Career And Technical Enrollment And Subsequent Employment By Sector

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Research Report No. 464_U

Legislative Research Commission
Frankfort, Kentucky
legislature.ky.gov

Accepted November 12, 2019, by the
Education Assessment and Accountability Review Subcommittee

Paid for with state funds. Available in alternative format by request.

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Background

Career and technical education (CTE) links the teaching of academic content with the skills and abilities that will be required of graduates when they enter the workforce. In recent years, state and national policymakers have focused on increasing alignment of high school CTE with workforce demand in a quickly changing economy. Educators now have unprecedented access to labor market data that allows for identification of specific occupations that will be in demand, along with the skills and education levels required for those occupations. They are working with industry leaders to promote CTE pathways that are aligned with these in-demand occupations. Career pathways are coherent sequences of at least four academic and technical courses relevant to a job sector; they form the basis of the CTE instructional experience for students. Courses within individual pathways are designed to lead to industry certification or preparation for ongoing education.

This report uses data from the Kentucky Center for Education Statistics to follow high school graduates from the graduating classes of 2013, 2015 and 2017, who have completed CTE pathways in specific program areas into postsecondary education and the workforce. It looks for relationships between CTE pathway completion and attainment of industry certification in high school, continuing postsecondary education, and wages in different workforce sectors.

The report focuses largely on those CTE program areas that are aligned with workforce sectors that have been identified by the Kentucky Workforce Innovation Board (KWIB) as high wage and high demand (HWHD):

- Business and information technology (IT)
- Healthcare
- Construction
- Advanced manufacturing
- Transportation and logistics

It reports outcomes for CTE pathway completers in these HWHD program areas as well as outcomes for graduates completing pathways that have not been identified as HWHD but are common in Kentucky high schools, including agriculture, law/public safety, and human services. The report shows wages for CTE pathway completers at various levels of continuing postsecondary education but focuses largely on graduates who have entered the workforce with no postsecondary education. Two thirds of the new jobs projected for Kentucky between 2018 and 2022 do not require postsecondary education and, historically, most high school graduates in the commonwealth have entered the job market without a postsecondary degree or credential.

Major Findings

The report shows clear and continuing wage premiums for CTE pathway completers versus noncompleters in almost every job sector, along with higher rates of labor market participation. These wage premiums are greatest in the years immediately following graduation and for graduates who do not earn a postsecondary degree or credential. CTE wage premiums persist for many years following graduation, however, and are present at every level of postsecondary education.

The report shows higher wages for CTE pathway completers with skills that prepare them for work in the manufacturing, construction, and transportation sectors. Of these workforce sectors, the highest wages are in the manufacturing sector. The supply of workers in the higher-wage sectors has not yet met demand. For example, while the over 8 percent of the jobs projected for 2018 to 2022 are in the manufacturing sector, less than 3 percent of graduates complete manufacturing pathways.

CTE completion in manufacturing, construction, and transportation is uneven across the state, depending on geographic region; whether students receive CTE in comprehensive high schools, state-operated area technology centers (ATCs) or local area vocational education centers (LAVECs); and student gender or race. In 2018, for example, more than one third of districts in the commonwealth—including Jefferson and Fayette Counties—had few or no graduates (less than 1 percent) completing manufacturing pathways. ATC students are much more likely than are LAVEC students to complete pathways in manufacturing, construction, and transportation. Few comprehensive high schools offer these programs.

CTE completers in the remaining HWHD program areas earn less than those in manufacturing, construction, and transportation and often less than those in pathways that are not considered HWHD, especially agriculture. Given that health pathways have seen the largest increase in recent years and had the greatest enrollment in 2019, it is notable that most health pathway completers do not earn a college degree and those working without a college degree earn less, on average, than CTE noncompleters. Whereas graduates in manufacturing, construction, and transportation earn relatively high wages even without any additional postsecondary education, health program pathway completers generally earn higher wages only after earning an associate's degree or above. For the relatively higher investment in health versus other CTE program areas to yield benefits for graduates and for the health industry, many more health program completers must earn postsecondary degrees of associate or above. Current limits in the number of postsecondary health enrollments available may be one factor that limits this potential

Given the relatively low projections for jobs in the agriculture sectors and the relatively high numbers of graduates completing CTE agriculture programs, it may seem surprising that these CTE agriculture program graduates earn wages that are often comparable to or greater than the HWHD program areas. The data suggest that skills and abilities learned in agriculture pathways may be transferable to many of the higher-wage sectors. Principals and superintendents

interviewed or surveyed for this study often expressed discontent about the relatively less funding or emphasis placed on agriculture and some other CTE programs for which they saw local need.

The report shows much smaller CTE wage premiums for female versus male students, federal free or reduced-priced lunch program (FRPL)-eligible versus noneligible students, and black versus white students.

In looking at 2018 wages of 2017 high school graduates, CTE completers who earned an industry certificate or passed a state-approved assessment and completed a CTE pathway earned more, on average, than graduates who earned a certificate or passed an exam but did not complete a pathway. The commonwealth's previous accountability system for districts and schools required graduates to complete at least two courses within CTE pathways in order to be considered career ready. The commonwealth's current system considers a student transition ready if the student has earned a certificate or passed an exam, regardless of whether the student has completed courses within a pathway.

Considerations For CTE Policies And Programs

The report provides the following general areas for consideration in the crafting of CTE policies or programs moving forward.

Expanding Access To Higher-Wage Pathways Among Kentucky Districts And Student Groups

Graduates completing CTE programs in the higher-wage program areas are more likely to work in higher-wage sectors and, on average, earn more than other graduates in those sectors. Access to higher-wage CTE programs is currently low for many students participating in CTE in comprehensive high schools or LAVECs. The relatively higher concentration of manufacturing, construction, and transportation pathways in ATCs versus LAVECs and comprehensive high schools likely reflect differences in the way CTE is funded in these settings. ATCs received approximate five times as much state funding per pupil each year than do LAVECs. The costs of starting up a pathway in manufacturing, construction, or transportation are generally much higher than in business or health sciences. In addition, female and black students complete these higher-wage pathways at lower rates than do male or white students.

Local Decision Making

OEA site visit and survey data indicate frustration of local leaders with limitations put on pathways that can be offered based on what is considered HWHD at the state level. Data in the

report show that wages in some of the pathways that are not considered HWHD—agriculture pathways, most specifically—can often surpass those in the health and business program areas.[a]

Data in this report also raise the concern that CTE opportunities offered to high school students may not always be in line with workforce demand and greatest opportunities for high school graduates.

Use Of Outcome Data To Evaluate Programs

This report provides strong evidence of likely positive effects of the state's recent efforts to expand access to pathways in manufacturing, construction, and transportation. It also illustrates that workforce outcomes for CTE graduates in other pathways may not always reflect desired outcomes. The General Assembly may wish to periodically review data on the relationship between CTE pathways offered and workforce outcomes.

In addition, the General Assembly may wish to request future studies that track the postsecondary outcomes of graduates who are being considered transition ready in the current accountability system. It is possible that, in response to the current policy incentives, some districts might elect to reduce the number of courses offered in individual pathways in favor of increasing the number of classes that might lead to industry certificates in different program areas. It is unknown whether graduates who earn industry certificates or pass state-approved exams without completing pathways can expect the same wage benefits.

[a] The agricultural power, structural, technical systems pathway is currently labeled HWHD for purposes of additional points in the accountability system, but other agriculture pathways are not and may not be approved for ATCs.

Chapter 1

Introduction And Overview

Career and Technical Education (CTE) links academic content with instruction relevant to the content knowledge and skills needed for jobs in specific occupations and industry sectors. Its goal is to prepare students to be successful in taking the next steps in their adult lives whether that be attending college or entering the workforce.

Nationwide, employers' concerns about a "skills gap" between the types of workers needed by industry and those available in the workforce have focused greater attention on the content of CTE programs. State and national leaders have enacted policies aimed at promoting greater alignment between industry demand and CTE programs. These include use of labor market information to inform decisions about what to offer in high school CTE programs and identification and promotion of CTE programs in industry sectors that are projected to be high wage and high demand (HWHD). The Kentucky Workforce Innovation Board (KWIB) has identified five HWHD sectors in Kentucky

- business and information technology (IT),
- healthcare,
- construction,
- advanced manufacturing, and
- transportation and logistics. [a] [b]

Recent state and national policies have also focused on easing the transition between high school CTE programs and postsecondary learning opportunities that further education and skill development. In Kentucky, these policies include scholarships for high school students to earn college credits while in high school and to later gain credentials or degrees in HWHD areas in the Kentucky Community and Technical College System (KCTCS).

[a] The 27-member Kentucky Workforce Innovation Board serves as an advisory board to the governor on workforce training and development issues. The KWIB is charged with creating a statewide vision for workforce development and adopting a plan to move Kentucky forward through workforce training and development.

[b] The Kentucky Department of Education has worked with KWIB to identify some additional HWHD pathways for Kentucky's accountability system. These include some education and agriculture pathways.

The highest wage jobs of the future will require at least some postsecondary education. It is critical, therefore, to strengthen the link between CTE in high school and postsecondary institutions. At the same time, it is important to understand the relationship between CTE at the high school level and workforce outcomes for those who do not go on to earn postsecondary degrees. Almost two-thirds of the jobs projected for Kentucky between 2018 and 2022 do not require any education past high school.[c] [1]Further, given Kentucky's historic college completion rates, it is likely that Kentucky's workforce will continue to rely heavily on workers with no postsecondary degrees.

This report tracks high school graduates from the graduating classes of 2013, 2015 and 2017, who have completed CTE pathways in specific program areas into postsecondary education and the workforce. It looks for relationships between CTE pathway completion, attainment of industry certification in high school, continuing postsecondary education, and wages in different workforce sectors.

Description Of This Study

In November 2018, the Education Assessment and Accountability Review Subcommittee requested that the Office of Education Accountability (OEA) study career and technical enrollment and subsequent employment by industry sector. It requested that OEA report on the CTE opportunities available to students relative to indicators of workplace demand. It also requested that OEA analyze the relationships between CTE pathways completed and credentials earned by high school students and sector-specific employment and wages. The committee requested, further, that the data be disaggregated by district, region and student demographic characteristics.

Major Conclusions

1. In 2018, 15,598 or 33 percent of all graduates completed at least one CTE pathway. Graduates' rates of CTE pathway completion varied substantially among districts. Districts with the highest percentages tend to be small or rural, whereas CTE completion rates in the state's largest, more

[c] Education levels required for projected jobs is based on staff analysis of the Kentucky Future Skills Report, which identifies the education level required in each occupation group, along with total jobs in that group.

urban districts are lower. Pathway completion rates are slightly higher for male versus female graduates and much higher for white versus black graduates.

2. CTE program completers earn college degrees at the same rate as graduates who do not complete CTE programs (27 percent) but are more likely to earn associate's degrees and postsecondary certificates versus bachelor's degrees.

3. CTE program completion yields salary premiums for workers at all levels of education but premiums are greatest for those with no postsecondary education. On average, 2013 graduates with no postsecondary education who were CTE pathway completers earned 22 percent more in 2018—five years after high school graduation—than did their peers who did not complete CTE pathways.

4. CTE pathway completers who enter the workforce without a postsecondary degree earn substantially higher wages if they have also earned an industry certificate or passed a Kentucky Occupational Skill Standards Assessment (KOSSA). In 2018, 70 percent of completers earned one of these additional credentials.

5. Graduates who completed manufacturing pathways earn, on average, much higher wages than those from any other program area, followed by graduates from construction and transportation pathways. A 2013 manufacturing pathway completer working in 2018 without a postsecondary degree earned about 150 percent more than a graduate who did not complete a CTE pathway. Relative to demand, enrollment in manufacturing and transportation pathways is low. While over 8 percent of new jobs are projected to be in manufacturing, only 2.8 percent of graduates in 2018 completed a manufacturing pathway. While 4.6 percent of occupations are in auto or other repair and installation, only 1.7 percent of graduates completed transportation pathways.

6. Of the HWHD pathway completers without a postsecondary degree or credential, those completing health pathways earned the lowest salaries and often less than those who did

not complete a pathway at all.[d] As of 2018, less than one quarter of 2013 health pathway completers had earned an associate's degree or above.[e] In order to realize the full wage benefit of working in the health industry, workers need to complete at least an associate's degree.

7. In 2018, pathway completions in HWHD CTE program areas were greatest in health sciences, followed by business. The growth in the total number of health science pathway completers between 2012 and 2018 is three times greater than in any other HWHD program area. By 2018, the number of graduates completing pathways in health sciences was 2 to 4 times greater than the numbers completing pathways in each of the program areas associated with highest wages—manufacturing, construction, and transportation.

8. Of the pathways that have not been identified as HWHD, agriculture had the greatest number of completers in 2018, accounting for almost as many completers as health sciences. The percentage of graduates completing agriculture pathways far exceeds the projected demand for agriculture jobs in the state; however, graduates from agriculture pathways earn relatively higher wages across many work sectors than those from other pathways.[f] One possible explanation may be that some of the skills acquired in agriculture pathways are transferable to other workforce sectors.

9. Access to manufacturing, construction and transportation programs is uneven in districts across the state and is

[d] While this finding reflects, in part, the fact that female graduates generally earn less than males and health completers are predominantly female, males who complete health pathways also earn less than their peers in manufacturing, construction, and transportation pathways.

[e] Recent graduates in health pathways appear more academically prepared for college than the average CTE student, and historical data indicate that they have earned postsecondary degrees at rates higher than the average CTE student. However, they are not yet earning degrees at rates that will lead the majority to higher wages.

[f] 2013 agriculture pathway completers that were working in the manufacturing sector in 2018 earned as much as manufacturing pathway completers working in that sector, and more than those from any other program.

concentrated in districts whose students attend ATCs. Few comprehensive high schools offer manufacturing, construction, or transportation programs. Compared with LAVECs, ATCs are much more likely to graduate students who have completed pathways in manufacturing (2 1/2 times as likely), construction (three times as likely) and transportation (three times as likely). Pathways in these programs cost more to operate than do those in other program areas; principals report the cost of equipment and supplies and availability of qualified teachers as barriers to opening new programs.

10. CTE wage premiums are lower for female versus male pathway completers, those eligible for the federal free or reduced-priced lunch program (FRPL) versus non FRPL-eligible completers, and black versus white completers. [g]

11. A relatively small percentage of pathway completers have access to work-based learning opportunities such as cooperative education credits, apprenticeships, internships or job shadowing. These opportunities are more commonly available in health science, business, agriculture, and family and consumer science pathways versus other pathways.

12. Graduates who complete CTE pathways are more likely than their peers who do not complete pathways, to earn
    - a grade of C or above in at least one dual credit class in high school,
    - a cooperative work credit, and
    - an industry certificate or pass a KOSSA exam.

Preliminary data indicate positive outcomes associated with all of these additional indicators. Graduates who complete dual credit classes enroll in college at higher rates versus those who do not. Graduates who compete a cooperative work credit, earn an industry certificate or pass a KOSSA exam earn, on average, higher wages than those who do not.

[g] Wage premiums vary depending on the year examined and generally decrease somewhat for both males and females in the years that follow graduation. Male CTE premiums remained robust, however, in all years examined.

Data Used For The Report

Data in this report were provided primarily by the Kentucky Center for Statistics (KYSTATS) which links high school data from the Kentucky Department of Education (KDE) with data from the Kentucky Council on Postsecondary Education (CPE), and unemployment insurance (UI) wage data from the Kentucky Education and Workforce Development Cabinet. KDE data include student demographic and academic data, CTE pathway, dual credit, and industry certificate/KOSSA data from the graduating classes of 2013, 2015, and 2017. CPE data include enrollment and specific degrees earned in all Kentucky postsecondary institutions.

To make regional comparisons, OEA reports supply and demand by the local workforce areas (LWAs) that are used by KYSTATS in reporting demand data. Appendix A shows districts in each of the state's 10 LWAs.

In addition, staff conducted site visits to four districts, interviewing superintendents, and principals of ATCs, LAVECs, and comprehensive high schools. The districts included one that housed an ATC, one ATC feeder district, and two districts that had formerly housed ATCs that were converted to LAVECs.

Finally, OEA administered a survey to principals in all the state's ATCs, LAVECs, and comprehensive high schools. Questions focused on factors that influence decisions to offer specific career pathways, barriers to offering career pathways, and work-based learning opportunities available to students in the program areas. Survey response rates were 75 percent for ATCs, 61 percent for LAVECs, and 73 percent for comprehensive high schools.

This report refers to school years by the year in which the school year ends. For example, the 2018-2019 school year is called the 2019 school year.

Limitations

Differences between the way that jobs are recorded in UI wage data and described in the standard occupation codes (SOC) that guide CTE curriculum development limit the degree to which close relationships between specific pathways and jobs can be understood in the data. Wage data are recorded by industry sectors and do not include SOC codes. It is not possible, for example, to determine whether an individual recorded as working in the health sector at a hospital is working as a surgeon or as a cook. In

addition, UI data does not indicate full- or part-time status. For that reason, it is unclear whether the wage differences between female and male graduates are explained in part by hours worked.

Tracking relationships between business and transportation pathways and workforce participation is especially challenging as jobs that require business marketing, management, or accounting skills can be found across workforce sectors. Transportation jobs also are difficult to track because many of the jobs that require auto mechanic or repair skills from CTE transportation pathways are found across workforce sectors.

This report focuses primarily on wage data as an indication of success. It does not suggest, however, that pathways in which graduates earn relatively lower wages are not valuable. Given that graduates will enter a labor market in which the majority of current job openings are in relatively lower-wage industries, it is not realistic to expect that all CTE pathways will lead to high wages. Educators interviewed for this study and responding to the survey cited benefits associated with engaging students, increasing the likelihood that they will graduate, and increasing the likelihood that they will participate in the job market and be productive members of their communities. Appendix B includes some survey respondents' comments on the broader benefits of CTE. While rigorous research on these benefits is lacking, research has shown that CTE can increase the likelihood of high school graduation.[2]

Organization Of The Report

The remainder of Chapter 1 will provide context for the delivery of CTE in Kentucky high schools, including governance of CTE pathways, reporting of CTE indicators in Kentucky's accountability system for districts and schools, efforts underway in the commonwealth to expand the reach of CTE, and state-level background data on workforce demand and CTE pathway completion generally.

Chapter 2 reports enrollment trends in specific CTE program areas and compares current CTE enrollments with workforce demand. The chapter also describes differences in patterns of CTE pathway completion among different school types, LWAs, and student demographic characteristics. Finally, the chapter reports on percentages of CTE pathway completers also passing dual credit classes, earning industry certificates or passing KOSSA exams, and participating in work-based learning.

Chapter 3 tracks high school graduates into the workforce and postsecondary education and describes differences in wages and postsecondary attainment among pathways in different program areas. The chapter also shows that the relationship between high school CTE and postsecondary outcomes is affected by gender and race-based differences in labor market outcomes generally.

High School CTE Outcome Indicators

Pathways

This study relies primarily on career pathway completion as its primary indicator of CTE attainment. Career pathways are coherent sequences of at least four academic and technical courses relevant to a job sector; they form the basis of the CTE instructional experience for students. Courses within individual pathways are designed to lead to industry certification or preparation for ongoing education. Examples of pathways completed by Kentucky students in 2018 include industrial maintenance/electrical engineering, horticulture and plant science systems, pre-nursing, and electrician assistant. Schools and districts can only offer pathways described in KDE's CTE program of studies. If a school or district wants to add a career pathway, they must follow a prescribed process for proposing and adding the new pathway.

In 2018, KDE reported 172 pathways as enrolling students in at least one location.[h] Those pathways are grouped into 12 major program areas based on groups established by the federal government in connection with the federal Strengthening Career and Technical Education for the 21st Century Act, which shapes much of CTE policy at the national level, including the requirement that CTE be based on career pathway systems.[i] The Perkins program areas used in the report are [j]

- agriculture and natural resources (agriculture);
- architecture and construction (construction);
- arts, A/V technology and communications (arts/AV);
- business and administration (business);

[h] Kentucky Department of Education 2018 Open House CTE pathway data.
[i] The Strengthening Career and Technical Education for the 21st Century Act was signed into law in 2018 and is the successor to the Carl D. Perkins Vocational and Technical Education Act of 2006 (Perkins IV). For brevity many refer to the Strengthening Career and Technical Education for the 21st Century Act as "Perkins V."
[j] For brevity, many pathways are shortened for reporting in this study, as indicated.

- health science (health);
- human services;
- information technology (IT);
- law & public safety (law/safety);
- manufacturing;
- retail/wholesale sales and service (retail);
- science technology engineering and mathematics (STEM); and
- transportation, distribution, and logistics (transportation).[k]

Human Services Pathway. The human services program area comprises a variety of pathways, including those related to food, such as food science, and education, such as early childhood education. On occasion, and as noted, this report separates the human services program area into food and education pathways.

Completion. Students who complete four credits in a specific pathway are completers. Students only begin to be counted for Perkins accountability and funding purposes if they are considered a concentrator, meaning they complete at least two credits in a pathway sequence.

Pathway Assessments

Industry Certifications. Career pathways are designed to prepare students to earn certificates that are developed by industry groups and recognized as valuable employers. As required by KRS 158.6455, industry certificates are only considered appropriate as a postsecondary readiness indicator in Kentucky if they have been recommended by KDE in consultation with local workforce investment boards and industry groups.

State Developed End-Of-Program Assessments. Assessments for career pathways that do not have an associated industry certificate are developed by KDE together with Kentucky postsecondary institutions and industry groups. These state-developed assessments were formerly known as the Kentucky Occupational Skills Standards and Assessment (KOSSA) system and will be referred to as such in this report.

Dual Credit Courses. Kentucky students are encouraged to take college-level courses while still in high school and earn credit towards both high school graduation and a potential postsecondary

[k] Human services is comprised of pathway areas that are sometimes reported separately—family and consumer sciences, and educational services.

degree. Dual credit courses for CTE students are offered primarily in KCTCS institutions and are aligned with course requirements for postsecondary credentials or degrees in the related pathway.

Work-Based Learning. Opportunities for work-based learning are considered important components of CTE education. These include mentorships, cooperative education experiences that allow students to earn work experience (co-ops), internships, and apprenticeships.

Kentucky's Revised Accountability System

Kentucky's revised accountability system, which is effective for the 2020 school year, offers multiple ways for CTE students to be counted as ready for adult life under the "transition ready" indicator of the new system. Kentucky students will be considered transition ready if they score at or above benchmark on an industry certificate or end of program assessment for articulated credit; complete 6 hours (2 classes) of dual credit with a C or higher; complete a KDE or Education and Workforce Development Cabinet-approved apprenticeship; or meet conditions to verify exceptional work experience. Further, through a collaboration of KWIB and KDE, those industry certificates that are identified as HWHD receive a weight of 1.25 in the accountability system.

While completion of a minimum of two courses within a CTE pathway was required to be considered career ready in the state's previous accountability system, course completion within pathways is not required in the current system.

