



# Ready for Causal Research: A National Evaluability Assessment of Career and Technical Education Programs (Final Report)

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This report is available on the CTE Research Network website at https://cteresearchnetwork.org/resources/evaluability-assessment-final-report.

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# Introduction

Career and technical education (CTE), also known as vocational, occupational, and workforce education, is widespread and popular at both the high school and college levels. Yet, despite a plethora of research on CTE, little is known about the causal effects of CTE—and of all its different varieties—on student outcomes. The Institute of Education Sciences, the independent, nonpartisan research arm of the U.S. Department of Education, funded the CTE Research Network in 2018 to address this lack of evidence. Through multiple efforts, the network seeks to encourage new CTE impact studies.[1]

One such effort is the evaluability assessment presented in this report. Evaluability assessments (also called feasibility studies) are used in education and other fields, such as international development and health care, and seek to determine whether a program or activity can be reliably evaluated. There are different definitions and approaches, but, in general, evaluability assessments tend to consider two primary factors: (a) a program or activity's theory of change and whether the theory of change is consistent with the program's components and activities and (b) whether the necessary data are available and accessible to conduct a study (Davies, 2013; Walser, 2015).

Our evaluability assessment of CTE programs aimed to point education researchers to CTE programs and program models that have been prescreened for the elements needed for a causal evaluation and are able and willing to participate in research. For more than 100 programs nationwide, we examined the following key factors:

- A theory of change and the program components that support it
- The size of the program and whether enough students are served to enable statistical inference
- Opportunities for creating student comparison groups that have sufficient service contrast
- Student eligibility and selection criteria that can make possible quasi-experimental or experimental research designs
- Data availability

Also important to research feasibility are program administrators who are interested in and willing to collaborate on a study, as well as agreeable to adjusting program implementation (if needed) to facilitate the conditions for a rigorous, causal study. Of the programs considered, the study yielded four that are most ready for rigorous research.

This report first provides an overview of CTE and a brief summary of the existing literature. Then it describes the evaluability assessment process, followed by a discussion of the factors that can facilitate or hinder causal research in CTE. Finally, the report describes the four programs identified as most immediately viable for causal research.

# Career and Technical Education

CTE encompasses a range of education and training programs focused on providing students with the academic, technical, and employability skills they need to succeed in future careers. Nationally, CTE programs serve a broad range of students, from middle schoolers to adults in both K–12 and postsecondary education settings. In the

[1] See https://cteresearchnetwork.org/ for more information.

2016–17 school year, 98 percent of public school districts in the United States offered CTE to high school students (Gray & Lewis, 2018; National Center for Education Statistics, Fast Response Survey System, 2017). Although CTE course taking among high school students has declined in the past few decades, a majority still take at least one CTE course (Malkus, 2019; National Center for Education Statistics, 2013). Among undergraduate credential-seeking college students, 38 percent pursue associate degrees or certificates in occupational fields of study (Zhang & Oymak, 2018).

CTE programs often are categorized into 16 career clusters, with numerous specializations in each cluster.[2] Programs are delivered in a range of formats and settings but are most commonly structured as multiyear course sequences that include work-based or other applied learning; the latter may happen in workplaces, hands-on instructional settings such as laboratories, or simulated work environments in school settings. High school programs are delivered as elective course sequences in comprehensive high schools, in regional CTE centers that students typically attend part-time, in full-time technical high schools, or online (National Center for Education Statistics, Fast Response Survey System, 2017). Many high schools have career academies, which vary nationally but tend to be structured as small learning communities with integrated technical and academic instruction and organized within a broad career theme. High schools may offer one or more career academies or have "wall-to-wall" academies, meaning that all students within a high school are enrolled.

Given the variability in format, setting, location, and specific program components, there have been evolving efforts by national and regional organizations to define the elements that quality CTE programs should include (Imperatore & Hyslop, 2018).[3] These efforts identified and recommended a variety of promising program components regardless of delivery format or setting: blended academic and technical curricula and shared planning for respective instructors; career advising systems that are longitudinal and individualized for students; a review of regional and national labor market information and community needs in establishing and continuing programs; work-based learning experiences on a continuum from broad exploration to immersion; the opportunity for students to earn industry-recognized credentials; and incorporation of career and technical student organizations (CTSOs) and industry-sponsored or -guided competitions.

Additional recommendations are the direct participation of industry and greater connectivity between secondary and postsecondary programs. For example, employers can serve as advisors on curricula, provide work-based learning placements, mentor students, and donate equipment, among other contributions (Advance CTE, 2019). High school CTE programs increasingly offer students the opportunity to earn college credits through articulation agreements and dual-enrollment programs.

The federal legislation that authorizes CTE funding to the states, the Strengthening Career and Technical Education for the 21st Century Act (also known as Perkins V), requires federally funded programs to include some of the aforementioned elements and encourages others. For example, states must now adopt one of three "quality" indicators—participation in work-based learning, earning of postsecondary credits, or attainment of a recognized postsecondary credential—when reporting on CTE student outcomes.

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[2] The National Career Clusters® Framework organizes CTE into 16 clusters that include 79 pathways. The clusters are agriculture, food, and natural resources; architecture and construction; arts, A/V technology, and communications; business management and administration; education and training; finance; government and public administration; health sciences; hospitality and tourism; human services; information technology; law, public safety, corrections, and security; manufacturing; marketing; science, technology, engineering, and mathematics; and transportation, distribution, and logistics. However, not all states classify CTE into these exact 16 clusters.

[3] Also see the Association for Career & Technical Education High-Quality CTE Tools library; Pathways to Prosperity five key implementation elements; and Linked Learning's Four Crucial Elements.

# The Research on Career and Technical Education

A great deal of research literature on CTE addresses a broad range of topics, such as changes in offerings and student participation across time, CTE teacher preparation, and work-based learning. This literature and evidence base on CTE is largely descriptive and suggests that CTE is related to a range of positive outcomes, including high school graduation, postsecondary enrollment, and measures of labor market success for participants (Rosen et al., 2018). A few studies use more sophisticated methods, including randomized controlled trials (RCTs) and quasi-experimental methods, such as regression discontinuity (RD) or instrumental variables (IV) approaches, to demonstrate the causal effect of high school career academies and stand-alone CTE high school programs on student outcomes.

Specifically, robust evidence exists on the impact of attending a career academy from several prominent lottery-based studies (Hemelt et al., 2019; Kemple, 2008; Page, 2012) and a quasi-experimental study that used a student's proximity to a high school offering a career academy as an instrument for participating (Cullen et al., 2005). These studies found that well-implemented career academies can have positive impacts on student outcomes, including high school completion, postsecondary enrollment, and labor market outcomes. Robust evidence also suggests positive effects for high school students attending a stand-alone CTE high school stemming from two RD studies leveraging strict cutoffs in the admission requirements, although the positive effects held for only male students in one of the studies (Brunner et al., 2019; Dougherty, 2018).

However, much more research is needed to determine the causal effects of other types of CTE programs, including, for example, youth apprenticeships, employability skills programs, and postsecondary CTE programs. There is little causal research on the effects of state- or districtwide CTE programs; the impact of services provided by regional CTE support providers; or the impact of curricula, courses, and pathways from independent developers. More research also is needed to determine whether the promising evidence on high school career academies and stand-alone CTE high schools can be replicated in additional settings and with different student populations; these programs continue to grow nationally.

# The Evaluability Assessment

The evaluability assessment was a four-step process with the goal of identifying up to six CTE programs or models whose leaders show interest in participating in causal research and that have the most potential for rigorous evaluation. Appendix A provides detail on all four steps. In step 1, the study began with broad outreach to the CTE community to give a variety of CTE stakeholders the opportunity to nominate programs or models to be studied that they felt were of high quality or that appeared to lead to positive student outcomes. Information about this study and a nomination form were posted on the CTE Research Network's website. The form asked for basic descriptive data on the program being nominated and was posted between January and June 2019. The study also was publicized by the CTE Research Network's lead partners, particularly the Association for Career and Technical Education, through a variety of e-newsletters with different distribution lists. In total, we received and reviewed 112 entries. Programs that were in operation for at least 2 years and served at least 100 students per year were invited to progress to step 2 and complete a longer online questionnaire.[4] Researchers followed up

[4] Programs in operation for fewer than 2 years at the time of nomination did not advance in the process because of the assumption that newly formed programs can experience large fluctuations in their key components in their first years of operation. Programs serving fewer than 100 students did not advance because they would be difficult to study in a causal manner, having low statistical power to detect any differences in the outcomes of participating students and established comparison students.

with these programs to assist by email or telephone in completing the questionnaire. Appendix B summarizes the data collected in steps 1 and 2.

The data collected in these first two steps of the study helped the study team understand the key components of the programs. These components included the enrollment process; students' experiences in areas such as course taking, advising, and work-based learning; and program structure, such as core academic and technical instructor collaboration, teacher professional development, and postsecondary and industry relationships. Drawing on the promising components thought to indicate quality compiled from multiple, national CTE initiatives or organizations, the study team assessed whether programs incorporated these components based on the information provided by the program representatives. The study team also noted other descriptive characteristics of the programs, such as the number of students served, in which types of settings, and in which states.

**Promising Program Components Used by the Study Team**

- Blended academic and technical courses or curricula
- Shared academic and technical instructor planning
- Career advising or guidance systems, processes, or supports
- Industry participation in curriculum and/or program development or delivery
- Review of labor market information
- Career exploration through work-based learning
- Career-specific work-based learning
- Immersive experiences for work-based learning, such as internships or preapprenticeships
- Opportunity to earn related credentials
- Direct links to postsecondary education through dual-enrollment expectations, articulation agreements with local institutions, or other postsecondary input
- Incorporation of CTSOs or industry competitions

After assessing the programs, the study team, with input from advisors, determined multiple criteria that could advance programs to step 3 of the process. The criteria were based on favorable conditions for causal research and the presence of promising components in the nominated programs. For example, programs that reported having more demand than they could accommodate and admitted students via lottery (or could potentially do so) were advanced to step 3. Oversubscription and admission by lottery would allow for the random selection of participants to mitigate unobservable characteristics that might influence their outcomes. Serving a large number of students (more than 500) also was a criterion that advanced programs because it would allow researchers a large enough sample for adequate statistical power to detect any differences in student outcomes. In addition, programs were advanced in the process if they self-reported a large number of the promising program components thought to indicate quality, even if they did not report unmet demand or large numbers of students served. The intention was to advance these programs based on quality and then learn more about potential opportunities for causal research during the interview process.

In step 3, researchers collected additional information through telephone interviews with program leaders and created a logic model for each program to describe components that could lead to possible measurable benefits for students. The data collected also helped determine the possibility for rigorous research by documenting important factors such as the number of participants, data availability, and student selection criteria that could be used or adapted to support a causal study. Appendix C presents brief descriptions of the 25 programs that advanced to step 3 of the process and agreed to interviews and inclusion in the report.

The study team intended to conduct site visits to a small number of potential finalists to verify program information and collect additional details in step 4 of the process. However, site visits were disrupted by school closures and

travel restrictions caused by the COVID-19 pandemic in spring 2020. Thus, we instead conducted additional telephone interviews with those programs. Based on those and prior interviews, the questionnaires, and program documents, four programs (described later in the report) are recommended for causal research.

# Factors That Facilitate or Hinder Causal Research Across CTE Program Types

Through our evaluability study and experience conducting causal research on CTE programs, we identified multiple factors that can facilitate or hinder causal CTE research in various settings and contexts. In this section, we summarize these factors so that CTE practitioners and researchers can consider them when assessing whether causal research is possible or appropriate in their context. We begin by describing a series of questions that researchers and practitioners should consider in determining, generally, whether a causal study may be viable. We go on to describe issues that arise in particular CTE educational settings and/or delivery models and describe how they relate to the specific questions.

## Key criteria for causal research

The goal of causal research is to determine the differences in outcomes for participants in a CTE program relative to what those outcomes would have been if the individuals had not participated. In a causal research study of a CTE program, researchers attempt to make apples-to-apples comparisons of key outcomes for both program participants and nonparticipants. Causal research is challenging because of self-selection: that is, participants in promising CTE programs choose to participate in them and hence differ from nonparticipants in meaningful ways that are likely to correlate with relevant outcomes. CTE practitioners and researchers should consider the following questions when determining whether causal research is possible or appropriate in their context.

1. **Is the program likely to show measurable, positive impacts on the participants?** To find positive causal impacts of a CTE program on desired outcomes, the program itself must be designed and implemented in a way that is likely to lead to improvement in those outcomes relative to business-as-usual, or what the students would have experienced in the absence of treatment.[5] To determine whether this might be the case, it can be useful to develop a logic model that articulates how the key program elements lead to changes in processes, outputs, and outcomes. It also can be useful to consult existing research to determine whether any studies suggest that the program or particular features of it have been shown to be related to specific outcomes. Similarly, one can consult research on promising practices for CTE, such as those we identified for this evaluability study, to determine the extent to which the program is aligned with such practices. Finally, it is important to assess the extent to which the program is implemented as intended and whether specific program features could be modified to address challenges prior to conducting a rigorous study. All of these considerations are important before embarking on a rigorous study, given the cost and effort involved.
2. **Is there a meaningful treatment-control contrast?** When conducting a causal research study, researchers must understand the nature of not only the intervention or program they wish to evaluate but also the counterfactual; that is, the programs and services received by students in the control condition. In the extreme case where control students receive a set of programs and services that are likely to improve their outcomes, it can become difficult to statistically distinguish the difference in outcomes between treatment and control

[5] Researchers may want to conduct causal research on widely scaled programs, particularly those that are costly, regardless of the anticipated effects. If such programs are found to be ineffective, policymakers could use such evidence to shift resources to other programs.

students. This can lead to a case where a study shows little effect of an intervention even when it is actually producing positive results for students. For example, if a researcher wanted to evaluate the impact of a CTE program that leverages an innovative curriculum and learned that students who do not receive the treatment typically end up in a similar program with another well-regarded curriculum, the researcher might not anticipate finding a meaningful difference in outcomes for treatment and control students. At the very least, knowledge about the control condition and the anticipated outcomes of students who receive it is important for interpreting the results of casual studies. Where possible, however, researchers should strive to focus on situations and design studies where the counterfactual is meaningful so that they can anticipate that treatment students are likely to have better outcomes than control students (Ross et al., 2020).

3. **Is there a sufficient number of participants to yield meaningful effects?** As with any study, it is important to focus on situations and design studies with a sufficient number of students to detect reasonable effect sizes. The required sample size relates directly to both the nature of the counterfactual and the anticipated differences in outcomes for treatment and control students based on a priori knowledge of the treatment and counterfactual conditions. Thus, sample size can be a limiting factor when researchers (a) desire to study programs with meaningful counterfactuals that are implemented at a small scale (such as a pilot program implemented within a single high school) and (b) wish to study more widely implemented programs with larger sample sizes but less meaningful counterfactuals (such as a novel software package that students can use in a particular CTE pathway that is implemented widely across many districts but not well integrated within the overall curriculum and pathway).
4. **Are data available to track intended outcomes for both participants and nonparticipants?** Researchers need to be able to capture accurate data on the intended outcomes of participants and nonparticipants to conduct a causal research study. Although most programs capture participation data, it often is less common to capture outcome data, particularly when outcomes are observed after program completion. Even when programs try to capture outcome data, it is difficult and often uncommon to capture such data from nonparticipants. Wherever possible, it is advantageous to use administrative databases that track relevant outcomes for all students in a district, college system, or state.
5. **Is there potential for a causal research design?** Although researchers can use a variety of methods to address the self-selection issue and make apples-to-apples comparisons for a causal study, they can be used only under certain circumstances. Here, we briefly describe the most common methods and the contexts in which they can be used.
    - **Randomized studies.** The “gold standard” for causal research is an RCT study, where interested students are randomly assigned to participate in the program or a well-defined control condition. Unfortunately, implementing an RCT is logistically challenging and often infeasible given constraints facing program administrators. Naturally occurring lotteries, such as those used to allocate slots in oversubscribed district magnet programs, may offer researchers the opportunity to conduct an RCT while placing much less burden on administrators. However, lottery-based studies often suffer from numerous challenges that limit their causal interpretation. These challenges include limited statistical power (there must be a sufficient number of students randomized), nonrandom attrition (e.g., where lottery winners are more likely to remain in the district than are lottery losers), and administrators giving preference to specific applicants based on information that is unobservable by the researcher (e.g., parents who are strong advocates for their children may be able to get their children into the program even if they do not win the lottery).

- **Regression discontinuity studies.** An RD study mimics an RCT in settings where students are selected for participation using an index with a well-defined cut point. For example, students may be chosen for participation based on whether they score above or below a given score on an assessment. In other cases, students may be ranked based on a range of observable factors—such as their score on an assessment, their grade point average, an essay, and an interview—and only the top 20 students based on the ranking are offered admission. An RD design uses statistical techniques to compare students just above or below the threshold for admission. The idea is that students just below or above the cut point should be very similar to one another, so the difference in outcomes between those just above and those just below the cut point provides the impact of the program.

  RD studies also suffer from various challenges that limit the types of settings where the approach is viable and/or may undermine their causal interpretation. These challenges include limited statistical power, limited interpretation of effects (because they are truly valid only for students scoring near the cut score), and manipulation of the score or cut score (e.g., administrators may lower the ranking required for admission to admit an additional student whom they believe will be successful based on other private information[6]).

