exercises and live classroom and lab training covering topics from hand tools through troubleshooting, maintaining, and repairing industrial machinery.³¹ The hybrid design offers potential to scale this program across the region.
- Muscle Shoals Career Academy in Alabama offers a K-12 example of a 4-course sequence. Its Industrial Maintenance program begins with knowledge-building in mechanical theory, industrial systems lubrication, bearings, piping practices and systems, pneumatics, and circuit design, and progresses to hydraulic systems and preventive and predictive maintenance.³²
- In addition to several specialized certifications (e.g., Fluid Power Pneumatic Technician), core certifications aligned with this occupation include the Plant Maintenance Technologist Certification Class II (Association of Boards of Certification) and the Certified Maintenance and Reliability Technician (Society for Maintenance and Reliability Professionals), neither of which requires 2 years of education past high school.

³¹ DSLCC, Industrial Maintenance Mechanic (IMM) Levels 1-4, <https://www.dslcc.edu/academic-program/industrial-maintenance-mechanic-imm-levels-1-4>

³² Muscle Shoals Career Academy, Industrial Maintenance, <https://www.msccs.k12.al.us/Page/451>

2.2 Reduce Existing Programs

One recommendation for program reduction is presented in the chart below. Program reduction is not program elimination but a recommendation to scale the program according to workforce need. Training and certification details for this occupation are described beneath the chart.

Occupation	High School	Community College	Recent Year Enrollment	Annual Job Openings
 Veterinary Technologists /Technicians	✓		46	12

Veterinary Technologists and Technicians

- This occupation performs medical tests in a laboratory environment for use in the treatment and diagnosis of diseases in animals; prepares vaccines and serums for prevention of diseases; prepares tissue samples, takes blood samples, and executes laboratory tests, such as urinalysis and blood counts; and cleans and sterilizes instruments and materials and maintain equipment and machines. Job titles include “certified veterinary technician” and “veterinary assistant.”
- The VDOE identified through the CTE Resource Center a two-course sequence: *Veterinary Science I* (8088) and *Veterinary Science II* (8089). Note that the CTE Resource Center lists this course sequence under Agricultural Sciences, but the Career Cluster/Pathways system lists it under the Health Science career cluster.
- BTEC offered a Veterinary Technology program with 46 enrolled students reported. The estimated annual job openings for this occupation is 12. Graduation data for this program was not reported; if the graduation rate is higher than the projected annual job openings, it is recommended that the program size be reduced but not eliminated, since this unique program is meeting a regional workforce need.

3. Diversify Program Delivery

Given the recommendations presented in Recommendations section 2.1 to expand program offerings, the LWDA Region 3 should consider expanding the methods of program delivery. In this section, the CTE academy, virtual instruction, new regional technical center, and mobile classrooms are discussed as viable options.

3.1 CTE Academy

Coupled with a regional planning approach, one or more CTE academies established in close collaboration with one or both of the region's community colleges and the school divisions could enhance existing program pathways to strategically address gaps in regional workforce preparation while integrating academics for career preparation and meeting or exceeding graduation requirements. CTE academies are programs of learning that are more personalized than the traditional high school experience. An academy is not bound by location – a student may attend classes in different locations and/or online.

A CTE academy engages a cohort of students and teachers in a smaller learning community in a thematic program built on a foundation of a rigorous college preparatory curriculum and career and technical education.³³ Academy classes include both core academic courses and a sequence of CTE courses that are usually scheduled back-to-back to support curriculum integration. Academy teachers come from different disciplines and work together as a team, manage the cohort program, and have common planning time. In this model, partnerships with community colleges enable students to earn high school and associate degrees at the same time or within a short period after high school graduation.

