

What Works in Career and Technical Education (CTE)? A Review of Evidence and Suggested Policy Directions

AUTHOR

Ann Huff Stevens*, University of California, Davis
and National Bureau of Economic Research

* **Email:** annstevens@ucdavis.edu. Any opinions or conclusions expressed are mine alone, and not those of the Aspen Institute or members of the Aspen Economic Strategy Group.

ABSTRACT

Career and technical education (CTE) is widely viewed as an important alternative to traditional four-year colleges, a means of increasing the earnings of U.S. workers, and an effective response to the changing skill requirements of U.S. employers. While abundant evidence confirms that CTE offerings at public institutions can increase the earnings and employment rates of graduates, substantial barriers to successful expansion of high-quality CTE remain. These barriers include a lack of accessible information about program quality that makes it difficult for students to identify high-return programs and insufficient funding for both CTE students and the public institutions that provide high-quality programs. Low completion rates among those starting CTE programs also limit their positive earnings effects.

1. Introduction

OVERVIEW AND DEFINITIONS

Career technical education, or CTE¹, generally refers to educational programs that are specifically designed to prepare students for future employment in a particular sector or occupation. CTE programs frequently combine career-specific instruction with more traditional academic content, with an emphasis on applying academic skills to career settings. In practice, CTE programs train individuals for a wide variety of occupations and industries (e.g., early childhood instruction, welding, correctional officer positions) with a wide range of technical skill requirements.

CTE is provided in several types of settings. Most community colleges offer a number of CTE programs, including short-term “certificates” or “diplomas” that require between six months and two years of study, as well as programs that lead to two-year associate degrees. CTE is also offered by for-profit colleges, and the fraction of “occupational education” programs offered by these for-profit institutions is rising. Nonprofit organizations that are not affiliated with educational institutions also offer employment training programs; substantially less is known about the population served and the offerings of these organizations. Finally, many high schools offer CTE programs for their students, often with dual goals of preparing students for future employment and increasing the chances that students graduate from high school.

Individuals frequently become connected to CTE via federal employment and training programs. Currently, for example, CTE is part of the services offered under the Workforce Investment and Opportunities Act (WIOA) of 2014, which replaced

1 CTE was previously referred to as “vocational education” and is similar to the Department of Education’s classification of “occupational field of study” programs. The terms are largely interchangeable for the purposes of this brief. For an extended discussion of the definition of CTE, see Career and Technical Education Foundation (n.d.).

and expanded the Workforce Investment Act (WIA), passed in 1998.² Other programs such as Trade Adjustment Assistance (TAA), Temporary Assistance for Needy Families (TANF), and the Supplemental Nutrition Assistance Program (SNAP) also refer workers to CTE.

All of these federal employment programs offer some workers other services as well, such as job search assistance or career counseling. These umbrella federal employment and training programs (and their predecessors) have often been the subject of formal evaluations. Thus, evidence on CTE comes from both evaluations of CTE courses and degrees directly and from evaluations of federal employment and training programs that refer workers to these CTE programs.

The population that CTE serves includes two distinct groups. The first is a category of workers referred to broadly as “disadvantaged workers” or the “hard to employ”—these are workers with low levels of education, skill, prior wages or experience, and/or other sources of disadvantage (such as prior incarceration).³ The second group is composed of “displaced” or “dislocated” workers who have lost long-term jobs.

In recent years, interest in CTE as a means of assisting both of these groups has expanded. The Great Recession and the job losses resulting from globalization and automation have highlighted the potential need for retraining for those affected by labor market disruptions. Over a longer time frame, stagnant wages at the lower end of the income distribution and the low rates of college completion among disadvantaged groups have focused attention on the need for increased access to CTE.

THE EVIDENCE ON CTE AT PUBLIC COMMUNITY COLLEGES AND FOR-PROFIT SCHOOLS

Economists and educational researchers who study the labor market returns to education have often ignored community colleges, and have paid even less attention to vocational or CTE programs within those colleges.