- **Differences-in-differences (DiD) approaches.** In a DiD study, researchers measure treatment and comparison groups across time. They evaluate program impacts by assessing the degree to which outcomes for the treatment group deviate from their baseline trend after the intervention differently from the comparison group. For example, a district may implement a novel CTE program in half of its comprehensive high schools in a given year and compare how student outcomes change in the schools where the program is implemented, relative to schools where it is not implemented. This approach effectively "differences out" any time-constant factors that make the schools where the program is implemented unique relative to the schools where the program was not implemented. The DiD approach, also referred to as a comparative interrupted time series, is a strong quasi-experimental design that has been shown to come close to replicating the experimental results for RCTs and RD studies when well implemented in appropriate settings. A DiD approach also is typically easier and less costly to implement than an RCT.

  DiD methods also suffer from challenges that can undermine their causal interpretation or limit the generalizability of findings. For example, researchers must be careful to ensure that the treatment group does not begin receiving other programs or resources that might affect their outcomes at the same time that they receive the treatment. Otherwise, the change in outcomes for the treatment group could be attributed to those additional programs and services, not to the intervention being studied. Returning to our previous example, if a district rolled out a peer mentoring program at the same time it implemented a novel CTE program, and the peer mentoring program was better implemented in schools that were implementing the novel CTE program, then part of the observed changes in student outcomes could be attributable to the mentoring program. It also is crucial to ensure that the treatment and comparison groups have similar outcome trends prior to treatment. Although preexisting trends can be controlled for statistically with sufficient preprogram data, differences in such trends generally suggest that the comparison group is not an ideal counterfactual for the treatment group and lessen our confidence in the causal interpretation of the results from a DiD study.

[6] Manipulation of the cut score is similar in nature to nonrandom assignment in an RCT, where administrators give preferences to applicants based on unobservable factors such as parental advocacy. In both cases, the behavior yields a situation where students are not truly randomized.

- **Instrumental variables studies.** An IV study attempts to mimic an RCT in settings where a variable influences whether a student participates in a program but does not directly affect student outcomes (outside its influence on participation). In such settings, researchers can use statistical methods to estimate the relationship between the instrument and the outcome and then scale that estimate up by an estimate of the relationship between the instrument and participation. The instrument effectively acts as a source of random variation in treatment. As an example, a researcher might use a student's distance to a treatment site with a novel CTE program as an instrument for whether the student participates or not, arguing that distance surely influences whether the student would participate but should have little or no effect on his/her academic or labor market success.

  Unfortunately, in practice, IV methods face challenges that tend to undermine their causal interpretation and/or limit the generalizability of findings in most cases, so the method is less common among causal studies. Importantly, it is rare to find an instrument that truly has no influence on outcomes. Returning to our previous example, one could argue that distance to a treatment site might be correlated with job opportunities that could influence a student's labor market outcomes. Even in cases where the instrument is truly valid, the estimates from an IV model apply only to the types of students whose participation is most likely influenced by the instrument. So, even if we believe that distance to a treatment site does not directly affect labor market outcomes, our estimates from using distance as an instrument must be interpreted as the effect of participating in the program for students who are most likely to decide to participate or not because of their proximity to the site. This could be problematic, if, for example, students with fewer resources and access to reliable transportation are those who are more likely to change their plans to participate because of the program's proximity. IV models also can suffer from statistical power issues, particularly in cases where the instrument is only weakly related to participation—a phenomenon referred to as "weak instruments."

## Factors arising in particular CTE settings

While conducting our evaluability study, we uncovered patterns in the way in which general questions and issues about the appropriateness and viability of causal research types tend to manifest themselves across CTE contexts. In this subsection, we distill some of these patterns and lay out salient issues and questions that arise when attempting to conduct causal research across the most common CTE settings.

### Local education agencies (school districts)[7]

Local education agencies (LEAs) often are natural research partners for conducting causal CTE research because they operate the majority of CTE programs designed for secondary students. However, the nature and context of CTE education varies considerably across and within LEAs. Our evaluability study identified several innovative CTE programs operated by LEAs that range from stand-alone CTE courses to well-defined career pathways to regional CTE secondary schools. These programs also vary considerably in the extent to which there are clear expectations for key program components such as advising, dual enrollment, and/or work-based learning. Our research suggests that without such features in place, we would be less likely to be able to identify a causal impact of the program, particularly on longer term outcomes such as college enrollment and labor market

[7] Interviewed programs in this category include Brookwood Integrated Entrepreneurship Program at Brookwood High School; Evanston Township High School Career and Technical Education Department; Miami-Dade County Public Schools Career-Themed Pathways and CTE Program; Introduction to the Trades Skilled Trades Program; Missoula County Public Schools District Automotive Program; Naperville School District 203 CTE Program; Northwest ISD Biomedical Science Academy; Perquimans County Schools CTE Program; Union Grove High School CTE Program; and William S. Hart Union High School District Career and College Readiness program. See Appendix C for program descriptions.

success. *We thus encourage researchers to focus on programs exhibiting a well-defined career pathway or program of study and having consistent expectations for such program components.* Doing so would allow researchers to focus on CTE programs that are likely to benefit students relative to business-as-usual, where there is likely to be a meaningful counterfactual.

More generally, identifying programs within LEAs that offered a meaningful counterfactual proved challenging in most cases. Students who are interested in participating in an innovative or promising CTE program are typically interested in participating in CTE generally. Particularly in the context of large districts with robust CTE programs, when students are unable to enroll in their first choice CTE program, they tend to enroll in an alternative program that is similar in nature. *We thus encourage researchers to focus attention on settings with unique CTE programs or models, such that students are unable to enroll in a program with similar features in the event that they do not gain admission to the program.*

One attractive feature of CTE programs operated by LEAs is that many programs allocated slots via the district's lottery program for magnet programs, whereas others had competitive admissions processes that could be candidates for an RD design. *We encourage researchers to focus on such programs with admissions processes that lend themselves toward causal research.*

Finally, as other reviews of CTE research note, the CTE programs we reviewed varied considerably in how they defined exposure and eventual completion and how and to what extent outcomes were tracked by the program, LEA, or state or were available through other sources (Dougherty et al., 2020). *We encourage researchers to focus on programs where program completion implies the completion of a course of study with college credit and a work-based learning component, and where there is a source of administrative data that would allow them to track the outcomes of nonparticipants.*

## Community Colleges[8]

Community colleges play a crucial role in the delivery of CTE education, both to young adults after high school and adults who are interested in expanding their career options. Unfortunately, during our study, we found it challenging to identify opportunities for causal research in the community college setting. CTE programs within community colleges tend to be open access and focused on specialized career pathways, making it difficult to identify a relevant counterfactual. Individual programs also tend to be small, raising issues of statistical power.

## Regional CTE support entities[9]

Our evaluability study uncovered promising CTE education support entities that provide a range of programs and resources to LEAs and other CTE providers in a specified region or county. *Although CTE support entities often appear to offer valuable supports and resources that could contribute to a positive CTE experience for students, they are difficult to evaluate.* The primary issue that arose with these programs is that they were used by all providers in their region, making it difficult to identify relevant comparison groups. However, given that our evaluability study was not intended to be comprehensive, other similar entities in other regions may offer services in ways that are more amenable to causal evaluation. *Also, if researchers can partner with a CTE support entity*

[8] Interviewed programs in this category include the Film Technician Program at Central New Mexico Community College and the Miami Animation & Gaming International Complex (MAGIC) at Miami Dade College. See Appendix C for program descriptions.
[9] Interviewed programs in this category include the Central Orange County CTE Partnership at the Orange County Department of Education and the Central Regional Area Career and Technical Center. See Appendix C for program descriptions.

*as it develops and rolls out its programs, it may be possible to develop a more comprehensive causal study alongside the rollout.*

### State-level programs[10]

Our evaluability study uncovered some promising CTE programs that were implemented statewide, often with support from a state education agency. *Although statewide programs often are novel and have most or all of the key program components that we identified as important for promoting student success, they are challenging settings for causal research.* In particular, the fact that these programs were implemented statewide made it challenging to identify relevant counterfactuals. In one case, we identified an opportunity to develop a causal study to evaluate the differential impact of two distinct models as part of a statewide CTE program. *Also, if researchers can partner with state education agencies as they develop and roll out statewide programs, it may be possible to develop a more comprehensive causal study alongside the rollout.*

### Independent developers of curricula, courses, and pathways[11]

Our evaluability study identified many developers of innovative and promising CTE curricula, courses, and pathways. These models vary considerably in the extent to which they are integrated within a larger CTE program or pathway. For example, a curriculum may be for a single course or a sequence of courses across a variety of CTE pathways. *We encourage researchers to focus on developers of multicourse curricula and pathways because they are likely to offer a more meaningful counterfactual.*

Programs of this nature also tend to vary considerably in their implementation across sites, with some sites integrating a curriculum throughout a set of CTE pathways and others using it within a single course. Some programs offer guidance for implementation and have strong supportive relationships with some or all of their partner sites. Some developers had detailed information and/or data about how their program was implemented across a number of sites. *We encourage researchers to focus on developers that offer implementation guidance and collect implementation data, particularly when they have a large number of partners that might be interested in conducting a causal study.*

# Programs Identified as Ready for Evaluation

At the present time, of the 112 programs nominated, four appear to be the most promising sites for causal research based on our criteria. In this section, we present brief descriptions of these programs, as well as suggestions for how to proceed with the causal studies, including factors that may need to be addressed. The programs are presented in no particular order.

## Virtual Enterprises International

### Program overview

Virtual Enterprises International (VEI) is a national nonprofit organization that supports a network of Virtual Enterprises (VE) programs in more than 400 schools in 17 states. Launched in 1996, VE is an in-school, live

[10] Interviewed programs in this category include Delaware Pathways and Simulated Workplace in West Virginia. See Appendix C for program descriptions.
[11] Interviewed programs in this category include INCubatoredu course (Uncharted Learning); NAF; The SWITCH Lab: Street Legal, Drivable Electric Vehicle Kit, Curriculum, and Support; Virtual Enterprises International; and Woz Ed STEM Kits. See Appendix C for program descriptions.

global business simulation with an accompanying curriculum in which students create and manage businesses that replicate the structures and practices of real-world companies. Each class produces a virtual product or service in an industry of their choice (e.g., technology, advertising, insurance, fashion). They engage in commerce with 7,500 student-run businesses in 45 countries, electronically transferring virtual funds through a web-based banking system that links all U.S. firms with other simulated businesses worldwide.

Students are responsible for working together to strategically plan for and operate their business. They track revenue and pay expenses using digital currency through VE's proprietary online banking system. They interview for and hold distinct positions within the business (e.g., marketing, sales, human resources, accounting, information technology, design, management) while also managing personal finance responsibilities. As "employees" of the business, students receive direct deposit (virtual) salaries and use their income to purchase products and/or services from other VE student-run businesses. They learn about personal finance by budgeting for and paying rent and other expenses, selecting insurance and retirement plans, and filing tax returns. In addition, students attend local, national, and global trade shows and competitions, in-person and online, during which they interact with real-world industry professionals and other simulated companies.

The yearlong VE course tends to be part of a business pathway, but it also can be a capstone course in other CTE clusters. The business operated by the class may incorporate additional technical, engineering, or computer science skills and coursework to develop prototypes or apps, for example. VEI works with industry representatives to review the program and curriculum on an ongoing basis. VEI also has relationships with many postsecondary institutions for students to receive dual credit for courses. Teacher training and collaborative events are available.

## Possible causal study description

VEI is interested in conducting causal research on the VE model and has agreed to help researchers connect with schools where VE is a key part of the school's CTE delivery model. VEI began reaching out to their contacts in an effort to identify oversubscribed programs that allocate slots via a lottery. VEI provided a list of preliminary contacts and indicated that programs in other schools would likely be interested in participating in a causal study. The study team was in the process of scheduling site visits on Long Island and in New York City prior to the start of the pandemic and was making contact with a third site in Broward County, Florida. Given the interest among VEI leadership and the large number of programs nationally, the study team is reasonably confident that interested and motivated researchers could work with VEI to identify several oversubscribed programs that are well implemented and well integrated within a CTE pathway and have slots allocated via lottery.

## Unknowns that future researchers would need to address

Researchers would need to work with VEI to identify viable programs and learn more about the number of lottery applicants for each program, as well as the particular lottery processes in use to ensure that they could support an RCT. Where possible, researchers could seek to work with partner districts to fine-tune the lottery process and monitor its implementation to ensure that it is conducted as planned and can support causal inference. At the very least, researchers would need to gather information about the nature of the lottery; for example, if applicants apply to a single program or multiple programs through the same lottery, if (and if so, how) the lottery provides preferences for students with certain characteristics, and the resulting implications for the numbers of students who are truly randomized via the lottery at each program. This information would allow researchers to determine the number of programs that would need to participate in a study to ensure adequate statistical power to detect reasonable effect sizes.

The nature of the counterfactual has important implications for the interpretation of impact estimates. For example, students who do not win a lottery may end up entering a well-implemented CTE pathway in the same or a similar field that does not include VE, or they may end up enrolling in a traditional academic pathway and taking a few CTE courses; the implications for interpreting the results and the anticipated effect sizes vary considerably across these contexts. As such, researchers would need to learn more about the types of programs (CTE or otherwise) that lottery applicants enter when they do not win the lottery to adequately characterize the counterfactual. To the extent that schools across multiple districts are required to adequately power a study, researchers should strive to identify programs where the counterfactual is similar.

Finally, researchers would need to navigate the process of negotiating data-sharing agreements and permission to conduct qualitative data collection with the districts that oversee the VE programs selected for the study. To the extent that researchers are interested in examining longer term outcomes, such as college enrollment and completion, or labor market outcomes, researchers would need to negotiate data-sharing agreements with relevant data providers and agencies, such as the National Student Clearinghouse, community college systems, higher education agencies, or state agencies responsible for overseeing unemployment insurance programs.

Inquiries regarding prospective research can be made by contacting Nick Chapman, president, VEI, at nchapman@veinternational.org.

## NAF Academies

### Program overview

Since 1980, NAF has been developing and supporting high school career academies.[12] NAF academies are small learning communities within existing schools that focus on growing career clusters or industries, including finance, information technology, engineering, health sciences, and hospitality and tourism. A school may house more than one NAF academy. NAF provides schools with a project-based-learning-focused curriculum that incorporates input from industry representatives. NAF also provides oversight and guidance on academy structure, data review, and student supports; business and community advisory board development and function; instructional supports, technical assistance, and peer networking for teachers; and training and supports for work-based learning. In the 2019–20 school year, 620 NAF academies were in operation in 406 schools nationally, serving more than 112,000 students.

### Possible causal study description

NAF is interested in conducting causal research on their academy model and has agreed to help researchers connect with schools with NAF programs, particularly those that are well implemented and designated as “distinguished”—programs at the highest level of implementation according to the organization’s annual assessment of academy strengths and challenges. NAF reached out to program contacts to identify oversubscribed programs that allocate slots via a lottery. Given the interest of NAF leadership and the large number of programs nationally, the study team is reasonably confident that interested and motivated researchers could work with NAF to identify several well-implemented and oversubscribed programs with slots allocated via lottery.

[12] NAF was formerly the National Academies Foundation.

### Unknowns that future researchers would need to address

The unknowns are similar to those with VEI. Specifically, researchers would need to work with NAF to identify viable programs; learn more about the lottery process and the number of programs that would need to participate to ensure adequate statistical power; assess the nature of the counterfactual at each participating site; and navigate the process of negotiating data-sharing agreements and permission to conduct qualitative data collection at the districts overseeing the participating programs.

Inquiries regarding prospective research can be made by contacting Marc Lesser, vice president, research and technology, at mlesser@naf.org; and Nick Minar, director of research and reporting, at nminar@naf.org.

## Delaware Pathways

### Program overview

Delaware Pathways is a regional state-level CTE model that serves 36 of Delaware's 38 comprehensive high schools and all six of its regional CTE centers and offers 24 career pathways. In the 2019–20 school year, about 16,000 high school students (40 percent of the total) participated in a Delaware Pathways program. The career pathways are designed at the state level, including course sequences, instructional frameworks, competency profiles, teacher training, and strategic industry and postsecondary partnerships. The program also provides oversight on other components: administration of advising and career exploration models, including a 5-year student success plan with mentoring for all students; advising on which CTSOs and competitions schools should offer; the development of agreements for articulated credit and/or dual credit with postsecondary institutions in every pathway; and the development of work-based learning opportunities and student placement through work-based learning coordinators at each school. About 15 percent of Delaware Pathways students currently participate in immersive work-based learning experiences. The program seeks to expand that percentage to 30 percent.

### Possible causal study description

The Delaware Department of Education is interested in participating in causal research on the Delaware Pathways model. Because the model is implemented statewide, it is difficult to design a rigorous study with a comparison group that does not participate in the program. However, the policy-relevant question for the department is the impact of a more intensive Delaware Pathways model relative to a less intensive one.

