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

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Contents

Introduction to Career and Technical Education

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 2016–17 school year, 98 percent of public school districts offered CTE to high school students (Gray & Lewis, 2018; U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, 2017). While CTE course-taking among high school students has declined over the past few decades, the majority still take at least one CTE course (Malkus, 2019; U.S. Department of Education, 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).[1]

CTE programs are often categorized into 16 career clusters with numerous specializations within each cluster.[2] Programs are delivered in a range of formats and settings but are most commonly structured into multiyear course sequences that include work-based or other applied learning; the latter may happen in hands-on instructional settings such as laboratories or simulated work environments in school settings. Programs are delivered in a variety of locations, primarily as elective offerings in comprehensive high schools, or in CTE centers that students may attend full-time or part-time, or online (U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, 2017).

Given the variability in format, setting, and location, and in 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 have identified and recommended a variety of promising program components: blended academic and technical curricula and shared planning for respective instructors; career advising systems that are longitudinal and individualized for students; 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, n.d.). High school CTE programs increasingly offer students the opportunity to earn college credits through articulation agreements and dual credit programs.

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[1] Data from Georgetown University's Center on Education and the Workforce found that about 9 percent of undergraduates are enrolled in certificate programs, which are primarily for career preparation (Carnevale et al. 2020).
[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; transportation, distribution, and logistics. However, not all states classify CTE into these exact 16 clusters.
[3] Also see Pathways to Prosperity, five key implementation elements (https://ptopnetwork.jff.org/about-us); and Linked Learning, Four Crucial Elements (https://www.linkedlearning.org/search?q=four+crucial+elements).

The federal legislation that authorizes CTE funding to the states, the Strengthening Career and Technical Education for the 21st Century Act (Perkins V), requires federally funded programs to include some of the above 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.

The Research on Career and Technical Education

There is a great deal of research literature on CTE, addressing a broad range of topics such as changes in offerings and student participation over time, CTE teacher preparation, and work-based learning. This literature and evidence base on CTE are largely descriptive, and suggest 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, Visher, & Beal, 2018). A few studies use more sophisticated methods including randomized controlled trials and quasi-experimental methods, such as regression discontinuity or instrumental variables approaches, to demonstrate the causal effect of career academies and standalone CTE high school programs on student outcomes.

Specifically, there is robust evidence on the impact of attending a career academy from several prominent lottery-based studies (Hemelt, Lenard, & Paeplow, 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, Jacob, & Levitt, 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. There is also robust evidence suggesting positive effects for students attending a standalone CTE high school stemming from two regression discontinuity studies leveraging strict cutoffs in admission requirements (Brunner, Dougherty, & Ross, 2019; Dougherty, 2018).

In general, 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 CTE programs delivered in postsecondary settings. More research is also needed to determine whether the promising evidence on career academies and standalone CTE high schools can be replicated in larger settings and with different student populations, as these programs scale more widely.

The Evaluability Assessment

The Career and Technical Education (CTE) Research Network was funded by the Institute of Education Sciences, the independent, nonpartisan research arm of the U.S. Department of Education, with the aim of expanding the evidence base on the impact of CTE on student outcomes. To help foster new impact studies, CTE Research Network partners conducted an evaluability assessment (also called a feasibility study). The evaluability assessment was a multistage process with the goal of identifying existing CTE programs or models that show interest in and potential for rigorous evaluation. Making such programs known to the field should encourage CTE researchers to pursue IES or other grant funds to conduct evaluations.

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 was also publicized by the CTE Research Network's lead partners, particularly the Association for Career and Technical Education, via a variety of e-newsletters with different distribution lists. In total, 112 entries were received and reviewed. Programs that were in operation for at least two years and that served at least 100 students per year were invited to complete a longer online questionnaire. Researchers followed up with these programs to assist by e-mail or phone in completing the questionnaire.

The data collected in these first two phases of the study helped the study team to understand key components of the programs. These 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. The study team assessed whether programs incorporated a range of promising components[4] compiled from multiple, national CTE initiatives or organizations, as well as the scope of the program; that is, how many students were served in which states.

After assessing the programs, the study team, with input from advisors, determined multiple criteria that could advance programs to the next phase 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 all advanced to the next stage. 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 (more than 500) was also a criterion that advanced programs, in that it would allow researchers a large enough sample for adequate statistical power to detect any differences in student outcomes being studied. In addition, programs were advanced in the process if they self-reported a large number of the promising program components thought to indicate quality 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 to learn more about potential opportunities for causal research during the interview process.

In the next phase, researchers collected additional information via phone 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 to 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.