CTE School Types and Governance

School Types

CTE courses are available to Kentucky students in most Kentucky comprehensive high schools and in two types of career and technical schools—state operated Area Technology Centers (ATCs) or locally operated vocational education centers (LAVECs). Statewide, there are 53 ATCs that serve a total of 124 districts, 42 LAVECs serving a total of 34 districts, and an additional 8 locally-funded CTE centers that are similar to LAVECs but receive no state funding.[1] Students in many districts take college-level classes that earn them dual credit in high school and college credit in the Kentucky Community and Technical College System (KCTCS). In several districts, these classes are the only CTE options outside of the comprehensive high schools. Appendix C contains a complete accounting by district of the CTE delivery options that are provided.

Governance

Area Technology Centers. As required by 780 KAR 2:030, each ATC has a steering committee through which ATC principals receive guidance from members that include:

- the principal of the technology center, who shall serve as chairman;
- the superintendent or designee of each cooperating school district;
- a board member from each cooperating school district;
- one principal from each cooperating school district;
- one representative from each site-based council;
- one or more representatives of the local labor market area; and
- a guidance counselor from each cooperating school district.

ATCs also have program committees comprised of industry representatives, to advise the ATC on issues related to particular programs. Although housed in Kentucky districts, management decisions about personnel, pathways and all matters related to the governance of ATCs are, however, made ultimately by the Kentucky Department of Education (KDE). ATCs looking to add a new pathway, for example, must await KDE approval.

[1] Jefferson and Fayette counties each operate multiple LAVECs.

Local Area Vocational Education Centers. As is required of all CTE programs by 705 KAR 4:231, LAVECs, must have an advisory committee comprised of "business and industry representatives, parents, education representatives, and, if applicable to the program area, labor organizations representatives to assist in planning, implementing, and evaluating programs" assist with planning and evaluation of programs. Management of resources, personnel, and curriculum in LAVECs and other local CTE centers are ultimately made by building principals with oversight from the district and local board. Superintendents in two site visit districts that had switched from ATCs to LAVECs explained that the local control over personnel and curriculum was the primary factor motivating the decision.

Although KDE staff do not have any direct influence over the pathways offered in LAVECs or other local CTE centers, they encourage LAVECs and other local CTE centers to consult local labor market data and review these data during site visits in order to align the pathways offered with workplace demand.

Comprehensive High Schools. As with all high school courses, decisions about CTE classes to be offered are determined ultimately by local school-based decision-making councils (SBDMs). In some cases, a local school board may elect to provide funding for a specific CTE position. In that case, authority to approve the position would rest with the local school board.

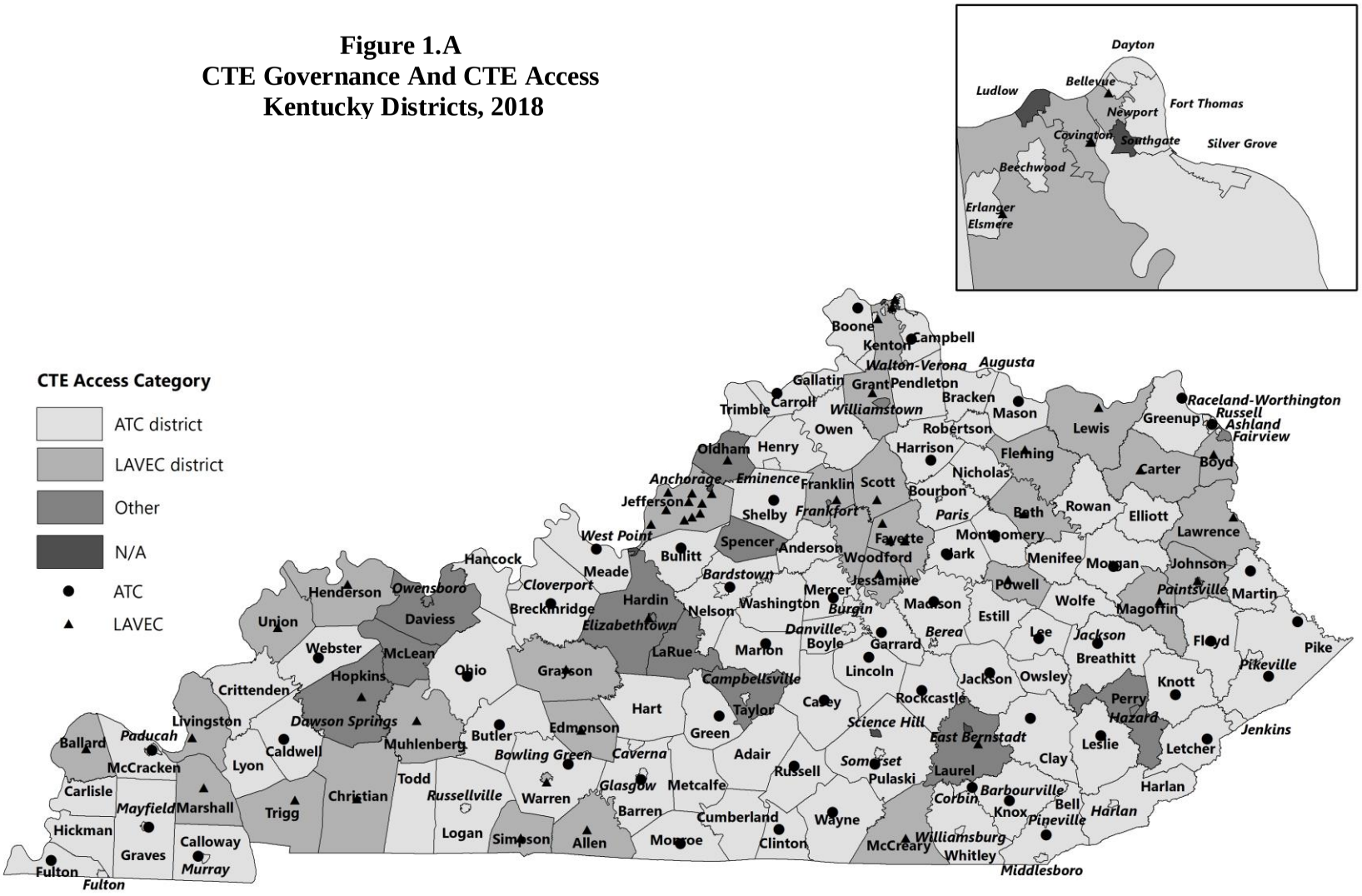
Desire For Local Decision Making

Administrators interviewed during OEA site visits as well as many principals responding to OEA's survey expressed discontent at what they perceived as a disconnect between determinations of pathways and need at the state versus local levels. They gave examples of local industry or community needs that are met by pathways not considered HWHD or not in the program of studies. In one ATC district, for example, a pathway that was highly valued by a local manufacturer was discontinued at the state level. Several central Kentucky principals mentioned the need for pathways related to the equine industry and several others that were located next to major tourist centers identified the need for hospitality pathways. Agriculture pathways were mentioned more than any other as an example of valuable pathways that are not considered HWHD but are valuable. As explained by one principal,

> In our county, 1 out of every 12 jobs is directly related to agriculture. Agriculture 'touches' every sector of life including the areas that have been identified as high growth/high demand, yet we cannot offer those courses in an agriculture context because they are not in an approved pathway.

CTE Access. Figure 1.A shows which types of CTE schools are available to students in Kentucky districts. It distinguishes ATCs, LAVECs, and "other" districts, such as Oldham County, that finance their own career and technical center, or those like Ashland Independent that provide CTE only in comprehensive high schools. Appendix C contains a complete accounting by district of the CTE delivery options that are provided.

Figure 1.A
CTE Governance And CTE Access
Kentucky Districts, 2018



Source: OEA analysis of data from the Kentucky Department of Education.

CTE Finances

OEA's 2019 report, *Revenues and Expenditures for Career and Technical Education in Kentucky,* reviews Kentucky's financing of CTE and describes in detail the total state funding for CTE and methods by which that funding is distributed to ATCs, LAVECs, and districts.[3] Particularly relevant to this study are data showing that ATCs receive per pupil state funding at a rate of 5 to 1 relative to LAVECs.[4]

Unlike the Support Education Excellence in Kentucky (SEEK) base funding, which awards higher proportions of state funding to lower wealth districts, state funding for ATCs and LAVECs is not adjusted for district wealth. Appendix D shows the per-pupil property assessment of districts by CTE delivery type. It shows that LAVECs and ATCs each serve higher- and lower-wealth districts. This means that LAVECs, which receive less state funding, include some of the state's least wealthy school districts like Magoffin, McCreary and Carter Counties. ATCs, which are almost exclusively state funded, include some of the state's wealthiest districts such as Campbell, Boone and Shelby Counties. Also noted in OEA's report is the fact that state funding for CTE covered only about one third of districts' CTE transportation costs in 2018. District costs were reimbursed at that level independent of total transportation costs or district wealth. Under the current method for funding transportation, poor and rural districts that transport students may be absorbing greater costs than wealthier, urban districts with shorter travel distances.

Much of the imbalance that will be reported in Chapter 2 in access to CTE pathways is likely associated with the financial challenges of opening new pathways in the costly program areas of manufacturing, transportation and construction. Relevant to this challenge, the New Skills for Youth grant, described below, encourages regional collaboration among high school, postsecondary and workforce leaders. The Kentucky Work Ready Skills Initiative provides state bonds for regional cooperatives to address equipment and infrastructure needs in adding new pathways and the Kentucky Work Ready Scholarships cover tuition for graduates pursuing credentials in HWHD sectors.

New Skills For Youth. Kentucky has received two rounds of grants from the JP Morgan Chase & Co. to promote cooperation among school districts, employers, and postsecondary institutions

in the development of regional approaches, including regional academies, in the delivery of CTE. The initial grant of $100,000 in 2016 and the second grant of $2 million in 2017 support grantees in their efforts to align high school CTE with workforce demand in high wage high demand jobs. The grants, which are a collaboration of JP Morgan Chase & Co, the Council of Chief State School Officers (CCSSO), and Advance CTE, promote sharing of resources and articulation of high school CTE programs with postsecondary degrees and certificates.

Kentucky Work Ready Skills Initiative. Through the Kentucky Work Ready Skills Initiative (KWRSI), 40 applicants have been awarded a total of $100 million in state bonds to assist school districts and the KCTCS towards adding or upgrading facilities and equipment. Grants must be used to develop strategies to meet regional workforce needs in collaboration with education agencies, employers, and other regional or local partners.

Kentucky Work Ready Scholarships. The Kentucky Work Ready Scholarship program provides scholarships that cover tuition for certificates, diplomas and associate's degrees for qualifying individuals in high wage high demand sectors. The scholarships also cover the cost of dual credit classes in these HWHD sectors for high school students whose tuition is not otherwise covered.

Workforce Demand And Pathway Completion

Workforce Demand

Figure 1.B shows the number of job openings projected for 2018-2022 in Kentucky by major occupation group and skill level. KYSTATS provides these projections based on a combination of data from the Kentucky Longitudinal Data System (KLDS) and the Bureau of Labor Statistics (BLS). The total number of projected openings within each occupation group are divided among jobs that are low-, medium-, or high skilled, based on the education required for those jobs as reported by employers. Low-skilled jobs are those that require only a high school diploma or less. Medium-skilled jobs require postsecondary education but less than a bachelor's degree and high-skilled jobs require a bachelor's degree or above.[m]

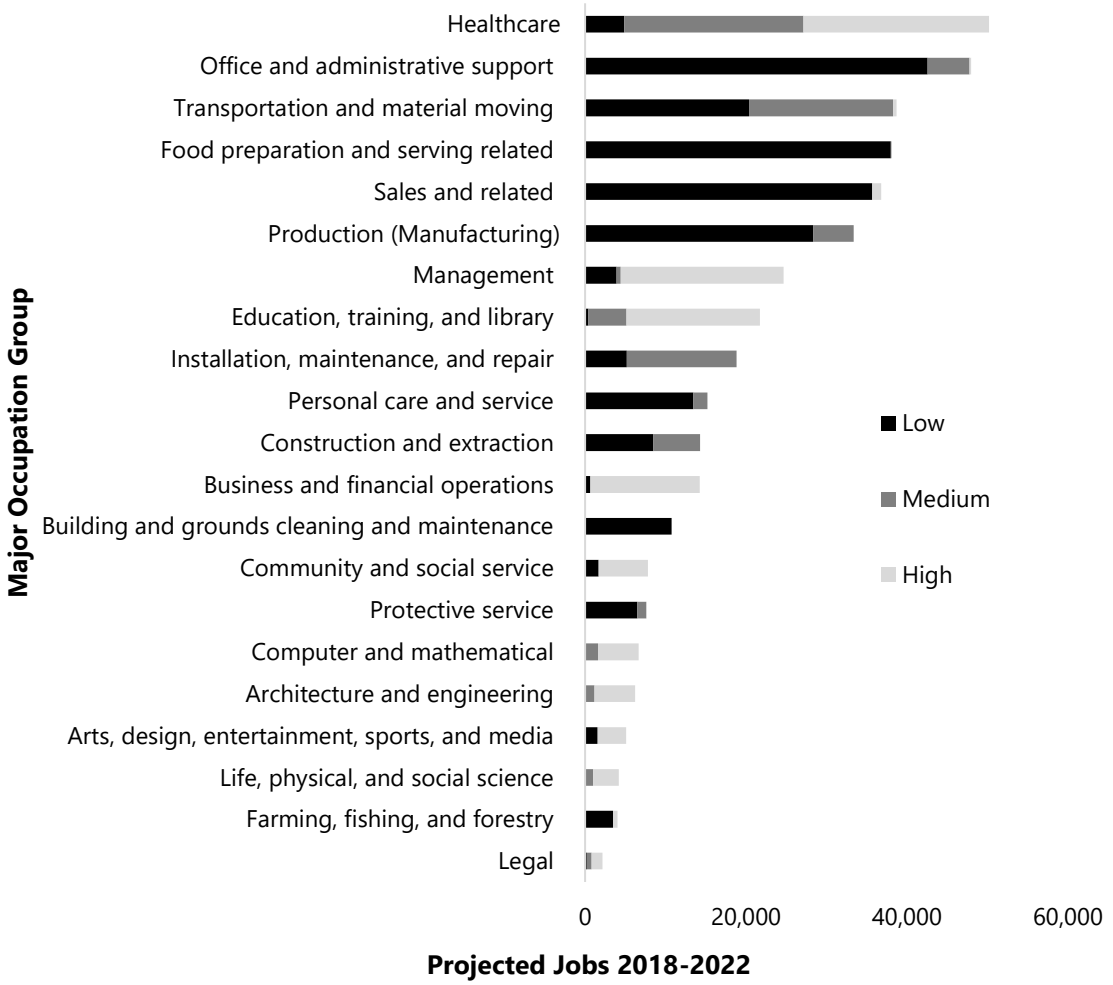
[m] Also included in this group are jobs identified by KDE as favoring applicants with certain certifications that can be obtained in high school. These occupations

About two thirds of the projected jobs for 2018-2022 require no education beyond high school. Three of the highest demand occupation groups—office and administrative support, food preparation and serving, and sales—do not pay high wages; therefore, are not considered HWHD.

In the HWHD sectors of health and business, most jobs will require at least some education after high school. These data will be important to keep in mind when understanding data reported in Chapter 3, which shows the relatively low wages earned by most graduates from those pathways, who are working without a postsecondary degree or certificate. Of the HWHD sectors, manufacturing, construction, and transportation have greater percentages of jobs that will not require postsecondary education.

include carpenters, electricians, plumbers, welders, machinists, and maintenance and repair workers.

Figure 1.B
Projected Job Openings 2018-2022
By Major Occupation Group and Skill Level



Source: Staff analysis of data from the Kentucky Center for Statistics.

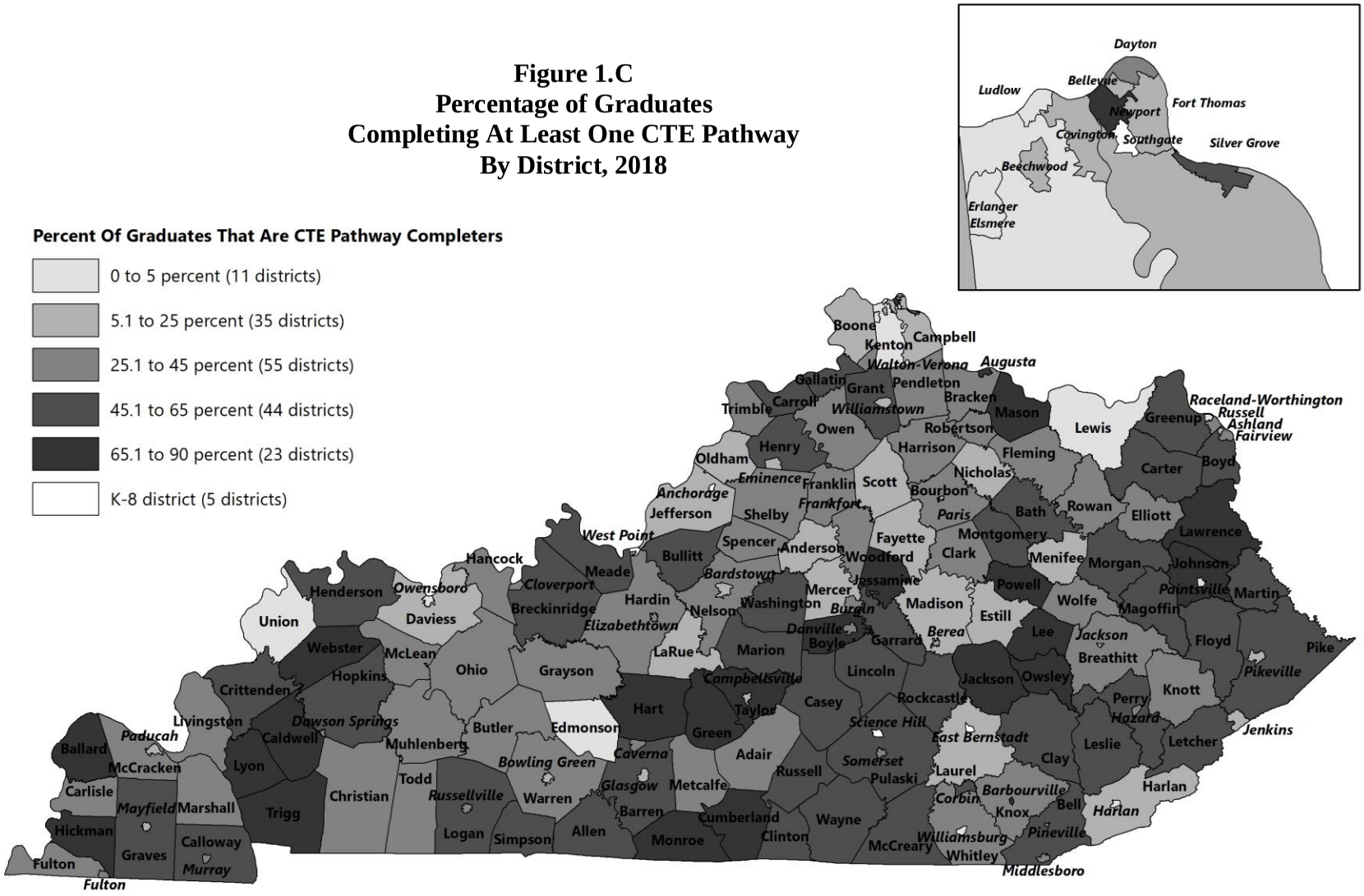
CTE Pathway Completion By District

Figure 1.C shows the percentages of graduates by Kentucky district that completed career pathways in 2018. Statewide, 33 percent of graduates completed a pathway in 2018. Percentages range broadly among districts, from less than 5 percent in some of the state's small, independent, districts to as high as 88 percent in some of the state's

other, mostly rural districts.[n] CTE pathway completion rates are lower in the state's larger, more urban districts, including Jefferson (19.8 percent) and Fayette (12.5 percent) counties.

[n] A principal from Meade County High School noted that the school requires all graduates to complete a pathway. It is possible that other high schools do the same. The OEA survey did not ask that question specifically.

Figure 1.C
Percentage of Graduates
Completing At Least One CTE Pathway
By District, 2018

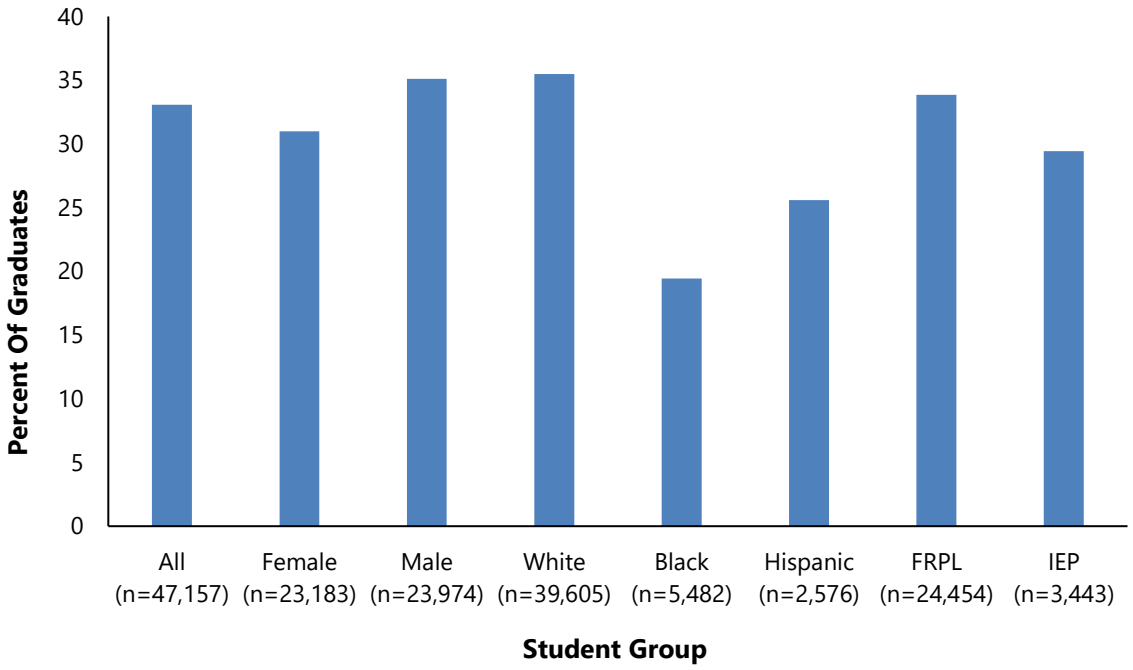


Source: OEA analysis of data from the Kentucky Department of Education.

Pathway Completion By Student Demographic Characteristics And Program Eligibility

Figure 1.D shows the percentage of graduates, by student demographic characteristics and program eligibility, who completed pathways in 2018. Female graduates completed pathways at lower rates than male graduates (31 percent versus 35 percent). Compared to white students (35 percent) black and Hispanic students completed pathways at much lower rates (19 and 26 percent, respectively).[o]

Figure 1.D
Percent of Graduates Completing At Least One CTE Pathway By Student Demographic Group And Program Characteristics 2018



Note: FRPL = students eligible for free or reduced-price lunch; IEP = students eligible for individualized education plans (special education students). Most students are counted in more than one group.
Source: Staff analysis of data from the Kentucky Center for Statistics.