Students apply to an academy based on their career goals and are accepted by meeting a variety of requirements, such as an essay written about their interest in the career area, teacher recommendations, school counselor recommendations, and other typical data collected in students' school records. Students attend their academy as a cohort and must be able to complete academy requirements within the regular school day, with the exception of work-based learning and dual enrollment college classes. Academy participation may start at 9th or 10th grade, and by the 11th or 12th grade should include resume-building work experience and a capstone project through which students extend their learning beyond their teachers and classroom learning. During their senior year, students

Regional Academy Model: The Lynchburg Area CTE Regional Academy

Developed in partnership with Amherst County Public Schools, and other school divisions in the Lynchburg area, this academy based at Central Virginia Community College will serve dual-enrollment students, recent high school graduates, and unemployed or underemployed adults who wish to earn credentials for targeted, high-demand industry employment sectors.

The academy will be built upon programs such as precision machining and welding and will expand the college's offering of courses, most notably in trades such as plumbing, construction, and industrial maintenance.

An important element of this academy is the establishment of a standard system-wide G3 student onboarding process that begins with a "One Door" advising model and includes eligibility determination, FAFSA completion, domicile establishment, program orientation, community service commitment tracking, and student support services.

³³ Academy Source: College and Career Academy Support Network (CCASN), <http://casn.berkeley.edu>

receive college and career counseling and support for transition to college or directly to employment.

There are several advantages of a CTE academy model. Students make meaningful connections between their classroom learning and their college and career goals. CTE classes provide career guidance and develop applied knowledge and skills in the student's career pathway, while college and career counseling and support ease students' transition to college or employment. Academy students may also participate in required and elective classes outside the academy, as well as other school-wide activities such as clubs and sports. The connection with a rigorous college-preparatory curriculum also confronts misperceptions that CTE programs are "too easy" and not intended for students on a college track. In sum, an academy approach is employer outcome- and student- focused and provides clear paths, through college, to high wage, high demand employment.

The typical CTE academy is offered as a smaller learning community within an existing high school. However, since LWDA Region 3 benefits from highly engaged industry partners that have demonstrated an interest in and commitment to engaging in workforce training as well as community colleges with ample capacity to provide training, an academy could leverage existing regional facilities and capabilities provided by one or both community colleges and also by local industry (e.g., old Roanoke Hospital already in use to train health professions; F&S Building Innovations has developed educational programs for building trades) to provide programs that lead to certification, licensure, and/or college credit. Hybrid or online courses (discussed in 1.3.3) should also be considered when possible due to regional transportation issues.

Securing funding to reduce tuition and/or dual enrollment costs and pay for transportation, thereby reducing the financial burden on families, must be addressed for this approach to succeed. The G3 ("Get Skilled, Get a Job, Give Back") Capacity Building Grant program, available from the U.S. Department of Labor, Employment, and Training Administration through VCCS, provides a potential funding stream to support regional planning and implementation of a CTE academy. Other state and regional funds might be available to support this initiative.

In addition to core funding, a CTE academy could also apply for and house a Governor's Health Sciences and/or Governor's STEM Academy, which would provide additional recognition, funds, and meet other regional objectives.³⁴ The Governor's Academies require approval by the Virginia Department of Education, SCHEV, and the Virginia State Board of Education.

³⁴ BCAT already hosts one of the 22 Governor's STEM Academies in Virginia. The STEM Academy at BCAT focuses on engineering and technology, facility and mobile equipment maintenance, and journalism and broadcasting; student learning and achievement are enhanced through integration of academic, STEM curriculum, applied technology, and increased participation in student organizations.

3.2 Virtual Programming

Virtual programming, or online coursework, is an appropriate option given the transportation challenges faced by students in the LWDA Region 3 region. School closures due to COVID-19 also create uncertainty related to the structure of future CTE courses and programs, which may encourage greater use of online instruction. Virtual programming offers many advantages for CTE instruction in the region, including:

- *Improved student access to CTE:* By offering online educational opportunities in CTE, more students can access a wider variety of courses and programs, regardless of their geographic location. It is also potentially ideal for small enrollment courses that otherwise might not meet minimum enrollment at individual schools.
- *Improved flexibility in delivery:* Virtual learning options provide school divisions and colleges more flexibility in the delivery of CTE courses and enable them to expand current course offerings. In the post-pandemic era, the ability to continue high-quality instruction online is an immense benefit. For example, a CTE school in Massachusetts recently had culinary arts students videotape themselves cooking and veterinary students watched live webcams from zoos to improve their observation skills.³⁵ Other schools reported distributing equipment to students' homes during the pandemic to continue hands-on learning in the virtual setting. In Nebraska, for example, faculty at the community college developed take-home kits, such as electrical components which could be used for virtual basic electrical theory class.³⁶ The Southern Regional Education Board recently assembled a list of resources for virtual CTE instruction.³⁷
- *Expanded capability to deliver CTE:* Given overcrowding in CTE classrooms across the region and the potential need for post-pandemic social

