The Evolution of Career and Technical Education

1982–2013

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Executive Summary

Nearly a year after Congress reauthorized the Carl D. Perkins Vocational and Technical Education Act, states are in the thick of developing the CTE plans the law requires. Over the past three decades, the courses and students making up CTE have shifted dramatically. What we now know as CTE was once thought of as "vocational education," a term that not only carried social stigma for its nonacademic connotations but also harked back to a troubled era of schools' tracking of students by race and class.

By most accounts, we have moved past the "voc-ed" stereotypes. Some rigorous evidence has shown specific CTE programs have boosted student outcomes, and more generally, students concentrating in CTE courses boast increased graduation rates and higher earnings. However, the transformation from voc-ed to CTE may have hidden, rather than solved, the durable challenges in vocational education.

Examining 30 years of CTE course taking through transcripts of nationally representative samples of US high school graduates in selected years from 1982 to 2013, this report tracks how CTE course taking has changed over time, overall and by specific occupational areas. In addition, by examining the percentage of students who concentrate in a given CTE occupational area and the trends in those areas, the report finds distinct patterns among business, traditional vocational, and other CTE concentrations that should inform and challenge CTE policies and programs moving into the future.

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Career and technical education (CTE) is one of the most popular education policy issues today, both across the states and at the federal level. In 2017, gubernatorial candidates mentioned CTE more than any other education issue in their campaigns.[1] And in 2018, in "State of the State" addresses, more governors mentioned CTE than any other education issues. (Twenty-four of 46 speeches mentioned CTE.[2])

State legislatures passed 85 CTE-related bills, only five of which were vetoed, in 2018—more than any other education issue besides teaching.[3] That is up from 42 CTE bills in 2016 and 61 in 2017.[4] Federal legislators are also on board, and in late summer 2018, Congress reauthorized the Carl D. Perkins Vocational and Technical Education Act via voice vote, a sure indicator of bipartisan support in this political environment.

CTE's popularity across states and across the aisle might not have been possible 10—and certainly not 20—years ago. What we now know as CTE was once thought of as "vocational education," a term that not only carried substantial social stigma but also was associated with a general lack of egalitarianism and a specific role in tracking students by race and class. Running directly against the dominant grain of "college for all," vocational education was often viewed as a step backward for students, pushing them (especially low-performing students) toward the dead-end jobs of yesteryear rather than the careers of the future through the promise of postsecondary education.

CTE's surging popularity has been bolstered by good public relations and research that push back on the stigma long associated with CTE. Advocates such as the Association for Career and Technical Education have trumpeted promising statistics about CTE's ability to increase graduation rates, academic motivation, course taking, and earnings, to name a few.[5] After a successful rebranding, CTE has substantially shed the negative connotations of vocational education. Now it is widely hailed as a necessary and potentially viable path forward for students who have been poorly served by a college-for-all culture.

But this rebranding has made CTE more amorphous. One can advocate for precision welding and manufacturing in high school or for STEM career tracks that require significant postsecondary work, or even go outside traditional educational pathways to reskill adult workers, and still fall under the broad umbrella of CTE.

While there are marked differences from the stereotypical vocational education, today's high school CTE programs, which were and are the main provision of CTE education in high school, are substantially shaped by recent history. The developments in those high school programs—and the programs likely to be left on the cutting-room floor as CTE continues to evolve—are evident in the transcripts of generations of high school students.

In this report, I examine 30 years of CTE course taking by examining transcripts of nationally

representative samples of US high school graduates in selected years from 1982 to 2013. Using a classification of CTE occupational subject areas used in the most recently available transcript data from the National Center for Education Statistics (NCES), I show how CTE course taking has changed over that period, overall and by concentration. In addition, I use test scores to show changes in the relative academic level of CTE concentrators.

I find marked declines in CTE course taking over these three decades, declines that are larger and longer than previously detailed. Beneath that overall decline lie different patterns: Some CTE career concentrations are expanding and have participants with markedly higher test scores, while other concentrations, which are traditionally considered the heart of vocational education, are declining slowly and show no changes in participants' low relative test scores.

Recent and distinct patterns in CTE participation reflect developments in vocational education and CTE over the past century, and they reveal the thorny problems our education system has faced throughout history. Although they may be hidden beneath the veneer of new conceptions of CTE, those problems persist today. Whether they are resolved will substantially determine whether, and for whom, CTE provides the viable career pathways it promises. As states develop CTE plans pursuant to the latest Perkins reauthorization, they should grapple with these issues to ensure that CTE programs do not forsake the students who may need them the most.

A Century from Vocational to Career and Technical Education

CTE's recent history reflects tensions that have been around for over a century, when formal vocational education became a differentiated track. The first federal legislation on vocational education was the Smith-Hughes Act of 1917, which provided federal funds for state programs that taught agriculture, trades and industries, and home economics. Smith-Hughes was explicitly designed to create a separate vocational education that would provide a labor force of semiskilled workers. Participation was limited to students who were at least 14 years old and who were educated in a separate track from general academic programs, either by school or program.

The conditions that would later lead to stigma around vocational education were absent when Smith-Hughes was passed. In that same year, Mississippi became the last state to require compulsory education under law, and only 3 percent of American adults had bachelor's degrees,[6] leaving plenty of room for vocational education aimed at producing workers to appear egalitarian.

Smith-Hughes' structure—which required states to separate vocational tracks, establish state boards to drive their respective vocational education programs, and match federal spending dollar for dollar—remained intact for seven decades, with only marginal changes. The Vocational Education Act of 1963 marked a new and particular focus on students disadvantaged academically, economically, or due to disability—a focus that seemed sensible when only 10 percent of Americans had bachelor's degrees but that would later garner much scrutiny. Marginal amendments in 1968, which mentioned postsecondary students for the first time, and in 1976, which pushed for gender equality, promoted a bigger umbrella for vocational programs.

Substantial changes came after the dire warnings issued in the landmark report "A Nation at Risk," published in 1983,[7] which pushed for increases in academic course taking in high schools. These increases would come partly from steady declines in vocational course taking.