Chapter 2 will look at pathway completion program areas and compare them to workforce demand data shown in this chapter. It

[o] One factor that might partially explain the much lower rates of black graduate pathway completion is the high concentration of black students in Fayette and Jefferson Counties, both of which have pathway completion rates that are much lower than the state's.

will also look at differences among regions and student groups in the percentage of graduates completing pathways in specific program areas.

[1] Kentucky Center For Statistics. *Kentucky Future Skills Report.* Web. n.d. Accessed October 14, 2019.
[2] Jacob, Brian. *What We Know About Career And Technical Education In High School.* Brookings Institution. Web. Accessed Oct. 21, 2019.
[3] Kentucky. Legislative Research Commission. *Revenues And Expenditures For Career And Technical Education In Kentucky*. Research Report No. 461. Frankfort: LRC, 2019.
[4] *Ibid.*

Chapter 2

CTE Completion By Program Area

This chapter shows the number of high school graduates completing CTE pathways in specific areas and compares them, as a percentage of all graduates, with the percentage of jobs projected in corresponding workforce areas. It shows that the demand for graduates in the highest wage sectors exceeds supply.

Historically, the majority of Kentucky high school graduates have entered the workforce without a postsecondary degree or credential. Among the 2013 graduates that do not have a postsecondary degree or credential, graduates who completed a manufacturing, construction, or transportation pathway earn substantially more than graduates who completed other HWHD pathways in health or business. Relevant to that finding, this chapter shows that most districts offer health pathways whereas manufacturing, construction, and transportation pathways are more likely to be available in districts that house an ATC or send their students to an ATC in another district. It also shows that female versus male students and black versus white students are less likely to complete pathways in manufacturing, construction, and transportation pathways, which are associated with higher wages.

The chapter concludes by showing the percentage of CTE pathway completers who have earned an industry certificate or passed the KOSSA; earned a grade of C or above in at least one dual credit class; or earned an academic credit for a cooperative work experience. It shows that pathway completers are more likely than non-pathway completers to earn certificates or pass exams, pass dual credit classes, and complete cooperative work-based experiences, though rates vary among program areas.

CTE Pathways Completed Relative To Demand

Pathways Completed 2018

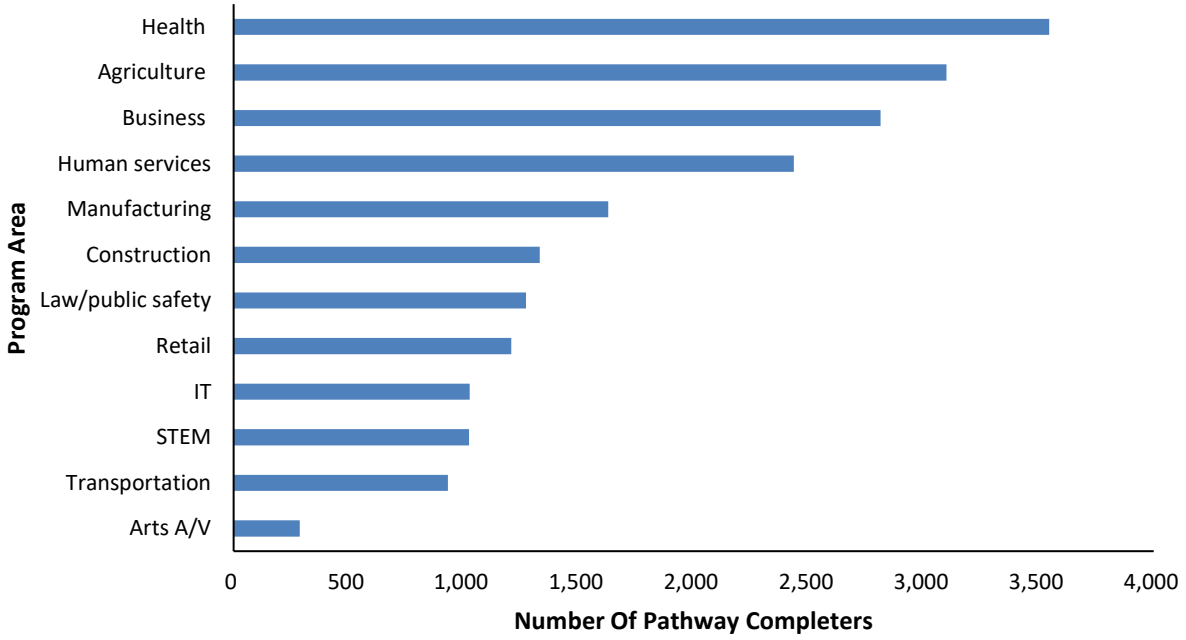
Figure 2.A shows the total number of pathways, by program area, completed by graduates in 2018. In that year, graduates completed a total of over 20,000 individual pathways with many completing more than one pathway.

The figure shows that three of the five program areas with the greatest number of pathway completers are HWHD sectors (health science, business, and manufacturing) though the other two

pathways, agriculture, and human services, are not HWHD pathways. Graduates completing health pathways far outnumbered those in all other program areas and were substantially greater than those completing manufacturing (2.2 times), construction (2.7 times) or transportation (3.8 times) pathways.

Of the pathways that have not been identified as HWHD, agriculture had the greatest number of completers in 2018, accounting for almost as many completers as health, and more than any of the remaining HWHD pathways.

Figure 2.A
Total Number Of Pathway Completers By CTE Program Area
2018 Graduates



Note: Many graduates completed more than one pathway. In some cases, graduates completed more than one pathway in an individual program area.
Source: Staff analysis of data from the Kentucky Department of Education.

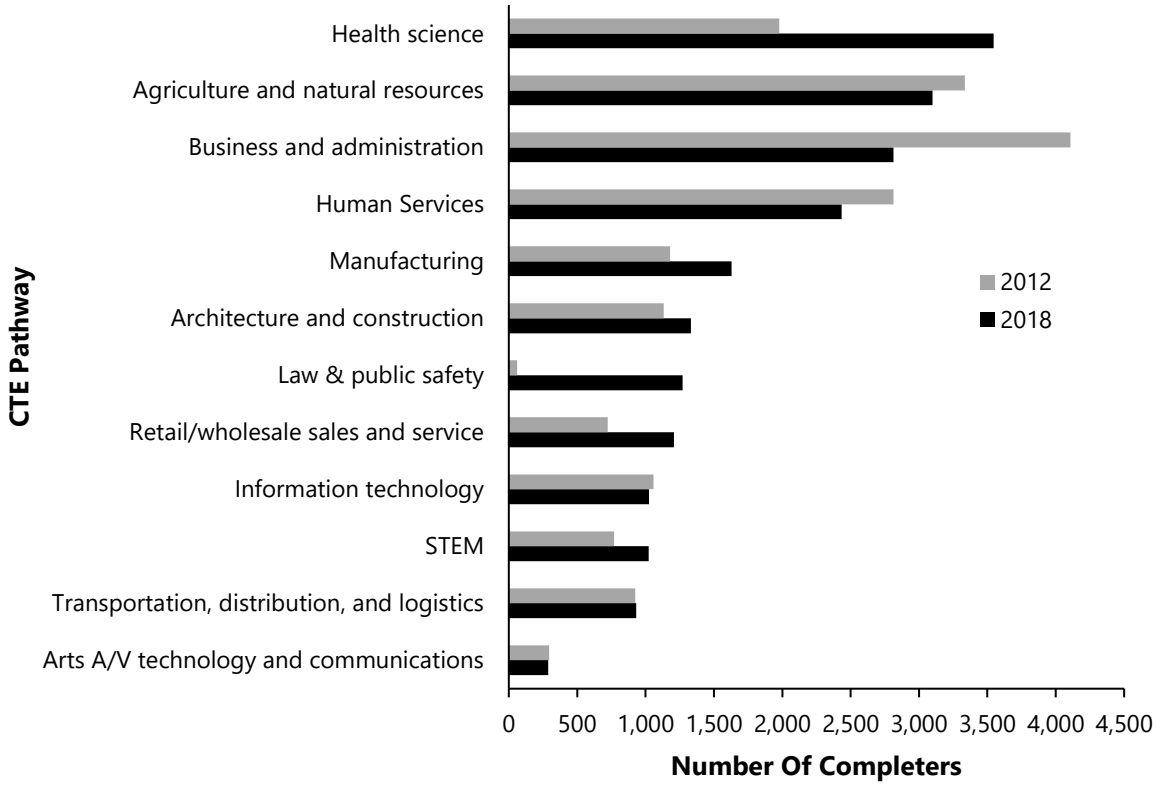
Pathway Completers 2012 To 2018

Between 2012 and 2018 the total numbers of pathways completed by high school graduates increased by 12 percent. As shown in Figure 2.B, increases have been primarily in the HWHD program areas, except for business pathways, which, following national trends, have decreased. The greatest growth has been in the health science pathway; pathway completions in this program area have increased by a total of 1,567 students or 79 percent. The increase in

the total number of additional health pathway completers is 2.4 times greater than total number of additional pathways in the manufacturing, transportation, and construction pathways combined. Increases in these pathways were 38 percent in manufacturing, 18 percent in construction, and 1 percent in transportation.

Outside the HWHD program pathways, retail pathways have increased by 40 percent and STEM pathways have increased by 25 percent. Law & public safety programs, which comprise primarily Reserve Officer Training Corps (ROTC) programs, had relatively few pathway completers in 2012 and had 1,271 completers in 2018, similar to the number of construction pathway completers.

Figure 2.B
Total Number Of Pathway Completers By CTE Program Area
2012 And 2018



Source: Staff analysis of data from the Kentucky Center for Statistics.

Pathway Completion Relative To Workforce Demand

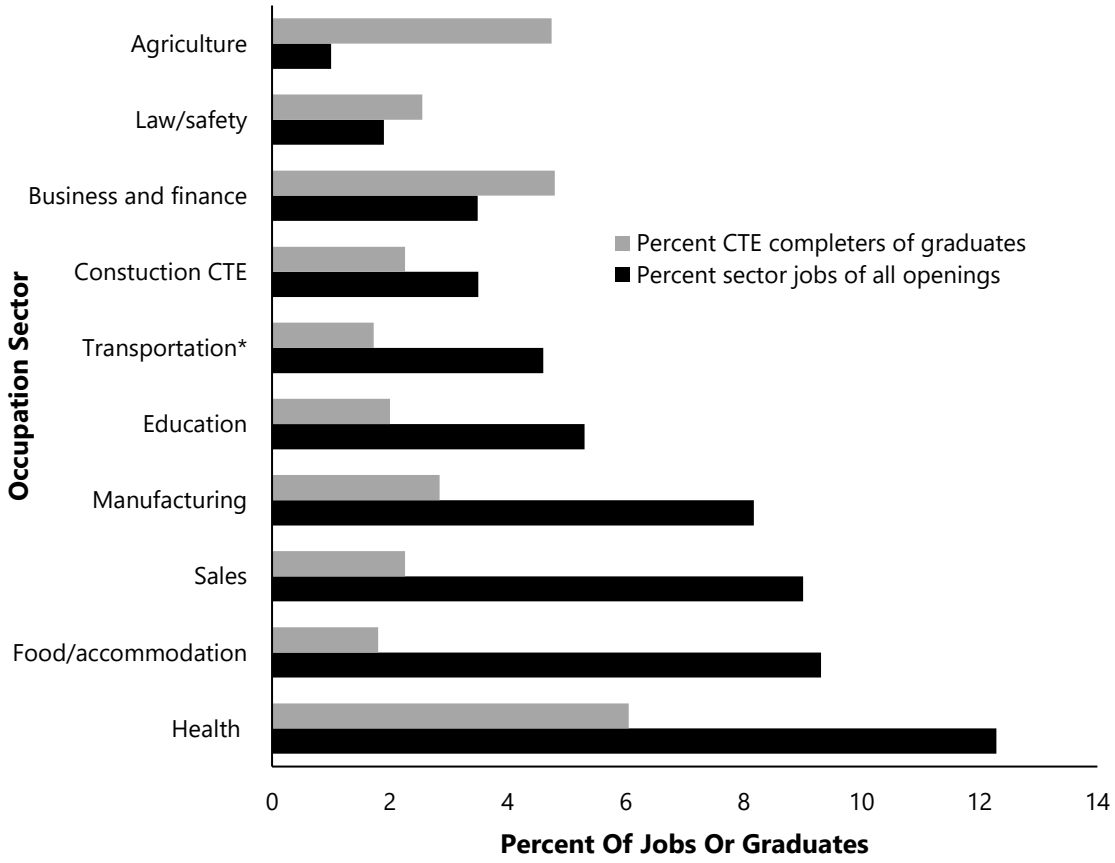
Figure 2.C compares the percentage of 2018 graduates completing pathways in particular program areas with the percentage of jobs in the closest corresponding workforce occupation group, as

projected by the Kentucky Future Skills Report described in Chapter 1.[a]

With the exception of business and public safety, the percentages of new jobs projected in HWHD industries exceed the percentages of high school graduates completing pathways in related programs. Relative to demand, enrollment in manufacturing and transportation pathways, especially, is low. While over 8 percent of new jobs are projected to be in manufacturing, less than 3 percent of graduates in 2018 completed a manufacturing pathway. While 4.6 percent of occupations are in auto or other repair and installation, only 1.7 percent of graduates completed transportation pathways.

[a] Measurement issues make exact comparisons of pathway enrollment versus industry demand impossible. Job class codes do not align directly with academic course codes. For example, some of the occupations in the repair and installation group correspond more closely with pathways that are considered construction pathways. Further, it is likely that many of the skills acquired in some pathways are transferable among industry sectors.

Figure 2.C
Percent Of Projected Job Openings By Occupation, 2018-2022
And High School CTE Completers of Related Programs
As A Percentage Of High School Graduates 2018



* No KSFR occupation sectors are a close match with the CTE transportation program pathways. The transportation occupations comprise largely drivers, freight movers, and other occupations that do not correspond with training received in transportation pathways which are most often related to auto mechanics and repair. Because the KSFR major occupation most closely corresponding with CTE transportation pathways is installation, maintenance, and repair, OEA reports projected jobs in this occupation group in calculating the percent of job openings in transportation. The installation, maintenance, and repair occupation group also contains occupations, such as HVAC repair, that would align with construction pathways.
Source: Staff analysis of data from the Kentucky Center for Statistics.

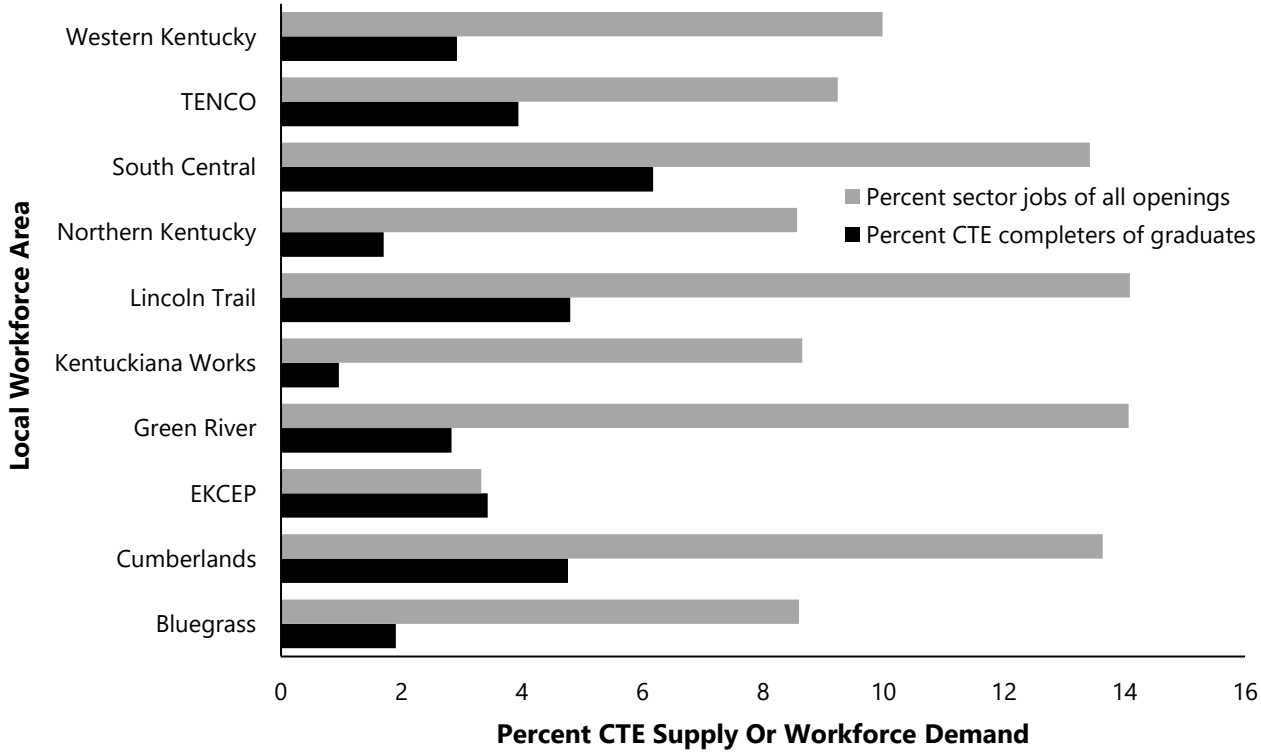
Variation In Supply Versus Demand By Local Workforce Area

As shown in Appendix E the percentage of graduates completing pathways in the various program areas relative to demand varies considerably by LWA. Health pathways are relatively common in every LWA but range from a low of 4 percent in Northern

Kentucky to a high of 11 percent in the Eastern Kentucky Concentrated Employment Program LWA (EKCEP). The West and South-Central LWAs have higher percentages of graduates that complete agriculture pathways than do other LWAs. Manufacturing, construction, and transportation vary considerably, with pathway completion being extremely low in some LWAs.

Supply And Demand By Local Workforce Area. Figure 2.D shows supply versus demand by LWA in manufacturing pathways and occupations. The South Central LWA has the highest percentage of graduates completing manufacturing pathways and is one of the LWAs with the greatest demand for manufacturing occupations. Relative to demand, pathway completions are especially low in the Kentuckiana Works (which includes Jefferson County), Northern Kentucky, and Bluegrass LWAs. As shown in Chapter 1, CTE pathway completion generally, as a percentage graduates, is lower in most of the state's larger and more urban school districts.

Figure 2.D
Percentage Of Graduates Completing Manufacturing Pathways In 2018
And Percentage Of Projected Jobs In Related Manufacturing Occupations 2018-2022
By Local Workforce Area

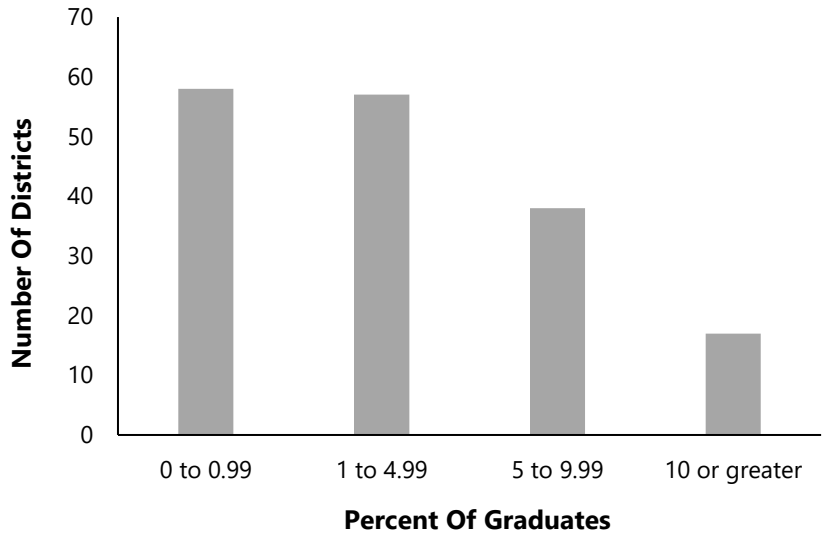


Source: Staff analysis of data from the Kentucky Center for Statistics.

Manufacturing Completers By District

As shown by Figure 2.E, in over one third (58) of school districts, the percentage of graduates completing manufacturing pathways is less than 1 percent. Jefferson and Fayette Counties, the state's two largest school districts, fall in this range. These two school districts also graduate the largest number of black students in the state. As will be shown later in this chapter, black graduates complete manufacturing pathways at less than one third the rate of white graduates.

Figure 2.E
Number Of Districts By Percentage Of Graduates Completing Manufacturing Pathways
2018



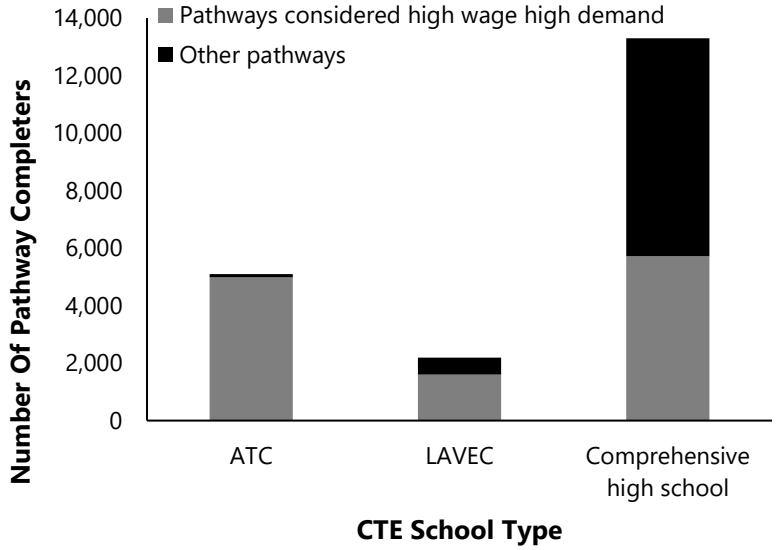
Source: Staff analysis of data from the Kentucky Center for Statistics.