Fortunately, this tendency has been corrected in recent years. A number of new studies examine the labor market returns to community college CTE programs. Virtually all of these studies are nonexperimental—they use observed data to compare the earnings of a group of workers who completed community college degrees or certificates to a comparable group of workers who did not receive CTE awards. The

2 For an overview of the success of WIA programs for disadvantaged adults, and suggestions for building on that success, see McConnell, Perez-Johnson, and Berk (2014).

3 This group is sometimes further divided into disadvantage adults and disadvantaged youth. For purposes of space, this brief will focus almost entirely on the adult population.

best of these nonexperimental studies use CTE participants' own preenrollment earnings to improve their ability to capture the true program effects. While this methodology is not perfect, these studies nonetheless provide useful evidence on the effects of CTE programs.

Many of these new studies show positive returns to CTE certificates and degrees obtained at community colleges. Research on CTE offerings at California community colleges showed that completion of certificate programs in CTE fields increased earnings by 14% to 28% and employment rates by 2 to 4 percentage points (more in the case of health fields). The same study found that longer certificate programs offered slightly higher returns—completion of an associate degree in a CTE field increased earnings by 27%. The highest returns were in the health occupations, but earnings increased by 15% to 22% in nonhealth occupations as well (Stevens, Kurlaender, & Grosz, 2018).

A study of Kentucky community colleges (Jepsen, Troske, & Coomes, 2016), using similar methods, showed that CTE associate degrees increased earnings, and that shorter CTE “diploma” programs increased the earnings of men (but not women). Xu and Trimble (2016) showed positive and significant returns, on average, to both short- and longer term certificates in North Carolina and Virginia.

Studies from other states have produced mixed evidence, often with positive returns only for some certificates or groups. Jacobson, Lalonde, and Sullivan (2005) focused on community college programs serving dislocated workers specifically and found positive effects for CTE programs with heavy science and math components, but little return to other areas of study.

Several studies of CTE in community colleges show differing results for men and women, and virtually all point to significant variation across occupational fields. These two findings may be related since men and women are often found to enroll in quite different fields within the set of CTE programs. In California, for example, women make up two-thirds of CTE award recipients in the high-return, health-related fields, but also account for 88% of CTE award recipients in the much lower return family and consumer services sector. This highlights the fact that heterogeneity in the effects of CTE programs across fields may interact with uneven allocation by gender, race, and other worker characteristics across these fields, leading to potential differences in the average effects of CTE programs across population subgroups.

Another recent study by Cellini and Turner (2018) offers important evidence on how the effectiveness of CTE varies across institutions. The researchers estimated CTE returns across all states, and also compared the returns to CTE programs offered by community colleges to those offered by for-profit colleges.

The researchers found that completing a CTE certificate at a public institution (primarily community colleges) increased annual earnings by more than 30%, on average, and increased employment rates by 4 percentage points, consistent with the more positive findings summarized above. Cellini and Turner (2018), however, found dramatically lower earnings and employment effects of for-profit CTE program completion. Individuals completing certificates at for-profit schools saw their earnings increase by roughly 15%, half the return of a public institution CTE program. The authors caution that these results could be skewed by the fact that their dataset included the years of the Great Recession, during which time earnings were trending downward for low-skill workers. Nonetheless, their findings suggest that the returns to for-profit programs deserve significant scrutiny.

Cellini and Turner (2018) offer another important contribution by providing estimates of the earnings and employment effects of beginning, but not completing, a CTE program. This produces even greater cause for skepticism with respect to CTE programs at for-profit colleges. Students who enrolled in, but did not complete, a CTE certificate program at a for-profit institution saw their earnings fall by approximately 9%. By contrast, among students who enrolled in but did not complete a CTE program at a public institution, the researchers found a 6% earnings increase.