The study team intended to conduct site visits to a small number of potential finalists to verify program information and collect additional details, but site visits were disrupted by school closures and travel restrictions due to the COVID-19 pandemic in spring 2020. Based on the data collected through the questionnaires, telephone interviews, and program documents to date, four programs (described below) are recommended for causal research. The appendix also includes a summary of the evaluation assessment steps and timeline.

[4] Promising program components used by the study team included (1) blended academic and technical courses or curricula, (2) shared academic and technical instructor planning, (3) career advising or guidance systems, processes, or supports, (4) industry participation in curriculum and/or program development or delivery, (5) review of labor market information, (6) career exploration through work-based learning, (7) career-specific work-based learning, (8) immersive experiences for work-based learning such as internships or preapprenticeships, (9) opportunity to earn related credentials, (10) direct links to postsecondary education through dual enrollment expectations, articulation agreements with local institutions, or other postsecondary input, and (11) incorporation of CTSOs or industry competitions.

Programs Identified as Ready for Evaluation

The following 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 global business simulation with 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, IT, 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 as well as filing tax returns. In addition, students attend local, national, and global trade shows and competitions, in-person and online, during which they interact with industry professionals and other simulated companies.

The yearlong VE course tends to be part of a business pathway, but it is also used as a capstone course in other CTE clusters. The business operated by the class may incorporate additional technical, engineering, or computer science skills and coursework in order 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 also available.

Possible causal study description

VEI is interested in conducting causal research on their model and has agreed to help researchers connect with schools where VE is a key part of their CTE delivery model. VEI began reaching out to their contacts in an effort to identify such programs that are oversubscribed and allocate slots via a lottery. VEI provided a list of preliminary contacts and indicated that there are programs in other schools that 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 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 programs that are well implemented and well integrated within a CTE pathway that is oversubscribed and slots are allocated via lottery.

Unknowns that 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 used to ensure they could support a randomized study. Where possible, researchers could seek to work with partner districts to fine-tune the lottery process and monitor its implementation, so as to ensure 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 to 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 numbers of students that 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 in order 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 school 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 reaching out to Nick Chapman, president, Virtual Enterprises International, at nchapman@veinternational.org.

NAF Academies

Program overview

Since 1980, NAF[5] has been developing and supporting high school career academies. 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. The NAF organization 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.

[5] NAF was formerly the National Academies Foundation. Now it is simply NAF.

Possible causal study description

NAF is interested in conducting causal research on their model and has agreed to help researchers connect with schools with NAF programs, particularly those that are well implemented and designated as "distinguished," according to the organization's metrics. NAF reached out to program contacts to identify such programs that are oversubscribed and allocate slots via a lottery. For example, NAF recommended an Academy of Information Technology in Central Florida. 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 programs that are oversubscribed with slots allocated via lottery.

Unknowns that 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 given those processes; 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 school districts overseeing the participating programs.

Inquiries regarding prospective research can be made by reaching out to 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 (DE Pathways) is a regional state-level CTE model that serves 36 of Delaware's 38 comprehensive high schools, 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 DE 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 five-year student success plan with mentoring for all students; advising on which career and technical student organizations and competitions schools should implement; development of articulation agreements for articulated credit and/or dual credit with postsecondary institutions in every pathway; and development of work-based learning opportunities and student placement through work-based learning coordinators at each school. About 15 percent of DE Pathways students currently participate in immersive work-based learning experiences. DE Pathways seeks to expand that to 30 percent.

Possible causal study description

The Delaware Department of Education is interested in participating in causal research on the DE 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 DE Pathways. However, the policy-relevant question for the department is the impact of a more-intensive DE 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 credits of CTE coursework in a dedicated career cluster following the DE 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 school districts in New Castle County, where they enroll in the standard three-course DE Pathways model. The study would evaluate the implementation of both the eight- and three-course DE Pathways 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 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 those efforts were curtailed by the pandemic.

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 a randomized study 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 that are truly randomized via the lottery. Researchers would also 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 in order 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 reaching out to 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 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 school districts outside of Joplin, and home-schooled 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 math/science, offer employability skills training, and use the SkillsUSA curriculum. A few more than half of the pathways have dual credit opportunity with two local community colleges.

Possible causal study description

Franklin Tech has expressed interest in participating in a causal research study. Twelve out of 14 of its 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 (due to admitted students deciding not to join) in their order of preference.

Franklin Tech has expressed a willingness to adapt their 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 a regression discontinuity study. It may also consider implementing a lottery for a set of students with rankings near the admission threshold to support a randomized study. In either case, treatment students would be compared to 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 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 would also need to assess the educational options in the Joplin district and other surrounding districts for applicants who do not gain admission to Franklin Tech in order to characterize the counterfactual and verify that there is likely to be a meaningful treatment or control contrast.