Program Completion by CTE School Type

Figure 2.F shows the total number of pathway completers in program areas considered HWHD versus other pathways in each of the state's CTE school types. It shows that graduates completing pathways in ATCs are more likely to do so in HWHD programs versus those in other CTE school types. Statewide, 60 percent of pathways completed in 2018 were in HWHD program areas. Almost all (98 percent) of pathways completed in ATCs were in HWHD program areas, compared with 73 percent in LAVECs and 43 percent in comprehensive high schools.[b]

[b] Some of the pathways counted as "other pathways" in the figure are considered HWHD in KDE's updated list of approved industry certificates. These include

Figure 2.F
Number Of Pathway Completers
By School Type And High Wage High Demand Designation
2018



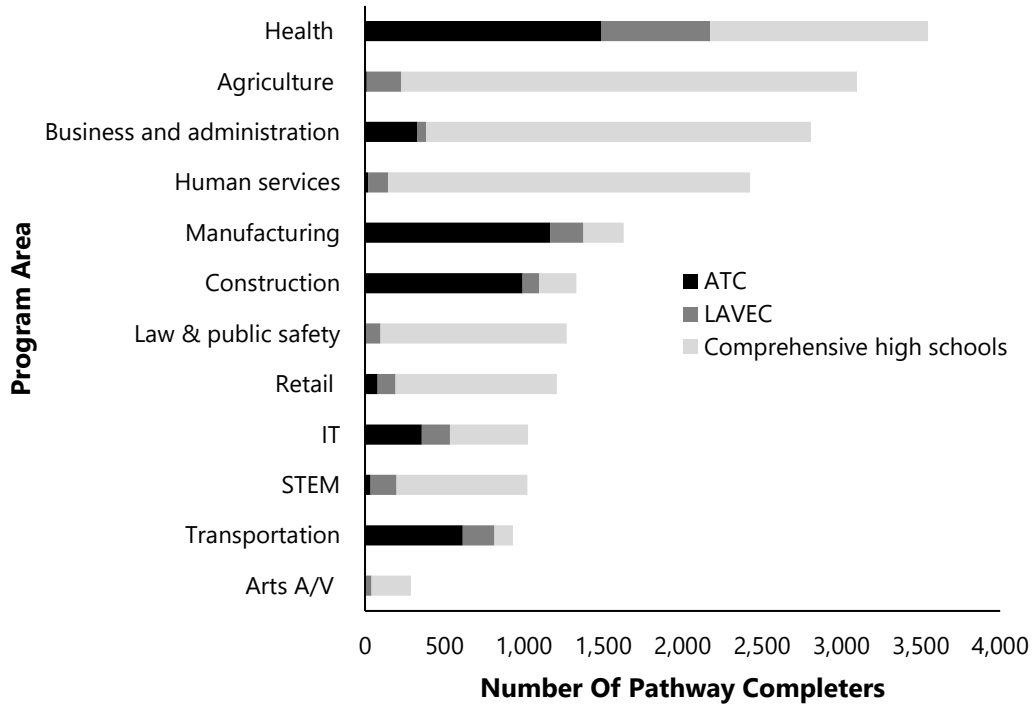
Source: Staff analysis of data from the Kentucky Center for Statistics.

As will be shown in Chapter 3, however, not all of the pathways that are considered HWHD have resulted thus far in higher wages for most graduates. Health pathways, in particular, are associated with relatively lower wages. Conversely, agriculture pathways, most of which are not considered HWHD, have been associated with higher wages.

CTE Completion By Program Area. Figure 2.G shows the number of pathway completers by program area and type of school in which pathways were completed in 2018. It shows that, of the HWHD program areas, health science pathway completion is common in all three types of CTE school locations whereas pathway completers in manufacturing and construction are concentrated in ATCs. Agriculture, business administration, and human services completers are concentrated primarily in comprehensive high schools.

Agricultural Power Structural Technical Systems (Agriculture), Engineering (STEM), and early childhood education (human services).

Figure 2.G
Number Of Pathway Completers
By Program Area And CTE School Type, 2018



Note: ATC = area technology center; LAVEC = local area vocational education center; IT = information technology; STEM = science, technology, engineering, and math; A/V = audio visual technology.
Source: Staff analysis of data from the Kentucky Center for Statistics.

As stated earlier, the total number of pathway completers varies substantially by school setting and is greatest in comprehensive high schools followed by ATCs and LAVECs. It is important, therefore, to interpret the data in Figure 2.G as a percentage of completers in each school setting. Appendix F shows pathway completers in this way.

As a percentage of completers, health pathways make up the highest percentage in both ATCs and LAVECs at about 30 percent. Compared with LAVECs, ATCs have a much higher percentage of completers in manufacturing (23 percent versus 9 percent) and construction (20 percent versus 5 percent). LAVECs offer a greater variety of programs that are not offered in any ATCs including agriculture (10 percent), human services (6 percent), retail (5 percent), and law and public safety (4 percent). Students in

comprehensive high schools are most likely to complete pathways in agriculture (22 percent), business and administration (18 percent), and human services (17 percent).

Causes Of Variation In Pathways Offered By School Type

Several factors influence the differences in the pathways offered in Kentucky's different CTE settings. Of these, the relatively higher cost of equipment and supplies in some pathways versus others appears to be a major factor. Also important are differences among school types in the ultimate authority to add or remove pathways at the state versus local levels and in differences among school settings in the likelihood that students are interested in and will enroll in the different pathways.

Funding

The relatively higher concentration of manufacturing, construction, and transportation pathways in ATCs versus LAVECs and comprehensive high schools likely reflect differences in the way CTE is funded in these settings. ATCs received approximate five times as much state funding per pupil each year than do LAVECs.[1] The costs of starting up a pathway in manufacturing, construction, or transportation are generally much higher than in business or health sciences. Compare, for example, the costs of beginning a Truck Service Technology Technician pathway ($276,000), Welder-Entry Level ($424,000), or Industrial Electrician Assistant ($189,000), versus Pre-Nursing ($68,000), or Retail Services ($47,000).[2]

Barriers To Starting CTE Programs. Compared to principals of ATCs, principals of LAVECs and comprehensive high schools responding to OEA's 2019 survey were more likely to report barriers in beginning new CTE pathways, with lack of necessary supplies and equipment being generally the most commonly reported barrier, followed by the inability to find a qualified teacher. The programs most frequently reported by principals as lacking because of this barrier were manufacturing, transportation and engineering programs in comprehensive high schools and construction, transportation, manufacturing, and media arts in LAVECs. Appendix G shows the number of respondents reporting barriers by school type and program area. OEA survey responses from two LAVEC principals illustrate this challenge. One explained that, "manufacturing and transportation is a high demand pathway for our area. We cannot fund those programs at our

school." Another LAVEC principal in one of the state's lowest wealth districts explained that cost is a barrier, adding "I would love for our county to offer: HVAC, plumbing, electricity, machine tool, EMT, pharmacy technician, and media arts."

Principals of small schools or schools in small independent districts identified special challenges in providing students with sufficient choice and opportunities in CTE pathways. They mentioned size, funding and in some cases their rural or remote location as impediments.

Pathway Approval Process

The overwhelming majority of ATC and LAVEC principals (75 percent and 79 percent respectively) identified local industry need as the most critical factor in determining what pathways to offer. As noted in Chapter 1, however, ultimate authority for pathway approval differs among CTE school types. Authority to approve new pathways for ATCs rests ultimately with KDE, whereas authority to approve new pathways for LAVECs rests with local districts and school boards. Because KDE only approves pathways that are considered HWHD, it is not surprising that the number of different program areas in ATCs is fewer than in LAVECs.

Student Interest

Student interest was reported by over 50 percent of principals in all school types as a deciding factor in whether to add a pathway but was the most often cited determining factor by principals of comprehensive high schools, two thirds of whom identified it as a deciding factor. As compared with ATCs and LAVECs, CTE classes in comprehensive high schools serve a broad range of students and include those who take CTE classes for elective credit and not as a route to pathway completion. Comprehensive high school principals cited the importance of CTE classes for engaging students who might otherwise not be interested in school and being a critical factor in encouraging school attendance and support towards high school graduation. During OEA site visits, many principals reported that they were seeking consumer and family science teachers because these classes served such an important function for students, independent of specific preparation for the workforce.

While not the most frequently cited factor, student interest was also cited as a determining factor by ATC principals (67 percent) and LAVEC principals (59 percent). In some cases, a class may be

reported as in demand by local workforce representatives but not popular with students. Unlike academic classes, which students are required to take in order to graduate from high school, CTE classes are not guaranteed student attendance and most schools cannot afford to maintain classes with low attendance. KDE has a policy of closing CTE programs at ATCs that fall below a student to teacher ratio of 12.5 or less.[3] One superintendent reported that the district, at the request of a local aviation board, had added an aviation pathway at great expense. Ultimately, the pathway was not popular with students and the district could not afford to maintain it. Thus, the initial investment in the expensive equipment for the pathway was lost. Across school settings, health was among the least likely to be identified as lacking in student interest.

Strategies Employed By Districts. The OEA survey did not specifically ask principals to explain strategies used to generate student interest. Several explained that recruitment and engagement are central to the CTE programs in their districts. Strategies include guest speakers such as industry representatives or recent graduates working in those industries, field trips to local industries, and industry fairs. For example, one explained that

> [w]e are building partnerships with community leaders and work closely with the Chamber of Commerce to expose students to local careers and to build a local workforce. Industry tours and guest speakers are a regular part of our curriculum. [We also utilize] project based learning.

Another reported that the district uses a

> mock interview process with all juniors and seniors (industry partners involved in the process); industry projects and connections to on-the-job learning through partnerships with companies; soft skills/work-ready skills curriculum in all programs; and 8th grade advanced manufacturing rotation program to allow students to explore careers and skills in our most sought after jobs in this community.

Variation In Pathway Completion By Student Demographics

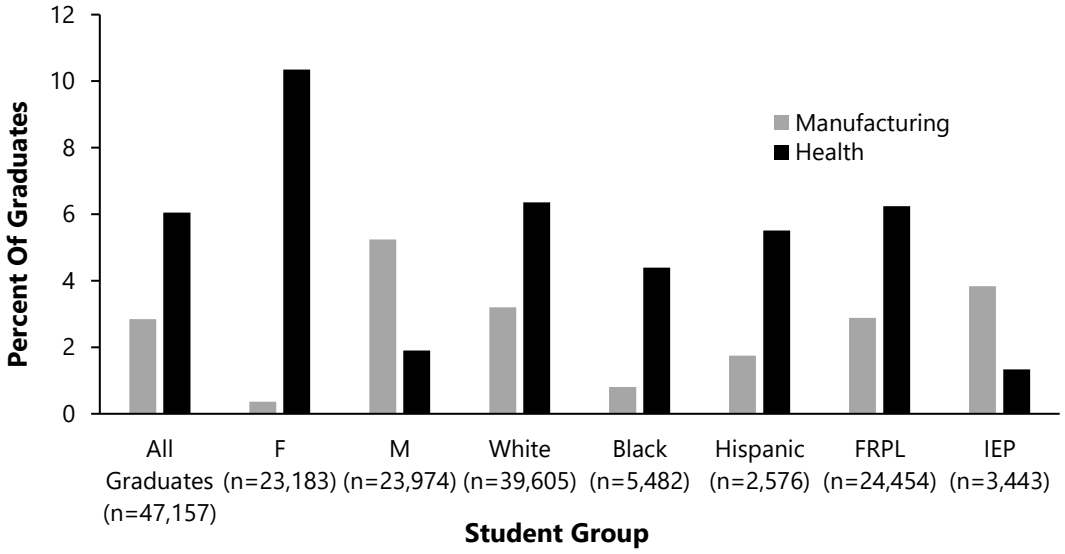
As shown in Chapter 1, female students are less likely than male students to complete CTE pathways whereas black students and Hispanic students are much less likely to complete pathways than are white students.

Figure 2.H shows additional differences, based on student demographic characteristics and eligibility for FRPL or having an

individualized education program (IEP), in the percentage of pathway completers in manufacturing or health. As will be shown in Chapter 3, manufacturing pathway completers earn, on average, the highest wages of all program areas whereas health pathway completers earn, on average, the lowest of all the HWHD program areas.

The figure shows that female, black, and Hispanic students are less likely to complete pathways in manufacturing and more likely to complete pathways in health. Pathway completion patterns for FRPL and IEP students differ less from all CTE pathway completion patterns. Appendix H shows demographic differences in the percentage of pathway completers in other program areas.

Figure 2.H
Percentage Of All Pathway Completers In Manufacturing Or Health Pathways By Student Demographic Characteristics, 2018



Note: F = Female; M = Male; FRPL= students receiving free or reduced-price lunch; IEP = students with individualized education programs (special education students). Most students belong to more than one group.
Source: Staff analysis of data from the Kentucky Center for Statistics

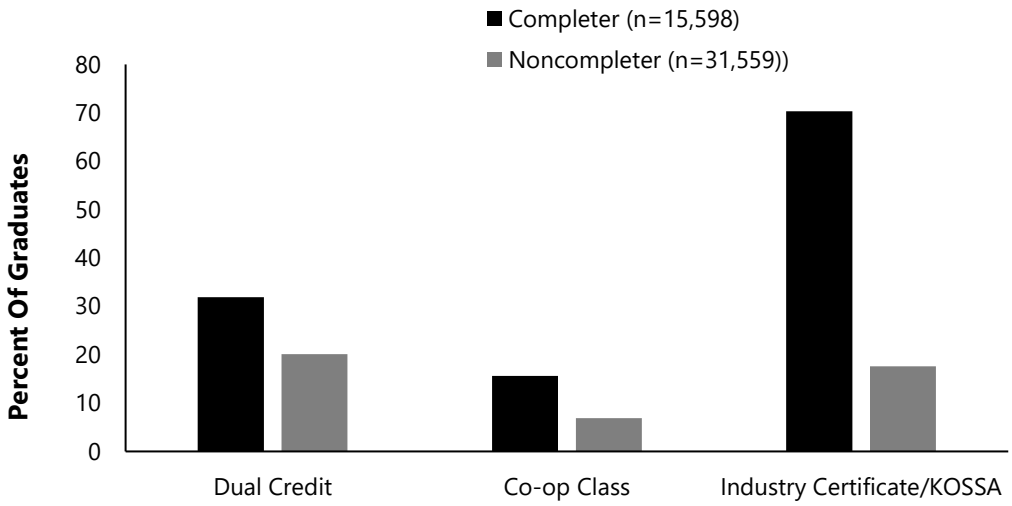
Additional High School CTE Outcomes

Figure 2.I shows the percentage of CTE pathways completers versus noncompleters attaining other outcomes related to CTE education: earning a grade of C or above in a dual credit class, earning a cooperative work credit, or passing an industry or

KOSSA exam. Cooperative education classes combine in-school instruction with job experience that is supervised by the school and employer, to ensure that work experience is related to a student's educational goals or career pathway.

The rate at which CTE completers attained these other indicators was higher than those of noncompleters. In 2018, nearly one third of pathway completers earned a C or above in a dual credit class and 70 percent earned an industry certificate or passed a KOSSA exam. At 16 percent, rates of participation in co-op classes were much lower; one possible explanation is that these are experiences reliant on placement with local employers.

Figure 2.I
Number And Percentage Of CTE Program Completers And Non-Completers Earning A Grade Of C Or Above In A Dual Credit Class, A Cooperative Work Credit, Or An Industry Certificate/ KOSSA Exam 2018



Source: Staff analysis of data from the Kentucky Center for Statistics.

Appendix I shows variation among program areas on the indicators shown in the figure.

Work Based Learning

Figure 2.I, above showed relatively low percentages of students gaining work experience by earning a credit in a cooperative education class. Other options available for CTE students to gain real world experience through work-based learning include job shadowing, approved apprenticeships, internships, mentoring, and

student-run school-based businesses, such as furniture making or culinary services (school-based enterprises). Except for cooperative education experiences and, in recent years, KDE approved apprenticeships, data on student work-based learning are not available. As shown above, only 16 percent of CTE students in 2018 completed a cooperative work experience for credit.

The majority of principals responding to OEA's survey indicated that less than 25 percent of graduates had the opportunity to participate in any form of work-based learning. Principals in LAVECs were more likely to report opportunities for work-based learning versus the other CTE school types and ATC principals were the least likely. The percentage of principals reporting work-based learning experiences for at least half of CTE students was 28 percent for LAVECs, 18 percent for comprehensive high schools, and 5 percent for ATCs.

Across all settings, health sciences was the most likely to be reported as having work-based learning opportunities for students who seek them. The percentage of principals reporting that these opportunities were mostly or always available in health sciences was 65 percent for comprehensive high schools, 56 percent for LAVECs, and 42 percent for ATCs.

[1] Kentucky. Legislative Research Commission. *Revenues And Expenditures For Career And Technical Education In Kentucky*. Research Report No. 461. Frankfort: LRC, 2019.
[2] Thomas Thompson, Director, Division of Technical Schools and Continuous Improvement. Kentucky Dept. of Educ. "Program Startup Costs." Email to Sabrina Olds. August 14, 2019.
[3] Thomas Thompson, Director, Division of Technical Schools and Continuous Improvement. Kentucky Dept. of Educ. "Flagging Programs and Closing Programs Policy." Email to Sabrina Cummins. January 16, 2019.

Chapter 3

Career And Technical Education Outcomes

Introduction

This chapter follows graduates for up to five years after high school graduation, showing differences in workforce participation, wages, postsecondary education, and sector of employment for graduates who completed CTE pathways versus those who did not. It looks, in particular, for differences in labor market outcomes among pathways in different CTE program areas.

The chapter shows that postsecondary education attainment rates for CTE completers and noncompleters are similar, but wages and workforce participation rates—especially for the majority of graduates who do not earn postsecondary degrees—are substantially higher for CTE completers versus noncompleters. As measured by wages, the immediate labor market value of the HWHD pathways in manufacturing, construction, and transportation is greater than for business and health. As shown in Chapter 2, CTE pathway completion is higher in health and business than in manufacturing, construction, and transportation. Further, completion of manufacturing, construction, and transportation pathways has not yet met labor market demand and is especially low, relative to demand, in some local workforce areas.

The data also show that completers in the HWHD program areas of business and health often earn about the same as, or less than, completers in pathways such as agriculture or retail that have not been identified as HWHD.

Given the high numbers of graduates completing health pathways, it is notable that the majority of health pathway completers go on to earn relatively lower wages. As shown in Chapter 1, most job openings in health and business fields require an associate's degree or higher. Graduates who complete health pathways but do not earn college degrees earn, on average, less than completers of some program areas that are not considered HWHD.

Given the also high number of graduates completing CTE pathways in agriculture, which is not a HWHD industry sector, it is encouraging that these pathway completers earn relatively high wages, which are comparable to manufacturing, construction, and

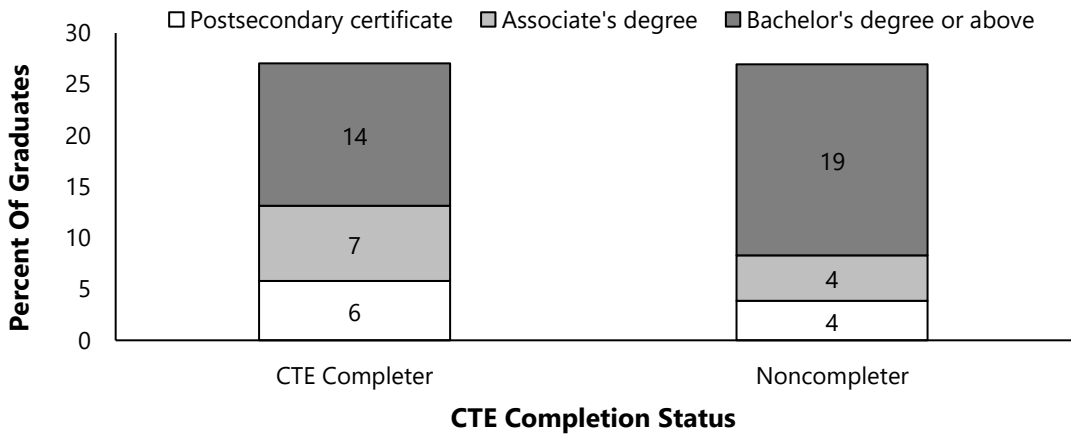
transportation pathway completers. This finding suggests that agriculture pathway completers may be acquiring skills that transfer well to other industry sectors.

The magnitude of CTE wage premiums and the relatively lower wages in some pathways versus others are explained when gender and other demographic characteristics are taken into account. On average, male graduates earn higher wages than female graduates, regardless of CTE completion. The same holds true for white versus black graduates and FRPL-eligible graduates versus graduates that are not eligible for FRPL.[a] CTE wage premiums do, however, exist for both genders and for most subgroups examined.

Postsecondary Education Outcomes

Figure 3.A shows postsecondary education attainment rates of 2013 graduates through school year 2018. CTE completers earned postsecondary degrees or credentials at the same rate as noncompleters (27 percent). Compared to noncompleters, completers were, however, more likely to earn certificates (6 percent versus 4 percent) and associate degrees (7 percent versus 4 percent), and less likely to earn bachelor's degrees (14 percent versus 19 percent).

Figure 3.A
Percent of 2013 Graduates By Level Of Postsecondary Education Through School Year 2018
Pathway Completers and Noncompleters



Source: Staff analysis of data from the Kentucky Center for Statistics.

[a] Hispanic graduates earn wages similar to or above other graduates generally. CTE wage premiums are lower.

Appendix J shows differences in postsecondary education rates among CTE programs. These rates range from a high of 41 percent for STEM completers to a low of 9 percent for transportation and logistics completers. Consistent with general gender-based differences in postsecondary education rates, program areas that are predominantly male, such as manufacturing, construction, and transportation, have lower postsecondary attainment rates than program areas that are predominantly female such as retail, human services, and health.[b]

Industries Of Employment And Average Wages All Graduates

Figure 3.B shows the major industry sectors in which 2013 graduates worked in 2018 and average wages by sector. The figure shows wages and employment sectors for all graduates, regardless of CTE completion or level of postsecondary education. Also important to note is that, while the industry sector names are similar to the CTE program names:

- The minority of workers in any of the industry sectors are CTE completers from a related program area.
- The majority of CTE completers are not employed in the sector most closely corresponding with their program area.

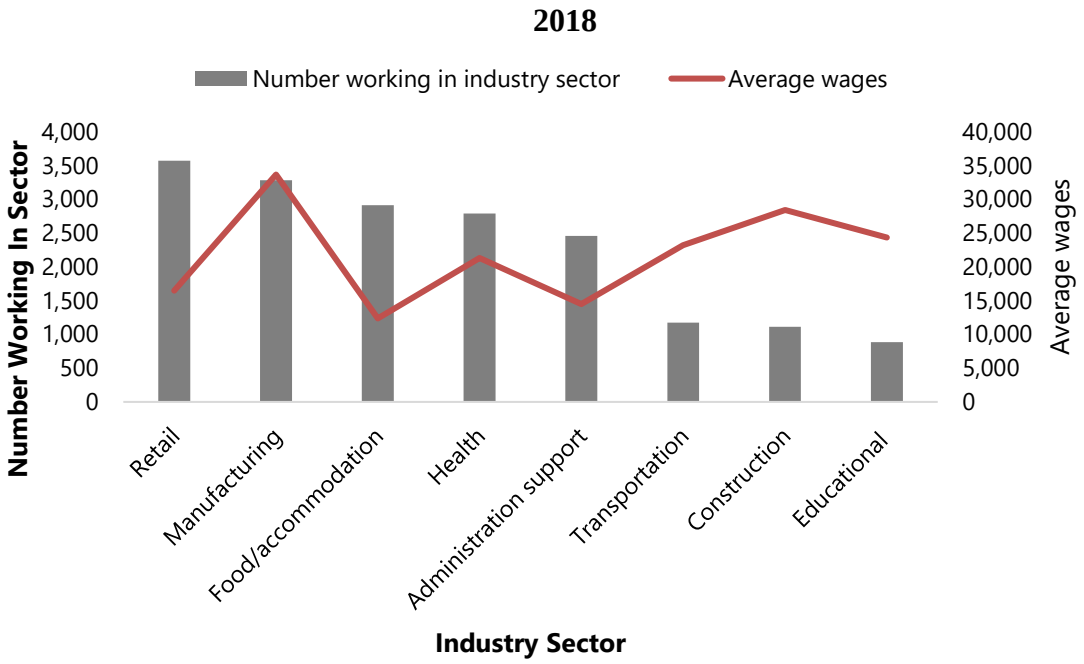
The relationship between program area and sector of employment is shown in Appendix K and will be summarized later in this chapter.