Virginia's Online CTE Courses

In Virginia, virtual CTE courses are available through Virtual Virginia and through approved multi-division online providers (AMOP).

Each Virginia public school can enroll up to 15 students in a Virtual Virginia course with no enrollment fees. Available CTE courses include *Computer Science Programming* and *Introduction to Game Design & Development*.

School divisions contract AMOPs to provide online courses. The following CTE courses affiliated with the targeted domains were identified among 2019-20 AMOP offerings: *Foundations of Game Design* (Proximity Learning); *Certified Nurse Aide*, *Construction Technology*, *Game Development*, *Health Science 1 & 2*, *Introduction to Cybersecurity*, *Principles of Health Science A/B*, *Principles of Transportation A/B*, *Distribution & Logistics*, *VA Computer Applications A/B*, and *VA Computer Information Systems A/B* (EdOptions Academy).

³⁵ S. De La Rosa (May 2020). CTE courses transforming for online learning, <https://www.educationdive.com/news/cte-courses-transforming-for-online-learning/577346/>

³⁶ B. Buckley & D. K. Rubin (May 2020). Construction apprentice programs face new COVID-19 learning curve, <https://www.enr.com/articles/49417-construction-apprentice-programs-face-new-covid-19-learning-curve>

³⁷ Southern Regional Education Board, CTE Resources, <https://www.sreb.org/cte-resources>

distancing, virtual programming allows schools to expand their instructional capacity. For example, prerequisite or entry-level courses with low requirements for hands-on instruction and computer-based courses could be prioritized for virtual delivery, freeing up on-site classrooms for other courses.

Virtual programming typically includes offering CTE courses in two formats: blended learning or virtual learning. In a blended learning environment, students take what could be described as a hybrid of courses, both virtually and in-person³⁸. This approach allows for students to take online courses but also experience hands-on or real-world experiential learning that is often an identifying feature of CTE. Virtual courses can also be offered synchronously (students learn the same material at the same times), asynchronously (students learn the same material at different times) and using a blend of both approaches. As a result, virtual programming offers students a high degree of flexibility in terms of time, place, and pace of their courses and learning. Typically, courses, rather than complete CTE pathways can be completed virtually. As noted earlier, prerequisite, entry-level, or computer-based courses translate well to online learning.

Registered apprenticeships can also take advantage of online learning. Nationally, registered apprenticeships require two components: classroom learning and on-the-job training with a mentor. Classroom learning can be translated readily into a virtual environment, but on-the-job training does not easily translate to an online component. When COVID-19 caused schools to close, both classroom learning and on-the-job-training had to move online. A few schools developed innovative ways to meet both requirements. For example, Apprenti, a tech apprenticeship program, pivoted to online education for learning requirements; it is working with companies to help apprentices continue their on-the-job training at home. Another example is Catalyte, a company that offers information technology apprenticeships. This company moved its programming, including its mentorship component, online and created opportunities for virtual reality-based apprenticeships in manufacturing. Currently, there is no clear guidance about whether the Department of Labor will allow mostly or 100% virtual apprenticeships. Positives of virtual training include decrease in injury and mistakes that will negatively impact others. However, companies might not want to pay virtual apprentices the wage in-person apprentices typically receive. Virtual apprenticeships could expand student access but must be designed so students are held to the same standards as in-person training.³⁹

³⁸ Edmentum. (February 2019). Blended learning vs. virtual learning in career and technical education, <https://blog.edmentum.com/blended-learning-vs-virtual-learning-career-and-technical-education>

³⁹ M. St. Amour (June 2020). The future of apprenticeships, <https://www.insidehighered.com/news/2020/06/09/are-virtual-apprenticeships-future-after-pandemic>

3.3 Regional Career & Technical Center

Creation of a regional career and technical center (RCTC) is the most expensive option but could provide dedicated facilities and staff to expand CTE offerings in this region. Even if built in a central location, a regional center would not be a viable solution for the entire region, given that some rural school districts and students would be more than an hour away.