Finally, researchers would need to navigate the process of negotiating data-sharing agreements and permission to conduct qualitative data collection with Joplin ISD and surrounding school 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 reaching out to Elsie Morris, Vocational Special Services Coordinator, Franklin Technology Center, at elsiemorris@joplinschools.org.

Conclusion

The evaluability assessment yielded four CTE models or programs that show promise as sites for future causal studies, and that have distinctive features that make them especially potentially instructive. Virtual Enterprises 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. Franklin Tech uses a competency-based curriculum, which is becoming more common in CTE programs nationally but has yet to be rigorously studied. 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 could also 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 to a less-intensive model embedded within a standard high school setting.

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 that are 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 included 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. Should studies go forward, much will be learned to help inform and guide the field, policymakers, and future researchers.

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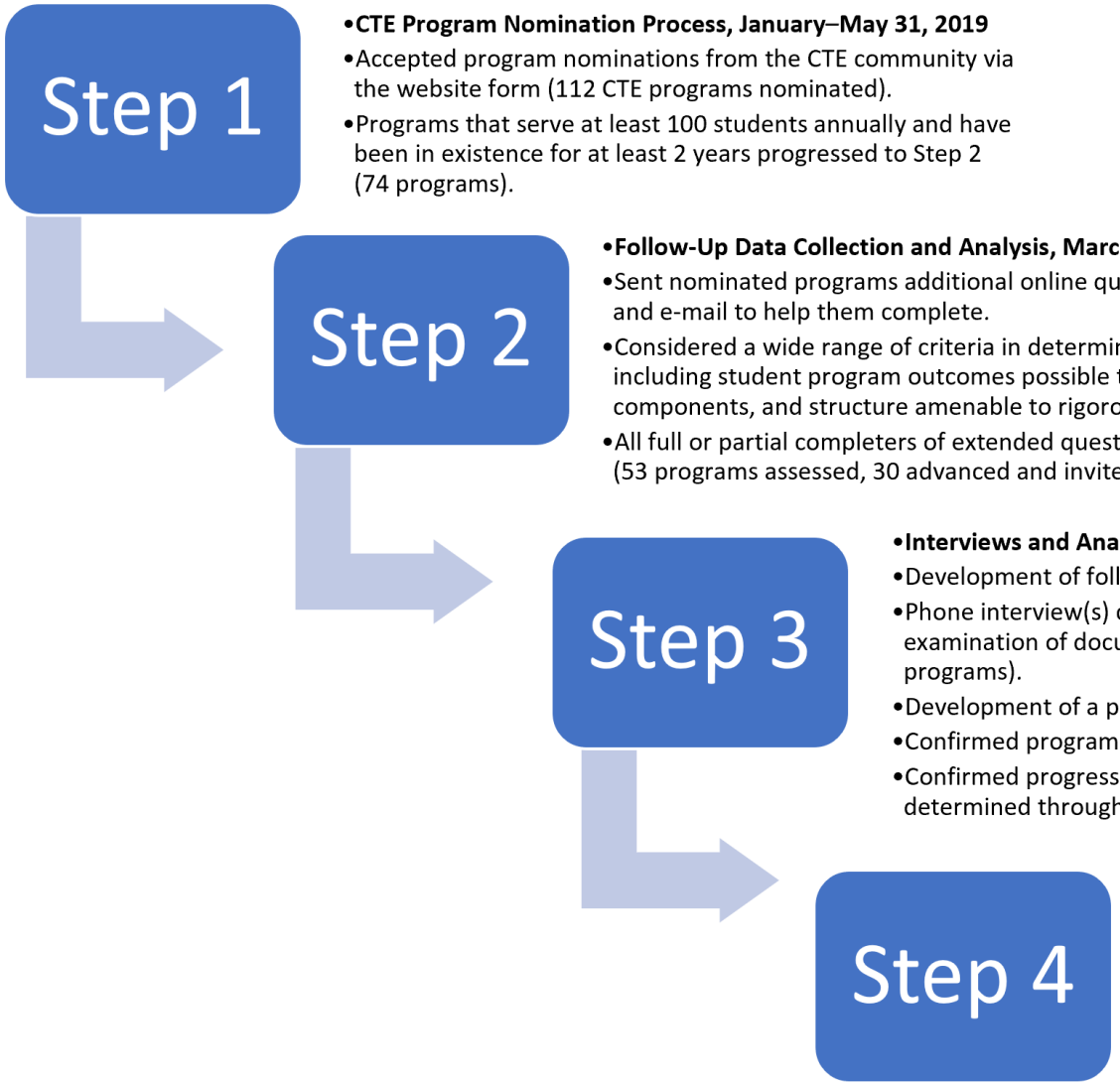
Appendix A. Summary of Evaluability Study Steps and Timeline



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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.

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