Figure 3.B shows that wages are highest in the manufacturing sector, which is also the sector with the second highest number of employees. Wages and employment in the manufacturing sector explain much of the difference in wages between CTE completers and noncompleters because of the higher likelihood that CTE completers are employed in the manufacturing sector.

While wages in the construction and, to a lesser extent, the transportation sectors are also relatively high, those sectors employ far fewer workers. Two of the three sectors with the largest number of workers—retail and food/accommodations—have the lowest wages.

Figure 3.B
Number of 2013 Graduates Employed And And Average Wages By Industry Sector

[b] See Appendix H for differences by student group in pathway completion in the program areas in 2018.



Note: Industry sectors include wages for a variety of specific occupations associated with jobs in those industries, not all of which are directly related to that industry; for example, the health sector includes not only health workers but drivers, cooks, and maintenance workers in hospitals. Figure includes only those graduates who were not enrolled in postsecondary education at any point in the 2018 school year. The figure does not include relatively smaller industry sectors such as public administration, finance, or professional services.
Source: Staff analysis of data from the Kentucky Center for Statistics.

Appendix L shows gender-associated differences in employment by sector. The percentages of females employed in the highest wage sectors are low, at 24 percent for manufacturing, 28 percent for transportation, and 7 percent for construction. Females are more likely than males to be employed in health (86 percent) and education (71 percent).

Appendix M shows the average wages by industry sector and education level of 2013 graduates working in 2018. With the exception of retail and food/accommodations, average salary increases substantially with education level.

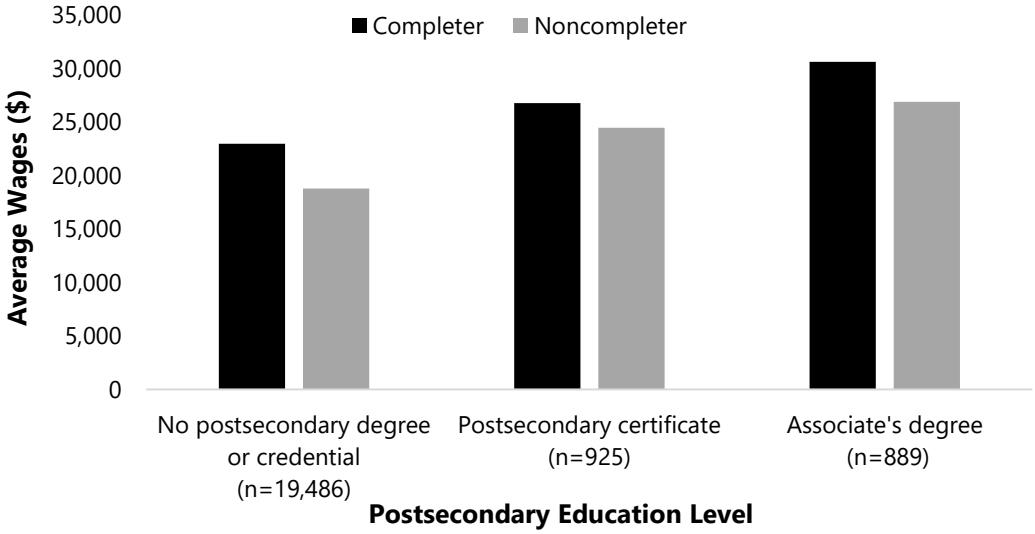
Wages By Postsecondary Attainment And CTE Completion

Figure 3.C shows average wages of 2013 graduates working in 2018 by education level and CTE completion. As with all of the wage calculations in this report, graduates who were enrolled in a postsecondary institution at any time during the academic year corresponding with the fiscal year analyzed were not included in the analysis.

On average, CTE completers earned more than noncompleters at every level, but wage premiums were greater for those with no postsecondary credential or degree than for those with higher levels of education. High school graduates in 2013 who were working in 2018 with no postsecondary degree or credential earned an average of about $23,000 compared with about $19,000 for graduates who did not complete pathways—a CTE-associated wage premium of 22 percent. In comparison, CTE-associated wage premiums were 9 percent for those with postsecondary certificates or diplomas and 14 percent for those with associate degrees.

Because graduates with no postsecondary degree or credential comprise the majority of the workers in the graduating class of 2013 and Kentucky's workforce in general, this chapter focuses largely on that group.

Figure 3.C
Average Wages of 2013 Graduates By CTE Completion Status And Postsecondary Education Level, FY 2018



Note: Wages for bachelor's degrees are not reported as most workers were recently graduated.
Source: Staff analysis of data from the Kentucky Center for Statistics.

To understand the relationship between CTE and workforce outcomes as they are measured by the data available for this report, it is important to take into consideration the gender-associated differences in sectors of employment and wages especially as they apply to graduates working without a postsecondary degree or credential. As shown later in this chapter, male completers' CTE wage premiums are far greater than female completers' wage premiums.

Wages By CTE Program Area

No Postsecondary Degree Or Credential

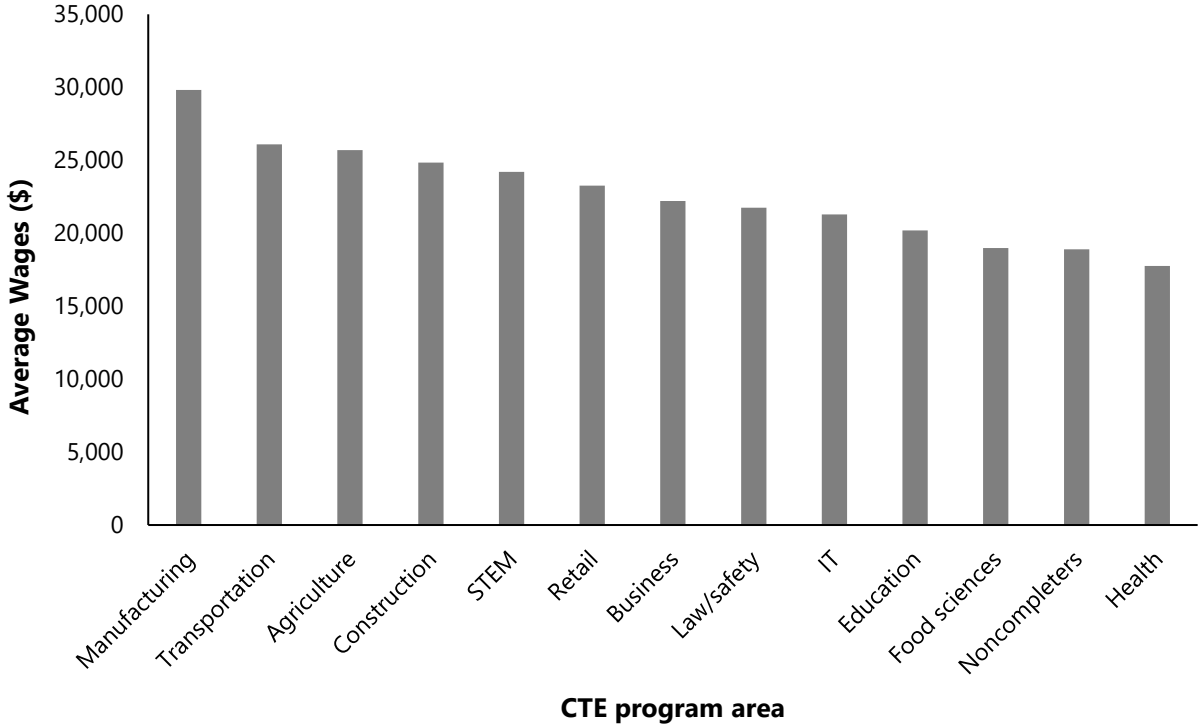
Figure 3.D shows the average wages of 2013 graduates, by CTE program area, working in 2018 with no postsecondary degree or credential. As noted earlier and shown in Appendix K, a minority of the CTE completers in each program area go on to work in the sector most closely associated with their program areas. The figure does not show all program areas. Appendix N shows 2018 wage data for graduates in all program areas.

The figure shows that, of the HWHD programs, wages for CTE completers in manufacturing ($29,800), transportation ($26,100), and construction ($24,900) were the highest. Wages in these higher-wage pathways were even higher for graduates working in those sectors. Average wages for manufacturing pathway completers working in the manufacturing sector were $36,200 and average wages for construction pathway completers working in construction were $31,800. As shown in Appendix K, pathway completers in the manufacturing, construction, and transportation tend to earn higher wages in those sectors.

The figure shows also that completers in health pathways earned relatively low wages ($17,800), which was less than the average CTE non-completer ($18,900). This is consistent with data shown in Chapter 1 indicating that most high-wage jobs in the health sector require at least an associate's degree. Similarly, the figure shows relatively lower wages for business program completers working with no postsecondary degree or credential. About two thirds of health pathway and business pathway completers in 2013 had not earned a postsecondary degree or certificate by 2018.

The figure also shows that, for graduates with no degree, average wages of agriculture program completers ($25,700) were comparable to wages in construction and transportation programs.

Figure 3.D
Average Wages Of 2013 CTE Completers
With No Postsecondary Degree Or Credential
By Program, 2018



Note: STEM = science, technology, engineering and math; IT = information technology.
Source: Staff analysis of data from the Kentucky Center for Statistics.

Agriculture pathways. Given lack of demand for agriculture workers, the higher wages of agriculture program graduates is surprising and suggests that many of the skills acquired by completers in these program areas may be transferable to other sectors. Appendix O shows the individual pathways within each program area that earned the highest wages in 2018**.** The agriculture power, structural technical systems pathway within the agriculture program area includes coursework on construction, equipment, and machinery operation, that are likely relevant to the manufacturing and construction sectors. Not shown in the figure is that agriculture pathway completers working in the manufacturing and construction sectors specifically earn, on average, as much or more than manufacturing and construction completers.

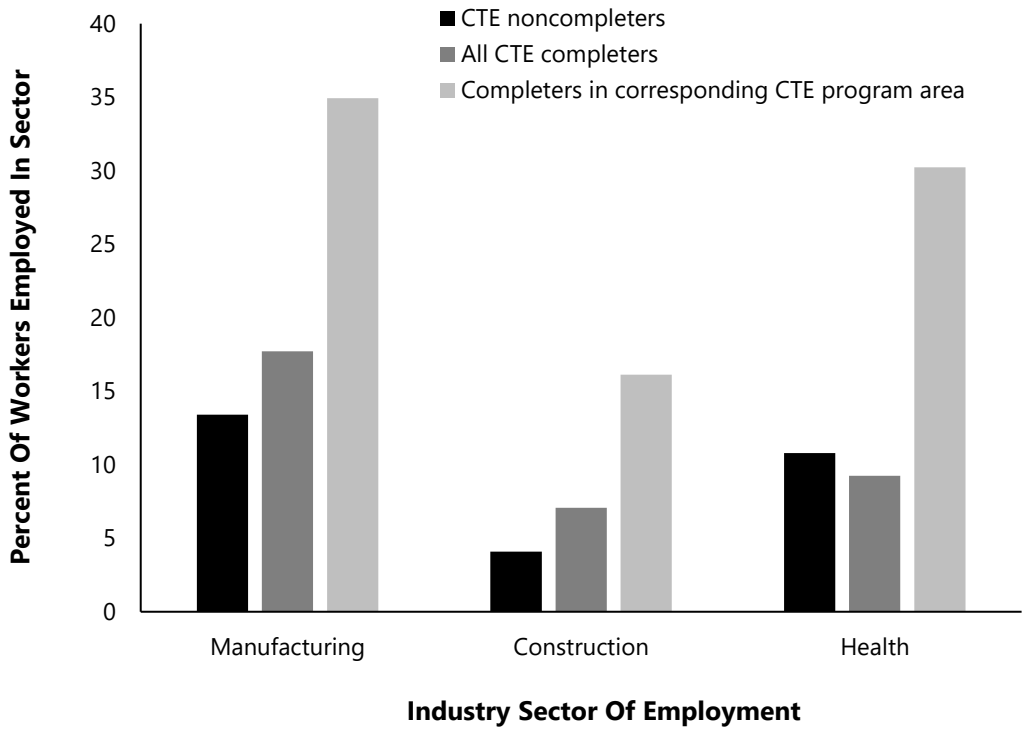
It is also possible that agriculture pathway completers are more likely to participate in student organizations or related work-based learning over the summer. KRS 157.360(12)(a) requires that agriculture teachers work 12 months out of the year in order to

supervise work based learning opportunities for agriculture students and their participation in student organizations. It is possible that these experiences prepare pathway completers for the workforce.

As explained earlier, a minority of program completers worked in the sector most closely aligned with their program area. For example, of the manufacturing program completers working with no postsecondary degree or credential, only about one third were working in the manufacturing sector. Appendix K shows sectors of employment in 2018 by program area of 2013 graduates.

Figure 3.E highlights employment trends in three of the HWHD industry sectors, showing differences in the percentage of completers and noncompleters who were working in 2018 and employed in each sector. It also shows, as a subset of all CTE workers, the percentage of completers in the aligned program area who were employed in that sector. Fourteen percent of noncompleters were working in the manufacturing sector, compared to 18 percent of completers and 35 percent of manufacturing program completers. Thus, manufacturing program completers were 2.6 times more likely to be working in the manufacturing sector than were noncompleters. Construction pathway completers were four times more likely to be working in the construction sector than CTE noncompleters (16 percent versus 4 percent), and health completers were 2.8 times more likely to be working in the health sector than CTE noncompleters (30 percent versus 11 percent).

Figure 3.E
Percent Of 2013 Graduates Working In 2018 With No Postsecondary Degree Or Credential In The Manufacturing, Construction, And Health Sectors, By CTE Completion



Source: Staff analysis of data from the Kentucky Center for Statistics.

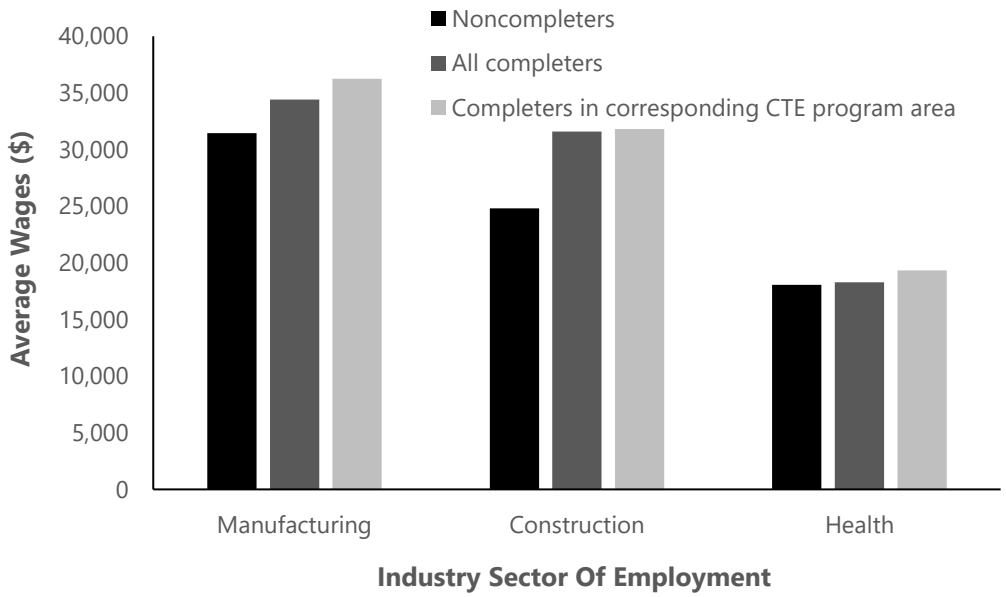
Figure 3.F shows average wages of 2013 graduates working in the same sectors by CTE completion and sector-specific CTE completion. The figure shows that while all graduates in the manufacturing sector earned higher wages, CTE completers earned more than noncompleters ($34,400 and $31,500, respectively) and manufacturing completers earned even more—$36,300, or 15 percent more than noncompleters. In the construction sector, construction pathway completers earned 27 percent more than CTE noncompleters, but not much more than other CTE completers. This may be because of the high wages of manufacturing and agriculture program completers who were working in the construction sector.[c]

Health program completers earned an additional 7 percent over CTE noncompleters. The CTE wage premium for health program

[c] Manufacturing completers working in the construction sector earned approximately the same wages as construction completers but agriculture pathway completers earned an average of over $34,000—greater than construction completers.

completers working in the health sector is greater in the years immediately following graduation, but fades over time for those who do not go on to earn postsecondary credentials or degrees.[d]

Figure 3.F
Average Wages Of 2013 Graduates Working In 2018 With No Postsecondary Degree Or Credential In the Manufacturing, Construction, And Health Sectors, By CTE Completion



Source: Staff analysis of data from the Kentucky Center for Statistics.

Wages By Program Area And Postsecondary Credential Or Degree

Figure 3.G compares averages wages, by CTE program area, of pathway-completing graduates with no postsecondary degree or credential with pathway-completing graduates who attain postsecondary certificates or degrees of associate or higher. The figure shows substantial wage increases in some program areas as graduates earn postsecondary certificates. Increases are especially great for pathway completers in transportation, construction, and law/ safety.[e] Average wages of manufacturing and construction

[d] Health pathway completers who graduated in 2017 made an average of about $10,256 in the health sector, an additional 23 percent over the $8,278 made by CTE noncompleters.

[e] Two thirds of the postsecondary certificates earned by transportation completers and almost one half of architecture and construction program completers were in mechanic repair technology technician. Only 1 of the 22 certificates earned by law/safety program graduates was in a field related to law

program graduates also increase substantially with attainment of associate degrees or higher. The majority earned associate degrees in technical fields and were subsequently employed in the manufacturing industry.[f]

Average wages of health pathway completers increase with postsecondary certificates but are notably still lower than graduates who did not complete CTE programs. While KFSR demand data indicate that about one third of health jobs are in this middle skill category, the entry wages for nursing assistants, which are the largest occupation group in that category, are relatively low. Average wages for health science completers increase only with the attainment of an associate's degree.[g] By 2013 11 percent of health completers had earned an associate's degree and 12 percent had earned a bachelor's degree. Of the health degree completers who earned an associate's degree or above, 57 percent did so in a health related field.

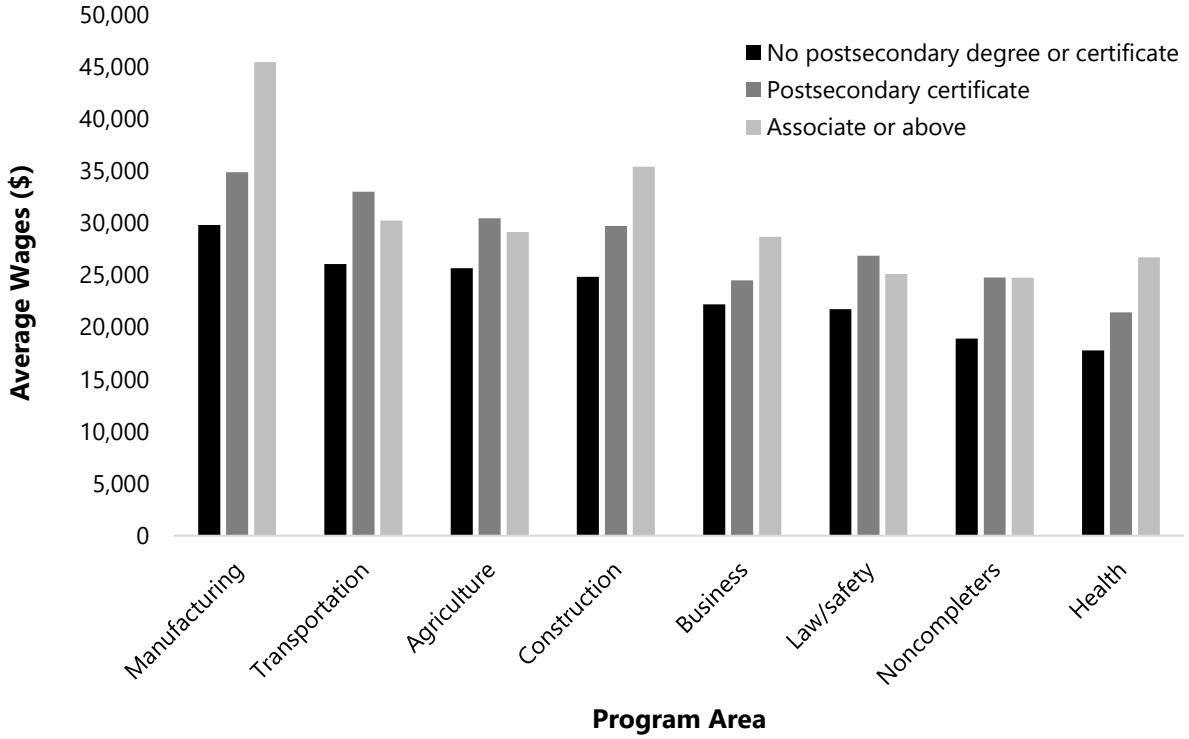
Understanding the comprehensive barriers to degree attainment for health pathway completers is beyond the scope of this report. It is worth noting, however, that the challenges associated with increasing postsecondary health program slots in response to the increased supply of potential degree candidates include lack of qualified clinical instructors and faculty; low availability of clinical rotation sites; and costs associated with increasing the number of students. [1]

or safety. Academic areas varied, but liberal arts certificates were the most common.

[f] Of the construction pathway completers earning associate degrees, about 1/3 did so in mechanic repair technology and another third in technical fields. The higher wages from these associate degree earners were in the manufacturing sector. Of the manufacturing sector associate degree earners, about two thirds were in technical fields including precision production, mechanic repair technology, and construction and highest wages came from those working in the manufacturing sector.

[g] The figure shows wages of all health pathway completers who earned associate degrees. Of those, about two thirds did so in health fields and most were employed in the health industry in 2018. The 50 health pathway completers who earned an associate's degree in health earned, on average approximately $33,000 in 2018.

Figure 3.G
Average Wages Of 2013 CTE Graduates
By Level of Education and Program, 2018



Source: Staff analysis of data from the Kentucky Center for Statistics.

Appendix P contains data showing postsecondary education trajectories and wages of completers in the health program areas. It shows that CTE health pathways earn degrees or credentials in health fields at higher rates than those in other program areas, but average wages after obtaining those degrees are not higher than CTE noncompleters.

The data in this report suggest that continued efforts to encourage enrollment in health pathways, absent aggressive efforts to assist students in taking steps toward associate degrees or higher, are unlikely to yield higher wages for most program completers. This is not to say that students should be discouraged from enrolling in health pathways. As evidenced by the data and as reported on the OEA survey and by principals during site visits, health pathways are popular with students. And, as shown above, health pathway completers working in the health sector earn slightly higher wages than noncompleters. However, educators and policymakers should be aware that health pathways will not lead to higher wages for the majority of completers who do not earn college degrees.