Finally, as noted above, many public high schools also offer CTE coursework and tracks. While the primary focus here is on programs for adults, a recent survey by Jacob (2017) summarizes the limited evidence on high school CTE. He notes one frequently cited evaluation of CTE “Career Academies” within public high schools that found little evidence of improved graduation rates or college enrollment and no effect on earnings for female students, but did find evidence of increased earnings for male students (Kemple & Willner, 2008). Another recent evaluation considered regional vocational and technical high schools—entire schools devoted to CTE instruction—in Massachusetts. This study found strong effects on high school graduation from attending these high schools, but little effect on academic achievement within high school (Dougherty, 2018).

As the research highlighted above illustrates, the first answer to the question of “what works” in CTE is that while there is variation by the length of the certificate, the field of study, and the state, the overall evidence suggests that CTE programs at public community colleges can raise earnings and improve employment prospects. Even among workers who enroll and only partially complete short-term CTE training, the programs appear to provide some benefits. In the for-profit CTE sector, by contrast, there is evidence that completion of certificate programs produces much lower returns for the typical graduate (as compared to graduates of public programs), and that enrollment without completion may actually lower earnings significantly.

THE EVIDENCE ON FEDERAL TRAINING PROGRAMS

Individuals can also come to CTE programs through safety net or federal employment and training programs. A separate set of evidence on the effectiveness of CTE for U.S. workers comes from the evaluation of these federal programs. Unfortunately, a reading of media coverage relating to major federal employment and training efforts provides a negative and confusing picture of the effectiveness of training. For example, major evaluations of these federal programs have generated the following headlines from across the political spectrum:

- “The False Promises of Worker Retraining” (Selingo, 2018)
- “So far, federal job-training programs have been outright failures” (Muhlhausen, 2017)
- “In the Dark on Job Training: Federal Job Training Programs Have a Record of Failure” (Kersey & Muhlhausen, 2004)

An overly negative media characterization of program evaluation studies might not be unusual, but in this case it is symptomatic of widespread and continuing skepticism of federal programs that rely heavily on the public CTE offerings summarized as generally effective above.⁴ Understanding how and why this conflict exists is helpful in untangling the ways in which the evidence on federal employment and training initiatives relates to the more direct evidence on returns to CTE programs.

First, a key distinction between studies of the effects of certificates and degrees earned by individuals versus studies of federal employment and training programs is that most federal programs offer a combination of employment (or reemployment) services and training services. This means that many, and sometimes the majority of, participants in these federal programs do not receive any actual CTE.

Second, even when focusing on program participants who do receive training, it is important to understand the benchmark against which the effects of training under the program are compared. The preferred approach to evaluating federal training programs is to use random assignment into the program or into the program’s available services, so that eligible or participating individuals can be compared to a control group of nonparticipants.

In the case of the most recent WIA study (McConnell et al., 2016) that addresses training specifically, individuals eligible for WIA services were randomly allocated to receive: (1) only job search; (2) more intensive services but not training; or (3) all

4 If anything, headlines from earlier decades were even more negative, likely reflecting the fact that federal programs in this area have improved over time. Evaluations of the Job Training Partnership Act (JTPA) or Comprehensive Employment and Training Act provisions did not provide much evidence of success.

services including training. Thus, the assessment of training within WIA is based on a comparison of the earnings for those randomly selected to be offered training and those offered only the less intensive program services.

Random assignment is generally viewed as the gold standard for program evaluation, but in this case, random assignment may uncover an answer to a narrow question that does not inform us about the effectiveness of training or CTE more generally. The problem here (and in many other related program evaluations) is that members of the control group are free to engage in training outside of the program, and many of them do. The WIA study reports that, among those randomly assigned to receive training, 43% actually did so. Among the control group, 30% participated in training (outside the program). Thus, the WIA evaluation of training compares a group in which 43% receive training to a group in which 30% receive training, so simple differences in outcomes cannot be directly interpreted as the effect of training.