In the late 1980s and into the 1990s, vocational education came under increased scrutiny for the populations it "served" and whether it actually served them. Vocational programs were shown to frequently function as an inferior track that diverted mainly disadvantaged students away from academic programs and the road to a bachelor's degree.[8] An even more pernicious form of tracking, dubbed "dumping,"[9] funneled disadvantaged students into low-quality vocational education programs to sustain the programs' related jobs. The growing stigma pushed down enrollments in vocational education and increasingly

Do CTE Programs Benefit Students?

Studies have attempted to determine whether there are benefits to CTE, but multiple analytic challenges make that difficult. One is the differing nature of CTE programs across time, across states, across delivery systems, and across occupational areas or programs of study. Since CTE has changed dramatically in recent decades,[10] studies finding some or no benefits to CTE quickly become outdated. States also differ substantially in the types of CTE offered and the policy surrounding those offerings and the labor market contexts, meaning any lessons from one study might not transfer broadly.[11] CTE delivered in more focused programs, such as dual enrollment, career academies, or regional CTE centers, may have benefits that do not materialize in the regular high school programs in which most students take CTE classes.[12] There is limited and circumstantial evidence of differential benefits across courses of study, but the contrasts evident in this report suggest heterogeneity across occupational subject areas is probable, even if the direction of those differences is uncertain.

Most of this research has not focused on differences in student test scores, as CTE is not necessarily focused on raising them, and such differences are infrequently found.[13] Instead, researchers more frequently assess outcomes more proximal to CTE's theory of action, including graduation from high school, employment, earnings, and postsecondary attendance.

Recent research is mixed on these outcomes; however, where evidence of benefits has been found, it tends to be in more focused and coherent CTE delivery systems.[14] Career academies, which are like CTE-focused schools within a school, have been shown in one causal study to produce income benefits, and others suggest graduation increases.[15] CTE-focused schools, some of which are explicitly described as high quality,[16] and others explicitly described as unremarkable,[17] have also produced benefits.

Although the variation in settings, times, and programs makes the research base on CTE programs far from conclusive, it suggests some CTE programs, particularly those that are coherently organized to produce labor market readiness, can have material benefits for students.[18] Unfortunately, such programs are the exception rather than the rule, and most CTE courses are taken in regular high schools. This evidence is insufficient to render any judgments on CTE course taking writ large. However, it does suggest that if, broadly speaking, CTE as most often administered results in lackluster benefits for students, there is likely room for improvement. Increasing CTE program coherence and its alignment to labor market needs is probably the best way to improve CTE's results.

built pressure to revitalize, reconfigure, and, to some degree, rebrand vocational education.

The stigma around vocational education may have never been absent, especially given regular reference to its purpose to prepare students directly for careers and not higher education. However, the broad shift toward viewing college as the natural end of high school and the only viable route to economic success exacerbated that stigma. By the 1990s, more than 20 percent of Americans had a bachelor's degree;[19] 60 percent of high school graduates were entering college, up from 45 percent in 1960. As college attendance and preparation became more common, vocational programs were increasingly viewed as an inferior career path that led away from the promise of higher education.[20] The growing stigma around vocational education built pressure to rebrand and repackage it as "career and technical education," or CTE, which enjoys so much popularity today.

That rebranding began with the Carl D. Perkins Vocational and Applied Technology Education Act Amendments of 1990 (Perkins II). Perkins II embraced

new accountability structures for vocational programs, increased the focus on aligning secondary and postsecondary paths of study, and increased the integration of academic offerings with business needs. At the turn of the century, the term "career and technical education" was gaining currency, and the 2006 passage of Perkins IV formally replaced the term "vocational education."

Perkins IV's stated purpose was "to develop more fully the academic and career and technical skills of secondary education students and postsecondary education students who elect to enroll in career and technical education programs."[21] It coincided with the introduction of the National Career Clusters Framework, which included a much broader array of careers and industries, expanding the range of CTE programs. At the same time, it broadened its appeal to more students and lessened its focus on disadvantaged populations.

The fifth and most recent reauthorization of Perkins in the summer of 2018 slightly decentralized CTE programs by emphasizing states' role in engaging localities to shape them. Still, it retained the basic structure outlined in the Smith-Hughes Act, complete with requirements for state oversight of CTE programs, alignment with industry needs, dollar-for-dollar matching, and a focus on producing a capable labor force. Perkins V's language returned to the earlier

Overview of Perkins V

Perkins V, reauthorized in July 2018 by the Strengthening Career and Technical Education for the 21st Century Act, provides $1.3 billion in federal funds for CTE programs for youth and adults. Key to Perkins' theory of action is that states need flexibility in developing and aligning coherent CTE programs that will prepare "an educated and skilled workforce (including special populations)" and meet "the skilled workforce needs of employers, including in existing and emerging in-demand industry sectors and occupations as identified by the State."[23] The law's required state plans lay out how states' CTE programs will help meet these goals and include a "needs assessment" that provides the framework for aligning the workforce built in secondary and postsecondary CTE programs with available careers.

State plans, as described in the Department of Education's draft "State plan guide,"[24] flesh out the mechanisms that apply that framework. These plans, which must be approved by the US Department of Education, will be developed in consultation with a broad range of stakeholders.[25] Key requirements include:

- "Requiring extensive collaboration among State- and local-level secondary, postsecondary, and business and industry partners to develop and implement high-quality CTE programs and programs of study;
- Introducing a needs assessment to align CTE programs to locally identified high-wage, high-skill, and in-demand career fields;
- Revising and expanding the list of special populations to be served and requiring States to set aside funds to recruit and serve these students in CTE programs; and
- Shifting responsibility to States to determine their performance measures, including new program quality measures, and related levels of performance to optimize outcomes for students."[26]

The plans describe how state agencies overseeing CTE will communicate programs to the public, devise programs with multiple entry and

(*continued on the next page*)

focus of increasing employment opportunities for disadvantaged populations and required states to report on subpopulations' CTE outcomes. In 2019, states are developing their Perkins plans, which can be either a five-year plan or single-year transition plan followed by a full plan for the remainder of the five-year term, due for submission beginning in April 2019.