Workforce Participation And Wages 2017 Graduates

Additional CTE Indicators

As shown in Appendix Q, CTE completers from the class of 2017 earned an average of almost 30 percent more than noncompleters in 2018. Of graduates not enrolled in college, 76 percent were working in sectors that submit data to the UI system, compared to 70 percent of noncompleters. Actual workforce participation is likely higher for both groups as UI data does not contain data for the self-employed, military, or federal workers. The appendix also shows regional variations in workforce participation rates and CTE-associated wage premiums. CTE-associated premiums in wages and workforce participation were high in the eastern part of the state.

Industry Certificates And State Developed End-of-Program Exams

Beginning in the 2020 school year, graduates will be considered transition ready in Kentucky's accountability system if they earn an industry certificate or pass a state-developed end-of-program assessment, whether or not they complete a career pathway.

Table 3.1 shows average wages for pathway completers and non - completers for the 2017 graduating class, with or without earning an industry certificate or passing a state-developed assessment, previously known as the KOSSA. The table shows generally that CTE completers earned more than noncompleters ($12,036 versus $9,305, an additional 29 percent) and also had higher rates of workforce participation (76 percent versus 70 percent).

In addition, the table shows that pathway completers who earned an industry certificate or passed a KOSSA earned, on average $12,521, or 12 percent more than pathway completers who did not pass those performance-based measures ($11,161). Wages for pathway noncompleters who earned a certificate or passed a KOSSA were $10,867 versus noncompleters who did not pass these measures $9,030, a premium of 20 percent.

The table also shows that CTE pathway completers earned more than noncompleters regardless of whether a certificate was earned or KOSSA passed. For example, a non-completer who earned a certificate or passed a KOSSA earned an average of $10,867, still lower than the $11,161 earned by program completers who did not complete a certificate. Appendix R shows the industry certificates

associated with highest wages for 2017 graduates in 2018. In that year, the NIMS - Machine Tool Certification (Level 1) certificate earned by pathway completers appeared to have the great market value. Completers who earned this certificate earned an average of $22,400, more than double the average wage of 2017 graduates in 2018.

Table 3.1
Wages Of 2017 Graduates By CTE Completion And Industry Certificate Or KOSSA, 2018

CTE Completion Status	Total graduates not enrolled	Percent working 2018	Average Wages
All CTE Completers	6,792	76%	12,036
With industry certificate or KOSSA	4,350	77	12,521
Without industry certificate or KOSSA	2,442	76	11,161
All Noncompleters	15,034	70	9,305
Noncompleters with industry certificate or KOSSA	2,084	75	10,867
Noncompleter without industry certificate or KOSSA	12,950	69	9,030

Source: Staff analysis of data from the Kentucky Center for Statistics.

Data shown in Table 3.1 indicate that, historically, graduates who completed pathways and earned an industry certificate or passed a KOSSA earned more than those who passed the performance-based measures but did not complete a pathway. As noted in Chapter 1, Kentucky's revised accountability system does not require students to complete courses with a pathway in order to be considered transition ready. There is a possibility that this change will have the unintended consequence of causing some schools to offer the minimum number of courses that they believe are necessary to prepare students to pass the certification tests, rather than the full four-course sequence necessary to complete a pathway. During site visits made in connection with this study, staff did learn of a possible strategy that included planning coursework and personnel hires around industry certificates rather than career pathways.

Cooperative Education Classes

Appendix S shows that average wages of CTE completers and noncompleters who earned cooperative work credits under supervised employment prior to high school graduation were greater than those who did not complete co-op classes. CTE pathway completers who also participated in cooperative education classes earned over 20 percent more than pathway completers who did not participate in cooperative education classes.

Dual Credit And Postsecondary Enrollment

Chapter 2 showed that CTE completers are more likely than noncompleters to earn a grade of C or above in a dual credit class. As shown in Appendix S, dual credit completers were more likely to enroll in college in 2018 than those who did not earn dual credits, with increased likelihoods of between 15 percent and 30 percent, depending on students' GPAs.

Demographic Differences In CTE Outcomes

Table 3.2 shows gender-associated differences in wages for 2013 graduates working in 2015 and 2018 without a postsecondary credential or degree. While CTE completion is associated with higher wages for both male and female graduates, the wage premiums associated with gender are greater than those associated with CTE completion. For example, two years after graduation, male completers from the class of 2013 made 30 percent more than noncompleters whereas female completers made only 9 percent more than female noncompleters. Average wages of $16,089 for male completers in 2015 were 58 percent higher than the average wages of $10,138 for female completers.

Table 3.2
Average Wages of 2013 Graduates
By Gender And High School CTE Completion, 2015 And 2018

		Average Wages		CTE
Fiscal Year of Employment	Gender	Completers	Noncompleters	Premium
2015	Female	10,138	9,265	9%
	Male	16,089	12,381	30
2018	Female	17,305	16,386	6
	Male	27,048	21,555	25

Source: Staff analysis of data from the Kentucky Center for Statistics.

As shown in Appendix M, males are more likely than females to work in the higher wage employment sectors of manufacturing, construction, and transportation. Females are more likely than males to work in the lower wage sectors of food/accommodation and retail. These trends do not entirely explain the gender-associated CTE wage gaps, however, as females make less than males in every sector.

It is unclear from the data how much of this difference might be associated with differences in full versus part time work. Wage data available do not distinguish between full and part time employees.

Appendix T contains additional demographic wage data showing that CTE completers eligible for FRPL earn, on average, less than those who are not eligible, black CTE completers earn less than white CTE completers, while Hispanic graduates earn more than white graduates, regardless of CTE completion. With the exception of Hispanic graduates, CTE completion is associated with wage increases for all the demographic groups examined.

Conclusion

The report provides data supporting existing calls to expand access in highest demand areas. In addition, the report reinforces the importance of connecting CTE in high school with continuing opportunities for postsecondary education. It highlights, in particular, the need to increase the number of health pathway completers earning degrees of associate or above. The report also suggests that ongoing and periodic analysis of postsecondary outcomes would be helpful to ensure that the intent of CTE and other policy initiatives is borne out by data.

Expanding Access To Higher-Wage Pathways Among Kentucky Districts And Student Groups

Higher Wages In Manufacturing Construction And Transportation. Data on the employment outcomes of CTE completers show highest wages for graduates who complete manufacturing, construction, and transportation pathways. The supply of graduates completing pathways in those program areas is much less than the demand for workers in related workforce sectors

Different Rates Of Pathway Completion By District. In 2018, for example, more than one third of districts in the commonwealth—including Jefferson and Fayette Counties—had few or no graduates (less than 1 percent) completing manufacturing pathways. Students attending school in districts with ATCs or districts that send students to nearby districts with ATCs generally have the highest manufacturing pathway completion rates, followed by those attending districts served by LAVECs. Those students who have access to CTE only at comprehensive high schools have the lowest manufacturing pathway completion rates.

Demographic Differences In Pathway Completion. The report also shows that the percentage of male graduates completing manufacturing (5.2 percent) is 18 times greater than the percentage of female graduates (0.4 percent) completing these pathways. Furthermore, the percentage of white graduates (3.2 percent) completing manufacturing pathways is four times greater than the percentage of black graduates doing so (0.8 percent). Relatively lower rates of manufacturing pathway completion by black students is explained, in part, by lower manufacturing pathway completion rates in Fayette and Jefferson Counties. It is unclear what explains the lower rates of female manufacturing pathway completion. To the extent that perceived student interest is a factor with any underrepresented student group, efforts should be made to inform, engage and recruit these students into manufacturing pathways.

Differences Between ATC And LAVEC Districts. Unlike state SEEK funding, current methods for funding CTE are not adjusted for district wealth. Costs associated with beginning and maintaining pathways in the highest-wage program areas are generally higher than they are for pathways in other program areas. ATCs, which have the highest concentration of graduates in these slots, receive approximately five times more state per-pupil funding per year than do LAVECs.[2] Districts operating LAVECs fund CTE pathways largely out of their general fund budgets. Some of the districts operating LAVECs are among the lowest-wealth districts in the state.

Transportation Costs. Increasing access to highest-wage pathways may rely on an increasingly regional approach to CTE delivery and will require students to be transported. Because

districts are only being reimbursed for about one third of the costs of transporting CTE students, districts with higher transportation costs are at a relative disadvantage. Rural or remote districts must often pay more to transport students. Many of these districts are among the state's lowest wealth districts.

Local Decision Making

OEA site visit and survey data indicate frustration of local leaders with limitations put on pathways that can be offered based on what is considered HWHD at the state level. Data in the report show that wages in some of the pathways that are not considered HWHD—agriculture pathways, most specifically—can often surpass those in the health and business program areas.[h]

Data in this report also raise the concern that CTE opportunities offered to high school students may not always be in line with workforce demand and greatest opportunities for high school graduates.

Use Of Outcome Data To Evaluate Programs

This report provides strong evidence of likely positive effects of the state's recent efforts to expand access to pathways in manufacturing, construction, and transportation. It also illustrates that workforce outcomes for CTE graduates in other pathways may not always reflect desired outcomes. As one example, most graduates in the state highest enrolled CTE program area—health sciences—go on to earn relatively lower wages. The General Assembly may wish periodically to review the relationship between CTE enrollment and workforce outcomes.

In addition, the General Assembly may wish to request future studies that track the postsecondary outcomes of graduates who are being considered transition ready in the current accountability system. The report notes the historically higher wages of graduates who both completed CTE pathways and earned industry certificates or passed KOSSAs. It is possible that, in response to the current policy incentives, some districts might elect to reduce the number of courses offered in individual pathways in favor of

[h] The agricultural power, structural, technical systems pathway is currently labeled HWHD for purposes of additional points in the accountability system but other agriculture pathways are not and may not be approved for ATCs.

increasing the number of classes that might lead to industry certificates in different program areas. It is unknown whether graduates who earn industry certificates or pass state-approved exams without completing pathways can expect the same wage benefits.

[1] Williams, Josh. *A Case For Change: The Movement Toward Employer Led Workforce Systems.* Presentation to the Kentucky Center for Statistics Data Use Conference, September 4, 2019.
[2] Kentucky. Legislative Research Commission. *Revenues And Expenditures For Career And Technical Education In Kentucky*. Research Report No. 461. Frankfort: LRC, 2019.

Appendix A

Workforce Investment Areas

Table A.1 displays Kentucky school districts by workforce investment area.

Table A.1
School Districts In Each Workforce Investment Area

Workforce Investment Area	School Districts
Bluegrass	Anderson, Berea Ind, Bourbon, Boyle, Burgin Ind, Clark, Danville Ind, Estill, Fayette, Frankfort Ind, Franklin, Garrard, Harrison, Jessamine, Kentucky School for the Deaf, Lincoln, Madison, Mercer, Nicholas, Paris Ind, Powell, Scott, Woodford
Cumberlands	Adair, Campbellsville Ind, Casey, Clinton, Corbin Ind, Cumberland, East Bernstadt Ind, Green, Laurel, McCreary, Pulaski, Rockcastle, Russell, Science Hill Ind, Somerset Ind, Taylor, Wayne, Whitley, Williamsburg Ind
EKCEP	Barbourville Ind, Bell, Breathitt, Carter, Clay, Elliott, Floyd, Harlan, Harlan Ind, Hazard Ind, Jackson, Jackson Ind, Jenkins Ind, Johnson, Knott, Knox, Lawrence, Lee, Leslie, Letcher, Magoffin, Martin, Menifee, Middlesboro Ind, Morgan, Owsley, Paintsville Ind, Perry, Pike, Pikeville Ind, Pineville Ind, Wolfe
Green River	Daviess, Hancock, Henderson, McLean, Ohio, Owensboro Ind, Union, Webster
Kentuckiana Works	Anchorage Ind, Bullitt, Eminence Ind, Henry, Jefferson, Kentucky School for the Blind, Oldham, Shelby, Spencer, Trimble
Lincoln Trail	Bardstown Ind, Breckinridge, Cloverport Ind, Elizabethtown Ind, Grayson, Hardin, LaRue, Marion, Meade, Nelson, Washington, West Point Ind
Northern Kentucky	Beechwood Ind, Bellevue Ind, Boone, Campbell, Carroll, Covington Ind, Dayton Ind, Erlanger-Elsmere Ind, Fort Thomas Ind, Gallatin, Grant, Kenton, Ludlow Ind, Newport Ind, Owen, Pendleton, Silver Grove Ind, Southgate Ind, Walton-Verona Ind, Williamstown Ind
South Central	Allen, Barren, Bowling Green Ind, Butler, Caverna Ind, Edmonson, Glasgow Ind, Hart, Logan, Metcalfe, Monroe, Russellville Ind, Simpson, Warren
TENCO	Ashland Ind, Augusta Ind, Bath, Boyd, Bracken, Fairview Ind, Fleming, Greenup, Lewis, Mason, Montgomery, Raceland-Worthington Ind, Robertson, Rowan, Russell Ind
West Kentucky	Ballard, Caldwell, Calloway, Carlisle, Christian, Crittenden, Dawson Springs Ind, Fulton, Fulton Ind, Graves, Hickman, Hopkins, Livingston, Lyon, Marshall, Mayfield Ind, McCracken, Muhlenberg, Murray Ind, Paducah Ind, Todd, Trigg

Note: EKCEP = Eastern Kentucky Concentrated Employment Program. TENCO = TENCO Workforce Investment Board.
Source: Kentucky Association for Economic Development.

Appendix B

High School Principal Comments On Benefits Of CTE

OEA's survey of principals in ATCs, LAVECS and comprehensive high schools included an open-ended comment section. Many principals offered comments on the benefits of CTE beyond preparing students for a specific occupation. These included student engagement, motivation, and productive work habits. Following is a sample of these comments.

"CTE plays an integral part in preparing our students to not only succeed after they graduate but become productive members of the community in which they live."

"CTE has a direct connection between graduation and a good job. CTE keeps students in school and engaged because students grasp the earning power of their learning."

"CTE provides students with programs that not only train them for specific pathways, but also provide general workplace readiness skills that benefit students and employers. Since most CTE staff have backgrounds in business/industry before becoming educators, they are able to transfer knowledge of those workplaces to our students. When a CTE teacher says "this is what industry is looking for", they are backing that up with prior work experience."

"CTE courses provide a great deal of life skills that are essential to being productive citizens. These skills include but are not limited to work ethic, consumerism, communication, personal finance, etc."

"Military/JROTC pathways are extremely important to consider adding back to CTE pathways. This pathway "saves" many of our students who make poor decisions and the curriculum offers rich and rigorous leadership content."

"CTE courses are a vital part of what we do to help prepare students for their futures. For many of our students, it is what drives them to be successful at school."

"We believe strongly that CTE is an avenue that has been overlooked for many years and that it plays a vital part of increasing a student's interest in their academic classes and provides a direction for a possible career after they graduate."

"Students are able to shine and show a strength that may be outside the realm of traditional coursework. This allows students to network and experience the world in a nontraditional way."

Appendix C

Career And Technical Education Access By District

Table C.1 shows how students access career and technical education (CTE) in Kentucky school districts. Students could access CTE through area technology centers (ATCs), local area vocational education centers (LAVECs), district funded CTE centers, or comprehensive high schools. Some districts housed either ATCs or LAVECs and others sent their students to ATCs or LAVECs in other districts.

Figure C.1
Career And Technical Education Access Category
By District, 2019

District	ATC	ATC Feeder	LAVEC	LAVEC Feeder	District-Funded CTE Center	Comprehensive High School Only	N/A
Adair County		✓					
Allen County			✓				
Anchorage Independent							✓
Anderson County		✓					
Ashland Independent						✓	
Augusta Independent		✓					
Ballard County			✓				
Barbourville Independent		✓					
Bardstown Independent		✓					
Barren County	✓						
Bath County		✓	✓				
Beechwood Independent		✓		✓			
Bell County	✓						
Bellevue Independent		✓					
Berea Independent		✓					
Boone County	✓				✓		
Bourbon County		✓					
Bowling Green Independent		✓	✓				
Boyd County			✓				
Boyle County		✓					
Bracken County		✓					
Breathitt County	✓						
Breckinridge County	✓						
Bullitt County	✓						
Burgin Independent		✓					
Butler County	✓						
Caldwell County	✓						

District	ATC	ATC Feeder	LAVEC	LAVEC Feeder	District-Funded CTE Center	Comprehensive High School Only	N/A
Calloway County		✓					
Campbell County	✓						
Campbellsville Independent		✓					
Carlisle County		✓					
Carroll County	✓						
Carter County			✓				
Casey County	✓						
Caverna Independent		✓					
Christian County			✓				
Clark County	✓						
Clay County	✓						
Clinton County	✓						
Cloverport Independent		✓					
Corbin Independent	✓						
Covington Independent			✓				
Crittenden County		✓					
Cumberland County		✓					
Danville Independent		✓					
Daviess County						✓	
Dawson Springs Independent		✓					
Dayton Independent		✓					
East Bernstadt Independent							✓
Edmonson County		✓	✓				
Elizabethtown Independent						✓	
Elliott County		✓					
Eminence Independent		✓					
Erlanger-Elsmere Independent		✓					
Estill County		✓					
Fairview Independent		✓					
Fayette County			✓				
Fleming County			✓				
Floyd County	✓						
Fort Thomas Independent		✓					
Frankfort Independent						✓	
Franklin County			✓				
Fulton County	✓						
Fulton Independent		✓					
Gallatin County		✓					
Garrard County	✓						
Glasgow Independent		✓					

District	ATC	ATC Feeder	LAVEC	LAVEC Feeder	District-Funded CTE Center	Comprehensive High School Only	N/A
Grant County			✓				
Graves County		✓					
Grayson County			✓				
Green County	✓						
Greenup County	✓						
Hancock County		✓					
Hardin County					✓		
Harlan County		✓					
Harlan Independent		✓					
Harrison County	✓						
Hart County		✓					
Hazard Independent						✓	
Henderson County			✓				
Henry County		✓					
Hickman County		✓					
Hopkins County					✓		
Jackson County	✓						
Jackson Independent		✓					
Jefferson County			✓				
Jenkins Independent		✓					
Jessamine County			✓	✓			
Johnson County			✓				
Kenton County			✓				
Knott County	✓						
Knox County	✓						
LaRue County						✓	
Laurel County					✓		
Lawrence County			✓				
Lee County	✓						
Leslie County	✓						
Letcher County	✓						
Lewis County			✓				
Lincoln County	✓						
Livingston County		✓	✓				
Logan County	✓						
Ludlow Independent							
Lyon County		✓					
Madison County	✓						
Magoffin County			✓				
Marion County	✓						
Marshall County			✓				
Martin County	✓						
Mason County	✓						

District	ATC	ATC Feeder	LAVEC	LAVEC Feeder	District-Funded CTE Center	Comprehensive High School Only	N/A
Mayfield Independent	✓						
McCracken County		✓					
McCreary County			✓				
McLean County						✓	
Meade County	✓						
Menifee County		✓					
Mercer County	✓						
Metcalfe County		✓					
Middlesboro Independent		✓					
Monroe County	✓						
Montgomery County	✓						
Morgan County	✓						
Muhlenberg County			✓				
Murray Independent	✓						
Nelson County	✓						
Newport Independent			✓				
Nicholas County		✓					
Ohio County	✓						
Oldham County					✓		
Owen County		✓					
Owensboro Independent					✓		
Owsley County		✓					
Paducah Independent	✓						
Paintsville Independent						✓	
Paris Independent		✓					
Pendleton County		✓					
Perry County						✓	
Pike County	✓						
Pikeville Independent		✓					
Pineville Independent		✓					
Powell County			✓				
Pulaski County	✓						
Raceland-Worthington Independent		✓					
Robertson County		✓					
Rockcastle County	✓						
Rowan County		✓					
Russell County	✓						
Russell Independent	✓						
Russellville Independent		✓					
Science Hill Independent							✓
Scott County			✓	✓			
Shelby County	✓						
Silver Grove Independent		✓					

District	ATC	ATC Feeder	LAVEC	LAVEC Feeder	District-Funded CTE Center	Comprehensive High School Only	N/A
Simpson County			✓				
Somerset Independent		✓					
Southgate Independent							✓
Spencer County		✓			✓		
Taylor County		✓			✓		
Todd County		✓					
Trigg County		✓	✓				
Trimble County		✓					
Union County			✓				
Walton-Verona Independent		✓					
Warren County	✓						
Washington County		✓					
Wayne County	✓						
Webster County	✓						
West Point Independent							✓
Whitley County		✓					
Williamsburg Independent		✓					
Williamstown Independent						✓	
Wolfe County		✓					
Woodford County				✓			
Total	52	72	32	4	8	10	5

Note: N/A= K-8 district. There are 53 total ATCs in a total of 52 districts. Pike County has 2 ATCs. There are 42 total LAVECs that are located in 32 districts
Source: Kentucky Department of Education

Appendix D

Per-Pupil Property Assessments By CTE Delivery Type

Tables D.1, D.2, D.3, D.4, and D.5 show district per-pupil property assessments by student access to career and technical education (CTE). Students could access CTE through area technology centers (ATCs), local area vocational education centers (LAVECs), district funded CTE centers, or comprehensive high schools. Some districts housed either ATCs or LAVECs and others sent their students to ATCs or LAVECs in other districts.