Specifically, one fourth of all eighth-grade students attending public schools in New Castle County, Delaware (the most populous county in the state), apply for admission to programs at one of four technical high schools in the New Castle County VoTech School District. VoTech students take eight CTE courses in a dedicated career cluster following the Delaware Pathways model and attend high school exclusively with other students pursuing a similar CTE-intensive pathway. Enrollment in the VoTech School District is oversubscribed, and slots are allocated via lottery. Students who do not gain admission to a VoTech high school through the lottery typically enroll in a comprehensive high school in one of several other districts in New Castle County, where they enroll in the standard three-course Delaware Pathways model. The study would evaluate the implementation of both the eight- and three-course models in New Castle County and leverage the lottery to assess the impact of attending the more intensive model relative to the less intensive one.

### Unknowns that future researchers would need to address

Researchers would need to gauge interest on the part of the New Castle VoTech School District and the other districts serving New Castle County in participating in a causal study. The Delaware Department of Education is interested in a potential study and was working with the study team to facilitate communication with and a possible site visit to the New Castle County high schools, but the pandemic curtailed those efforts.

Provided there is interest among the New Castle schools in participating in a study, researchers would need to learn more about the number of lottery applicants to the New Castle VoTech School District, as well as the particular lottery process used, to ensure that an RCT could be supported. For example, researchers would need to gather information about the nature of the lottery, if (and if so, how) the lottery provides preferences for students with certain characteristics, and the resulting implications for the numbers of students who are truly randomized via the lottery. Researchers also would need to gather information about the types of programs within the New Castle County schools that VoTech applicants participate in when they do not win the lottery to characterize the counterfactual.

Finally, to the extent that researchers are interested in examining longer term outcomes, such as college enrollment and completion or labor market outcomes, researchers would need to negotiate data-sharing agreements with relevant data providers. For example, in Delaware, researchers could explore the potential of linking lottery data to records from the Delaware Technical Community College System and the state unemployment insurance office.

Inquiries regarding prospective research can be made by contacting Luke Rhine, director, career and technical education/STEM initiatives, Delaware Department of Education, at luke.rhine@doe.k12.de.us.

## Franklin Technology Center

### Program overview

The Franklin Technology Center (Franklin Tech) is part of the Joplin School District in Joplin, Missouri. It offers 14 CTE pathways in 13 career clusters, all of which are centered on competency-based completion. The center serves about 700 students annually from nearby Joplin High School, three districts outside Joplin, and homeschooled and private school students. Approximately 200 students are juniors and seniors who apply to concentrate in a pathway. Freshmen and sophomore students can enroll in introductory CTE courses at the center. Both 1- and 2-year training programs are offered, aligned to industry-recognized certificates and with free testing for students. Students achieve a program's competencies by mastering a series of lessons or tasks, with 80 percent mastery required for program completion. All pathways have embedded academic credit for English and mathematics/science, offer employability skills training, and use the SkillsUSA curriculum. Slightly more than half of the pathways have dual credit opportunity with two local community colleges.

### Possible causal study description

Franklin Tech expressed interest in participating in a causal research study. Twelve of its 14 programs are oversubscribed and have a competitive admissions process. Currently, each program handles this differently, but most collect some information about grade point average and interests to determine which students receive an interview and then whom to admit. Most of the programs have their own rubric to rate students, and many rank students just below the cutoff so that additional students can be offered admission as slots open up (if admitted students decide not to join).

Franklin Tech has expressed a willingness to adapt the admission process to be more conducive to rigorous evaluation. For example, it would consider using a common rubric for the interview and asking programs to rank all interviewed students to support an RD study. It also may consider implementing a lottery for a set of students with rankings near the admission threshold to support an RCT. In either case, treatment students would be compared with control students who end up in traditional high schools in the Joplin School District and other surrounding districts, so the counterfactual is likely to be meaningful.

### Unknowns that future researchers would need to address

Researchers would need to work with Franklin Tech to tweak its admissions process in a way that meets the school's needs while also creating the conditions for a sufficiently powered causal study. Franklin Tech currently has approximately 650 applicants for the concentrations that start in the junior year, so researchers would need to design the admissions process such that the number of applicants who are randomized is sufficient to detect reasonable effect sizes with one or two applicant cohorts. Researchers also would need to assess the educational options in the Joplin School District and other surrounding districts for applicants who do not gain admission to Franklin Tech to characterize the counterfactual and verify that there is likely to be a meaningful contrast between treatment and control.

Finally, researchers would need to navigate the process of negotiating data-sharing agreements and permission to conduct qualitative data collection with Joplin School District and surrounding districts from which Franklin Tech draws its students. To the extent that researchers are interested in examining longer term outcomes such as college enrollment and completion or labor market outcomes, researchers would need to negotiate data-sharing agreements with relevant data providers and agencies such as the Missouri Department of Higher Education and Workforce Development, the National Student Clearinghouse, and the Missouri Division of Employment Security.

Inquiries regarding prospective research can be made by contacting Elsie Morris, vocational special services coordinator, Franklin Technology Center, at elsiemorris@joplinschools.org.

## Conclusion

The evaluability assessment yielded four CTE models or programs that (a) show the most promise as sites for future causal studies and (b) have distinctive features that would make them especially instructive. VE includes a significant online component, and virtual work skills are increasingly relevant today. VE also strongly incorporates simulated work-based learning into courses, which may make work-based learning more accessible to students in a time when many programs are struggling to provide it. NAF is a large national network of career academies, and studying the impact of well-implemented career academies in a range of settings across the country would deepen understanding of the impact of career academies at scale. Such a study also could allow for sufficient power to determine differential impacts by student characteristics that past studies have been unable to address. A study of Delaware Pathways would allow researchers to document the implementation of a well-regarded statewide CTE program and learn about the effects of a more intensive model delivered through a technical high school as compared with a less intensive model embedded within a standard high school setting. And, finally, Franklin Tech uses a competency-based curriculum, which is becoming more common in CTE programs nationally but has yet to be rigorously studied.

Overall, the assessment process produced a strong variety of models and programs that operate at different levels (national, state, and local); are in different geographic regions; include small learning communities situated within comprehensive high schools as well as whole high schools; and represent the full range of career areas. It is

regrettable that no postsecondary CTE programs are in the final selection, but far fewer nominations were received for that sector. Still, the breadth of models captured in the proposed studies is particularly important given that the few causal studies of CTE programs conducted to date have focused on either career academies or stand-alone CTE high schools in a single state. Our study does not address the ease with which the identified programs could scale to serve additional students in additional sites if study findings warrant expansion, although accompanying cost and implementation studies could help address questions regarding program scalability. Should studies go forward, much will be learned to help inform and guide the field, policymakers, and future researchers.

# References

Advance CTE. (2019). *Cheat sheet: Opportunities for employer involvement in CTE.* https://cte.careertech.org/sites/default/files/files/resources/EmployerInvolvementFactsheet_2019.pdf

Brunner, E., Dougherty, S., & Ross, S. (2019). *The effects of career and technical education: Evidence from the Connecticut Technical High School System* (EdWorkingPaper 19-112). Annenberg Institute at Brown University. https://doi.org/10.26300/z9y7-2222

Cullen, J. B., Jacob, B. A., & Levitt, S. D. (2005). The impact of school choice on student outcomes: An analysis of the Chicago Public Schools. *Journal of Public Economics, 89*(5–6), 729–760. https://doi.org/10.1016/j.jpubeco.2004.05.001

Davies, R. (2013). *Planning evaluability assessments: A synthesis of the literature with recommendations* (Working Paper 40). Department for International Development. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/248656/wp40-planning-eval-assessments.pdf

Dougherty, S. M., Kamin, S. J., & Klein, S. (2020). *Improving measurement in career and technical education to support rigorous research*. American Institutes for Research, Career and Technical Education Research Network. https://cteresearchnetwork.org/sites/default/files/2020-11/CTERN-MeasurementPaper-508.pdf

Dougherty, S. M. (2018). The effect of career and technical education on human capital accumulation: Causal evidence from Massachusetts. *Education Finance and Policy*, *13*(2), 119–148. https://eric.ed.gov/?id=EJ1175151

Gray, L., & Lewis, L. (2018). *Career and technical education programs in public school districts: 2016–17* (NCES 2018-028). U.S. Department of Education, National Center for Education Statistics. https://nces.ed.gov/pubs2018/2018028.pdf

Hemelt, S. W., Lenard, M. A., & Paeplow, C. G. (2019). Building bridges to life after high school: Contemporary career academies and student outcomes. *Economics of Education Review, 68*, 161–178. https://doi.org/10.1016/j.econedurev.2018.08.005

Imperatore, C., & Hyslop, A. (2018). *2018 ACTE quality CTE program of study framework.* Association for Career & Technical Education. https://www.acteonline.org/wp-content/uploads/2019/01/HighQualityCTEFramework2018.pdf

Kemple, J. J. (2008). *Career academies: Long-term impacts on work, education, and transitions to adulthood.* MDRC. https://www.mdrc.org/publication/career-academies-long-term-impacts-work-education-and-transitions-adulthood

Malkus, N. (2019). *The evolution of career and technical education: 1982–2013*. American Enterprise Institute. https://www.aei.org/wp-content/uploads/2019/04/The-Evolution-of-Career-and-Technical-Education.pdf

National Center for Education Statistics. (2013). *High School Longitudinal Study of 2009 (HSLS:09).* U.S. Department of Education. https://nces.ed.gov/surveys/hsls09/

National Center for Education Statistics, Fast Response Survey System. (2017). *Career and technical education programs in public school districts* (FRSS 108). U.S. Department of Education. https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2018028

Page, L. C. (2012). Understanding the impact of career academy attendance: An application of the principal stratification framework for causal effects accounting for partial compliance. *Evaluation Review, 36*(2), 99–132. https://doi.org/10.1177/0193841X12447248

Rosen, R., Visher, M., & Beal, K.. (2018). *Career and technical education: Current policy, prominent programs, and evidence.* MDRC. https://files.eric.ed.gov/fulltext/ED590008.pdf

Ross, S. L., Brunner, E., & Rosen, R. (2020). *Identification and counterfactuals for career and technical education program evaluation*. American Institutes for Research, Career and Technical Education Research Network. https://cteresearchnetwork.org/sites/default/files/2020-09/CTE-CounterfactualPaper-508.pdf

Walser, T. M. (2015). Evaluability assessment in higher education: Supporting continuous improvement, accountability, and a culture of assessment. *Journal of Assessment and Institutional Effectiveness,* 5(1), 58–77. https://doi.org/10.5325/jasseinsteffe.5.1.0058

Zhang, J., & Oymak, C. (2018). *Participants in subbaccalaureate occupational education: 2012* (NCES 2018-149). U.S. Department of Education, National Center for Education Statistics. https://nces.ed.gov/pubs2018/2018149.pdf

# Appendix A. Overview of Evaluability Study Steps and Timeline


**CTE Program Nomination Process, January–May 31, 2019**

- Accepted program nominations from the CTE community via the website form (112 CTE programs nominated).
- Programs that serve at least 100 students annually and have been in existence for at least 2 years progressed to step 2 (74 programs).


**Follow-Up Data Collection and Analysis, March–August 2019**

- Sent nominated programs additional online questions and followed up via telephone and email to help them complete.
- Considered a wide range of criteria in determining who would move to step 3, including student program outcomes possible to study, promising program components, and structure amenable to rigorous research.
- All full or partial completers of extended questions were individually assessed (53 programs assessed, 30 advanced and invited to interview).


**Interviews and Analysis, September 2019–January 2020**

- Development of follow-up questions after assessing previous responses.
- Telephone interview(s) conducted with program representatives, along with examination of documents to gather further, clarifying information (25 programs participated in interviews).
- Development of a program logic model.
- Confirmed program leadership's willingness to participate in research.
- Confirmed progression to Step 4 based on viability for rigorous research determined through the above (four programs).


**Site Visits, February–April 2020**

- Site visits planned and scheduled but disrupted because of the COVID-19 pandemic.
- Based on data collected to date without site visits, determined that all four programs have strong potential for rigorous research.
- Results prepared and released in June 2020.

# Appendix B. Overview of CTE Programs That Participated in the Study

This appendix presents aggregated information collected from the CTE program nomination process and follow-up survey that collected additional information from a verified program contact. As described in the report, the study began with broad outreach to the CTE community to give a variety of CTE stakeholders the opportunity to nominate programs or models for potential study that they felt were of high quality or appeared to lead to positive student outcomes. Information about this study and a nomination form were posted on the CTE Research Network's website and publicized by its national partners. In total, we received and reviewed 112 entries. Nominators often but not always were affiliated with the program directly. Researchers identified verified program contacts authorized to speak on behalf of the nominated program. Programs that were in operation for at least 2 years and served at least 100 students per year were invited to complete the second online questionnaire. Researchers followed up with these programs to assist them in providing the information by email or telephone.

## Information collected during the nomination process

The form to nominate programs was accessible on the CTE Research Network's website from January through June 2019. The beginning of the form provided information and examples describing what types of secondary and postsecondary authentic education settings were eligible for nomination and inclusion in the study. The language clarified that the study was not intended to evaluate local, regional, or state CTE policies, such as those involving high school graduation requirements that included CTE, requirements for the completion of CTE courses or programs, CTE funding, or student CTE access or enrollment policies. The nomination form had 13 questions about the program, ending with the option for the nominators to provide a written description of why they were recommending the program. The questions included the following topics:

- Which state(s) the program operated in
- What career clusters the program included
- How many years the program had been in operation
- Approximately how many students the program had served in the prior academic year (2017–18)
- Which type(s) of settings (e.g., high schools, middle schools, regional CTE centers, community colleges, universities/colleges, technical colleges, workplaces) the program was operating in for the 2018–19 academic year
- Whether the program could currently serve all interested students; if the program had a documented waitlist and, if so, what data were maintained for how long; what factors contributed to high demand for the program
- How students entered the program (e.g., open registration, demonstration of prerequisite requirements, application review with/without standard scoring process, lottery-based assignment)
- Student data collected/maintained as a part of the program (e.g., demographic information, secondary, postsecondary, and employment outcomes)

## Locations and CTE career clusters represented

Of the 112 unique CTE programs nominated for the evaluability study, seven programs[13] operated in multiple states, and the rest each operated within one state. Exhibit B1 provides the range in the number of nominated programs from each state/territory and Washington, D.C.

**Exhibit B1. CTE programs nominated within states and territories[a]**

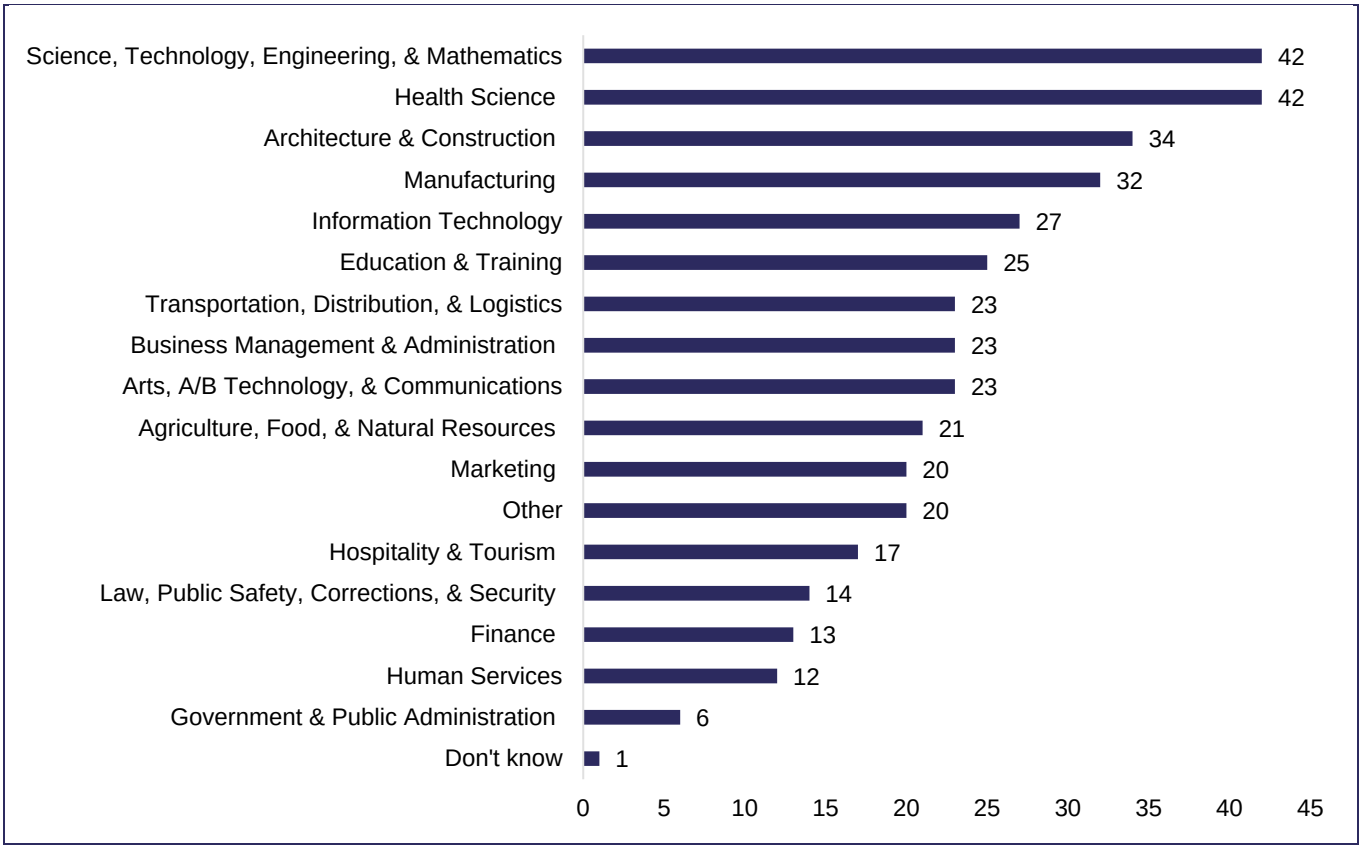
| Number of CTE programs nominated | Number of states with this many programs nominated | States and territories |
|---|---|---|
| Between 8 and 13 programs nominated | 9 | California, New York, Illinois, Florida, Texas, Arizona, Georgia, North Carolina, and Oregon |
| Between 5 and 7 programs nominated | 7 | Virginia, Massachusetts, Pennsylvania, Colorado, Nebraska, New Mexico, and Ohio |
| 4 programs nominated | 11 | Alabama, Connecticut, Louisiana, Maryland, Michigan, Minnesota, Missouri, New Jersey, Rhode Island, South Carolina, and Wisconsin |
| 3 programs nominated | 8 | Delaware, Indiana, Kentucky, Montana, Nevada, Oklahoma, Tennessee, and Washington |
| 2 programs nominated | 6 | Arkansas, Maine, Mississippi, New Hampshire, South Dakota, and Wyoming |
| 1 program nominated | 9 | Alaska, Hawaii, Idaho, Iowa, Kansas, North Dakota, West Virginia, Washington, D.C., and Guam |

[a] No programs were nominated from Utah or Vermont.