The evolution of Perkins substantially redefined CTE: It now covers a broader range of career areas, many of which are more clearly aligned with postsecondary paths that involve higher percentages of students pursuing a bachelor's degree. Research and stigma from previous decades suggest that vocational students were likely to have lower test scores, graduation rates, and college attendance rates than their peers. But more recent research suggests that, with the rebranding of CTE, the *opposite* is now occurring and that CTE concentrators graduate at higher rates.[22]

To explain this transformation from vocational education to CTE, we need to look at how much and what kinds of CTE courses US high school graduates have taken over time. In this report, I apply current definitions of CTE to historical transcript data and examine course taking and the percentage of CTE concentrators (meaning they took three or more CTE courses in a given CTE occupational area), by a few students' characteristics that are available across all years, and then I look at the most recent cohort of

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exit points,[27] leverage labor market data to align programs of study to local economic needs, ensure equal access to special populations, support collaborations between employers and secondary and postsecondary schools, and "improve outcomes and reduce performance gaps for CTE concentrators, including those who are members of special populations."[28]

Perkins V accountability requirements include typical secondary school outcomes for CTE concentrators[29]—the percentages graduating high school and passing standard state assessments, as well as atypical measures such as the percentages going on to postsecondary education, service in the military or the Peace Corps, or employment shortly after graduation.

As for indicators specific to CTE program quality, Perkins V departs from prior requirements that CTE program quality measures be negotiated with the federal government, giving states flexibility to choose one of the following: (1) the percentage of concentrators who graduate high schools with a recognized postsecondary credential, (2) the percentage who earn dual credit or concurrent enrollment credits in their CTE program of study, or (3) the percentage who participate in work-based learning.[30] States also have the option to include an additional indicator that reports "the percentage of CTE concentrators achieving on any other measure of student success in career and technical education that is statewide, valid, and reliable, and comparable across the State."[31]

Perkins requires the state to report CTE students' progress by subgroups. These include the typical subgroups described in the Elementary and Secondary Education Act of 1965,[32] as well as Perkins' own specific special populations—which include students with disabilities, students who are poor, students preparing for nontraditional fields, single parents, homeless and foster youth, youth with an active military parent, and English language learners.

Importantly, Perkins also requires CTE outcomes to be reported by CTE program of study or career cluster, which these analyses show to be an important disaggregation. However, as addressed in the discussion section, reporting outcomes by occupational areas or programs may be valuable quality indicators for different CTE participants but still fail to capture what portion of the overall population of students are being served by CTE programs. That means the underlying patterns found in these analyses may continue unobserved by Perkins' accountability requirements.

graduates, from 2013, in more detail to examine their experiences during and after high school. In addition, by examining trends in specific CTE occupational areas, I find distinct patterns among business, traditional vocational, and other CTE concentrations that should inform and challenge CTE policies and programs moving into the future.

Data

These analyses draw on data collected by the National Center for Education Statistics. To produce a portrait spanning 30 years, I examined national representative data from the transcripts of public high school graduates. The data from 1982 are drawn from the High School and Beyond (HSB) study of 1982 high school graduates, who were in 10th grade in 1980.[33] Data from 1990, 1994, 2000, 2005, and 2009 were drawn from the High School Transcript Studies (HSTS), which sample high school graduates in each respective year.[34] Since the regularly scheduled HSTS studies were postponed in 2013, I used data from the 2013 High School Longitudinal Study (HSLS),[35] which collects the transcripts of public high school graduates from 2013 who were in the ninth grade three years earlier, in the 2009 base year of the study.[36] By drawing on data from both earlier and later than other surveys of student transcripts, this report captures longer trends and greater changes in CTE than have been captured before.

To provide comparable samples for each year of data analyzed, I followed analysis protocols used by earlier HSTS reports.[37] All the public high school graduates included in this analysis reported receiving a regular or honors diploma. Only students with a total of 16 or more credits and at least one credit of English were included in the analysis.

Over three decades of transcript data collections, the classification systems for courses changed multiple times, and, as mentioned earlier, so did the definitions of CTE career concentrations. This report depends on 12 career concentrations based on the School Courses for the Exchange of Data (SCED), which is a classification of secondary and postsecondary courses that was used in the HSLS transcript data and allows standardization of transcript data over time. To create comparable classifications across studies, I started with the 12 SCED career concentration areas and mapped them backward on prior years' transcript studies.

In addition to transcript data, in most years linked assessment scores were available. I transformed nationally representative math assessments—the HSB math assessment from 1982; National Assessment of Education Progress (NAEP) mathematics assessments linked to HSTS transcripts for 1990, 2000, 2005, and 2009;[38] and the mathematics assessment in 2013 from the HSLS—into percentile rankings to capture CTE concentrators' academic achievement relative to their peers. These percentile rankings are comparable across the different assessments and across time. They provide a perspective on whether there have been shifts in the kinds of students concentrating in CTE, writ large and by specific career areas.

The 2013 HSLS data are longitudinal and thus contain survey data during and after high school, in addition to transcript data. After examining the trends in CTE over time across all studies, I use the more detailed data available in the HSLS to create a more detailed portrait of today's CTE students.

Mapping the CTE Course-Taking Landscape. There is no single method for organizing CTE courses into career areas. The National Career Clusters Framework (CCF), which included 16 subject areas, was used in Perkins IV. Although the CCF is a viable organization, I chose to use the SCED classification system for two main reasons, both related to the transcript data I am analyzing.

The SCED was used to classify courses on transcripts in the HSLS, the most recent nationally representative study. This makes analysis straightforward in the 2013 data and should make comparable analyses of future data sets easier. In addition, the SCED uses 12 CTE career areas, and fewer categories allow me to keep cell sizes reasonably large (though often smaller than I would like). Those 12 categories are listed in Table 1 with their official name, the shorter version used in this report, and a brief description of the courses included therein.[39]