Table D.1
Per Pupil Property Assessment LAVECs, 2018

LAVEC	Per-Pupil Property Assessment
Magoffin County	$198,599
McCreary County	211,855
Carter County	266,077
Johnson County	278,026
Bath County	281,605
Powell County	286,015
Lewis County	293,874
Fleming County	354,429
Grant County	364,461
Allen County	368,355
Grayson County	368,962
Lawrence County	387,769
Muhlenberg County	390,693
Edmonson County	396,255
Bowling Green Independent	409,816
Henderson County	467,311
Covington Independent	481,907
Union County	505,034
Christian County	511,355
Ballard County	535,925
Simpson County	539,897
Boyd County	545,226
Trigg County	567,028
Marshall County	575,271
Newport Independent	581,575
Scott County	594,046
Jessamine County	601,477
Franklin County	633,846
Kenton County	687,786
Fayette County	850,392
Jefferson County	856,184
Livingston County	890,610
Average	477,552

Source: Kentucky Department of Education

Table D.2
Per Pupil Property Assessment, ATC Operating Districts, 2018

ATC Operating Districts	Per-Pupil Property Assessment
Clay County	$197,703
Corbin Independent	204,245
Jackson County	218,594
Mayfield Independent	221,684
Bell County	227,161
Morgan County	233,640
Rockcastle County	235,359
Breathitt County	242,652
Butler County	260,063
Letcher County	264,596
Martin County	275,389
Leslie County	280,989
Knox County	283,637
Monroe County	291,496
Pike County	304,252
Ohio County	307,526
Green County	321,247
Knott County	322,217
Clinton County	322,804
Casey County	323,012
Wayne County	326,463
Lincoln County	327,965
Lee County	360,129
Caldwell County	363,124
Floyd County	363,200
Meade County	366,204
Murray Independent	367,945
Greenup County	367,947
Montgomery County	372,620
Webster County	373,168
Barren County	374,204
Garrard County	382,137
Russell Independent	408,359
Harrison County	408,570
Russell County	414,430
Logan County	421,797
Carroll County	454,582
Pulaski County	461,989
Marion County	467,804
Fulton County	470,856
Breckinridge County	483,260

ATC Operating Districts	Per-Pupil Property Assessment
Paducah Independent	501,468
Madison County	511,668
Mercer County	539,842
Bullitt County	541,126
Mason County	567,460
Warren County	607,559
Clark County	623,220
Nelson County	626,112
Shelby County	629,765
Boone County	745,815
Campbell County	849,301
Average	392,661

Source: Kentucky Department of Education

Table D.3
Per Pupil Property Assessment, ATC Feeder Districts, 2018

District	Per-Pupil Property Assessment
Cloverport Independent	$116,196
Dawson Springs Independent	121,569
Jackson Independent	134,196
Pineville Independent	142,185
Barbourville Independent	170,884
Eminence Independent	195,450
Harlan Independent	197,680
Owsley County	204,065
Augusta Independent	205,548
Menifee County	206,133
Jenkins Independent	208,947
Elliott County	214,800
Raceland-Worthington Independent	214,923
Wolfe County	215,085
Whitley County	228,865
Berea Independent	243,880
Williamsburg Independent	248,237
Dayton Independent	252,314
Estill County	263,575
Fairview Independent	269,263
Harlan County	269,791
Robertson County	287,264
Fulton Independent	294,632
Nicholas County	315,950
Metcalfe County	320,338
Russellville Independent	325,274
Adair County	337,190
Hart County	353,757
Pendleton County	358,704
Todd County	366,139
Glasgow Independent	371,632
Henry County	387,891
Walton-Verona Independent	398,142
Paris Independent	402,547
Crittenden County	406,519
Gallatin County	413,632
Carlisle County	425,152
Owen County	430,802
Middlesboro Independent	437,392
Erlanger-Elsmere Independent	440,375
Bracken County	444,470
Washington County	444,470
Cumberland County	445,180
Campbellsville Independent	447,491
Graves County	461,363
Fort Thomas Independent	467,855
Rowan County	474,897
Bourbon County	487,267
Boyle County	511,574
Somerset Independent	521,378

District	Per-Pupil Property Assessment
Anderson County	527,227
Hickman County	531,904
Trimble County	533,981
Danville Independent	552,646
Hancock County	562,545
Burgin Independent	563,032
Bardstown Independent	568,225
Pikeville Independent	582,335
McCracken County	617,408
Caverna Independent	618,579
Bellevue Independent	648,869
Silver Grove Independent	699,549
Calloway County	699,779
Lyon County	959,825
Average	387,012

Source: Kentucky Department of Education

Table D.4
Per Pupil Property Assessment, District-Funded CTE Centers, 2018

District	Per-Pupil Property Assessment
Owensboro Independent	$349,399
Laurel County	400,719
Hopkins County	457,961
Hardin County	509,892
Oldham County	574,064
Average	458,407

Source: Kentucky Department of Education

Table D.5
Per Pupil Property Assessment, Comprehensive High Schools Only, 2018

District	Per-Pupil Property Assessment
Williamstown Independent	$230,609
Hazard Independent	263,937
Frankfort Independent	333,914
Elizabethtown Independent	338,474
Perry County	346,617
LaRue County	354,196
Ashland Independent	372,684
Paintsville Independent	374,031
McLean County	399,136
Daviess County	553,703
Average	3,567,301

Source: Kentucky Department of Education

Appendix E

Percent of Projected Jobs By Local Workforce Area And Graduates Completing CTE Pathways

Table E.1 shows the percent of projected jobs by major occupation group and local workforce area (LWA) in 2018-2022. Table K.2 shows the percent of graduates completing career and technical education (CTE) pathways by CTE program area and LWA in 2018.

Table E.1
Percent Of Projected Jobs
By Major Occupation Group And Local Workforce Area
2018-2022

Local Workforce Area	Total Jobs	Production	Construction	Installation And Repair	Health	Education	Administrative Support	Sales	Food Preparation And Related
Bluegrass	61,980	9%	3%	4%	9%	7%	11%	10%	11%
Cumberlands	18,912	14	2	4	15	5	11	9	10
EKCEP	16,844	3	4	4	15	6	14	13	11
Green River	14,042	14	4	6	11	4	12	10	10
Kentuckiana Works	87,546	9	4	5	13	3	12	10	10
Lincoln Trail	14,842	14	4	6	7	4	12	11	11
Northern Kentucky	35,098	9	3	4	10	4	12	10	11
South Central	19,292	13	3	5	11	5	12	11	11
TENCO	11,444	9	4	4	16	6	10	12	13
West Kentucky	26,277	10	3	6	11	5	10	11	13
Kentucky, Unassigned LWA	102,457	4	4	5	14	7	12	5	4
Grand Total	408,734	8	4	5	12	5	12	9	9

Note: EKCEP = Eastern Kentucky Concentrated Employment Program. TENCO = TENCO Workforce Investment Board.
Source: Staff analysis of data from the Kentucky Center for Statistics.

Table E.2
Percent Of 2018 Graduates
Completing CTE Pathways
By Program Area And Local
Workforce Area
2018

Program Area	Bluegrass	Cumberlands	EKCEP	Green River	Kentuckiana Works	Lincoln Trail	Northern Kentucky	South Central	TENCO	West Kentucky
Agriculture	5.1%	7.3%	3.9%	3.6%	1.8%	5.0%	2.1%	8.1%	7.7%	8.3%
Architecture and construction	1.4	2.6	6.2	1.1	0.5	2.9	1.9	4.2	2.6	1.7
Arts A/V	0.4	0.1	0.1	0.4	1.7	0.2	0.9	0.0	0.0	0.5
Business and administration	2.1	5.1	9.4	1.0	4.2	4.5	3.4	6.7	5.6	7.8
Health science	5.0	8.4	11.3	4.7	3.8	8.0	2.7	6.9	6.8	7.2
Human Services	4.4	5.4	5.2	3.8	3.0	4.1	2.7	5.8	6.4	7.2
Information technology	1.9	0.7	4.4	2.1	1.4	1.4	0.7	1.5	2.8	2.1
Law and public safety	1.1	3.6	4.1	3.6	3.1	2.5	0.8	2.8	3.5	2.1
Manufacturing	1.9	4.8	3.4	2.8	1.0	4.8	1.7	6.2	3.9	2.9
Retail	3.0	6.1	1.0	2.0	1.6	1.7	1.3	2.5	2.3	1.6
STEM	1.9	3.2	1.7	2.1	1.2	2.5	0.8	0.3	2.5	2.8
Transportation and logistics	1.5	2.2	3.0	1.0	0.8	2.4	1.2	2.2	2.9	2.0
Total Number of Graduates	8,303	3,716	4,869	2,438	9,588	3,395	4,808	3,579	2,310	4,145

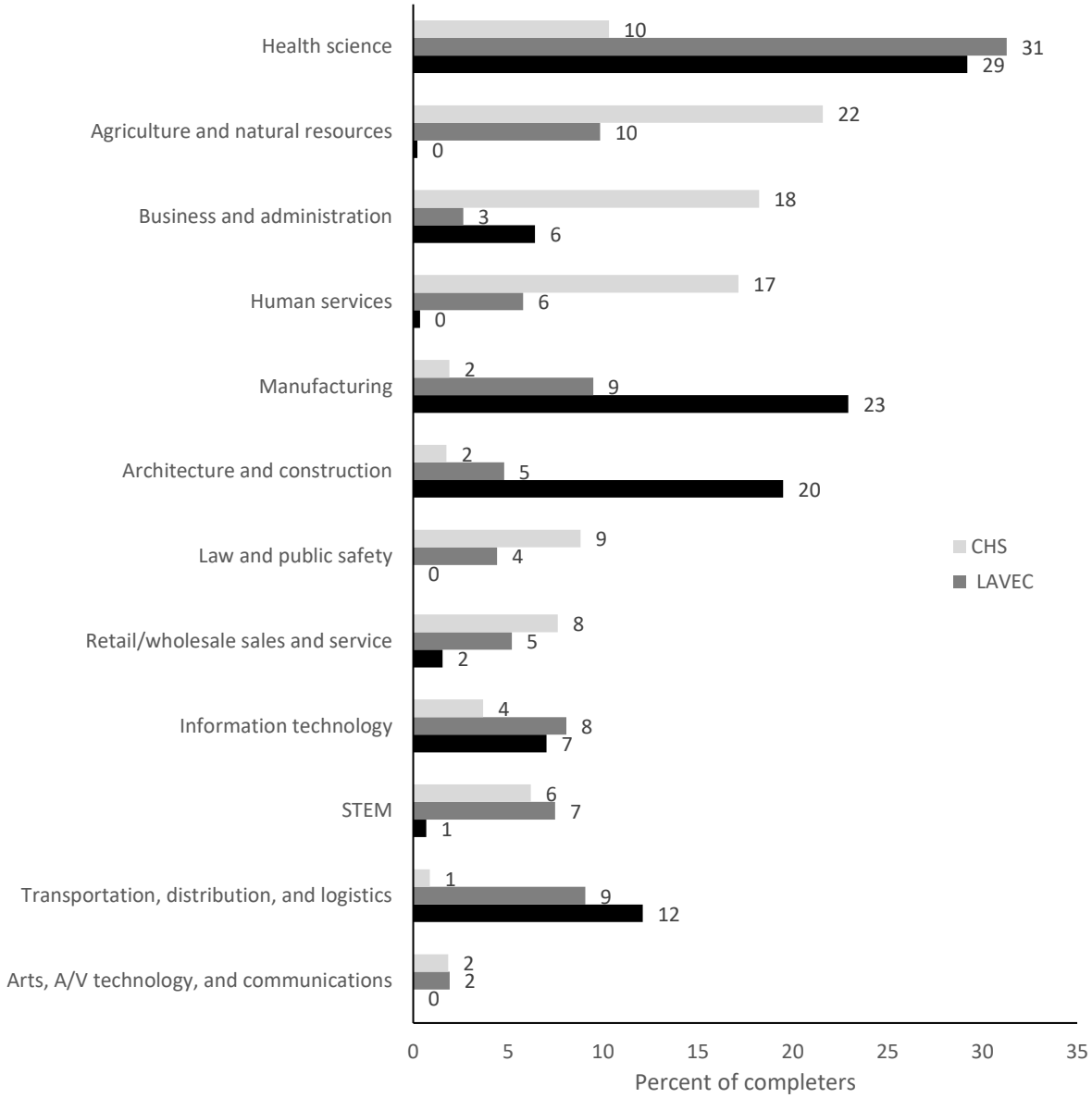
Note: EKCEP = Eastern Kentucky Concentrated Employment Program. TENCO = TENCO Workforce Investment Board.
Source: Staff analysis of data from the Kentucky Center for Statistics.

Appendix F

CTE Pathway Completers By Program Area And CTE Delivery Model

Table G.1 shows the percent of CTE pathway completers by program area and CTE delivery model utilized for school year 2018.

Figure G.1
Percent Of Pathway Completers By Program Area
And CTE Delivery Model, 2018



Note: CHS = comprehensive high school; LAVEC = local area vocational education center; ATC = area technology center.
Source: Staff analysis of data from the Kentucky Center for Statistics.

Appendix G

Perceived Barriers To Adding CTE Career Pathways

Table G.1
Comprehensive High School Principals' Challenges In Adding CTE Pathways By Program Area, 2019

		Types Of Challenges Reported			
Program Area	Respondents Reporting Challenges	Qualified Teacher Not Available	Lack Of Necessary Equipment Or Supplies	Lack Of Student Interest	Pathway Not Approved By The Kentucky Department Of Education
Agriculture	40	12	16	23	0
Business and marketing	16	5	5	8	0
Construction	40	12	21	18	0
Engineering Technology	49	28	23	15	2
Family and Consumer Sciences	29	15	7	11	1
Health Science	25	17	17	4	0
Information Technology	30	14	12	13	1
Manufacturing Technology	47	20	23	18	1
Media Arts	55	21	21	25	3
Transportation	64	23	23	35	3

Note: Totals for each program area represent number of respondents finding challenges in adding career and technical education pathways in that program area. There were 137 comprehensive high school principals who responded to the survey. Respondents could answer with more than one challenge.
Source: OEA Staff Survey of Principals and Superintendents

Table G.2
ATC School Principals' Challenges In Adding CTE Pathways By Program Area, 2019

Program Area	Respondents Reporting Challenges	Types Of Challenges Reported			
		Qualified Teacher Not Available	Lack Of Necessary Equipment Or Supplies	Lack Of Student Interest	Pathway Not Approved By The Kentucky Department Of Education
Agriculture	4	1	3	3	0
Business and marketing	1	0	0	1	0
Construction	6	2	5	1	0
Engineering Technology	7	3	7	3	0
Family and Consumer Sciences	3	1	3	0	0
Health Science	2	0	1	1	0
Information Technology	6	2	6	0	0
Manufacturing Technology	4	2	4	1	0
Media Arts	6	2	6	1	1
Transportation	4	2	4	1	0

Note: Totals for each program area represent number of respondents finding challenges in adding career and technical education pathways in that program area. There were 40 area technology center (ATC) principals who responded to the survey. Respondents could answer with more than one challenge.
Source: OEA Staff Survey of Principals and Superintendents

Table G.3
LAVEC Principals' Challenges In Adding CTE Pathways By Program Area, 2019

Program Area	Respondents Reporting Challenges	Types Of Challenges Reported			
		Qualified Teacher Not Available	Lack Of Necessary Equipment Or Supplies	Lack Of Student Interest	Pathway Not Approved By The Kentucky Department Of Education
Agriculture	11	3	3	7	1
Business and marketing	5	2	2	3	0
Construction	13	4	10	3	0
Engineering Technology	8	3	4	2	0
Family and Consumer Sciences	6	3	2	2	0
Health Science	5	1	5	0	0
Information Technology	6	3	3	3	0
Manufacturing Technology	11	4	9	1	0
Media Arts	11	5	7	4	0
Transportation	14	5	8	6	0

Note: Totals for each program area represent number of respondents finding challenges in adding career and technical education pathways in that program area. There were 30 local area vocational education center (LAVEC) principals who responded to the survey. Respondents could answer with more than one challenge.
Source: OEA Staff Survey of Principals and Superintendents

Appendix H

Percent Of Graduates Completing CTE Pathways By Student Group And Program Area

Table H.1 shows the percent of graduates completing career and technical education pathways by student group and program area in 2018.

Table H.1
Percent Of Graduates Completing CTE Pathways
By Student Group And Program Area, 2018

Program Area	Female (n=23,183)	Male (n=23,974)	All (n=47,157)	White (n=39,605)	Black (n=5,482)	Hispanic (n=2,576)	FRPL (n=24,454)	IEP (n=3,443)
Agriculture	4.3%	5.2%	4.7%	5.4%	0.8%	0.2%	4.4%	4.7%
Construction	0.2	4.2	2.3	2.6	0.6	0.1	2.8	4.6
Arts/AV	0.7	0.5	0.6	0.5	0.8	0.0	0.4	0.1
Business	4.6	5.0	4.8	5.0	3.7	0.2	4.3	1.9
Health	10.3	1.9	6.1	6.4	4.4	0.2	6.2	1.3
Hospitality	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Human services	7.7	1.4	4.5	4.7	3.4	0.2	5.3	4.9
IT	0.5	3.2	1.8	2.0	0.9	0.1	1.8	1.7
Law/safety	1.7	3.3	2.6	2.6	1.9	0.1	3.3	3.3
Manufacturing	0.4	5.2	2.8	3.2	0.8	0.1	2.9	3.8
Retail	1.8	2.7	2.3	2.3	1.8	0.1	1.9	1.0
STEM	0.5	3.0	1.8	2.0	0.7	0.1	1.2	0.7
Transportation	0.2	3.2	1.7	1.9	0.6	0.1	2.1	3.6

Source: Staff analysis of data from the Kentucky Center for Statistics

Appendix I

CTE Completers Successfully Completing Dual Credit Classes, Cooperative Learning Classes, And Industry Certificates

Table I.1 shows the percent of career and technical education (CTE) pathway completers earning a C or higher in a dual credit class, completing a cooperative learning credit, earning an industry certificate, or passing a Kentucky Occupational Skills and Standard Assessment (KOSSA) in 2018.

Table I.1
Percent Of Completers Earning C Or Above In A Dual Credit Class, Credit For Cooperative Education, or Meeting Benchmark On KOSSA Exam Or Industry Certificate By Program Area, 2018

		Percent		
Program Area	Total Number	Dual Credit Class	Cooperative Learning Credit	KOSSA or Industry Certificate
Agriculture	2235	32%	26%	72%
Construction	1064	17	14	67
Arts/AV	276	15	13	78
Business	2263	38	15	63
Health	2854	51	13	80
Human services	2123	27	12	75
IT	868	27	7	73
Law and public safety	1203	15	3	48
Manufacturing	1341	28	16	75
Retail	1063	33	34	74
STEM	836	43	12	82
Transportation and logistics	814	14	16	65

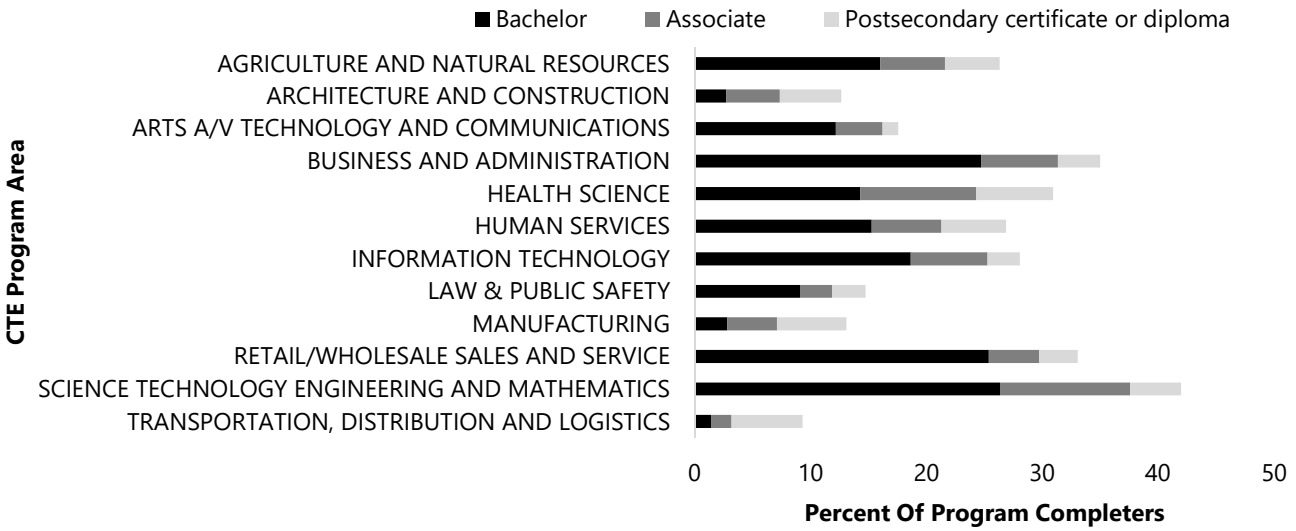
Source: Staff analysis of data from the Kentucky Center for Statistics

Appendix J

Career And Technical Education Pathway Completion And Postsecondary Education

Figure J.A shows the percent of 2013 career and technical education (CTE) pathway completing graduates earning postsecondary degrees or certificates.

Figure J.A
Percent of 2013 CTE Pathway Completing Graduates
By Level of Postsecondary Education Through 2018



Note that the figure reports education levels by program area whether or not the postsecondary education was attained in the academic area of CTE completion. For example, less than half of the CTE health completers who went on to earn a postsecondary credential or degree did so in health.
Source: Staff analysis of data from the Kentucky Center for Statistics.

Appendix K

Career And Technical Education Graduates Workforce Outcomes

Table K1 shows the percent of 2013 graduates working in different workforce sectors in 2018. Table K.2 shows the average wages of 2013 high school graduates who completed a career and technical education (CTE) pathway but did not earn a postsecondary certificate or degree.

Table K.1
Percent Of 2013 Graduates With No Postsecondary Degree Or Credential Working In Major Workforce Sectors By CTE Program, 2018

CTE Program Area	Total working	Food Service And Accommodation	Admin. Support	Construction	Health Care And Social Assistance	Manufacturing
Agriculture	1,262	7%	9%	10%	10%	21%
Construction	657	6	11	17	4	22
Arts/AV	196	11	7		8	17
Business	1,554	10	9	5	11	15
Health	807	11	9		31	8
Human services	923	15	9	1	21	13
IT	334	9	12	3	7	18
Law/safety	531	13	14	3	7	19
Manufacturing	667	4	8	16	1	35
Retail	129	14	10		8	11
Transportation	583	5	11	11	2	22
All completers	6,860	10	10	7	11	18
Noncompleters	12,626	15	12	4	9	13

Source: Staff analysis of data from the Kentucky Center for Statistics.

Table K.1
Percent Of 2013 Graduates With No Postsecondary Degree Or Credential Working In Major Workforce Sectors By CTE Program, 2018
Continued

	Total working	Public Administration.	Retail	Transportation And Warehousing	Wholesale Trade
Agriculture	1,262	4%	12%	4%	4%
Construction	657	4	15	4	4
Arts/AV	196		21	5	
Business	1,554	3	18	7	3
Health	807	1	13	3	2
Human services	923	2	18	3	2
IT	334		22	6	4
Law/safety	531	5	15	5	3
Manufacturing	667	2	9	5	3
Retail	129		17		
Transportation	583	3	16	6	5
All completers	6,860	3	15	5	3
Noncompleters	12,626	2	16	6	3

Source: Staff analysis of data from the Kentucky Center for Statistics.