To understand the importance of this detail given the actual rates of training participation in the WIA study, imagine a hypothetical case in which we know that any type of training raises annual earnings by \$4,500 (and assume those without training get no earnings boost). Using the actual rates of training participation from the WIA study, a comparison of the treatment and control groups in this (hypothetical) case would show that the treatment group experienced an earnings increase of:

$$(.43)*(\$4500) + (.57)*(\$0) = \$1935.$$

The control group would show an earnings increase of:

$$(.30)*(\$4500) + (.70)*(\$0) = \$1350.$$

A naïve conclusion from the randomized trial would be that the “treatment” increased earnings by less than \$600, the difference between the treated and untreated groups. That finding would coexist with the underlying fact that training (in this example) actually raised the earnings of those who received it by \$4500. In this setting, the randomized study correctly identified the effect of the program, but the size of that effect was largely driven by the fact that the majority of the treated group received no training, and a large minority of the control group did receive training.

The time frame of the WIA evaluation (and likely many other evaluations) also contributes to the negative view of the study results. The study was the first round of two planned evaluations and presented results on earnings and employment outcomes 15 months after the initial offering of WIA services. In many cases, training had not been completed, or had barely been completed. Many CTE programs offered through community colleges can take one to two years to complete, assuming full-time study (which may be impossible without some form of income support). Other intensive services will also take time to complete. As the WIA study authors note:

It is too soon to judge the effectiveness of the availability of both training and intensive services. Just as five quarters is too short a period to judge the effectiveness of training, it is also too short a period to judge whether the availability of both WIA-funded training services and intensive services was more effective than a counterfactual in which neither of these services were available. (pg. XXVII)

While 15 months is enough time to observe the effectiveness of short-term job search assistance or career counseling on labor market outcomes, it is clearly not long enough to correctly evaluate the effectiveness of 12- to 24-month training programs. Because programs are administered as a single unit, these types of evaluations may not deliver informative analysis of individual components of the programs.⁵

An earlier, nonexperimental study of WIA's effectiveness also looked at the training component of the federal program (Heinrich, Mueser, Troske, Jeon, & Kahvecioglu, 2013). The lack of an experimental framework in this study means that selection into the WIA services could bias results, although the authors used a variety of methods to control for potential bias based on observable characteristics of treated and comparison groups. Like much prior literature, the study found positive effects on earnings for disadvantaged adults who received training, although these results did take some time to appear.

Among dislocated workers, earnings effects were smaller, and negative for several quarters after initiation of training, again reflecting that completion of training takes time. The finding of weaker results for dislocated workers (compared to disadvantaged adults) is common and likely reflects the very large and persistent effects of dislocation on earnings and employment in the absence of any intervention. Nonexperimental matching methods for dislocated workers in particular raise the question of why the control groups are not eligible for dislocation assistance, including the possibility that the controls face better employment opportunities, which could explain the lack of positive findings.

This evidence on training under WIA is largely consistent with reviews of earlier federal employment and training programs. A 1995 review of federal training programs by Robert LaLonde concluded that public sector training programs in earlier decades produced modest gains, with some of the largest gains going to disadvantaged women. This summary also noted the weaker evidence on the systemic benefits of public sector training for dislocated workers (compared to other adult workers).

Later work (LaLonde & Sullivan, 2010) argued that dislocated workers are likely underinvesting in retraining due to insufficient funding and income support and a lack of information about the returns to training, both in general and with respect to specific training programs.

5 A second evaluation of the WIA programs was scheduled to be released in 2017. While that report has been completed by the contracting agency, the Department of Labor has not released the report at this time.

2. Known challenges for CTE programs

Even if, on average, CTE programs offered by public institutions produce positive and often substantial returns for those students who complete them, there remain important challenges to overall effectiveness. These include: low completion rates for many programs with positive returns, questions of access and capacity, and a growing need for information to help students distinguish high- from low- or no-return programs.