The 112 programs represented a wide variety of the 16 career clusters. Exhibit B2 displays the number of nominated programs that reported offering programming in each cluster.

[13] The seven programs operating in more than one state included an Aviation Maintenance Technology postsecondary program, INCubatoredu, NAF, the SWITCH Lab, Virtual Enterprises International, Woz Ed, and Year Up Arizona.

**Exhibit B2. Number of CTE programs nominated in each career cluster**




*Note*. *N* = 112 programs total.

## Programs often offer CTE in more than one career cluster

Forty-five percent of the programs (50 programs) offered courses or programming in only one cluster, and 32 percent of the programs (36 programs) offered between two and three career clusters. Eleven percent (12 programs) offered between 4 and 10 clusters, and 14 percent (16 programs) offered between 11 and 16 clusters.

## Number of students served annually per program

Among the nominated programs, the number of students served annually varied from as few as 12 students to more than 100,000 students. Exhibit B3 displays the number of nominated programs serving various ranges of students annually. Thirteen programs could not provide an estimated annual enrollment.

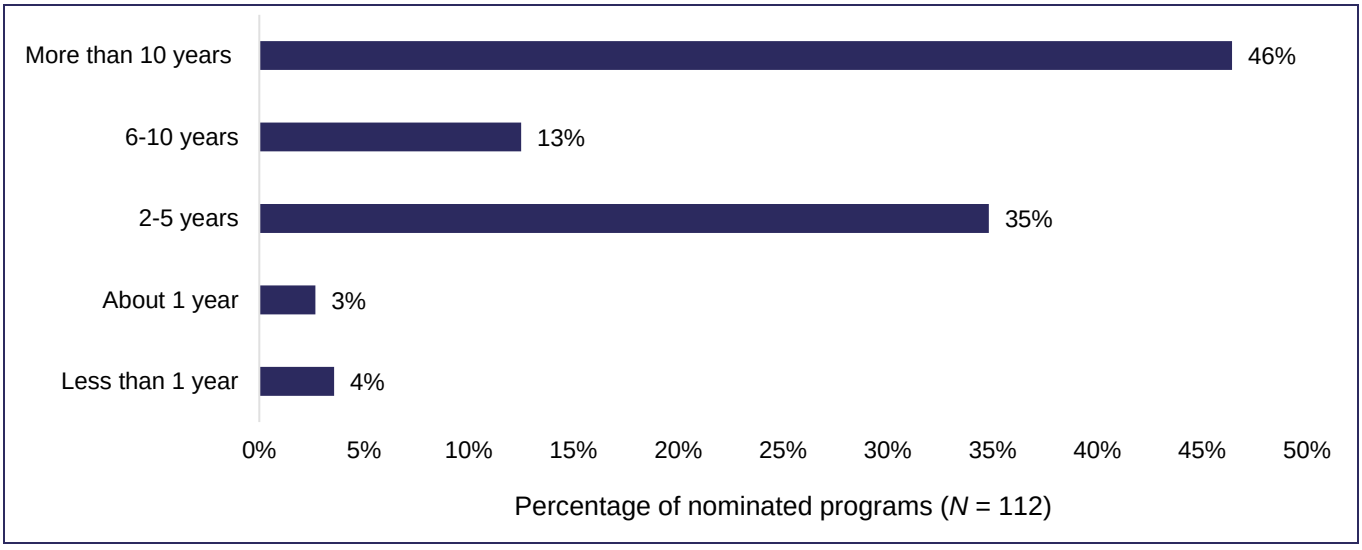
**Exhibit B3. Range of students served annually by nominated programs**

| Number of students served annually | Number of programs | Percentage of programs |
|---|---|---|
| Fewer than 100 | 34 | 30% |
| Between 100 and 199 | 19 | 17% |
| Between 200 and 399 | 12 | 11% |
| Between 400 and 599 | 12 | 11% |
| Between 600 and 999 | 4 | 4% |
| Between 1,000 and 3,500 | 12 | 11% |
| Between 10,000 and 16,000 | 4 | 4% |
| Approximately 25,000 | 1 | 1% |
| Approximately 100,000 | 1 | 1% |
| Unable to provide estimated enrollment | 13 | 12% |
| *Total* | *112* | |

## Length of time programs have been in operation

Close to half of the nominated programs have been in operation for more than 10 years, whereas more than one third have been operating between 2 and 5 years (see Exhibit B4).

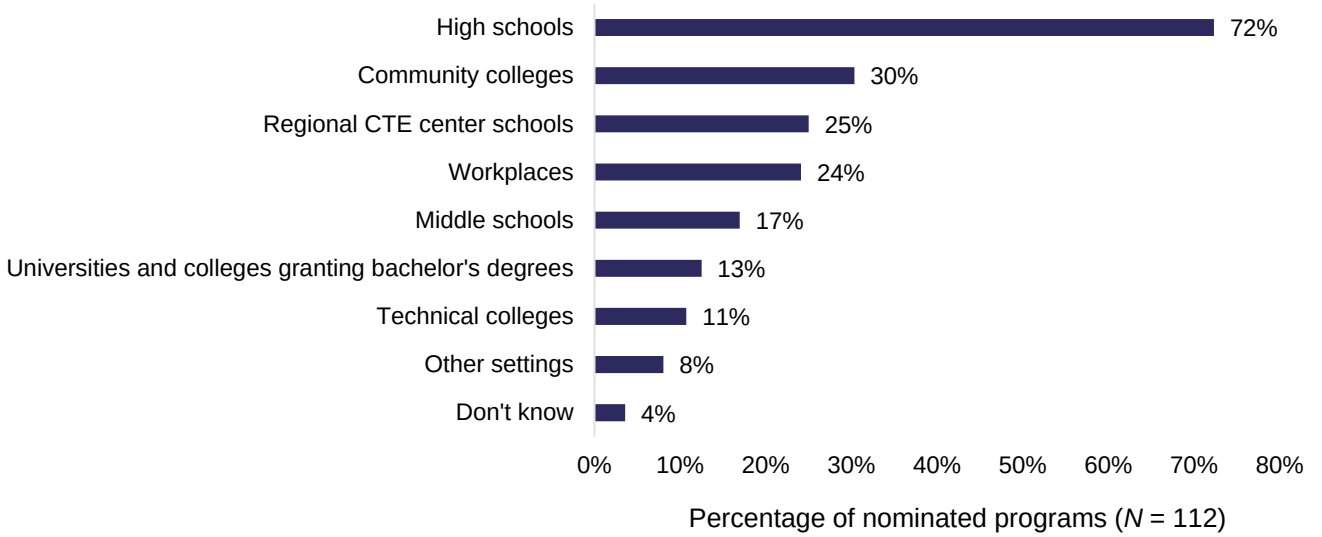
**Exhibit B4. Years nominated programs were in operation**



## Program settings

More than 70 percent of the nominated programs served students in some capacity in comprehensive high schools. Thirty percent of the nominated programs reported at least some activities in community colleges, 13 percent of the programs reported at least some activities in colleges or universities, and 11 percent reported activities in technical colleges. However, only 16 nominated programs (14 percent) reported serving students primarily in postsecondary settings. Of the nominated programs that completed the second step of extended survey questions, only five programs served students primarily in postsecondary settings. Exhibit B5 displays the percentage of nominated programs that reported program activities in each type of setting.

**Exhibit B5. Types of settings reported by nominated programs**



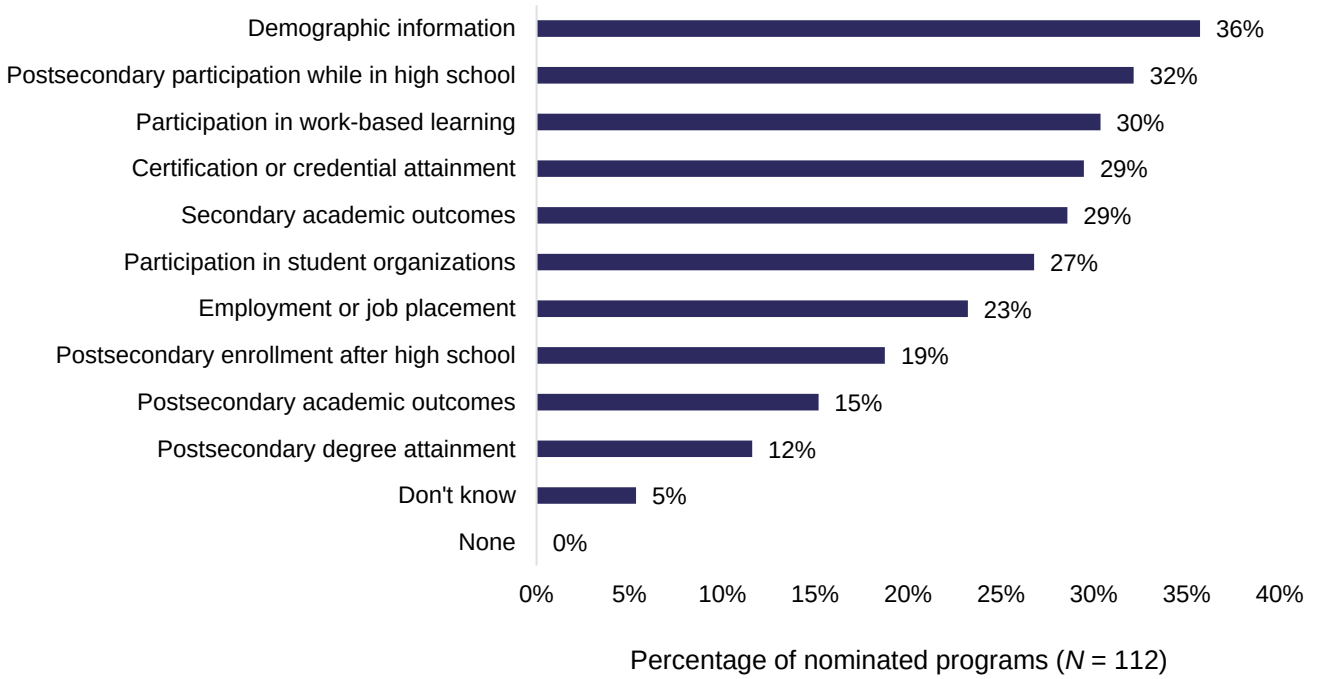

## Program capacity and student entry

About 50 percent of the nominated programs reported high demand from students to the extent that not all interested students can participate in a CTE program. An additional 44 percent of the nominated programs reported high demand but with an ability for all interested students to be served. Six nominators could not provide information on program capacity. Of the programs that reported that not all interested students could participate, 27 programs (24 percent of the nominated programs) maintained a waitlist. Ten of these nominated programs reported using lottery-based assignment to determine which students entered the program, but of those, six did not move forward in the process because of nonresponse to requests for additional information through the extended survey questions or the number of students served annually.

## Student data collected by programs

Nominated programs reported collecting a variety of student information during and after participation in the program. Less than one quarter of the programs reported collecting data on student outcomes after high school, including postsecondary enrollment, degree attainment, or employment (see exhibit B6).

**Exhibit B6. Types of student data collected by nominated programs**




## Additional survey data collection

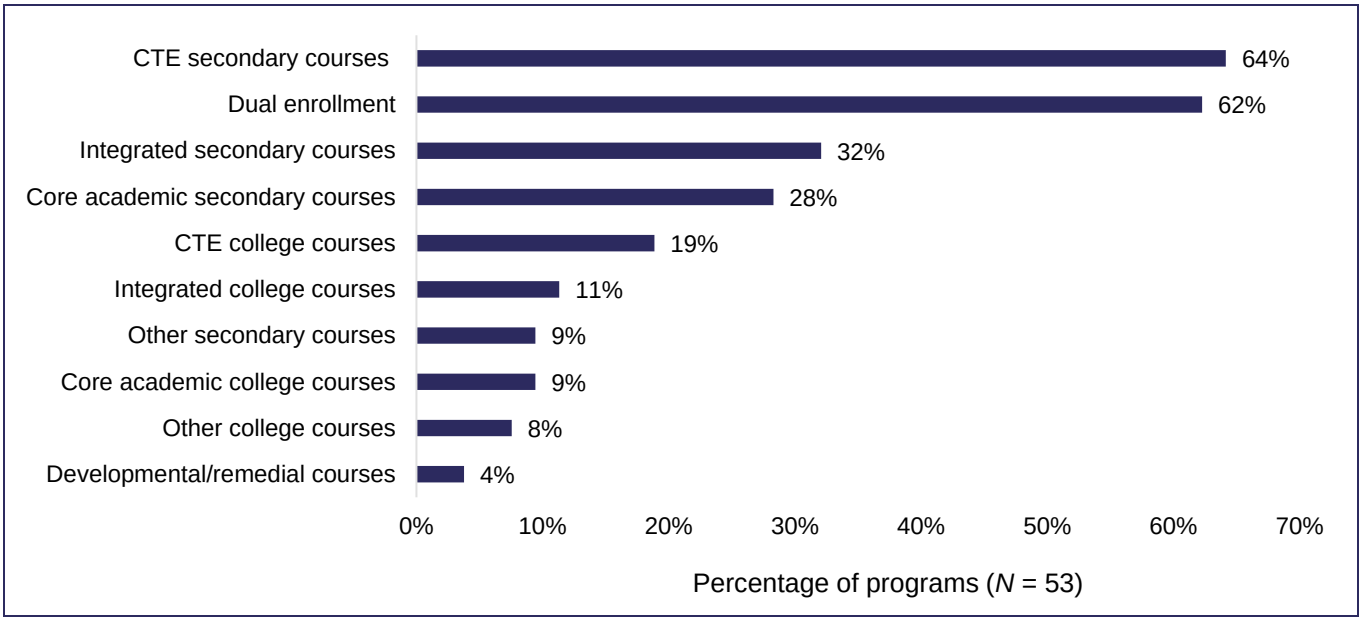
Nominated CTE programs that have been in operation for at least 2 years and serve at least 100 students per year were invited to complete a longer online questionnaire. The criteria to advance were determined in consultation with CTE Research Network partners and advisors. Programs in operation for fewer than 2 years at the time of nomination did not advance in the process because of the assumption that newly formed programs can experience large fluctuations in their key components in their first years of operation. Smaller programs did not advance because they would be difficult to study in a causal manner, having low statistical power to detect any differences in the outcomes of participating students and established comparison students.

Seventy-four nominated programs met these criteria and were invited to complete the additional survey questions. This second step helped the study team understand the key components of the programs in more detail, including the enrollment process; students' experiences in areas such as course taking, advising, CTSOs, and work-based learning; and program structure, such as core academic and technical instructor collaboration, teacher professional development, and postsecondary and industry relationships. The study team followed up with programs consistently by email and telephone until September 2019 to offer assistance with any questions and invite programs to complete the survey with a study team member by telephone. Fifty-three of the 74 invited programs (about 72 percent) completed the additional survey items. Of these 53 programs, 35 programs reported that students participate in high school or other secondary settings, five programs reported student participation in only postsecondary settings, and 13 reported students participating in both settings (e.g., high school students participating in dual-enrollment courses or in collaboration with postsecondary institutions for program components).