A new RCTC could be designed to address the special requirements of high-need employment gaps, such as LPN and plumbing. The center could house CTE programs that are viewed as too expensive to operate, maintain, or modernize, such as those required in Architecture and Construction, Health Science, and Manufacturing, and Transportation, Distribution, and Logistics clusters. A RCTC could also provide programs that may be undersubscribed in local school divisions and not feasible for any one division to support but are necessary for the region's employers or future employers.

Typically, RCTC students attend a partial day for the CTE programming. This requires school day schedule alignment by the participating school divisions. The class schedules are set up in blocks that allow enough time for teachers to set up process or performance lessons and students have time to learn the hands-on skills and requirements of a career and accepted practices of a craft area. Students typically attain their academic requirements at the home school. This creates a need for a daily transportation schedule as students are bused, or drive (if they are old enough and it is allowed) to the RCTC for a partial day and return to their home school or go to work-based learning sites.

The regional center could organize around an academy model (see Recommendation 3.1) and also apply for and house a Governor's Health Sciences and/or Governor's STEM Academy, which could provide additional recognition, funds, and help meet other regional objectives. The Governor's Academies require approval by VDOE, SCHEV, and the Virginia State Board of Education.

A RCTC will require a regional planning team, coordinated by the WVWDB or other regional planning group, or the creation of a new council. Once established, RCTC

Regional Center Model: New Horizons Regional Educational Centers

Located in Hampton, VA, New Horizons first opened in 1965 as the Virginia Peninsula Vocational Technical Education Center with an initial high school faculty consisting of five teachers. Today, New Horizons is distributed across four sites, has an annual budget of over \$20 million, and enrolls over 1,500 public school students and 1,200 adults.

Owned and operated by 6 school divisions (Gloucester, Hampton, Newport News, Poquoson, Williamsburg/JCC, and York), New Horizons is the largest of Virginia's regional centers in both size and scope of service. Its centers include a Career and Technical Education Center, Governor's School for Science and Technology, Center for Autism, Newport Academy, Center for Apprenticeship and Adult Training, Youth Workforce Center, and Family Counseling Center.

The CTE Center offers 24 programs, including over 7 dually enrolled programs with Thomas Nelson Community College. New Horizons also offers an Academy for Advanced Technical Careers within this Center, offering automotive, manufacturing and construction programs.

governance is typically divided among participating school divisions by written agreement and on a cost-sharing basis. In some regions, the management of the RCTC is split equally among participating school divisions, with one school division taking responsibility for fiscal accounting, one for human resources, etc., and each division appoints a school board member to the RCTC governing board; the New Horizons Regional Education Centers, for example, which is owned and operated by 6 school divisions, utilizes this model.⁴⁰

Budgets for a RCTC are based on anticipated enrollment, number of accepted students from the application process, historical enrollment or rolling average, or some combination. Financial support for a regional center could draw upon Perkins V, state equipment, CTE credentials, and other funds available from local, state and federal education agencies. It is strongly recommended that representatives from the VDOE's Office of Career, Technical, and Adult Education, such as the Director of Operations and Accountability and the Director of Workforce Development and Initiatives, are asked for guidance to ensure that all components of the application process are known. Creating a regional center will at least require State Council of Higher Education for Virginia (SCHEV) approval and legislative action in the Virginia General Assembly.

Approved RCTCs and Governor's Academies have their own school identity in the Virginia state reporting systems. If an RCTC also has a Governor's STEM or Health Sciences Academy, the RCTC and the academies could have their own school identity even if housed in the same building.