Table 1. Occupational Subject Areas Based on SCED Classification System

Short Name	SCED Title	SCED Two-Digit Code	Example Courses
Computer Sciences	Information Technology	10	Computer Coding, Data Management, Network Administration
Communications	Communication & Audio/ Visual Technology	11	Journalism, TV and Radio Production, Graphic Arts, Publications
Business	Business & Marketing	12	Principles of Business, Accounting, Typing, Data Entry and Processing
Manufacturing	Manufacturing	13	Manufacturing, Handicrafts
Health Science	Health Care Sciences	14	Medical Office Procedure, Medical and Dental Assistance, Nursing
Public Service	Public, Protective, & Government Services	15	Law Enforcement, First Responder Training, Public Affairs
Hospitality	Hospitality & Tourism	16	Hotel Management, Parks and Recreation Management, Custodial and Food Service
Construction	Architecture & Construction	17	Architecture, Building Trades, Industrial Mechanics, Craftsmanship
Agriculture	Agriculture, Food, & Natural Resources	18	Principles of Agriculture, Animal Science, Forestry and Wildlife, Floral Work
Human Services	Human Services	19	Cosmetology, Education, Personal Service Occupations
Transportation	Transportation, Distribution, & Logistics	20	Auto and Aviation Mechanics, Warehousing
Engineering	Engineering & Technology	21	Electrical Engineering, Civil Engineering, Structural Engineering, Robotics, Computer Assisted Drafting

Source: National Center for Education Statistics, "School Courses for the Exchange of Data (SCED)," https://nces.ed.gov/forum/sced.asp.

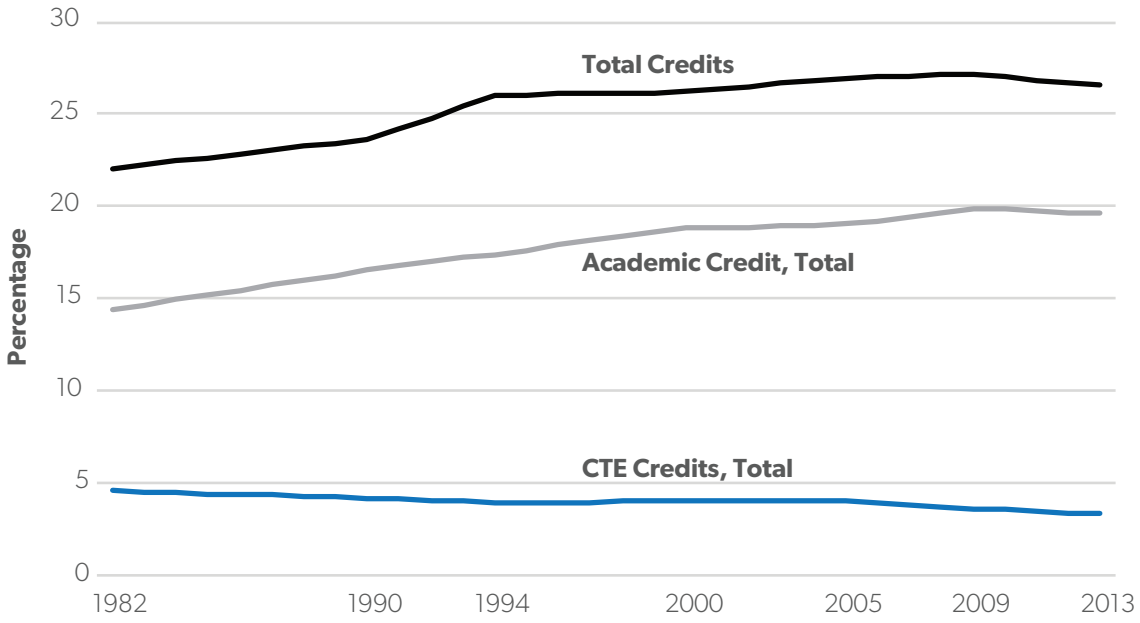
The SCED classification system was not available before the HSLS; this required me to develop a crosswalk between the SCED and the Classification of Secondary School Courses (CSSC), which was used in the HSTS studies and in the HSB data from 1982. The crosswalk I used may diverge slightly from other categorizations used in previous studies; this will explain small variations between previously published studies of CTE course taking and this one. Additional details on these classifications and the crosswalk used here are available in Appendix B.

Long-Term Trends in CTE Course Taking

From "A Nation at Risk" through the rest of the past century, total and academic credits rose quickly and then continued more slowly in the 2000s. CTE credits declined over the same period, by smaller absolute amounts, but still by considerable proportions.

The big-picture trends in credits earned over these three decades are evident in Figure 1. Looking at three full decades of data, instead of the roughly two decades between 1990 and 2009 covered by the HSTS,

Figure 1. Total, Academic, and CTE Credits Earned by Graduates in Select Years, 1982–2013



Note: Estimates are available in Table A1.
Source: National Center for Education Statistics, HSB, 1982; National Center for Education Statistics, HSTS, 1990, 1994, 2000, 2005, and 2009; and National Center for Education Statistics, HSLS, 2013.

provides a more complete picture of these long-term trends. For instance, the 15 percent rise in total credits from 1990 to 2009 started well before that period, rising 20 percent over 31 years, despite a net fall after 2009. The same pattern holds for academic credits, which rose by an estimated 5.2 credits—fully 36 percent from 1982 levels and well above the 3.3 credit growth between 1990 and 2009.