## Program components offered to students

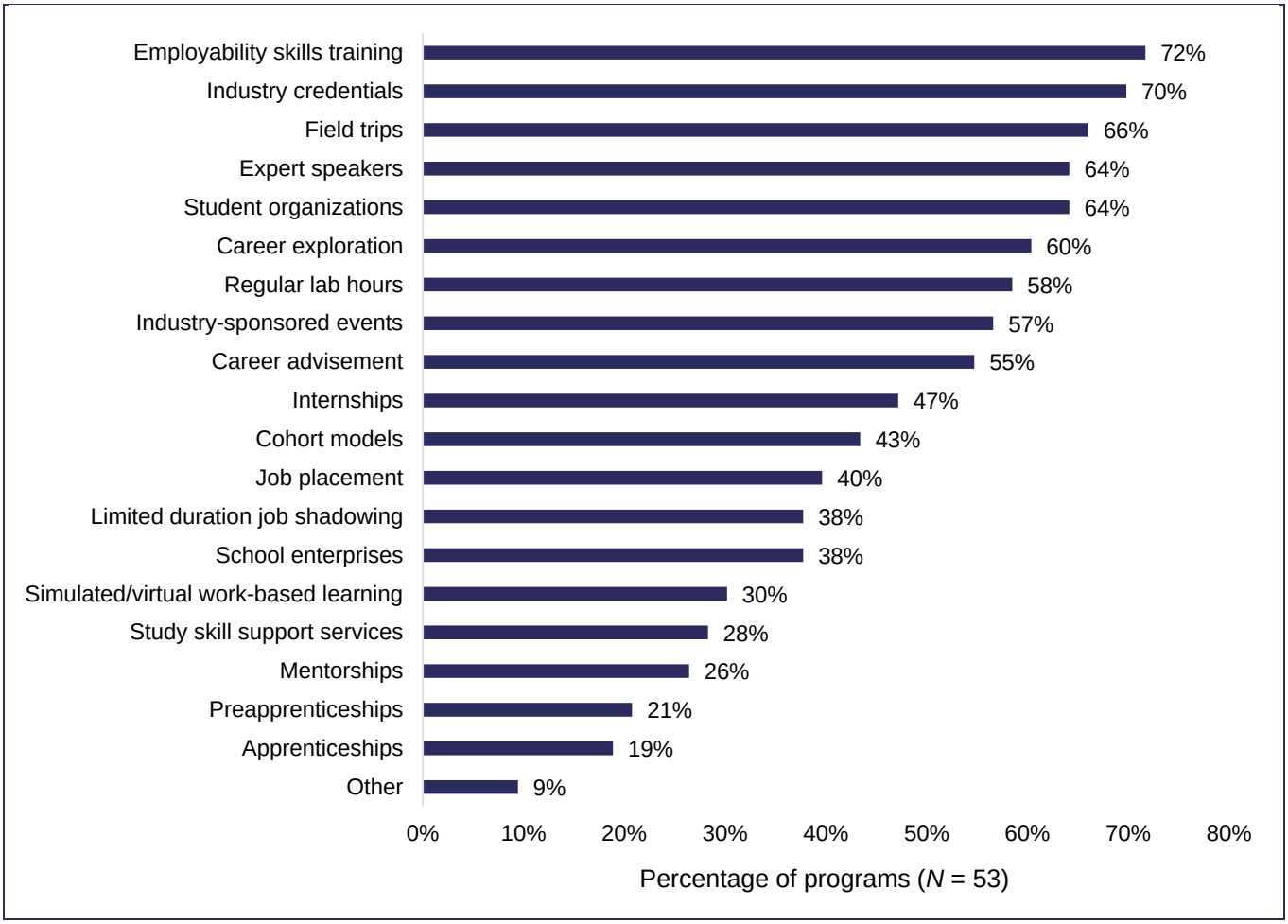
Exhibit B7 displays the types of courses that the remaining 53 programs reported offering. Integrated courses were defined as CTE and traditional or core academic combined. Sixty-two percent of the programs (33 programs) reported offering dual enrollment courses, defined as secondary-level courses for which postsecondary credit was received.

**Exhibit B7. Courses offered to students as a part of CTE programs (secondary and postsecondary programs completing step 2 extended survey)**




Programs reported a variety of additional components that give students work-based exploration, exposure, immersion, and preparation (exhibit B8). Notably, employability skills training and the opportunity to earn industry-recognized credentials were the most frequently reported across the 53 programs.

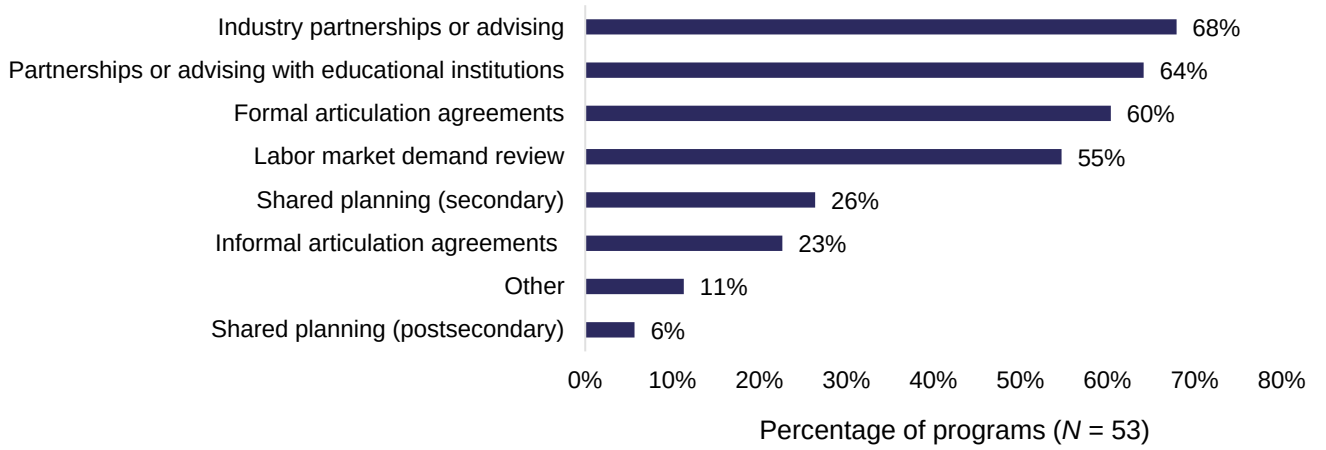
**Exhibit B8. Program components offered in addition to courses**




## Program design elements

Programs reported the incorporation of additional features into their overall design or structure, including connection to industry through partnerships and a review of labor market information to make decisions about programs of study or career pathways; partnerships and agreements with other educational institutions, such as between LEAs and colleges or universities for program or pathway planning or teacher professional development and formal or informal articulations of course credit agreements between secondary and postsecondary institutions; and the presence of shared planning time between CTE instructors and core academic instructors. Exhibit B9 displays the percentage of programs with each of these elements in place.

**Exhibit B9. Additional program design elements**

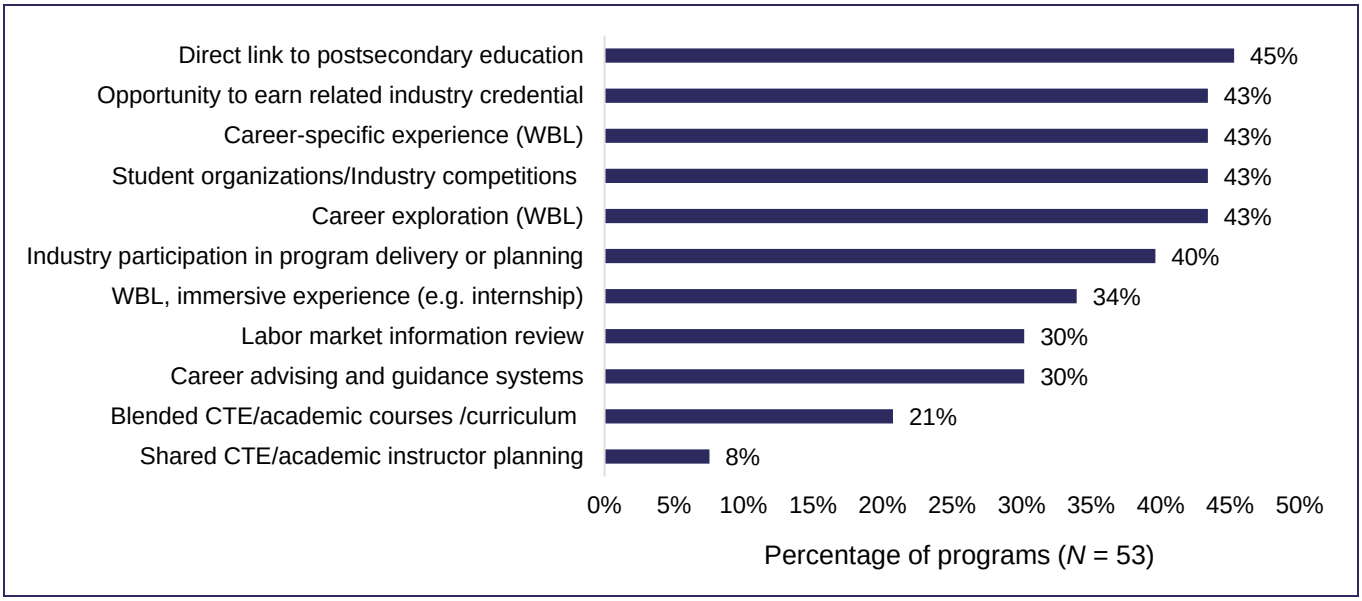



Using the responses to the additional survey items, the study team determined whether programs incorporated a range of promising components noted by multiple, national CTE initiatives or organizations as being indicative of comprehensive or high-quality CTE programs. These included the following:

- Blended academic and technical courses or curricula
- Shared academic and technical instructor planning
- Career advising or guidance systems, processes, or supports
- Industry participation in curriculum and/or program development or delivery
- Review of labor market information
- Career exploration through work-based learning
- Career-specific work-based learning
- Immersive experiences for work-based learning, such as internships or preapprenticeships
- Opportunity to earn related credentials
- Direct links to postsecondary education through dual-enrollment expectations, articulation agreements with local institutions, or other postsecondary input
- Incorporation of CTSOs or industry competitions

Exhibit B10 displays the percentage of programs that the study team determined to have each promising component.

**Exhibit B10. Programs completing the extended survey that incorporate promising components**




*Note*. WBL = work-based learning.

As described in the report, programs were advanced to the next step of the process—an invitation to participate in an interview—based on the presence of promising components and/or favorable conditions for causal research. Although no program had all 11 promising components assessed, 10 programs reported having 10 promising components present in their programs. Thirty programs were advanced to the interview step because of a combination of the following:

- **A large number of identified promising components.** Programs were advanced in the process if they self-reported a large number of the promising program components thought to indicate quality in the student experience based on national organization frameworks, even if they did not report unmet demand or large numbers of students served. The intention was to advance these programs based on quality and then learn more about potential opportunities for causal research during the interview process.
- **Oversubscription and/or admission by lottery.** Programs that reported having more demand than they could accommodate, and admitted students via lottery or could potentially do so, were all advanced to the next step. Oversubscription and admission by lottery would allow for random selection of participants to mitigate unobservable characteristics that might influence their outcomes.
- **Serving a large number of students.** Programs with more than 500 students served annually or completing the program within the last 3 years also was a criterion that advanced programs because it would allow researchers a chance to design a study with a large enough sample for adequate statistical power to detect any differences in student outcomes being studied.

In addition to the final four selected programs described in this report, Appendix C includes descriptions of the other 21 programs that were interviewed. Five programs from the 30 invited programs declined to be interviewed or advance in the process.

# Appendix C. Summary of CTE Programs That Participated in the Step 3 Interviews for This Study

| | Brookwood Integrated Entrepreneurship Program at Brookwood High School |
|---|---|
| Operations | **Programmatic Level:** High school<br>**Location**: Snellville, Georgia<br>**Number of Students Served (estimated, annual):** 350<br>**Website**: https://www.gcpsk12.org/Page/22073<br>**Entrance Requirement**: Open enrollment cohort model<br>**Overview**: Co-curricular (CTE [entrepreneurship and marketing] and language arts) project-based learning course sequence in grades 9–10 with instructors parallel teaching; additional language arts courses in grades 11–12 with entrepreneurial lens |
| Curriculum | **Number of Pathways**: One<br>**Curriculum Overview**: Comprehensive *high school-based nine-credit course sequence* (i.e., *two, 2-hour block courses in grades 9–10*) that uses project-based learning to help students develop language arts and entrepreneurship competencies. Courses use language arts as a vehicle for students to design, plan, launch, and sustain a student-led business.<br>**Additional Information**: Co-curricular approach embeds employability skills training: critical thinking, communication, research, marketing, and technology. |
| Components | **CTE/Program-Centered Components**: Strategic partnerships with local business leaders, members of the chamber(s) of commerce, and municipalities to provide overall guidance, mentorship, business licenses, and consultation and judging of entrepreneurial competitions.<br>**Proximal Components**: Teachers have instructional planning time to parallel teach and receive project-based learning training on how to integrate and embed entrepreneurship through the language arts curriculum. At least one instructor has work experience and/or certification in an entrepreneurial content area (marketing). |
| Completion | **Completion Definition**: Students who complete a two-period blocked course in grades 9 and 10 are considered CTE pathway completers.<br>**Number/Percentage of Completers**: Approximately 100 annually |

Items in italics are required activities for CTE students.

| | The Central Orange County CTE Partnership |
|---|---|
| Operations | **Programmatic Level**: Orange County Department of Education<br>**Location**: Orange County, California<br>**Number of Schools**: 21 high schools in 3 Central Orange County school districts<br>**Number of Students Served (estimated, annual):** 17,000 (2018–19)<br>**Website**: https://ocde.us/EducationalServices/CareerEducation/ctep/Pages/default.aspx<br>**Entrance Requirements:** None<br>**Unique Information**: This partnership is a subset of the Orange County Pathways programs run by the Orange County Department of Education and serves 200 CTE teachers. |
| Curriculum | **Number of Pathways**: 26 pathways in 15 career clusters<br>**Sequenced CTE Pathway Curriculum**: 188 courses across *introductory, completer, and capstone* levels (*300 hours minimum for each pathway*); some pathways (46 courses) incorporate college credit (articulation agreements with 10 local community colleges).<br>**Proximal Curriculum**: Many pathways offer blended coursework—traditional academic courses taught through a CTE lens.<br>**Additional Information**: Some pathways (83 courses) meet one or more of the prerequisites for entrance into California State University or the University of California. |
| Components[14] | **CTE/Program-Centered Components**: Work-based learning (internship or apprenticeship) through capstone courses (common student experience); six career and technical student organizations (participation varies across pathways), with industry challenges incorporated through these organizations.<br>**Additional Components**: Each pathway has an optional accompanying 4-year plan of secondary courses that students can choose to follow to get a fuller experience within the pathway. The CTE Partnership had more than 400 active business partnerships as of 2018–19. The partnerships with local businesses include agreements that the businesses will take interns and help review curriculum. |
| Completion | **Completion Definition**: Students must take at least one level 2 and one level 3 course within the same pathway.<br>**Number/Percentage of Completers**: 1,260 completers (2018–19); many students complete more than one pathway.<br>**Credentials Available**: Every pathway also has at least one relevant industry credential associated with it. Some credentials are attached to specific classes, and some are separate to be done as activities or modules outside class. In all cases, the school pays for students to take the examinations to obtain these credentials. |

Items in italics are required activities for CTE students.