CTE is often criticized for having very low completion rates, both in the context of community college programs and in the for-profit sector. The federal WIA evaluation (McConnell et al., 2016) found that, among members of the treatment group participating in any training, approximately 71% completed the training. Among control group members, the comparable completion rate was 60%.

National Center for Educational Statistics (NCES) data include summary measures for all higher education programs eligible for federal aid, including completion rates for cohorts of students enrolling in postsecondary “occupational” fields of study at both for-profit and public colleges. The most recent data available follows cohorts of students that entered these programs during the 2003-4 academic year and observes their completion status as of 2009. Of the 1.3 million students who enrolled in occupational programs in 2003-4, just 40% had completed a degree or certificate six years later.⁶

These low completion rates have many causes and present a genuine reason for caution in evaluating the effectiveness of CTE. At the same time, many workers enroll in CTE coursework specifically to brush up on skills in their current sector and have no plans to complete an entire certificate or degree. Because it can be impossible in many data sources to distinguish those who wish to complete degrees from those who simply want to improve skills with a class or two, it is not necessarily accurate to interpret these low completion rates as failures.

Another under-appreciated challenge to CTE completion likely exists for many dislocated workers. One of the purposes of training and “retraining” is to facilitate the movement of workers from declining industries to those expected to offer employment and robust wages in the future. Individual dislocated workers, however, may not have a clear incentive to transition out of their industry. Many studies of displaced workers show that workers who are able to remain in the same sector, industry, or occupation have better wage outcomes than those who switch.

For example, Couch and Placzek (2010) found that displaced manufacturing workers who leave their specific industry group had earnings losses that were 1.65 to 2 times as

⁶ For full table, see National Center for Education Statistics, Table B01 (n.d.a.)

large as those reemployed in the same industry, consistent with many earlier studies. This partially reflects the fact that switching industries is likely to reduce earnings in the short- to medium-term. Furthermore, even sharply declining industries do not disappear overnight, so dislocated workers who begin retraining may face strong incentives to return to their industry if the opportunity arises. If the true extent of an industry's decline is uncertain, or if political rhetoric focused on "bringing the jobs back" is added to the picture, it seems almost predictable that many dislocated workers will abandon training to return, at least temporarily, to their prior sector.

Another potential concern with CTE in its current form is access to and capacity of the current system. The fact that large numbers of dislocated workers and disadvantaged adults find their way to training suggests that CTE opportunities are broadly available, but there is also evidence of capacity constraints within high-return CTE programs. The U.S. Department of Education has noted long wait lists for CTE programs throughout the country (USDOE, 2012).

In California, which has the largest community college system in the nation, CTE programs have often been underfunded, with long waiting lists. A stark example of this comes from work by Michel Grosz (2018), who studied nursing programs offered in the California community college system and found major capacity constraints for this high-return program. Because community colleges are intended to be open access, these constraints often lead programs to establish wait lists or lottery systems for admission to high-demand programs. Grosz analyzed a high-demand, high-return nursing program at a California community college with roughly 30 seats available each year and more than 100 students typically eligible for admission. This mismatch has prompted the program to admit qualified students via a lottery, a solution mimicked by at least a dozen other nursing programs throughout the state. Grosz found that students not admitted to the program via lottery may remain on wait lists for several years before becoming eligible to enroll. While health programs have been in particularly high demand in recent years, these capacity constraints may extend to other programs and states.

Financial challenges in the public higher education sector contribute to access concerns. Economic downturns result in greater numbers of dislocated workers, and high unemployment rates for all workers make it a particularly appealing time to invest in training. Unfortunately, these may be precisely the times when public programs are particularly constrained by state fiscal challenges. In California, for example, Bohn, Reyes, and Johnson (2013) showed that, in the three years following the onset of the Great Recession, there were reductions in the availability of CTE enrollment slots in California Community Colleges of 6-9%.