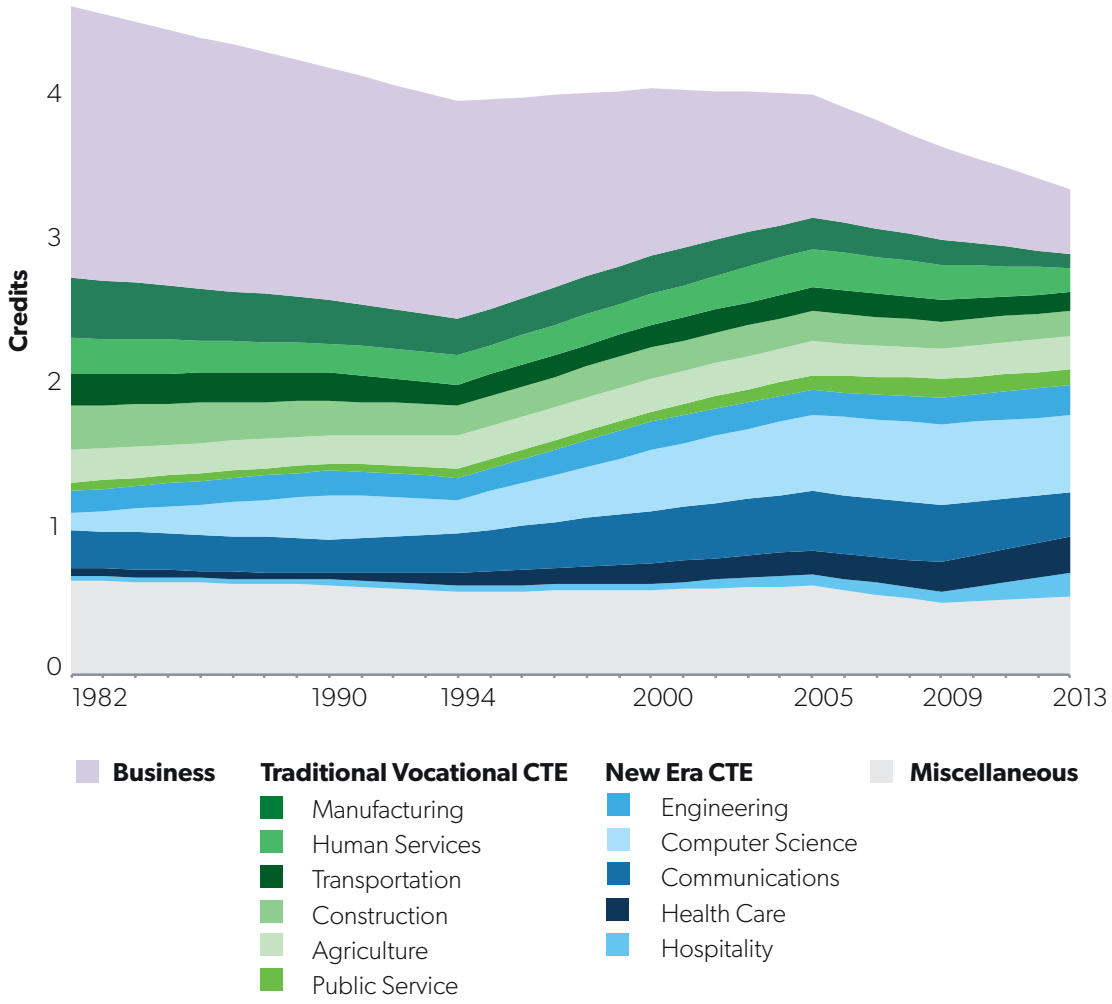
The difference in the decline in CTE credits is even more dramatic. Between 1990 and 2009, CTE credits seem to be declining slowly, largely due to stable levels between 1994 and 2005, with declining trends in the four years preceding and following that period. Overall CTE credits declined 13 percent, losing 0.5 credits between 1990 and 2009, leaving open the question of whether the trend was the stability from 1994 to 2005 or the declines on either side. Looking from 1982 to 2013 makes clear that the overall trend is not one of stability, with an estimated reduction in total CTE credits of 1.3 percentage points, more than 27 percent, over three decades.

Figure 2 adds perspective and texture to these patterns of CTE course taking during the same period. Figure 2 is structured in the same way as Figure 1, but with a smaller vertical axis. It focuses on CTE courses only and breaks out credits by the 12 occupational areas and a set of miscellaneous CTE courses that do not fall under any of those areas.[40]

This closer view brings the overall declines in CTE course taking into sharper relief. It also shows that underneath the total decline were occupational areas that declined, remained stable, or grew appreciably. Overall CTE declines of more than 25 percent over this period may seem disconcerting, but there may be some comfort in examining the reason behind them.

The most obvious change over time is in the top occupational category, business, which declined by 75 percent, from an average of two credits in 1982 to less than half a credit in 2013. Business course taking, which drove overall CTE course-taking declines, may not have declined because of a lack of interest in business per se, but because of the ubiquity

Figure 2. CTE Credits Earned by Graduates in Select Years, by Occupational Area, 1982–2013



Note: Data for this figure are available in Table A2.
Source: National Center for Education Statistics, HSB 1982; National Center for Education Statistics, HSTS, 1990, 1994, 2000, 2005, and 2009; and National Center for Education Statistics, HSLS, 2013.

of personal computers during this period. Typing classes, once a standard part of many high school programs, were classified as business courses and lost their popularity dramatically after the 1980s. Keyboarding and classes on office procedures and word processing—all skills that have become common since the advent of desktop publishing programs—also help explain the bulk of the decline in business courses, which suggests the large declines in CTE course taking may be less dramatic than they appear. The declines in business course taking are so large that apart from them, CTE course taking actually increased by a negligible amount on net, from the 1980s to the 2010s (though the estimates show considerable volatility in between).

Even if one dismisses the importance of the decline in business course taking, several other patterns are worth noting. First, the six occupational areas just below business in Figure 2 (shown in green) were stable or declining over this period. (For more detail, see Table 2.) In total, average course taking in these areas, which I collectively refer to as "Traditional Vocational"

Table 2. Average CTE Credits Earned by Graduates by Occupational Area, 1982–2013

	Total	Business	Traditional Vocational CTE							New Era CTE						Miscellaneous CTE
			Total	Manufacturing	Public Service	Construction	Agriculture	Human Services	Transportation	Total	Computer Science	Communications	Health Care	Hospitality	Engineering	
1982	4.6	1.9	1.5	0.4	0.1	0.3	0.2	0.2	0.2	0.6	0.1	0.3	0.1	0.0	0.2	0.6
1990	4.2	1.6	1.2	0.3	0.0	0.2	0.2	0.2	0.2	0.8	0.3	0.2	0.0	0.0	0.2	0.6
1994	4.0	1.5	1.1	0.2	0.1	0.2	0.2	0.2	0.1	0.8	0.2	0.3	0.1	0.0	0.2	0.6
2000	4.1	1.2	1.2	0.3	0.1	0.2	0.2	0.2	0.2	1.2	0.4	0.4	0.1	0.0	0.2	0.6
2005	4.0	0.9	1.2	0.2	0.1	0.2	0.2	0.3	0.2	1.4	0.5	0.4	0.2	0.1	0.2	0.6
2009	3.7	0.6	1.1	0.2	0.1	0.2	0.2	0.2	0.2	1.4	0.6	0.4	0.2	0.1	0.2	0.5
2013	3.4	0.5	0.9	0.1	0.1	0.2	0.2	0.2	0.1	1.5	0.5	0.3	0.3	0.2	0.2	0.5

Note: Standard errors are available in Table A2.
Source: National Center for Education Statistics, HSB, 1982; National Center for Education Statistics, HSTS, 1990, 1994, 2000, 2005, and 2009; and National Center for Education Statistics, HSLS, 2013.

subject areas, declined by a third (Table 2). The bulk of that decline was in manufacturing, which fell by more than three-quarters, from the largest estimated number of credits of the Traditional Vocational CTE areas in 1982 to the smallest by 2013.