[14] Percentages not available.

| | The Central Regional Area Career and Technical Center |
|---|---|
| Operations | **Programmatic Level:** Virtual CTE center<br>**Location**: Bismarck, North Dakota<br>**Number of Schools**: One virtual CTE center provides services for 28 member districts.<br>**Number of Students Served (estimated, annual):** 600 (as of 2018–19)<br>**Website**: https://cractc.org/<br>**Entrance Requirement**: Open enrollment is available for students in member districts.<br>**Unique Information**: Students participate in CTE coursework that would otherwise be unavailable because of high equipment cost and/or prohibitive per-pupil course cost in part because they live in rural districts. Local facilitators assist in coordinating and managing course operations. |
| Curriculum | **Number of Pathways**: Eight career areas: agriculture, aviation, family and consumer sciences, graphic design, information technology, marketing, medical careers, and STEM (science, technology, engineering, and mathematics)<br>**Curriculum Overview**: Thirty online, blended, or interactive television courses; all courses embed project-based learning principles and employability skills (e.g., communication, collaboration, problem solving).<br>**Additional Information**: The model heavily relies on technology (content delivery and simulation), local facilitators, and scheduled whole-class in-person meetings (central or widely accessible location) to deliver coursework. Local facilitators provide on-the-ground support to students in their local areas and administrative support for each course. Courses follow either a distance learning or blended learning format delivered by Moodle (a learning management system). |
| Components[15] | **CTE/Program-Centered Components**: Career exploration activities and college tours (middle school); industry competitions, internships, and work-based learning experiences vary by sector and course sector.<br>**Additional Components**: The program highlights the availability and requirements for state-funded CTE postsecondary scholarships. Each instructor has work experience and/or certification in the course content and receives training in technology, blended learning pedagogy, and the effective use of local facilitators. |
| Completion | **Completion Definition**: Course or program of study completion<br>**Number/Percentage of Completers:** Unavailable<br>**Credentials Available**: Many courses include industry-relevant skills assessments as part of the coursework, or the coursework is aligned with one or more certification examinations. |

[15] Percentages are unavailable.

| | Delaware Pathways |
|---|---|
| Operations | **Programmatic Level:** State level<br>**Location:** Delaware<br>**Number of Schools**: Students from all of Delaware's 38 high schools and all 6 regional CTE centers<br>**Number of Students Served (estimated, annual)**: 16,000 high school students (40 percent of the state total in 2019–20)<br>**Website**: http://delawarepathways.org/<br>**Entrance Requirement**: None at the state level. Individual schools may have pathway entrance requirements. To enter one of the four technical schools in the New Castle Vocational/Technical School District (serving New Castle County, Delaware), the POLYTECH School District (serving Kent County, Delaware), or the Sussex Technical School District (serving Sussex County, Delaware), which house more intensive CTE programs, an application is required, and entrance is determined by lottery.<br>**Unique Information**: CTE programs are designed at both the state and local levels, with parallel expectations for state approval. For programs designed at the state level, the Delaware Department of Education designs the career pathways, course sequences, postsecondary and industry partnerships, teacher training, policies, instructional framework, competency profiles, and procedures while also structuring some of the program components, such as graduation planning and the career and technical student organizations that the high schools implement. |
| Curriculum | **Number of Pathways**: 24 career pathways<br>**Curriculum Overview**: CTE pathways consist of at least *three sequenced CTE courses that offer early college credit* and certificate courses. Some pathways incorporate Project Lead the Way curricula and/or are NAF academies. Students at New Castle Vocational/Technical School District typically complete eight CTE courses within a designed sequence. Students in POLYTECH School District and Sussex Technical School District typically complete more than six CTE courses within a designed sequence.<br>**Additional Information**: Delaware Pathways works with one community and technical college (Delaware Technical Community College, a statewide system), and four universities/colleges provide dual enrollment for early college credit and certification courses. |
| Components | **CTE/Program-Centered Components**: Career and technical student organizations aligned to pathways (40 percent–50 percent of students), work-based learning (16 percent), and *development of a 5-year student success plan* (100 percent)<br>**Additional Components**: Each school may extend the CTE program through additional dual-enrollment courses and work-based learning programs. Each technical school and most comprehensive schools have a work-based learning coordinator or a teacher/administrator who handles the career immersion aspect of the work-based learning continuum. Teachers receive between 40 and 80 hours of training. They have two types of training: content development and professional practice development. |
| Completion | **Completion Definition**: Completion of three CTE courses<br>**Number/Percentage of Completers**: In 2019–20, 71 percent of all students in grades 9–12 (31,202) successfully completed a CTE course, 58 percent of all juniors (5,869) concentrated in a CTE program, and 63 percent of all high school graduates (5,904) completed a CTE program.<br>**Credentials Available**: Credential obtainment is a focus in information technology, construction, manufacturing, culinary, education, and health care. Approximately 15 percent of the students receive credentials through the pathway.<br>**Other Outcomes**: Delaware Pathways is measuring career and college readiness and transition to postsecondary education or the workforce. As of 2017–18, 65 percent of the students were college and career ready, and 64 percent of the completing students transitioned to postsecondary education or the workforce. |

Items in italics are required activities for CTE students.

| | Evanston Township High School Career and Technical Education Department |
|---|---|
| Operations | **Programmatic Level**: High school/district<br>**Location**: Evanston, Illinois<br>**Number of Students Served (estimated, annual)**: In 2018–19, the program served 625 ninth graders, 554 tenth graders, 552 eleventh graders, and 524 twelfth graders.<br>**Website**: https://www.eths.k12.il.us/domain/366<br>**Entrance Requirement**: Most entry into the program is through open registration, with a few courses requiring prerequisites or lottery-based entrance because of demand.<br>**Unique Information**: Students must take at least one CTE course to graduate from Evanston Township High School; a majority of students do not commit to completing a pathway. |
| Curriculum | **Number of Pathways**: Seven<br>**CTE Pathway Curriculum**: Pathways have between two and 10 courses; they include a mix of CTE courses (including Project Lead the Way courses), Advanced Placement courses, engineering and manufacturing dual-enrollment courses through a local community college, two integrated courses, and lab hours.<br>**Curriculum Overview/Additional Information**: Some pathways have lab hour requirements, including manufacturing (4 days per week), engineering (4 days per week), automotive technology (4 days per week), early childhood education (twice per week), and culinary arts (twice per week). |
| Components[16] | **CTE/Program-Centered Components**: *Complete one CTE course* (100 percent) and *career exploration through SchooLinks* (100 percent); additional components are course specific: Work-based learning exposure such as expert speakers or field trips (<40 percent), industry-sponsored events or challenges (<15 percent), and coordination with external organizations for job placement (<5 percent). |
| Completion | **Completion Definition**: Pathway course sequence completion<br>**Number/Percentage of Completers**: Unavailable<br>**Credentials Available**: Pharm Tech, Water Operator in Training, Early Childhood Education (Illinois ECE level I), OSHA (Occupational Safety and Health Administration) Workplace Safety, and ServSafe Food Handler & Food Manager |

Items in italics are required activities for CTE students.

[16] Percentages indicate the percentage of students in the high school receiving particular components.

| | The Film Technician Program at Central New Mexico Community College |
|---|---|
| Operations | **Programmatic Level**: Dual enrollment in high school and postsecondary within a community college<br>**Location**: Albuquerque, New Mexico, and local high schools<br>**Number of Schools**: One community college<br>**Number of Students Served (estimated, annual)**: 400<br>**Website**: https://www.cnm.edu/programs-of-study/programs-a-z/film-technician<br>**Entrance Requirement**: An open registration process is for introductory classes. Students must meet the Accuplacer scores necessary to enroll in other courses at the community college. High school students must meet dual-enrollment requirements set by the college and the area school district.<br>**Unique Information**: The postsecondary portion of the program is a preapprenticeship in film production; courses are led by Central New Mexico (CNM) instructors who are active members of the International Alliance of Theatrical Stage Employees or affiliated with the union. They are working professionals with strong connections in the industry. Bilingual courses are offered. |
| Curriculum | **Number of Pathways**: One (multiple certifications and credentials available)<br>**Sequenced CTE Pathway Curriculum**: **Secondary students (grades 10–12)**: dual-credit classes in Introduction to Film and/or Introduction to Editing at their high school (approximately 85 percent of students) or at CNM (approximately 15 percent of students) with access to the film studio and other resources. **Postsecondary students**: Regular courses and hours in the studio and film editing lab are part of their coursework. |
| Components | **CTE/Program-Centered Components**: Field trips and industry events to the Prop House, ABQ Studios, NM Music and Film Experience (postsecondary students); SkillsUSA and industry events (all students); and a variety of work-based learning experiences, including staffing the WESST Productions broadcast studios (all students).<br>**Additional Components**: Recently launched a summer bootcamp to provide professional development opportunities for high school teachers leading dual-credit courses. Students earn 15 days of credit on a feature film, which counts toward the required 30 days needed to become a member of the International Alliance of Theatrical Stage Employees Local 480. |
| Completion | **Completion Definition**: Course completion and credential attainment<br>**Number/Percentage of Completers**: Approximately 95 students earn a credential (certificate or degree) each semester.<br>**Credentials Available**: Part of the associate of applied science and associate in arts degree programs; Credentials in Film Crew Technician, Postproduction Technician, and/or Construction for Film. |

| | Franklin Technology Center at Joplin School District |
|---|---|
| Operations | **Programmatic Level**: District<br>**Location**: Joplin, Missouri<br>**Number of Schools**: One center serving Joplin High School, three nearby school districts, and home-schooled and private school students<br>**Number of Students Served (estimated, annual)**: 700 in grades 9–12, approximately 200 juniors or seniors in pathways<br>**Website**: http://ftc.joplinschools.org/<br>**Entrance Requirement**: An application and interview are required to concentrate in a pathway starting in the junior or senior year; open enrollment for introductory CTE courses. |
| Curriculum | **Number of Pathways**: 14 pathways<br>**Curriculum Overview**: Both 1- and 2-year training programs are offered. All courses incorporate a competency-based curriculum. Students achieve a program's competencies by mastering a series of lessons or tasks. All pathways have embedded academic credit for English and mathematics/science.<br>**Additional Information**: There are typically 30–35 students enrolled in each pathway. For eight of the 14 pathways, dual credit classes are available through two local community colleges: Crowder College and Ozark Technology College. |
| Components | **CTE/Program-Centered Components**: *Lab hours* (*3–4 days per week*), industry-sponsored events, expert speakers, internships, job shadowing, apprenticeship, employability skills training, résumé writing, job interviewing based on SkillsUSA curricula, career and technical student organizations (DECA [formerly known as Distributive Education Clubs of America], Future Business Leaders of America, Future Health Professionals [formerly known as Health Occupations Students of America], Technology Student Organization), and career counseling with a full-time counselor.<br>**Additional Components**: To stay current with their instruction and industry trends, most instructors and administrators participate in industry externships, the ACT Summer Institute hosted by the state of Missouri, and other professional development conferences or sessions that are relevant to their pathway. |
| Completion | **Completion Definition**: Successful course completion with 80 percent competency mastery.<br>**Number/Percentage of Completers**: One hundred twenty-four students completed a pathway in the 2018–19.<br>**Credentials Available**: All pathways lead to an industry certificate with assessment that is free to students. Students enrolled in a CTE pathway also can earn a 1- or 2-year certificate of training if they complete their program with 80 percent mastery of program competencies. |

Items in italics are required activities for CTE students.

| | William S. Hart Union High School District Career and College Readiness Program |
|---|---|
| Operations | **Programmatic Level**: District<br>**Location**: Santa Clarita, California<br>**Number of Schools**: Seven comprehensive high schools (including one academy school), an adult school, a continuation school, a school for those with emotional needs, and six middle schools<br>**Number of Students Served (estimated, annual)**: 10,700 students (2017–18); 22,000 (2020-21)<br>**Website**: https://www.pathwaytomyfuture.org<br>**Entrance Requirement**: 90 percent open registration; academy school requires application<br>**Unique Information**: Not all career pathways are available in every school, but students can enroll in classes at any site. Students in the district are required to take at least one CTE course. |
| Curriculum | **Number of Pathways**: 32 unique pathways (75 across all schools)<br>**Sequenced CTE Pathway Curriculum**: *Two years of coursework with lab settings and two to four community college courses*<br>**Nonsequenced CTE Pathway Curriculum:** 36 CTE electives for junior high<br>**Curriculum Overview/Additional Information**: The district ensures that college courses either help complete an associate degree or are transferable to the Cal State or the University of California System; 10 percent of students have an integrated course experience. |
| Components[17] | **CTE/Program-Centered Components**: College and career seminar (ranges by school; 10 percent–25 percent of students participate); career and technical student organizations (approximately 20 percent; most students committed to pathways participate), *internships, 40–120 hours* (approximately 25 percent of students); work-based experiences, including job shadowing in 10th grade (80 percent of students), expert speakers (90 percent of students), and field trips (50 percent of students); and school-based enterprise (10 percent of students)<br>**Proximal Components**: Connecting to Success Career Conference (approximately 100 percent of students), Xello college and career readiness activities (approximately 100 percent of students), college credit through dual enrollment (approximately 20 percent of students)<br>**Additional Components**: Annual meeting hosted by the district, teacher convenings, college faculty convenings, and supplemental training (e.g., externships) for teachers |
| Completion | **Completion Definition**: Any student completing a capstone course (California); 300 hours of CTE curriculum (Perkins V definition), completing 2 years of coursework plus two to four college courses plus internship (district requirements)<br>**Number/Percentage of Completers**: 80 percent (California), 50 percent (Perkins V), district completion unavailable<br>**Credentials Available**: Medical assistant, pharmacy technical, dental assistant, phlebotomy, dental radiology, infection control, ServSafe, and cardiopulmonary resuscitation<br>**Credentials Awarded**: Approximately 30 percent of students committed to a pathway obtain an industry-recognized or state agency certification |

Items in italics are required activities for CTE students.

[17] Percentage participation indicates the number of students in the district.

| | INCubatoredu Course (Uncharted Learning) |
|---|---|
| Operations | **Programmatic Level**: External organization<br>**Location**: Alabama, California, Colorado, Florida, Georgia, Illinois, Indiana, Louisiana, Maine, Minnesota, Nebraska, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Tennessee, Texas, Virginia, and Wisconsin; the majority of participating high schools are in Texas and Illinois.<br>**Number of Students Served (estimated, annual)**: 3,192 students (2017–18); 4,084 students (2018–19); and 7,700 students (2019–20)<br>**Website**: https://www.unchartedlearning.org/student-programs/incubatoredu<br>**Entrance Requirement**: Determined by district or school<br>**Unique Information**: Uncharted Learning, a nonprofit organization, partners with districts and schools to provide the INCubatoredu entrepreneurship curriculum, experiential professional development, and resources to engage communities. Schools implement the program with their own teachers in their own facilities in an academic classroom setting. Students enroll and engage in a full-year course (170 school days) or a one-semester course if there is block scheduling. |
| Curriculum | **Number of Pathways**: One pathway (business and marketing course)<br>**Curriculum Overview/Additional Information**: Eight units of 35 structured lesson plans and assessment. Uncharted Learning aligns courses to the National Consortium of Entrepreneurship Standards, the Common Core State Standards, and 21st Century Learning and Innovation Skills. The curriculum includes employability skills training in networking, public speaking, and writing. The curriculum centers on the entrepreneurial process and lean start-up methods, where student teams fully develop a business concept and bring it to market. Businesses are fully owned and operated by students. |
| Components[18] | **CTE/Program-Centered Components**: *Mentoring* (100 percent), *expert speakers* (100 percent), *and employability skills training* (100 percent); instructors build business partnerships within the local area that will serve as hosts for field trips, expert speakers, mentors that advise student businesses, and investors.<br>**School Opt-in Components**: Some schools (15) have articulated agreements with postsecondary institutions that designate the course as dual enrollment, proficiency, or prior learning credit.<br>**Additional Components**: Uncharted Learning provides oversight on updates to the curriculum every year with the support of subject matter experts, training through a 2-day conference and a virtual meeting for teachers, and materials and assessments for classroom instruction. |
| Completion | **Completion Definition**: Passing the INCubatoredu course<br>**Number/Percentage of Completers**: Unavailable<br>**Credentials Available**: Some schools incorporate Certiport Entrepreneurship and Small Business certification. |

Items in italics are required activities for CTE students.

[18] Percentages of students, if available.

| | Introduction to the Trades Skilled Trades Program |
|---|---|
| Operations | **Programmatic Level**: District<br>**Location**: Fairbanks, Alaska<br>**Number of Schools**: Students from five high schools in the district can enroll in the program.<br>**Number of Students Served (estimated, annual)**: 160, with 12–15 high school juniors and seniors annually enrolled in each course<br>**Website**: https://www.k12northstar.org/Page/7859<br>**Entrance Requirement**: Ranked order admissions process with waiting lists common. Criteria for consideration include whether the student is on track to graduate, attendance record, demonstrated interest and commitment, future career goals, and a letter of recommendation and transcript.<br>**Unique Information**: Courses are held at the Fairbanks Pipeline Training Center, a 30-acre facility funded by the state and local trades unions. |
| Curriculum | **Number of Pathways**: Six (building trades, welding, electrical, heavy equipment maintenance, laborers, and process technology)<br>**Curriculum Overview**: Afterschool preapprenticeship course, offered on a pass/fail basis, 2 days per week for 2.5 hours per day during the spring semester. Curriculum aligns with union standards and emphasizes preparedness for working on an adult work crew. All classes have a classroom and a hands-on skill development component.<br>**Additional Information**: The process technology class is a dual-enrollment class with the University of Alaska–Fairbanks. Emphasis is placed on the importance of attendance and frequent drug and alcohol testing in these fields. |
| Components | **CTE/Program-Centered Components**: *Work site visits and industry field trips*<br>**Additional Components**: Union instructors have strong industry connections and provide mentoring and career guidance in a simulated work environment. Local apprenticeship programs reserve spots for Introduction to the Trades graduates. Course completion can be the first stage of applying to the School to Apprenticeship Pathway, which provides an entry position in a union apprenticeship. |
| Completion | **Completion Definition**: A student must attend 90 percent of the time to be a completer of the program. Passage or failure of the course indicates completion.<br>**Number/Percentage of Completers**: 35–45 annually<br>**Credentials Available**: Industry certifications, including Occupational Safety and Health Administration certifications, are embedded in the curriculum.<br>**Other Outcomes**: Union data show that prior to the development of the Introduction to the Trades course, students enrolling in an apprenticeship program directly from high school were likely to drop out in the first year, with only 35 percent completing. Since the course has been offered, approximately 80 percent persist in/complete the apprenticeship. |

| | Jessamine Career and Technology Center |
|---|---|
| Operations | **Programmatic Level**: District<br>**Location**: Nicholasville, Kentucky<br>**Number of Schools**: One county CTE center, three district comprehensive high schools, and two middle schools<br>**Number of Students Served (estimated, annual)**: 2,112 in grades 9–12<br>**Website**: https://www.jessamine.k12.ky.us/12/Home<br>**Entrance Requirement**: Predominately open registration, but some final pathway courses require an application.<br>**Unique Information**: Students typically spend one to two periods daily at the Jessamine Career and Technology Center campus. |
| Curriculum | **Number of Pathways**: 32 pathways in 9 career clusters<br>**Sequenced CTE Pathway Curriculum**: *Four sequenced courses per pathway*. Some pathways have options for the four courses; others have set four courses. Pathways can include required courses, electives, integrated courses, and dual enrollment.<br>**Curriculum Overview/Additional Information**: Focus is on student development of four employability skills: time, task, and resource management; communication and collaboration; participation and problem solving; and professionalism (10 percent of grade). |
| Components[19] | **CTE/Program-Centered Components**: Engage with industry through expert speakers and field trips (100 percent); meet with college and career readiness advisor in a career and technical student organization aligned to a pathway (Family, Career and Community Leaders of America; FFA [formerly known as Future Farmers of America]; DECA, formerly known as Distributive Education Clubs of America; Future Health Professionals, formerly known as Health Occupations Students of America; Student Technology Leadership Program; Technology Student Organization); mock trial; military team; gain work-based experience through internship elective or other opportunity (20 percent); work through a school-based enterprise (small number of students).<br>**Additional Components**: The Center provides oversight on articulated agreements with regional universities, curriculum and content updates, and professional development (18 hours annually) for CTE teachers and tracks program outcomes (e.g., completing pathways, assessments, certifications). |
| Completion | **Completion Definition**: Finishing the four-course sequence in a career pathway and high school graduation<br>**Number/Percentage of Completers**: 400 in 2018–19; about 80 percent of students complete the program.<br>**Credentials Available**: State Registered Nurse Aide, Certified Phlebotomist, ProStart Culinary certification, Kentucky Child Development Associate, Automotive Service Excellence Student Certification (Diesel Mechanics), and many information technology certifications<br>**Credentials Awarded**: About 65 percent of students graduate with a credential.<br>**Other Outcomes**: Although not required, students are encouraged to take the CTE end-of-program assessment and/or certification in pathways. |

Items in italics are required activities for CTE students.