These financial constraints are particularly important for CTE programs, which are often more expensive to offer than traditional academic programs. For example,

researchers have estimated instructional costs per student at community colleges in both academic disciplines and CTE fields (Shulock, Lewis, & Tan 2013). For academic fields including humanities, biology, and engineering, these costs (as of 2011-12) range from \$52 to \$73 per student credit hour. For CTE programs including medical assisting, drafting, and respiratory care, comparable costs are \$131 to \$265 per student. The same researchers note these cost differentials likely reflect class size constraints and specialized lab and equipment needs in some CTE fields.

Finally, given the variation in effectiveness of training for different groups, across public versus for-profit programs, and across different occupational fields, there likely exist substantial and growing information barriers for workers who wish to invest in effective CTE.

This need is most clearly demonstrated by the growth in for-profit CTE programs. Many for-profit programs offer training that is unlikely to significantly boost the earnings of those who enroll, given low completion rates and much lower earnings effects than in the public sector. The trend, however, is toward more for-profit CTE offerings. NCES data shows that from 2000 to 2014, the number of for-profit institutions offering occupational education programs rose from just over 2000 to more than 3000. In 2000, for-profit institutions accounted for 47% of all institutions offering occupational education; by 2014, that share had risen to 57%.⁷ While the majority of students completing CTE-type training continue to graduate from public two-year programs, a worker searching for a CTE program will encounter a landscape where for-profit institutions abound.

3. The Policy Response

There is abundant evidence from CTE offerings in the public sector and from properly interpreted studies of federal employment and training programs that occupational training can raise the earnings and employment rates of many workers. At the same time, the growth of CTE programs offered by for-profit institutions with small or negative earnings and employment effects means that even highly motivated workers will benefit from information and guidance to navigate the diversity of CTE options they face.

Furthermore, the lack of extended income support for many disadvantaged and dislocated workers seeking training and the challenging fiscal environment facing many public providers of CTE may pose additional barriers.

A more promising CTE policy should include the following key elements.⁸

7 See National Center for Education Statistics, Table P141 (n.d.b.) for institutional counts and National Center for Education Statistics, Table P161 (n.d.c.) for student attainment

8 Robert Lalonde and Daniel Sullivan (2010) present several related policy suggestions in a brief considering the retraining needs of displaced workers.

EXPANDED TRAINING OPPORTUNITIES FOR DISADVANTAGED AND DISLOCATED WORKERS, POTENTIALLY THROUGH AN EXPANSION OF INDIVIDUAL TRAINING VOUCHERS OFFERED UNDER WIOA.

There is little direct evidence on the number of U.S. workers that should be engaged in training, but simple comparisons with other countries suggest we are underinvesting in CTE. A study by Strittmatter (2016) compared OECD and U.S. involvement in worker training and noted that OECD countries spend approximately 0.15% of their GDP on training which involves just over 1% of the labor force at a given time. In Germany, spending on training is 0.24% of GDP. In the United States, the study noted that just 0.04% of GDP is spent on training.

Expanded income support during training

Unemployment Insurance in the United States is typically offered for a maximum of 26 weeks, although this may be expanded during national or local recessions. Other safety net programs for prime-age workers are limited and, increasingly, may prioritize work over training to maintain eligibility. Strittmatter (2016) noted that, in Germany, most workers engaged in training have some form of income support; in the United States, only one-in-five training participants receive income support. Workers who must choose between training and a return to employment are likely to face strong financial incentives to return to work, even if it means accepting low-wage work or returning to an industry clearly in decline.

Recent proposals for wage insurance or reemployment insurance over the short- to medium-term could make engagement in, and completion of, training more feasible for a significant segment of the workforce.

Support for capacity building among public sector training providers, especially community colleges

Given the greater fiscal variability at the state level, a federal role in supporting CTE provision, especially during economic downturns, is likely to be essential to avoid capacity constraints that limit effective training. Federal funding for programs aimed at individual workers should be accompanied by funding for CTE programs.