In contrast, the next five areas—engineering, computer science, communications, health care, and hospitality—which I refer to as "New Era" CTE courses, *increased 238 percent*. The contrasting course-taking patterns in these two groups, Traditional Vocational and New Era CTE courses, are just the first in a number of distinctions that shed considerable light on how CTE courses and the students taking them have changed during this transition from vocational education to CTE.

CTE Course Taking by Student Sex. If differential growth in CTE occupational areas is worth highlighting, so is what drives students to those different areas. And one of the major drivers is graduates' sex.

In 1982, female graduates earned more CTE credits than male graduates. (See Table 3.) While those percentages dropped for both sexes over time, declines were faster for females, so much so that by 2013 the positions had flipped. Average CTE credits earned by women dropped by a third over three decades, while men's average dropped by a fifth.

Again, the driver here was business course taking. Male graduates' average number of business credits declined by half a credit, about 50 percent, but for women the drop was more than two full credits, again to a lower estimate (though not statistically different from men in 2013). The explanation for the business declines holds here and suggests that in the 1980s and 1990s many female graduates took typing and other classes that were made somewhat obsolete by programs such as Word Perfect and later Word.

Why Divide New Era and Traditional Vocational Occupational Areas?

Skeptical readers might question my categorization of New Era and Traditional Vocational CTE concentrations, especially because neither include business, which was long the largest concentration area. My logic for these division starts with removing business from either.

The main reason business should stand alone is not that it is unlike other New Era concentrations, but that its coherence under the SCED taxonomy differs over time. In the 1980s, the popularity of typing was high, and it made sense to include it in the category of business courses, which made concentrators much more common. As that popularity dwindled, so did the proportion of concentrators. This makes interpreting what a business concentrator is, and what value it might be to students, difficult. I exclude business from the other categories because the patterns are more interpretable.

Deciding where to place other concentrations was based on intuition more than anything else. I find this appropriate in the case of CTE because so much of what influences course taking is stigma, which itself is grounded in intuition rather than data.

In defense of this division, the Traditional Vocational occupational areas all have roots in blue-collar industries, while the New Era concentrations are more strongly associated with the knowledge economy. Some concentrations—particularly hospitality, tourism, government, and public service—are not so clearly associated. Fortunately for this analytical decision, they are a relatively small part of CTE course taking and would not substantively alter the patterns found here.

Finally, the evidence backing these divides becomes ever plainer as you examine the test scores and student characteristics across the categories. The concentrations within each group hold together across quite a few measures in these tables, as well as more that were available but not important enough to belabor. While there are certainly alternative classifications that could be used, the primary virtue of this division between New Era and Traditional Vocational CTE occupational areas is that it serves to highlight patterns in CTE course taking that deserve consideration.

Traditional Vocational CTE course-taking declines are more dramatically gendered. Female graduates had relatively steady average credits over time, and these were drawn primarily in the human services area. In clear contrast with females, males earned more credits in manufacturing, construction agriculture, and transportation courses than any subject but business. Further, male course taking in these subjects dropped over time, by nearly 50 percent between 1982 and 2013, with about half of that decline driven by manufacturing.

New Era CTE courses had unsurprisingly low credit totals in the 1980s and 1990s, in part because the new era that created a home for them was developing, and in part because computer science, which drove much of this growth, was such a nascent field in 1982. The total average credits earned for New Era CTE courses were similar across genders, and though less gendered than Traditional Vocational subjects, the components of New Era CTE courses also showed gender imbalance. Females earned more communications and hospitality credits and far more health care credits than males, while males earned slightly more computer science and far more engineering credits.

From Credits to Concentrators. The trends in CTE course taking are clear, but average course taking may be a poor barometer of meaningful CTE participation because haphazard CTE course taking may not deliver coherent labor force preparation. Knowing this, most research and policy focuses on CTE concentrators, defined here as graduates who earned

Table 3. Average CTE Credits Earned by Graduates by Occupational Area and Sex, Select Years, 1982–2013