⁴⁰ The New Horizons organizational structure is discussed at length on the center's website: <https://nhrec.org/governance/legal-structure/>

3.4 Mobile Classrooms

Mobile classrooms or labs allow schools to expand their instructional space temporarily and provide greater access to specialized equipment and courses to a larger number of students. A mobile lab could be used at one school or college during the fall semester, then moved to another campus for the spring semester, allowing both schools to benefit from the equipment during a single academic year.

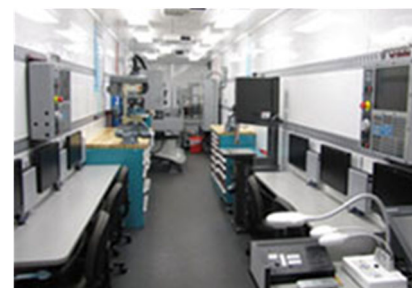
Mobile classrooms or labs are frequently acquired to house STEM or CTE instruction that requires expensive or specialized equipment so that more schools and students may benefit from the investment. Mobile classrooms are often built in a tractor-trailer, allowing for a large interior working space that can be easily moved from one location to another. Costs for mobile classrooms include typical equipment for the training purpose and certifications and costs associated with buying, licensing, and maintaining tractor-trailers, instructors, and CDL-licensed staff to drive the rig to sites.

Mobile classrooms are ideal for housing instruction with high-end equipment. California's Moreno Valley College's iMake Mobile Innovation Center, for example, provides access to high-end equipment such as 3D printers, laser printers/cutters, vinyl printers, virtual reality equipment, coding with Raspberry Pi, Arduino, and more.⁴¹ Oregon's Sherwood High School was able to take its Digital Fabrication Lab (FabLab) on the road using a Mobile FabLab. The purpose of the FabLab was to bring technology and course ideas directly to students and teachers, offering hands-on experiences for students and professional development for teachers. Based on MIT's FabLab model, the Bowmen Mobile FabLab has a 3D printer, laser cutters, microcontroller boards, vinyl cutters, and laptops with CAD software.⁴²

Mobile classrooms are ideally suited to supporting instruction across a large geographic area, carrying instruction to the student wherever they might be. Colorado's Pueblo Community College, for example, delivers workforce development training courses to industry sites through mobile, innovative, state-of-the-art training facilities. Their Mobile Learning Labs feature portable classrooms with professional trainers and instruction stations. Sponsored through the U.S. Department of Labor, these customized training tools provide a wide range of skill development, from fundamentals to advanced troubleshooting. With a fleet of semi-trailers, designed for specific training, the college is able to meet regional employer needs on-site.⁴³ See side bar for more information.

Mobile Classroom Model: Pueblo Community College

Pueblo Community College maintains a fleet of Mobile Labs for workforce development training—two focused on mechanical technology, two electrical systems technology, two welding technology, and one machining manufacturing. All mobile labs are equipped with power generators, air compressors, and audio-visual equipment.



Interior view of the Mobile Lab showing the HAAS Toolroom CNC Mill



Exterior view of the Mobile Lab

⁴¹ Moreno Valley College, CTE, iMake Mobile Innovation Center, <https://mvccte.com/imakemobile/>

⁴² Sherwood Tech, Bowmen Mobile Fab Lab, <https://www.sherwoodtech.org/mobile-fablab.html>

⁴³ Pueblo Community College, Pueblo Corporate College: Mobile Learning Labs, <https://www.pueblocc.edu/Mobile-Learning-Labs/>

Acknowledgements

The authors wish to thank and acknowledge the support of the staff of the Western Virginia Workforce Development Board and the elected officials and other leaders from the education, business, and industry sectors who participated in this study.

Special thanks to staff at the following institutions, which hosted our team during site visits and participated in interviews:

Schools, Technical Centers, & Community Colleges

Botetourt Technical Education Center

Burton Center for Arts & Technology

Dabney S. Lancaster Community College

Franklin County Career Center

Jackson River Technical Center

Roanoke Technical Education Center

Salem High School

Virginia Western Community College

Regional Businesses & Industry

Carilion Clinic

F&S Building Innovations

Medical Facilities of America

PowerSchool

ProAmpac

Wabtec Corporation

WestRock – Low Moor Converting Plant