Table K.2
2018 Average Wages Of 2013 Graduates With No Postsecondary Degree Or Credential By Workforce Sector And CTE Program Completion

Workforce Sector	Food Service And Accom.	Admin support	Construction	Health Care And Social Assistance	Manufacturing	Public Admin.	Retail	Transportation And Warehousing	Wholesale Trade
Agriculture	$12,794	$14,732	$34,193	$19,095	$36,518	$29,060	$19,782	$30,703	$26,413
Construction	11,535	17,933	31,809	18,763	33,159	27,130	16,357	15,973	28,554
Arts/AV	15,640	13,534	N/A	15,807	34,963	N/A	20,079	14,279	N/A
Business	14,056	17,526	27,129	18,716	35,235	26,126	18,653	25,006	N/A
Health	12,409	13,133	N/A	19,324	28,624	24,321	14,910	19,617	23,495
Human services	13,306	14,648	24,881	15,898	29,664	19,996	18,315	25,878	20,106
IT	13,781	16,654	N/A	15,520	32,211	N/A	16,521	23,547	31,734
Law/Safety	12,202	18,803	36,016	18,885	30,841	27,599	16,957	21,844	28,414
Manufacturing	12,426	17,606	31,396	N/A	36,250	34,922	20,087	33,512	29,150
Retail	17,375	17,456	N/A	18,522	38,589	N/A	21,348	N/A	N/A
Transportation	13,296	16,103	34,046	17,568	34,947	29,689	21,646	23,202	29,287
All completers	13,126	16,097	31,602	18,274	34,421	27,316	17,918	24,555	27,650
All noncompleters	11,919	12,735	24,803	18,048	31,461	28,267	15,763	22,102	23,884
All CTE wage Premium	10%	26%	27%	1%	9%	None	14%	11%	16%

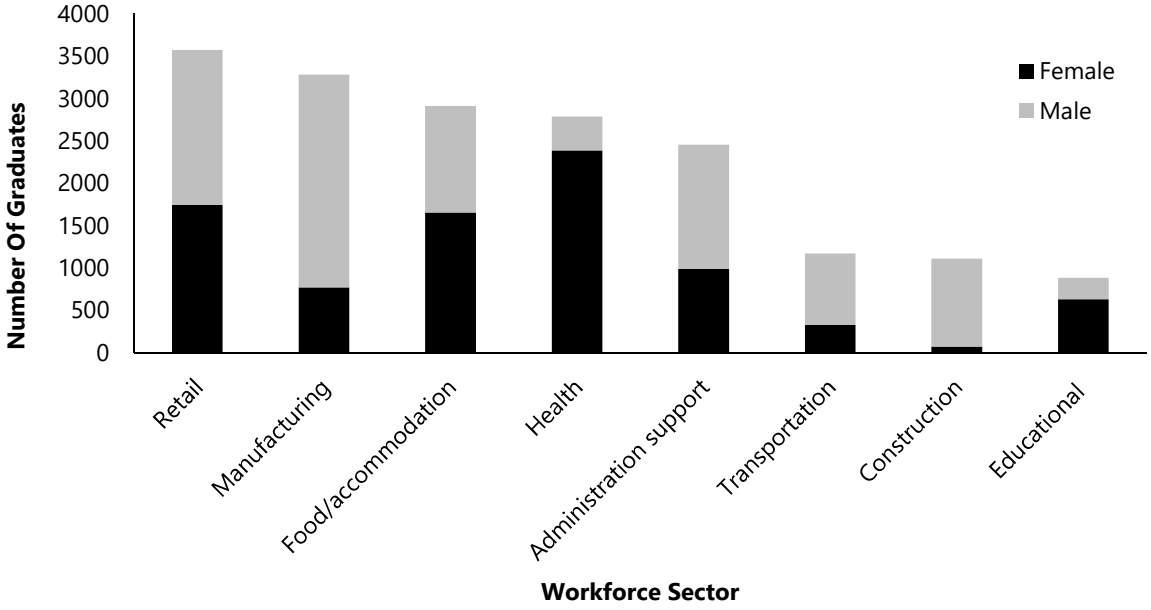
Source: Staff analysis of data from the Kentucky Center for Statistics.

Appendix L

Number Of 2013 Graduates By Industry Sector And Gender

Figure L.A shows the number of 2013 female and male graduates employed in major industry sectors in 2018. It shows the proportionately lower number of female graduates working in the manufacturing, transportation, construction, and administration support sectors and the proportionately lower number of male graduates working in the health, educational, and food/accommodation sectors.

Figure L.A
Number Of 2013 Graduates By Industry Sector And Gender, 2018



Note: The figure includes graduates of all postsecondary education levels but does not include any graduates enrolled in postsecondary education in 2018.
Source: Staff analysis of data from the Kentucky Center for Statistics

Appendix M

Major Industry Average Wages By Education Level

Table M.1 shows wages for 2013 graduates who were working in 2018 by education level and workforce sector.

Table M.1
Major Industry Average Wages By Education Level
2013 Graduates Working in 2018

	No Postsecondary Degree Or Certificate		Postsecondary Certificate		Associate's Degree Or Above	
Workforce Sector	**Number**	**Wages**	**Number**	**Wages**	**Number**	**Wages**
Accommodation and Food Services	2,625	$12,227	46	$15,284	241	$13,279
Administrative and Support and Waste Management and Remediation Services	2,244	13,783	57	20,140	155	22,866
Agriculture, Forestry, Fishing and Hunting	44	24,214	Redacted		12	22,690
Arts, Entertainment, and Recreation	154	11,513			66	11,401
Construction	987	28,082	42	30,405	83	31,568
Educational Services	293	14,904	24	17,983	569	29,469
Finance and Insurance	427	25,541	24	24,246	210	28,368
Health Care and Social Assistance	1,900	18,134	276	25,296	613	29,436
Information	254	22,753	12	26,721	81	22,524
Management of Companies and Enterprises	54	21,555	N/A		18	32,800
Manufacturing	2,930	32,714	115	38,348	238	43,016
Mining, Quarrying, and Oil and Gas Extraction	54	42,534	N/A		N/A	
Other Services (except Public Administration)	413	20,506	25	23,065	57	17,711
Professional, Scientific, and Technical Services	430	19,054	15	22,646	235	24,902
Public Administration	425	27,818	20	35,181	155	27,257
Real Estate and Rental and Leasing	184	21,386	N/A		43	22,338
Retail Trade	3,018	16,507	130	16,731	425	16,063
Transportation and Warehousing	1,056	22,855	36	31,267	81	24,338
Utilities	62	43,917	N/A		19	50,279
Wholesale Trade	578	25,298	20	29,980	96	31,590
(blank)	1,354	15,767	52	21,445	202	22,823
Grand Total	19,486	20,192	925	25,463	3,603	25,920

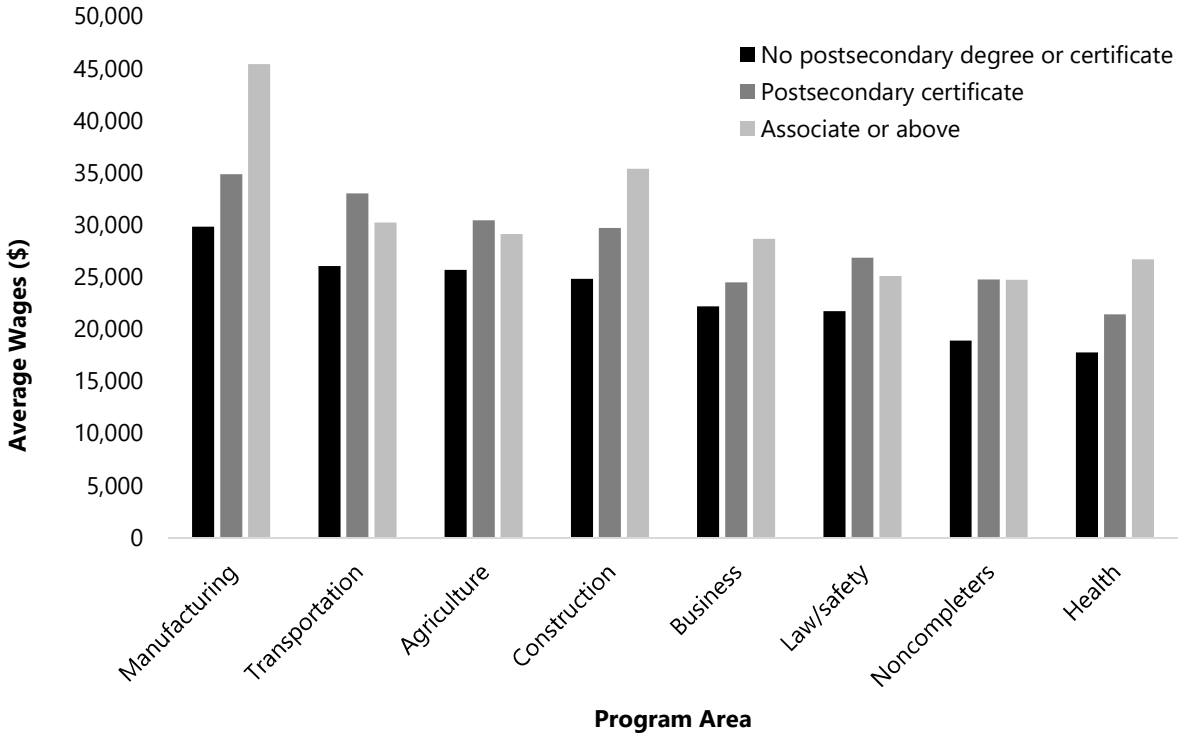
Note: N/A = Not available. Industry sectors include various job class codes. For example, those working in the health sector include janitors, drivers, and cooks. Table includes only those graduates who were not enrolled in postsecondary education at any point in the 2018 school year.
Source: Staff analysis of data from the Kentucky Center for Statistics

Appendix N

Wages Of CTE Graduates By Education And CTE Program Area

Figure N.A shows the average wages of 2013 career and technical education (CTE) graduates by level of education and program area completed. Table N.1 includes the average wages of 2013 career and technical education (CTE) graduates by level of education and program area completed.

Figure N.A
Average Wages Of 2013 CTE Graduates
By Level of Education And CTE Program Area, 2018



Source: Staff analysis of data from the Kentucky Center for Statistics.

Table N.1
Average Wages Of 2013 CTE Graduates
By Level of Education And CTE Program Area, 2018

CTE Program Area	No postsecondary degree or certificate	Postsecondary certificate	Associate or above
Manufacturing	$29,827	$34,891	$45,450
Transportation	26,077	33,020	30,230
Agriculture	25,683	30,444	29,133
Construction	24,847	29,714	35,398
STEM	24,199	N/A	46,225
Retail	23,249	N/A	21,342
Business	22,205	24,510	28,678
Law/safety	21,741	26,852	25,108
IT	21,290	27,727	23,151
Education	20,192	15,051	29,084
Food sciences	18,979	20,191	25,290
Noncompleters	18,900	24,764	24,745
Health	17,763	21,434	26,712

Note: N/A = Not available due to redaction**.**
Source: Staff analysis of data from the Kentucky Center for Statistics.

Appendix O

Highest Earning CTE Pathways

Table O.1 displays the top 20 highest-wage career and technical education (CTE) pathways for 2013 graduates who completed CTE pathways. The table includes only those workers that did not obtain a postsecondary degree or credential.

Table O.1
Top 20 Highest-Wage Career And Technical Education Pathways
For 2013 High School Graduates With No College Degree, 2018

Pathway	Number Of Graduates	Average Wages
Heavy equipment sciences	10	$37,663
Computerized manufacturing and machining	88	33,183
Air conditioning technology	20	32,225
Welding (manufacturing)	440	29,933
Industrial maintenance technology	60	29,540
Agriculture power structured technology systems	307	29,521
Metal fabrication	11	28,749
Agriculture Education/Communications and leadership	18	28,357
Machine tool technology - secondary	36	27,962
Electricity	204	27,937
Computer aided drafting	26	27,050
Automotive technology	460	26,603
Marketing technology	26	26,059
Animal systems	527	25,976
Wood products (manufacturing)	37	25,928
Environmental sciences/natural resources systems	84	25,872
Fire protection and safety technology	17	25,620
Technology	161	25,283
Diesel technology	41	24,575
Autobody collision/repair technician	96	24,471

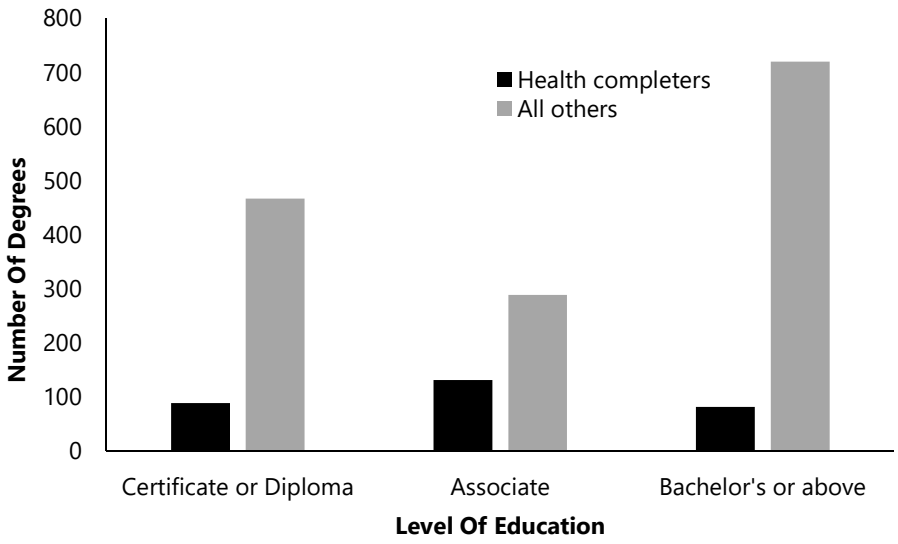
Note: Includes only graduates not enrolled in postsecondary education in 2018. Includes graduates who earned a postsecondary certificate but none who earned a degree of associate or above.
Source: Staff analysis of data from the Kentucky Center for Statistics.

Appendix P

Workforce And Postsecondary Education Outcomes Of 2013 Health Pathway Completers

Figure P.A shows the number of degrees obtained by health pathway completers compared to all other graduates. Table P.1 shows the percent of health pathway completers earning a postsecondary degree or credential in heath fields and all other fields. Table P.2 shows average wages of 2013 graduates with postsecondary education in health fields.

Figure P.A
Number Of Postsecondary Credentials Earned In Health Fields
By Class of 2013 Graduates Through 2018
Health Pathway Completers And All Other Graduates



Source: Staff analysis of data from the Kentucky Center for Statistics

Table P.1
Percent Of 2013 Graduates Earning Postsecondary Credentials Or Degrees
In Health And Other Fields Through 2018
High School Health Pathway Completers And All Other Graduates

	Health (n=1,996)		All Others (n=42,470)	
Postsecondary credential	Health Fields	Other Fields	Health Fields	Other Fields
Certificate or diploma	4%	9%	1%	4%
Associate's degree	7	11	1	5
Bachelor's or above	4	12	2	17

Source: Staff analysis of data from the Kentucky Center for Statistics.

Table P.2
Average Wages Of 2013 Graduates With Postsecondary Education In Health Fields
By Postsecondary Education Level
High School CTE Health Pathway Completers And All Others, 2018

High School CTE	Postsecondary Certificate		Associate's Degree		Bachelor's Degree Or Higher	
Pathway	Number	Wages	Number	Wages	Number	2018
Health	39	$23,818	50	$32,840	32	$34,767
All others	216	25,791	120	30,951	223	37,219

Note: Includes only graduates not enrolled in postsecondary education in 2018.
Source: Staff analysis of data from the Kentucky Center for Statistics.

Appendix Q

Workforce Participation And Average Wages By CTE Pathway Completion And Local Workforce Area

Table Q.1 shows workforce participation rates, wages, and salaries for 2017 graduates that did and did not complete career and technical education (CTE) pathways by local workforce area. Across all workforce areas CTE completers earned more and were more likely to participate in the workforce.

Table Q.1
Workforce Participation and Average Wages 2017 Graduates
By CTE Pathway Completion and Local Workforce Area, 2018

	Average Wages			Workforce Participation		
Local Workforce Area	CTE Noncompleter	CTE Completer	CTE Wage Pemium	CTE Noncompleter	CTE Completer	CTE workforce participation ratio
Bluegrass (n=2,621)	$9,159	$12,250	34%	73%	78%	7%
Cumberlands(n=1,171)	9,791	12,356	26	71	79	11
EKCEP (n=1,142)	7,877	10,338	31	51	64	24
Green River (n=774)	8,745	11,927	36	61	76	26
Kentuckiana Works (n=3632)	9,728	12,252	26	76	83	10
Lincoln Trail (n=1170)	9,866	13,762	39	74	79	7
Northern Kentucky (n=1753)	9,711	12,154	25	76	76	0
South Central (n=1270)	9,827	13,394	36	70	79	12
TENCO (n=771)	8,213	10,819	32	65	75	14
West Kentucky (n=1285)	8,619	10,602	23	63	71	13
State (n=15682)	9,305	12,036	29	70	76	9

Note: EKCEP = Eastern Kentucky Concentrated Employment Program. TENCO = TENCO Workforce Investment Board.
Source: Staff analysis of data from the Kentucky Center for Statistics.

Appendix R

Highest-Earning Industry Certificates

Table R.1 shows the highest earning industry certificates for 2017 graduates working in 2018. The table reflects only those certificate earners not enrolled in a postsecondary education program. Average wages for all 2017 graduates not enrolled in postsecondary education in 2018 were $10,208.

Table R.1
Highest-Wage Industry Certificates
2017 Graduates Not Enrolled In Postsecondary Education
2018

Industry Certificate	Number Of Graduates	Average Wages
NIMS - Machine Tool Certification (Level 1)	49	$22,432
NCCER - Electrical Technician (Level 1)	18	20,591
ASE Student Certification - Suspension and Steering	77	17,998
2-F (AWS) Qualification Certification	167	17,636
AWS-Sense Certification (Level 1)	45	17,004
Kentucky TRACK Pre-Apprenticeship Certification	32	16,832
Kentucky Department of Transportation 3-G	180	16,755
ASE Student Certification - Brakes	104	16,559
ASE Student Certification - Automotive Maintenance and Light Repair	209	16,306
ASE Student Certification - Electrical/Electronic Systems	75	16,011
WCA - Woodwork Career Alliance (Green Credential)	15	15,813
Microsoft Access	13	15,761
Adobe - DreamWeaver	14	15,693
ASE Student Certification - Diesel Engines	12	15,469
EPA Section 608 Certification	32	15,080
ASE Student Certification - Engine Repair	14	14,731
NCCER - Industrial Maintenance Electrical & Instrumentation Technician (Level 1)	20	14,644
Internet and Computing Core Certification (IC3-3 Exams Required)	21	14,546
CompTia Strata IT Fundamentals	10	14,231
Autodesk Inventor Certified User	16	14,121

Note: Includes only graduates not enrolled in postsecondary education in 2018. Includes graduates who earned a postsecondary certificate but none who earned a degree of associate or above. The analysis eliminates the many higher wage industry certificates that had fewer than 10 graduates working and not enrolled. KOSSA exam data were not available for this report. N/A = redacted due to low n counts.
Source: Staff analysis of data from the Kentucky Center for Statistics.

Appendix S

2018 Outcomes 2017 Graduates
Additional Indicators

Tables S.1 and S.2, show wages for completers of cooperative education courses and dual The analyses are completed for career and technical education (CTE) pathway completers and noncompleters.

Table S.1
Average Wages By Cooperative Education Credit Completion
And Grade Point Average
CTE Pathway Completers, 2018

	Earned Cooperative Credit		Did Not Earn Cooperative Credit		
GPA	Number	Wages	Number	Wages	Co-op Wage Premium
< 2	60	$12,516	616	$10,937	14%
2 to 2.99	387	15,469	2,605	11,951	29
3 to 3.5	197	14,446	909	11,782	23
> 3.5	67	11,557	344	10,103	15
Total	711	14,568	4,475	11,633	25

Note: Includes only graduates not enrolled in postsecondary education in 2018.
Source: Staff analysis of data from the Kentucky Center for Statistics.

Table S.2
Average Wages By Cooperative Education Credit Completion
And Grade Point Average
CTE Noncompleters, 2018

	Earned Cooperative Credit		Did Not Earn Cooperative Credit		
GPA	Number	Wages	Number	Wages	Co-op Wage Premium
< 2	188	$10,679	2,394	$8,920	20%
2 to 2.99	480	11,667	4,649	9,872	18
3 to 3.5	142	11,592	1,484	9,682	20
> 3.5	83	8,803	1,009	5,531	59
Total	895	11,195	9,601	9,129	23

Source: Staff analysis of data from the Kentucky Center for Statistics.
Note: Includes only graduates not enrolled in postsecondary education in 2018.

Tables S.3 and S.4, show postsecondary enrollment rates for 2017 high school graduates who did and did not complete dual credit courses. The analyses are completed for career and technical education (CTE) pathway completers and noncompleters.

Table S.3
Postsecondary Enrollment Rates By High School Grade Point Average And Dual Credit Completion
Pathway Completers 2017 Enrolled In 2018

	Earned Dual Credit			Did Not Earn Dual Credit		
GPA	Number Dual Credit	Number Enrolled	Percent Enrolled	Number Dual Credit	Number Enrolled	Percent Enrolled
2 to 2.99	742	350	47	5,268	1,836	35
3 to 3.5	1,235	945	77	2,961	1,758	59
> 3.5	1,817	1,611	89	2,020	1,596	79

Note: The number of students with GPAs below 2.0 were redacted due to low N counts.
Source: Staff analysis of data from the Kentucky Center for Statistics.

Table S.4
Postsecondary Enrollment Rates By High School Grade Point Average And Dual Credit Completion
CTE Noncompleters 2017 Enrolled In 2018

	Earned Dual Credit			Did Not Earn Dual Credit		
GPA	Number Dual Credit	Number Enrolled	Percent Enrolled	Number Dual Credit	Number Enrolled	Percent Enrolled
< 2	47	8	17	3,789	466	12
2 to 2.99	856	495	58	10,222	3,727	36
3 to 3.5	1,696	1,326	78	5,406	3,429	63
> 3.5	3,270	2,796	86	5,092	3,589	70
Total	5,869	4,625	79	25,005	11,215	45

Source: Staff analysis of data from the Kentucky Center for Statistics.

Appendix T

CTE Wage Premiums By Student Group

Tables T.1, T.2, and T.3 show CTE completion rates and wage premiums for different students groups.

Table T.1
Average Wages 2015 Graduates With No Postsecondary Degree Or Credential By Pathway Completion And FRPL Eligibility, 2018

	CTE Completers		CTE Noncompleters		CTE wage
	Number	Wages	Number	Wages	premium
FRPL	3,894	$16,994	7,710	$14,328	19%
Not FRPL	2,308	20,737	4,803	15,944	30

Note: FRPL = Eligible for free or reduced-price lunch. Includes only graduates not enrolled in postsecondary education in 2018.
Source: Staff analysis of data from the Kentucky Center for Statistics.

Table T.2
Average Wages 2015 Graduates With No Postsecondary Degree Or Credential By Pathway Completion And Race And Ethnicity, 2018

	CTE Completers		CTE Noncompleters		CTE wage
Race/Ethnicity	Number	Wages	Number	Wages	premium
Black	450	$15,090	1,994	$12,526	20%
Hispanic	202	19,657	530	17,249	14
White	5,546	18,671	9,840	15,333	22

Note: Includes only graduates not enrolled in postsecondary education in 2018.
Source: Staff analysis of data from the Kentucky Center for Statistics.

Table T.3 shows 2018 wage premiums for 2017 graduates by eligibility for IEP. Complete data for IEP completers in 2015 were not available for this report.

Table T.3
Average Wages 2017Graduates With No Postsecondary Degree Or Credential By Pathway Completion And IEP Eligbility, 2018

	CTE Completers				CTE Noncompleters			
	Total not enrolled	Number working	Wages	Percent working	Total not enrolled	Number working	Wages	Percent working
IEP	724	443	$10,526	61%	1,805	991	$8,189	55%
Not IEP	6,068	4,743	12,176	78	13,229	9,505	9,421	72

Note: Includes only graduates not enrolled in postsecondary education in 2018.
Source: Staff analysis of data from the Kentucky Center for Statistics.