Improved student access to information about program quality and expected outcomes

Additional investments in training opportunities for individual workers need to be accompanied by well-designed access to information. As noted throughout, training often raises earnings and employment, but results vary dramatically by the training provider, field of study, and across individuals with different work and career histories.

At a minimum, workers in need of training support should have answers to the following questions:

- How often do individuals with similar education, work experience, and prior earnings complete a particular CTE program?
- What are the earnings and employment outcomes of individuals who complete this CTE program? Prior to completing the program, were the education, employment, and earnings of those completing the program similar to mine?
- What are the employment and earnings of workers who have been dislocated from jobs in my industry but do not engage in some form of training?

These steps could strengthen current training opportunities, but a final caveat is the need to recognize the limits of training in our current labor market. The best short-term training can raise earnings by perhaps 20%, with other programs offering smaller benefits. The modern economy poses many challenges for American workers, and CTE programs can't solve all of them.

The evidence is strong, however, that current public-sector CTE programs have the potential to improve earnings opportunities for students that enroll in and complete them. Providing better information on which programs are most likely to lead to higher earnings, providing short-term support to workers enrolling in CTE, and financially supporting successful programs even when state budgets are tight can give CTE the best chance of reaching this potential.

References

- Career and Technical Education Foundation. (n.d.). *A Guide to Understanding Career and Technical Education*. Alexandria, VA: Career and Technical Education Foundation. Retrieved from <http://www.iwnc.org/images/understanding-cte.pdf>
- Cellini, S.R. & Turner, N. (2018). Gainfully Employed? Assessing the Employment and Earnings of For-Profit College Students Using Administrative Data. *Journal of Human Resources*, 1016_8302R1.
- Couch, K.A. & Placzek, D.W. (2010). Earnings Losses of Displaced Workers Revisited. *American Economic Review*, 100(1), 572-89.
- Dougherty, S. (2018). The Effect of Career and Technical Education on Human Capital Accumulation: Causal Evidence from Massachusetts. *Education Finance and Policy*, 13(2), 199-148.
- Grosz, M. (2018). *Labor Market Returns to Community College: Evidence from Admissions Lotteries* (Working Paper).
- Heinrich, C.J., Mueser, P.R., Troske, K.R., Jeon, K.S., & Kahvecioglu, D.C. (2013). Do Public Employment and Training Programs Work? *IZA Journal of Labor economics*, 2(1).