[19] Percentage of CTE students; some activities do not have a known percentage.

| | Miami Animation and Gaming International Complex at Miami Dade College |
|---|---|
| Operations | **Programmatic Level**: Institution of higher education<br>**Location**: Miami, Florida<br>**Number of Students Served (estimated, annual)**: More than 500 (2017–18)<br>**Website**: https://magic.mdc.edu/<br>**Entrance Requirement**: Students must apply to Miami Dade College to enroll in the program.<br>**Unique Information**: The population is urban, low socioeconomic status, postsecondary students drawn heavily from the local Miami area, where 25 percent of the residents live in poverty. |
| Curriculum | **Number of Pathways**: Two associate in science degree pathways and one micro-credential (college credit certificate in virtual reality and augmented reality technologies)<br>**Sequenced CTE Pathway Curriculum**: Two-year, 60-credit postsecondary cohort-based program incorporating project-based learning throughout; biweekly consultation with assigned industry mentor; program focuses on employability skills, including collaboration, project management, and creative problem solving. Students learn software, coding/programming, and creative skills and use projects to generate material for their professional portfolios.<br>**Additional Information**: Pitches to the industry on game or animation ideas are developed as part of course requirements. The program receives 15 percent of any student earnings generated in this way. Students with grade point averages less than 2.5 receive targeted support to continue. |
| Components | **CTE/Program-Centered Components**: Industry internships; *expert speakers and frequent industry mentorship (embedded in program)*<br>**Additional Components**: All instructors in the program have industry-relevant work experience and take part in professional development each summer because technological advances in the animation field happen rapidly. |
| Completion | **Completion Definition**: Completion of an associate in science degree in game development and design or animation and game art and a 15-credit micro-credential (college credit certificate) in virtual reality or augmented reality<br>**Number/Percentage of Completers**: Estimated annual completion of 239 students<br>**Other Outcome**: The program estimates that approximately 90 percent of the graduates are either pursuing a 4-year degree, working in the animation industry, or participating in an internship. |

Items in italics are required activities for CTE students.

| | Miami Dade County Public Schools CTE program |
|---|---|
| Operations | **Programmatic Level**: County/district<br>**Location**: Miami, Florida<br>**Number of Schools**: 75 middle schools, 56 comprehensive high schools, 3 CTE centers, 7 alternative schools, and pathways with dual enrollment offered by Miami Dade Technical College<br>**Number of Students Served (estimated, annual)**: More than 100,000 students (approximately one third of the district's student body); in 2019–20, about 22,500 students in middle schools and 81,500 students in high schools<br>**Website**: https://ctemiami.net/<br>**Entrance Requirement**: Long-standing choice model in the district; option to choose a neighborhood school or apply to a magnet school or other programs in schools across the district. Application process involves assignment by a centralized random lottery, where students provide preferences for five choice options. The minimum grade point average for admission to CTE programs ranges from 2.0 to 2.5.<br>**Unique Information**: CTE courses delivered through NAF and non-NAF academies as well as magnet and nonmagnet schools. Miami Dad County Public Schools is the fourth largest district in the United States. |
| Curriculum | **Number of Pathways**: Approximately 80 career pathways across 16 career clusters, often offered at multiple high schools; 60 NAF academies<br>**Sequenced CTE Pathway Curriculum**: Designated courses in each program of study, CTE and non-CTE; CTE courses are classified as middle school/career exploratory (grades 6–8), career preparatory (grades 9–12), technical education (grades 6–12), work-based learning and capstone courses (grades 9–12), and postsecondary courses in technical colleges (dual enrollment). |
| Components | **CTE/Program-Centered Components**: Career and technical student organizations (DECA [formerly known as Distributive Education Clubs of America]; Future Business Leaders of America; Family, Career and Community Leaders of America; FFA [formerly known as Future Farmers of America]; Florida Public Service Association; Future Health Professionals [formerly known as Health Occupations Students of America]; SkillsUSA; and Technology Student Association); career-based competitions; field trips; college tours; paid summer internship experience (approximately 3,000 students annually among more than 800 providers, many of which are small businesses); academic supports; career counseling; advising; and dual enrollment (about 2,200 students)<br>**Additional Components**: Local business leaders and postsecondary partners serve as mentors, funders, and advisory board members. Teachers receive technological training and professional development and often collaborate with postsecondary faculty and industry leaders to ensure that content at the secondary level is aligned to promote college and career success. |
| Completion | **Completion Definition**: Completion of designated course sequence in the program of study (CTE and non-CTE courses)<br>**Number/Percentage of Completers**: Unavailable<br>**Credentials Available**: The Florida Career and Professional Education Act provides incentives for aligned certification attainment. Many but not all career pathways incorporate an industry certification attainment with articulated college credit in high school. |

| | Missoula County Public Schools District Automotive Program |
|---|---|
| Operations | **Programmatic Level**: District<br>**Location**: Missoula, Montana<br>**Number of Schools**: Four high schools<br>**Number of Students Served (estimated, annual)**: 125<br>**Entrance Requirement**: Open registration but typically higher demand than available space. Counselors identify students with a clear interest in the automotive industry.<br>**Unique Information**: The program takes place at the Community Auto Training Center, which is at one high school. Students from the three other district high schools commute to the center via bus for 2-hour block classes 5 days per week. |
| Curriculum | **Number of Pathways**: 1<br>**Sequenced CTE Pathway Curriculum**: *Four-course pathway* includes combination classroom and lab instruction. The program is based on the CDX curriculum, which aligns with Automotive Service Excellence certifications and other curriculum and industry certifications. Students must earn at least a C to move on to the next class in the sequence.<br>**Additional Information**: The program has articulation agreements with the local trade school and Butte Community College. An industry gap analysis identified the need for welders in the region, so the district developed a separate welding program that includes dual credit options with the local community college. Full alignment with SkillsUSA is a target for the program. |
| Components[20] | **CTE/Program-Centered Components**: Mentoring (three students to one mentor) and career advising (100 percent); development of portfolios and résumés in class (100 percent); required *job shadowing* (Auto 3 and Auto 4 students); internship at a local auto shop (approximately half of Auto 4 students); guest speakers; and field trips with local employers, such as the partnership with Montana Job Service (100 percent)<br>**Additional Components**: Teachers oversee their own continuing education/training each summer, local business partnerships, student exploration of the field and mentorships, and connection between students and employers. The local Ford dealer is now helping connect the program to Ford's Accelerated Career Exploration program, which offers Ford tech training and certifications to high schools. |
| Completion | **Completion Definition**: Completing a four-course pathway<br>**Number/Percentage of Completers**: Unavailable<br>**Credentials Available**: Tire Industry Association, Snap-On NC3 Certification Program, S/P2 (Safety and Pollution Prevention Training), Valvoline Oil, and Occupational Safety and Health Administration 10-Hour Safety curriculum; opportunities to earn industry certifications are integrated throughout the program. The program covers the cost of some but not all certificate examinations for students. |

Items in italics are required activities for CTE students.

[20] Percentage of students in the program who participate in the program.

| | NAF |
|---|---|
| Operations | **Programmatic Level**: External organization<br>**Location**: 34 states plus Washington, D.C.; Puerto Rico; and the U.S. Virgin Islands<br>**Number of Schools**: 406 nationally<br>**Number of Students Served (estimated, annual)**: 620 NAF academies and more than 112,000 students in 2019<br>**Website**: https://naf.org/<br>**Entrance Requirement**: None required by NAF; any requirements are school or district specific.<br>**Unique Information**: NAF academies are small learning communities within existing schools in which students focus on a career cluster or an industry. A school may house more than one NAF academy. |
| Curriculum | **Number of Pathways**: More than five pathways (finance, information technology, engineering, health sciences, hospitality and tourism, and other-themed)<br>**Curriculum Overview**: Four-course sequence with work-based learning often occurring in the summer between junior and senior year.<br>**Additional Information**: NAF provides schools with a project-based-learning-focused curriculum that incorporates input from industry representatives. NAFTrack certification is an optional experience available for schools and students. NAFTrack is a college and career readiness measure that also benefits students in job searching. |
| Components | **CTE/Program-Centered Components**: Expert speakers, college and career skills workshops, mock interviews, worksite tours, and internships (An estimated 84 percent of students participated in at least one work-based learning activity, 29 percent of students participated in internships.)<br>**Additional Components**: The NAF educational design consists of four essential elements: academy development and structure, curriculum and instruction, advisory board, and work-based learning. The NAF organization provides oversight and guidance on academy structure, data review, and student supports; business and community advisory board development and function; instructional supports, technical assistance, and peer networking for teachers; and training and supports for work-based learning. NAF also oversees an annual academy assessment cycle each year, during which academies reflect and review their student outcomes to implement continuous improvement. |
| Completion | **Completion Definition**: Four-course sequence and high school graduation; separate NAFTrack certification completion: four semesters of NAFTrack-approved courses and performance-based assessment, 120 hours of qualifying internships (currently reduced to 80 hours because of COVID-19-related limitations).<br>**Number/Percentage of Completers**: Ninety-nine percent of students still enrolled as seniors graduated from high school in 2018–19.<br>**Other Outcomes**: According to a propensity score matching study of 10 school districts released in 2017,[21] students with full program participation graduated at a 6 percent higher rate than non-NAF students. Students simply enrolled in NAF academies graduated at a 3.3 percent higher rate. Students with full program participation and also flagged as “at risk to graduate” after freshman year were 10 percentage points more likely to graduate than non-NAF students. |

[21] Sun, J., & Spinney, S. (2017). *Transforming the American high school experience: NAF’s cohort graduation rates from 2011–2015.* ICF International. https://files.eric.ed.gov/fulltext/ED590583.pdf

| | Naperville School District 203 CTE Program |
|---|---|
| Operations | **Programmatic Level**: District<br>**Location**: Naperville, Illinois<br>**Number of Schools**: Two high schools and one CTE center (the Technology Center of DuPage).<br>**Number of Students Served (estimated, annual)**: CTE courses had a combined, duplicated enrollment of 4,711 students in 2018–19.<br>**Website**: https://www.manula.com/manuals/naperville-community-unit/ncusd203-career-pathway/1/en/topic/welcome-ncusd203-career-pathway<br>**Entrance Requirement**: None<br>**Unique Information**: All students in the district must accumulate at least one CTE credit to graduate. All courses (aside from those at the Technology Center of DuPage) are housed within the two comprehensive high schools. |
| Curriculum | **Number of Pathways:** 23 in 7 career clusters<br>**Nonsequenced CTE Pathway Curriculum**: CTE options begin in sixth grade with a set of predetermined courses. Students in grades 7–12 choose their own *CTE courses* based on their abilities and interests. Each pathway includes multiple options for specific courses that promote exploration and skill development in a career field. Most courses are held in the high school (about 30 students per year attend the Technology Center of DuPage). In addition, students can gain *dual credit from the University of Illinois or the College of DuPage*, a local community college, for one to three courses in the pathway.<br>**Proximal Curriculum**: Each pathway has related courses that expand students' experiences. |
| Components[22] | **CTE/Program-Centered Components**: Career and technical student organizations (e.g., DECA [formerly known as Distributive Education Clubs of America]; Business Professionals of America; SkillsUSA) and recommended workplace-related experience recommendations (not standardized).<br>**Proximal Components**: All students experience the district's comprehensive counseling program and a curriculum that spans grades 6–12 and includes goal setting, planning, and developing an individual learning plan for each student.<br>**Additional Components**: All teachers attend professional development during two annual institute days. The district evaluates the program each year, reviews short- and long-term labor market demands, and reviews program material and content for updates. |
| Completion | **Completion Definition**: Diploma endorsement pathways exists for four clusters (education and training; information technology; agriculture, food, and natural resources; and business management and administration). Students must complete 2 years of career-specific coursework with at least 6 hours of early college credit (Advanced Placement or dual enrollment), 60 cumulative hours of supervised career-developing experience with professional skills assessment, two career exploration activities (or one extensive experience), and two team-based challenges with adult mentoring.<br>**Number/Percentage of Completers**: Unavailable; 2,270 students who graduated high school completed at least one CTE course in 2017–18. |

Items in italics are required activities for CTE students.

[22] Percentages are unavailable for this program.

| | Northwest ISD Biomedical Sciences Academy (incorporating Project Lead The Way) |
|---|---|
| Operations | **Programmatic Level**: Local education agency<br>**Location**: Dallas–Fort Worth, Texas, Metroplex<br>**Number of Schools**: One high school (offered to all high school students in the district)<br>**Number of Students Served (estimated, annual)**: 300 in 2019–20<br>**Website**: https://www.nisdtx.org/departments/cte__career___technical_education_/academies_and_pathways/biomedical_sciences_academy<br>**Entrance Requirement**: Open application process for eighth graders, including an interest survey, an e-portfolio, and student interviews. There is an active waitlist and opportunities for rising sophomores and juniors to enter the program.<br>**Unique Information**: Students placed in the academy transfer to that high school (one of four in the district) for all their coursework. |
| Curriculum | **Number of Pathways**: One (biomedical sciences)<br>**Sequenced CTE Pathway Curriculum**: *Four-course Project Lead The Way model* with a mix of classroom, lab, and work-based learning experiences. Senior-year students have the option to do the capstone course or enroll in the district's emergency medical technician or certified medical assistant courses, with the expectation that students will take certification examinations necessary to become licensed. |
| Components | **CTE/Program-Centered Components**: *Job shadowing as part of the senior biomedical innovation course and working to create an innovation within the location, internships, guest speakers* (classroom-embedded activities), Future Health Professionals (formerly known as Health Occupations Students of America) competitive events (approximately 45 students annually), real-world research through partnerships with Tulane University.<br>**Additional Components**: A local health clinic; Texas Health Resources will be adding clinical offices to meet local demand for sports medicine. Academy students will have the opportunity to intern in this clinic once it opens. |
| Completion | **Completion Definition**: Completion of four sequenced courses and certifications<br>**Number/Percentage of Completers**: Unavailable<br>**Credentials Available**: All participating students earn *Basic Life Support and Occupational Safety and Health Administration certifications*. |

Items in italics are required activities for CTE students.

| | Perquimans County Schools CTE Program |
|---|---|
| Operations | **Programmatic Level**: District<br>**Location**: North Carolina<br>**Number of Students Served (estimated, annual)**: 450 middle school students in CTE exploratory programming; 350 high school students in a CTE course<br>**Website**: http://www.pqschools.org/departments/career-and-technical-education<br>**Entrance Requirement**: There are no entry requirements for students to enroll in single CTE courses or pathways.<br>**Unique Information**: Courses are integrated into middle schools and comprehensive high schools; all students work with career development coordinators. |
| Curriculum | **Number of Pathways**: Seven<br>**Sequenced CTE Pathway Curriculum**: Four CTE courses in a pathway (prior to changes instituted for Perkins V implementation): two foundational courses, one upper-level course, and one enhancement course. A small portion of students take dual-enrollment courses with a local community college. |
| Components[23] | **CTE/Program-Centered Components**: **Middle School Students**: Field trips to business (100 percent), visits from expert speakers (100 percent), industry-sponsored events (100 percent), and career advisement (100 percent); **High School Students**: Regular hours in lab space (100 percent), field trips to business (100 percent), visits from expert speakers (100 percent), industry-sponsored events (100 percent), employability skills training (100 percent), comprehensive academic planning (100 percent), dual-enrollment courses (<5 percent), and semester-long internships (<5 percent).<br>**Additional Components**: The administration oversees the tracking and reporting of program outcomes, reviews labor market data, develops industry and higher education partnerships, and creates programming in conjunction with partners. |
| Completion | **Completion Definition**: Completion of four-course sequence to complete a pathway (prior to changes instituted for Perkins V implementation)<br>**Number/Percentage of Completers**: Each year, approximately 80 students complete a CTE pathway.<br>**Credentials Available**: Students can earn industry-standard credentials in every pathway. The National Career Readiness Certification is offered through passage of the WorkKeys assessment. |

Items in italics are required activities for CTE students.