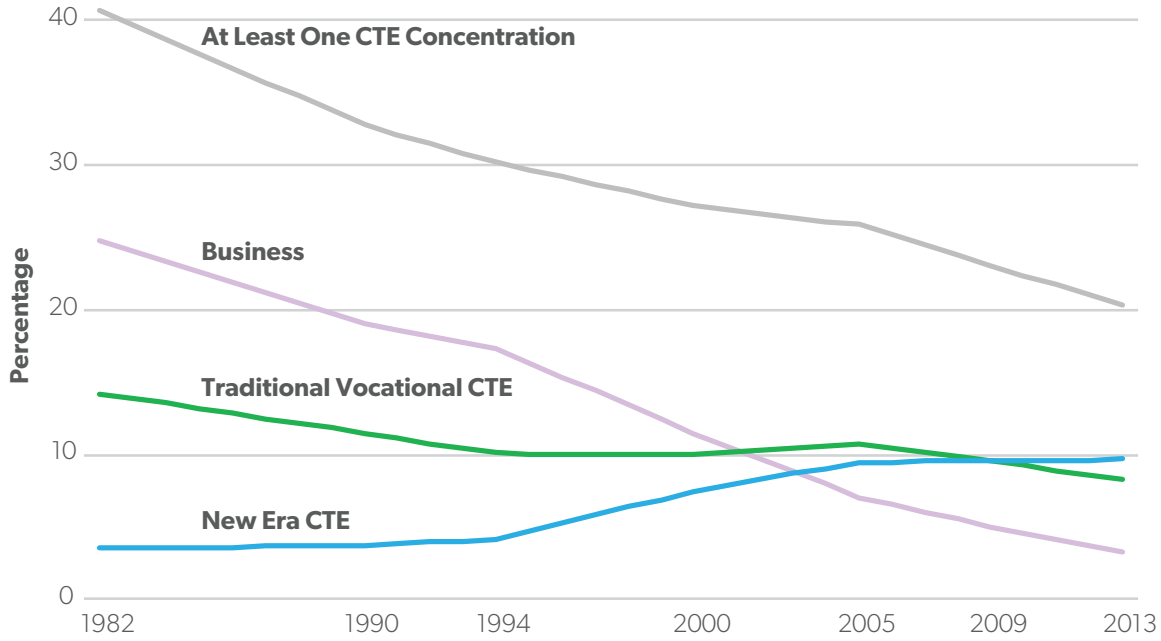
		Total CTE Credits	Business	Traditional Vocational CTE							New Era CTE						Miscellaneous CTE
				Total	Manufacturing	Public Service	Construction	Agriculture	Human Services	Transportation	Total	Computer Science	Communications	Health Care	Hospitality	Engineering	
Male	1982	4.5	1.1	2.3	0.8	0.1	0.6	0.4	0.0	0.4	0.7	0.1	0.3	0.0	0.0	0.3	0.4
	1990	4.3	1.1	1.8	0.5	0.1	0.5	0.3	0.0	0.4	0.9	0.3	0.2	0.0	0.0	0.3	0.4
	1994	4.1	1.2	1.6	0.5	0.1	0.4	0.4	0.1	0.3	0.9	0.3	0.3	0.0	0.0	0.3	0.4
	2000	4.5	1.1	1.6	0.5	0.1	0.4	0.3	0.1	0.3	1.3	0.5	0.3	0.1	0.0	0.3	0.5
	2005	4.4	0.8	1.6	0.4	0.1	0.4	0.3	0.1	0.3	1.4	0.6	0.4	0.1	0.1	0.3	0.5
	2009	4.0	0.7	1.4	0.3	0.1	0.3	0.3	0.1	0.3	1.5	0.7	0.4	0.1	0.1	0.3	0.4
	2013	3.6	0.5	1.2	0.2	0.1	0.3	0.3	0.0	0.2	1.5	0.6	0.3	0.1	0.1	0.3	0.4
Female	1982	4.8	2.6	0.7	0.1	0.1	0.0	0.1	0.4	0.0	0.5	0.1	0.3	0.1	0.0	0.0	0.9
	1990	4.2	2.0	0.6	0.1	0.0	0.0	0.1	0.4	0.0	0.7	0.3	0.3	0.1	0.0	0.1	0.8
	1994	3.9	1.8	0.6	0.0	0.1	0.0	0.1	0.3	0.0	0.7	0.2	0.3	0.1	0.0	0.0	0.7
	2000	3.7	1.2	0.7	0.1	0.1	0.0	0.1	0.3	0.0	1.1	0.3	0.4	0.2	0.1	0.1	0.7
	2005	3.7	0.9	0.8	0.1	0.1	0.0	0.2	0.4	0.0	1.3	0.4	0.4	0.3	0.1	0.1	0.7
	2009	3.4	0.6	0.8	0.0	0.1	0.0	0.1	0.4	0.0	1.4	0.5	0.4	0.3	0.1	0.1	0.6
	2013	3.2	0.4	0.7	0.0	0.1	0.0	0.2	0.3	0.0	1.5	0.5	0.3	0.4	0.2	0.1	0.6

Note: Standard errors are available in Table A2.
Source: National Center for Education Statistics, HSB, 1982; National Center for Education Statistics, HSTS, 1990, 1994, 2000, 2005, and 2009; and National Center for Education Statistics, HSLS, 2013.

credit in three or more courses within a given occupational area. (For more detail, see "Why Look at CTE Concentrators?")

The same patterns evident in the number of credits earned are more pronounced among CTE concentrators. For instance, during the same period (1982–2013) that the average number of credits dropped about 27 percent (Figure 1), the percentage of students with at least one CTE concentration fell by half (Figure 3). As mentioned, looking at the transcript data before and after the HSTS studies better captures CTE trends. The HSTS data from 1990 to 2009 show only a reduction in concentrators of 29 percent.

Figure 3. Graduates with Business, Traditional Vocational, and New Era Concentrations, 1982–2013



Source: National Center for Education Statistics, HSB, 1982; National Center for Education Statistics, HSTS, 1990, 1994, 2000, 2005, and 2009; and National Center for Education Statistics, HSLS, 2013.

Table 4. The Top Three Most Popular Courses in Select Occupational Areas in Texas

	Top Course	Second Course	Third Course
Manufacturing	Welding	Principles of Manufacturing	Advanced Welding
Health	Anatomy and Physiology	Principles of Health Science	Health Science
Business	Business Information Management I	Principles of Business, Marketing, and Finance	Business Information Management II
Marketing	Sports and Entertainment Marketing	Entrepreneurship	Fashion Marketing
Agriculture	Principles of Agriculture, Food, and Natural Resources	Principles and Elements of Floral Design	Agricultural Mechanics and Metal Tech
Architecture and Construction	Principles of Architecture and Construction	Construction Technology	Interior Design

Source: Matt S. Giani, *Who Is the Modern CTE Student? A Descriptive Portrait of Career and Technical Education Students in Texas*, American Enterprise Institute, March 26, 2019, http://www.aei.org/publication/who-is-the-modern-cte-student-a-descriptive-portrait-of-career-and-technical-education-students-in-texas/.