- Jacob, B.A. (2017). *What We Know About Career and Technical Education in High School*. Washington, DC: Brookings Institution. Retrieved from <https://www.brookings.edu/research/what-we-know-about-career-and-technical-education-in-high-school/>
- Jacobson, L., LaLonde, R.J., & Sullivan, D. (2005). The Impact of Community College Retraining on Older Displaced Workers: Should We Teach Old Dogs New Tricks? *Industrial and Labor Relations Review*, 58(3), 398-415.
- Jepsen, C., Troske, K., & Coomes, P. (2014). The Labor-Market Returns to Community College Degrees, Diplomas, and Certificates. *Journal of Labor Economics*, 32(1), 95-121.
- Kemple, J. & Willner, C. (2008). *Career Academies: Long-Term Impact on Labor Market Outcomes, Educational Attainment, and Transitions into Adulthood*. New York, NY: MDRC.
- Kersey, P. & Muhlhausen, D. (2004). *In the Dark on Job Training: Federal Job-Training Programs Have a Record of Failures*. Washington, DC: The Heritage Foundation. Retrieved from <https://www.heritage.org/jobs-and-labor/report/the-dark-job-training-federal-job-training-programs-have-record-failure>
- LaLonde, R.J. (1995). The Promise of Public Sector-Sponsored Training Programs. *Journal of Economic Perspectives*, 9(2), 149-168. LaLonde, R.J., & Sullivan, D. (2010). *Retraining Displaced Workers*. Washington, D.C.: The Hamilton Project.
- McConnell, S., Fortson, K., Rotz, D., Schochet, P., Burkander, P., Rosenberg, L., Mastri, A., & D'Amico, R. (2016). *Providing Public Workforce Services to Job Seekers: 15-Month Impact Findings on the WIA Adult and Dislocated Worker Programs* (No. f10aef594c3b4472b24d93a0879300d1). Princeton, NJ.: Mathematica Policy Research.
- McConnell, S., Perez-Johnson, I., & Berk, J. (2014). *Providing Disadvantaged Workers with Skills to Succeed in the Labor Market*. Washington, DC: The Hamilton Project. Retrieved from http://www.hamiltonproject.org/papers/providing_disadvantaged_workers_with_skills_to_succeed_in_labor_market
- Muhlhausen, D. (2017, March 14). So far, federal job-training programs have been outright failures. *The Hill*. Retrieved from <http://thehill.com/blogs/pundits-blog/economy-budget/323885-thus-far-federal-job-training-programs-have-been-an>
- National Center for Education Statistics. (n.d.a.). Table B01: Number and percentage distribution of 2003-04 beginning postsecondary students, by persistence and attainment status, initial degree or certificate program, and initial field of study: 2009 [Table]. Retrieved from <https://nces.ed.gov/surveys/ctes/tables/B01.asp>
- National Center for Education Statistics. (n.d.b.). Table P141: Number and percentage distribution of Title IV postsecondary institutions that offer subbaccalaureate occupational education programs, by control and level of institution: United States, 2003 through 2015 [Table]. Retrieved from <https://nces.ed.gov/surveys/ctes/tables/P141.asp>
- National Center for Education Statistics. (n.d.c.). Table P161: Number of subbaccalaureate occupational education credentials awarded by Title IV postsecondary institutions, by control and level of institutional and credential level: United States, selected years 2003 to 2015 [Table]. Retrieved from <https://nces.ed.gov/surveys/ctes/tables/P161.asp>
- Obama Administration Awards Nearly \$500 Million in First Round of Grants to Community Colleges for Job Training and Workforce Development. (2011, September 26.) U.S. Department of Education. Retrieved from <https://www.ed.gov/news/press-releases/obama-administration-awards-nearly-500-million-first-round-grants-community-coll>
- Orr, L., Bloom, H., Bell, S., Lin, W., Cave, G., & Doolittle, F. (1995). *The National JTPA Study: Impacts, Benefits and Costs of Title 11-A*. Bethesda, Md.: Abt Associates.

- Selingo, J. (2018, January 8). The False Promises of Worker Retraining. *The Atlantic*. Retrieved from <https://www.theatlantic.com/education/archive/2018/01/the-false-promises-of-worker-retraining/549398/>
- Shulock, N., Lewis, J. & Tan, C. (2013). *Workforce Investments: State Strategies to Preserve Higher-Cost Career Education Programs in Community and Technical Colleges*. Sacramento, CA: Institute for Higher Education Leadership & Policy.
- Stevens, A.H., Kurlaender, M., & Grosz, M. (2018). Career Technical Education and Labor Market Outcomes: Evidence from California Community Colleges. *Journal of Human Resources*, forthcoming.
- Strittmatter, A. (2016). What effect do vocational training vouchers have on the unemployed? *IZA World of Labor*. doi: 10.15185/izawol.316.
- United States Department of Education. (2016). *Let's Commit to Giving CTE Students the Opportunity They Demand and Deserve*. Retrieved from <https://sites.ed.gov/octae/2016/02/12/lets-commit-to-giving-cte-students-the-opportunity-they-demand-and-deserve/>
- Xu, D., & Trimble, M. (2016). What About Certificates? Evidence on the Labor Market Returns to Nondegree Community College Awards in Two States. *Educational Evaluation and Policy Analysis*, 38(2), 272-292.