[23] Percentage refers to the percentage of students taking any CTE course.

| | Rockcastle Area Technology Center, Health Sciences Pathway |
|---|---|
| Operations | **Programmatic Level**: State/county<br>**Location**: Rockcastle County, Kentucky<br>**Number of Schools**: One state-supported Area Technology Center<br>**Number of Students Served (estimated, annual)**: 116 (2017–18)<br>**Website**: http://rockcastle.kyschools.us/ratc/health-science/<br>**Entrance Requirement**: Application process with additional criteria for students to enroll in the pathway.<br>**Unique Information**: Center instructors are state employees, and state resources cover facilities and equipment costs. Students in the pathway attend regular classes at the nearby high school and pathway courses part-time at the Center. |
| Curriculum | **Number of Pathways:** One (as the focus of this nominated program; more within the Rockcastle Area Technology Center)<br>**Sequenced CTE Curriculum**: *Four core courses, including lecture and lab experiences: Principles of Health Science, Emergency Procedures for Heath Care Professions/Medical Terminology, Health & Wellness/Medical Math, and Body Structures & Functions.*<br>**Curriculum Overview/Additional Information**: The program has an articulation agreement with Somerset Community College, and students may choose to take courses for dual credit; scholarships are available to help cover the costs. |
| Components | **CTE/Program-Centered Components**: Work-based learning through co-op, apprenticeship positions, and clinicals (all grades 11 and 12 students participate); Future Health Professionals (formerly Health Occupations Students of America) and participation in industry events and health-related community service activities (100 percent)<br>**Additional Components**: The program launched an apprenticeship program for students in the state-registered nurse aides/nursing pipeline with Rockcastle County Regional Hospital. |
| Completion | **Completion Definition**: Completion of four-course sequence<br>**Number/Percentage of Completers**: Approximately 12 percent (2017–18)<br>**Credentials Available**: Industry certificates in phlebotomy, electrocardiography, pharmacy technology, and state-registered nurse aides. Available even if students do not complete the four-course sequence. |

Items in italics are required activities for CTE students.

| | Simulated Workplace in West Virginia |
|---|---|
| Operations | **Programmatic Level**: Statewide<br>**Location**: West Virginia<br>**Number of Schools**: 130 secondary schools<br>**Number of Students Served (estimated, annual)**: 24,000<br>**Website**: https://wvde.us/simulated-workplace/<br>**Overview**: Simulated Workplace (SWP) is a series of 12 frameworks or protocols that define how the traditional classroom setting and student experience will be altered to transform into student-led companies that simulate real-world work experiences. All state-approved CTE courses in West Virginia have followed the SWP model since 2016, resulting in more than 1,200 SWP companies.<br>**Entrance Requirement**: Decided on a school-by-school basis, with a requirement to pass a safety assessment and adhere to protocols. Students apply to student-led simulated companies through an interview process. Students who are not offered entry can receive guidance in finding a student-led simulated company. |
| Curriculum | **Number of Pathways**: Implemented within 82 pathways<br>**Sequenced CTE Curriculum**: *Four core classes (sequential and project-based learning)* and at least four elective courses; participating students master technical skills that stack along a career pathway. They work within business processes and expectations, with an embedded employability skill curriculum (e.g., communication, leadership).<br>**Curriculum Overview**: The West Virginia Department of Education worked with industries, businesses, and the education sector to create 12 framework-setting protocols and processes aligned to real working environments that define the course experience, including organization and roles of the student-led company; application/interview structure; formal attendance system that mimics an industry-related company; drug-free work zones; quality control (6S environment); safe work areas, workplace teams, and project-based learning/student engagement; student-developed company policy and procedures (handbook); company meetings; on-site business review; and an accountability system using data review that incorporates student reporting, portfolios, and technical assessments. |
| Components[24] | **CTE/Program-Centered Components**: Internship; industry challenges include events through Project Lead the Way or SkillsUSA; reverse career fairs; dual-enrollment opportunities (90 percent).<br>**Additional Components**: All SWP teachers must have at least 5 years of industry experience and complete a 2-year SWP training, which includes receiving 18 college credits, paid for by SWP, with optional annual training. |
| Completion | **Completion Definition**: To complete, students must complete the four core courses and pass a technical assessment.<br>**Number/Percentage of Completers**: Unavailable<br>**Credentials Available**: Student pursuit of 650 credentials is included overall, with the pursuit of three to four credentials associated with each pathway. Credentials are organized into three tiers based on difficulty and length to obtain. Funding is available to support student testing. |

Items in italics are required activities for CTE students.

[24] Percentages are unavailable.

| | South Technical High School, Special School District of St. Louis County |
|---|---|
| Operations | **Programmatic Level**: Technical high school/district<br>**Location**: St. Louis, Missouri<br>**Number of Schools**: 1 of 2 technical high schools in the Special School District of St. Louis County, a countywide district serving 23 comprehensive high schools<br>**Number of Students Served (estimated, annual)**: 750 (375 juniors and 375 seniors); students spend half of the day at South Tech.<br>**Website**: https://www.ssdmo.org/domain/41<br>**Entrance Requirement**: Admissions open to students who are on track to graduate and attending a high school in St. Louis County, including all public, private, and homeschool students. Process includes a South Tech application for one CTE pathway during the sophomore year. A student's application is scored based on a rubric with a set number of criteria (e.g., interest, course history). If a pathway fills, waitlists for eligible applicants are formed. |
| Curriculum | **Number of Pathways**: 29 pathways, including 5 hybrid pathways designed for students with special needs.<br>**Sequenced CTE Pathway Curriculum**: South Tech's curricula have three levels of objectives: *level 1 (primary), level 2 (secondary), and level 3 (tertiary)*. Students spend an average of 80 percent of course time in a lab and 20 percent in the classroom. The program has articulation agreements with community colleges to offer dual-enrollment credits for six pathways (<20 percent). |
| Components[25] | **CTE/Program-Centered Components**: Internships (15 percent), *SkillsUSA* (100 percent), *industry-sponsored events* (100 percent), expert speakers and field trips (100 percent), and career and technical student organizations (15 percent; e.g., Family, Career and Community Leaders of America); *"2+2 planning" to help students plan for South Tech and 2 years after graduation* (100 percent), employability skills training (100 percent), integrated secondary education courses (<20 percent), mentoring (<20 percent), and preapprenticeship training (<20 percent)<br>**Additional Components**: Administration oversees the tracking of student outcomes, develops partnerships with higher education institutions and regional/national career and technical networks, provides professional development for teachers, and reviews state and national labor data. To assess program quality, Missouri's Department of Elementary and Secondary Education requires each program to complete a Common Criteria for Quality Indicators assessment. |
| Completion | **Completion Definition**: Completion of courses and participation in ACT WorkKeys National Career Readiness Certification.<br>**Number/Percentage of Completers**: Approximately 83 percent of participants complete the 2-year program at South Tech and graduate high school. |

Items in italics are required activities for CTE students.

[25] Approximate percentage of students participating in the experience.

| | The Switch Lab: Street Legal, Drivable Electric Vehicle Kit, Curriculum, and Support |
|---|---|
| Operations | **Programmatic Level**: External organization<br>**Location**: 16 states (currently most widely used in California)<br>**Number of Students Served (estimated, annual)**: 4,500 students and 150 schools in 2020<br>**Website**: https://www.theswitchlab.com/<br>**Entrance Requirement**: There are no entrance requirements beyond what schools require for students to enroll in specific courses within which the kit and curriculum are used.<br>**Unique Information**: The Switch Lab offers a project-based learning program consisting of a full-size electric vehicle building kit, curriculum, and workshop opportunities for educators, high school students, college students, and community members interested in learning how to build electric vehicles. |
| Curriculum | **Number of Pathways**: Not applicable; known to be used in manufacturing; science, technology, engineering, and mathematics programs; and transportation, distribution, and logistics CTE pathways.<br>**Curriculum Overview/Additional Information**: The program is designed for implementation within an education setting as part of a contextualized, applied learning experience or capstone project for students within a related CTE pathway (e.g., automotive or engineering) or core education class (e.g., physics). It also is designed to build employability skills for the workplace. The standard curriculum package includes The Switch EV, Build Your Own Electric Vehicle textbook, instructor guide, and downloadable student workbook and study guide; there is an option to buy an enhanced curriculum with more materials. The program is implemented in a 17-week semester course, an 8-week afterschool course, or a 2-week intensive course. |
| Components | **School Opt-in Components**: SkillsUSA participation; schools vary in additional program components. Schools have indicated that opportunities include field trips to businesses, learning from expert speakers, taking part in engineering challenges, and limited job shadowing.<br>**Additional Components**: The Switch Lab staff implement a 4-day training for instructors, oversee developing secondary and postsecondary partnerships, work with the California Department of Energy for implementation, serve on college advisory boards, and perform outreach for interested schools.<br>Annual Design Award: Switch Vehicles Inc. provides schools funds to enhance the program by designing and presenting new features or vehicle enhancements. Successful presenters receive funds to construct and test their enhancements. |
| Completion | **Completion Definition**: Student ability to drive (or ride if too young to drive) the electric vehicle they assemble.<br>**Number/Percentage of Completers**: Unknown; information not collected from participating schools.<br>**Credentials Available**: Incorporated learning is applicable for the Automotive Service Excellence testing, which provides industry-recognized credentials. |

| | Union Grove High School CTE Program |
|---|---|
| Operations | **Programmatic Level**: High school<br>**Location**: Union Grove, Wisconsin<br>**Number of Students Served (estimated, annual)**: About 800 students take at least one CTE course each year (grades 9–12), of which about 400 are concentrators (students who take at least three courses within one career cluster during high school).<br>**Website**: https://www.ug.k12.wi.us/domain/70<br>**Entrance Requirement**: Students enroll in a CTE course through a standard course request process, and certain advanced-level CTE courses require instructor approval. |
| Curriculum | **Number of Pathways**: 15 within 4 career clusters<br>**Sequenced CTE Pathway Curriculum**: Pathways include three levels of courses: introductory, intermediary, and advanced/capstone course. Introductory CTE courses contain career exploration activities (e.g., field trips, expert speakers), which intend to expose students to the variety of careers aligned with the pathway. In all pathways, students spend about 80 percent of their time in the lab and 20 percent in the classroom.<br>**Nonsequenced CTE Pathway Curriculum**: The school has a formal articulation agreement with Gateway Technical College and has a "Start College Now Program," where students can take up to 19 credits of technical college classes. The school will pay for tuition and books if the student passes the class(es). |
| Components[26] | **CTE/Program-Centered Components**: *80 percent of course hours in lab space* (100 percent), *employability skills training* (100 percent), field trips to businesses and visits from experts (100 percent), participation in career and technical student organizations (50 percent), participation in dual-credit courses (<50 percent), participation in work study (<40 percent), and participation in youth apprenticeship (<5 percent).<br>**Proximal Components**: *Job shadowing* (100 percent, requirement as a junior) and *participation in overall high school career advisement and Career Cruising* (100 percent).<br>**Additional Components**: Administrators oversee curriculum development in partnership with student, school board, business partner, and chamber of commerce input; partnerships with industry and higher education professionals; program outcomes and improvements; and labor market assessment. Teachers are responsible for pursuing professional development (e.g., externships or auditing college courses) and creating articulation agreements with colleges. |
| Completion | **Completion Definition**: Completion of three courses in pathway.<br>**Number/Percentage of Completers:** About 80 students complete a pathway annually.<br>**Credentials Available:** Six of the 15 pathways incorporate pursuit of an industry-recognized credential. |

Items in italics are required activities for CTE students.

[26] Percentage of students taking at least one CTE course.

| | Virtual Enterprises International |
|---|---|
| Operations | **Programmatic Level**: External organization<br>**Location**: California; Florida; Illinois; Massachusetts; Michigan; Missouri; Nebraska; New Jersey; New York; North Carolina; Oregon; Pennsylvania; South Carolina; Tennessee; Texas; Virginia; West Virginia; and Washington, D.C.<br>**Number of Schools**: 430 in 2018–19 (approximately 40 in career centers or CTE centers)<br>**Number of Students Served (estimated, annual)**: 15,000<br>**Website**: https://veinternational.org<br>**Entrance Requirement**: Schools/districts oversee entrance requirements (if any); none required from Virtual Enterprises (VE) International.<br>**Unique Information**: VE provides a live, global business simulation, with accompanying curriculum, which can serve as an in-school, work-based learning option for schools and districts. The credited, yearlong course for schools to purchase uses an online platform (VE Hub) for students to form simulated businesses and virtual products or services in an industry of their choice (e.g., technology, advertising). Students interact with other virtual businesses across the country and are connected by a central web-based banking system. |
| Curriculum | **Number of Pathways**: The VE course often is taken within a business management, entrepreneurship, or marketing pathway, but it can be implemented as a capstone course in subjects such as engineering or computer science.<br>**Curriculum Overview**: Stimulates the functions and demands of real-world businesses by having students create and manage a start-up company. Students interview for and hold professional roles within the company and are responsible for working together to strategically plan for and operate their business; conduct market research; develop a business plan; design and implement an e-commerce website; pay wages and taxes; maintain a 401(k); and develop an annual report. Students receive virtual salaries, learning about personal finance by budgeting for real-world obligations such as rent and personal income taxes and act as consumers for the products of other simulated businesses. Students are assessed at the end of the year using a National Occupational Competency Testing Institute assessment and complete periodic self-assessments linked to employee performance evaluations focused on employability skill development.<br>**Additional Information**: VE aligns the curriculum with their Career Readiness Framework. |
| Components | **CTE/Program-Centered Components**: VE holds regional, national, and online trade shows/competitions with access to real professionals (70 percent–85 percent student participation).<br>**School Opt-in Components**: Other types of CTE experiences (e.g., mentorship, field trips) are dependent on the schools, geography, and ability to travel.<br>**Additional Components**: VE designs the curriculum with industry input (e.g., Intuit, Society for Human Resource Management Foundation), holds a 4-day intensive national teacher conference each summer for all new and returning teachers to attend, and fosters teacher collaboration. VE has agreements with colleges for dual enrollment. |
| Completion | **Completion Definition**: Completing course and assessment<br>**Number/Percentage of Completers**: 13,000 (2017–18); 12,000 (2016–17), and 12,000(2015–16)—site self-reported<br>**Credentials Available**: At some sites, students earn industry credentials (Microsoft, QuickBooks). |

| | Woz Ed STEM Kits |
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| Operations | **Programmatic Level**: External organization<br>**Location**: Operates in 12 states ( Arizona, California, Florida, Georgia, Illinois, Michigan, Montana, Nebraska, New York, Oklahoma, Tennessee, and Texas)<br>**Number of Students Served (estimated, annual)**: 10,000<br>**Website**: https://wozed.com<br>**Entrance Requirement**: School's discretion; there are no prerequisites or entrance requirements that Woz ED specifically recommends.<br>**Unique Information**: Woz ED is an organization that provides schools with STEM (science, technology, engineering, and mathematics) kits, curriculum, and support for grades K–12. |
| Curriculum | **Number of Pathways**: Not applicable; provides kits and curriculum within 10 areas: coding, engineering, mobile development, cybersecurity, data science, artificial intelligence, animation, drones, robotics, and augmented reality/virtual reality.<br>**Curriculum Overview**: Level 1 kits are for grades K–2, level 2 kits for grades 3–5, level 3 kits for grades 6–8, and level 4 kits are for high school. The levels 1–3 kits have 6–10 hours of curriculum each; the Level 4 kits have more, with some filling a semester course.<br>**Additional Information**: Each kit includes lesson plans and modules, student journals, and relevant technology (minus any computers and/or tablets used). The teacher is responsible for delivering the provided curriculum to students and for creating class assessments. Schools can combine kits to create a semester-long curriculum. Dual enrollment is available for some of the drone and coding kits; Woz ED has some articulation agreements with universities. |
| Components | **Additional CTE/Program-Centered Components**: Woz ED partners with TranZed Apprenticeships and Pubforge to develop and implement a national approach to preapprenticeships and registered apprenticeships.<br>**School Opt-in Components**: Students' participation in CTE-related activities (e.g., career and technical student organizations, field trips) varies by school. |
| Completion | **Completion Definition**: Completion is defined as starting and finishing a kit.<br>**Number/Percentage of Completers**: Unknown (not tracked by Woz ED)<br>**Credentials Available**: Students can earn a certificate stating competency with front-end coding and also can become licensed to fly commercial drones. The kits do not incorporate direct preparation for industry-recognized credential examinations. |



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The American Institutes for Research (AIR) and its partners—the Association for Career and Technical Education (ACTE), JFF, and Vanderbilt University—serve as the CTE Research Network Lead. The Network Lead provides network administration and coordination as well as research, training, and dissemination to increase the number and quality of CTE impact evaluations and strengthen the field's research capacity.


www.air.org


www.acteonline.org


www.jff.org


www.vanderbilt.edu

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