Table 5. Percentage of All Graduates in CTE Concentrations by Occupational Areas, 1982–2013

	Any Concentration	Business	Occupational Areas													
			Traditional Vocational							New Era						
			Total	Manufacturing	Public Service	Construction	Agriculture	Human Services	Transportation	Total	Computer Sciences	Communications	Health Care	Hospitality	Engineering
1982	40.7	24.8	14.2	4.7	0.0	2.9	3.3	1.8	2.6	3.5	0.3	1.4	0.6	0.2	1.0
1990	32.8	19.1	11.5	3.3	0.0	2.2	2.8	1.6	2.4	3.7	0.3	1.3	0.6	0.5	1.0
1994	30.2	17.3	10.1	2.2	0.1	1.9	3.5	1.6	1.6	4.1	0.3	1.6	1.0	0.4	0.8
2000	27.2	11.4	10.0	2.2	0.3	1.9	3.0	1.5	1.8	7.5	1.5	2.4	1.8	0.5	1.4
2005	25.9	7.1	10.8	1.5	0.5	2.0	3.0	2.2	2.1	9.5	2.6	2.8	2.3	0.7	1.2
2009	23.1	5.0	9.5	1.4	0.5	1.6	2.7	1.9	1.9	9.6	2.3	2.8	2.6	0.8	1.3
2013	20.3	3.3	8.3	0.8	0.4	1.6	2.7	1.5	1.6	9.7	2.2	1.6	3.2	1.1	1.8

Note: Totals may not sum to 100 percent because graduates could have more than one concentration. Standard errors are available in Table A3.
Source: National Center for Education Statistics, HSB, 1982; National Center for Education Statistics, HSTS, 1990, 1994, 2000, 2005, and 2009; and National Center for Education Statistics, HSLS, 2013.

Business concentrators declined dramatically over this period, from about one in four graduates in 1982—far and away the most of any occupational area through 2009—to one in 30 graduates, statistically no different from agriculture or health care concentrators. As a group, Traditional Vocational concentrators also declined substantially, by about 40 percent—again, largely driven by manufacturing declines (Table 5). In contrast, New Era CTE occupational areas saw substantial growth across the board during this period.[44] Computer science, health care, and hospitality occupational areas had the greatest relative increases, with each increasing at least fourfold between 1982 and 2013.

CTE Concentrators by Sex. The differences by sex are even more pronounced in the percentage of concentrators (Table 6). In 1982, 38 percent of female graduates were business concentrators; by 2013, the percentage dropped to 3 percent. This decline is remarkable for its sheer size, but also because business is the only concentration responsible for the 60 percent decline in female concentrators of any kind. During the same period, there were no real declines for female graduates in any other concentration. Percentages were flat for Traditional Vocational concentrations and grew for New Era CTE concentrations.

Male graduates also showed distinct patterns. The percentage of male business concentrators in 2013 dropped to a third of what it had been in 1982, from

Table 6. Percentage of All Graduates in CTE Concentrations by Occupational Areas, by Sex, 1982–2013

				Occupational Areas													
				Traditional Vocational							New Era						
		Any Concentration	Business	Total	Manufacturing	Public Service	Construction	Agriculture	Human Services	Transportation	Total	Computer Sciences	Communications	Health Care	Hospitality	Engineering
Male	1982	37.1	10.6	24.5	9.4	0.0	5.7	5.9	0.3	5.3	4.0	0.4	1.4	0.2	0.2	1.9
	1990	31.2	10.3	18.2	5.7	0.0	4.5	4.7	0.1	4.8	4.2	0.5	1.3	0.2	0.6	1.8
	1994	29.1	10.9	15.6	4.2	0.1	3.7	5.5	0.1	3.2	3.9	0.4	1.4	0.3	0.4	1.5
	2000	30.5	9.7	15.0	4.2	0.4	3.6	4.4	0.3	3.5	8.0	2.5	2.0	0.6	0.4	2.6
	2005	29.8	6.7	15.0	2.8	0.5	3.8	4.3	0.4	4.2	9.7	4.2	2.5	0.7	0.6	2.2
	2009	26.1	4.9	12.9	2.7	0.6	3.1	3.7	0.2	3.6	9.4	3.5	2.4	0.8	0.7	2.4
	2013	23.0	3.3	11.3	1.6	0.7	3.0	3.4	0.1	3.1	9.5	3.0	1.3	1.2	0.9	3.3
Female	1982	44.1	38.0	4.7	0.2	0.1	0.3	0.8	3.3	0.1	3.0	0.3	1.4	1.0	0.3	0.1
	1990	34.2	27.1	5.3	1.0	0.0	0.1	1.1	3.0	0.2	3.3	0.2	1.4	1.0	0.4	0.3
	1994	31.3	23.5	4.9	0.3	0.0	0.1	1.5	3.0	0.1	4.3	0.2	1.9	1.8	0.4	0.2
	2000	23.9	12.9	5.4	0.5	0.3	0.2	1.7	2.6	0.2	7.0	0.6	2.7	2.8	0.7	0.3
	2005	22.2	7.4	6.8	0.3	0.4	0.3	1.8	3.8	0.2	9.2	1.2	3.1	3.8	0.8	0.3
	2009	20.2	5.1	6.3	0.2	0.4	0.2	1.7	3.5	0.3	9.7	1.3	3.1	4.3	0.9	0.4
	2013	17.8	3.2	5.6	0.1	0.2	0.4	2.0	2.8	0.2	9.8	1.4	1.9	5.0	1.2	0.4

Note: Standard errors are available in Table A3.
Source: National Center for Education Statistics, HSB, 1982; National Center for Education Statistics, HSTS, 1990, 1994, 2000, 2005, and 2009; and National Center for Education Statistics, HSLS, 2013.

11 to 3 percent. Unlike females, business was not the most influential occupational area in the decline of male concentrators. Declines in male manufacturing concentrators were larger than those in business, and all together, Traditional Vocational concentrators declined by over half, from 25 to 11 percent of male graduates between 1982 and 2013.

For both sexes, overall growth in New Era CTE concentrators was similar but driven by different subject areas. As with credits, male concentrators predominated in computer science and engineering, while female concentrators predominated in health care and communications. The trends in CTE course taking and concentration clearly show overall declines in

business, but those declines were greater for females (and also more influential because they took fewer courses in other concentration areas). Traditional Vocational areas also saw overall declines, but these were driven primarily by male graduates. The growth areas for CTE for both sexes are the New Era subjects, but even these are driven by different occupations areas in this category.

CTE Concentrators' Test Scores over Time. In addition, academic achievement is strongly associated with different concentration areas. Table 7 displays the average percentile score on a mathematics assessment for concentrators, overall and by occupational area. In every year, all concentrators scored (on average) below the 50th percentile, the overall average score, but over time their scores rose from the 42nd to the 46th percentile. This shift may seem small, but it amounts to closing the CTE gap by about half in three decades.

New Era CTE concentrators scored higher than traditional CTE concentrators did from 2000 forward. Their higher scores had an increased effect on the overall percentile as they increased from 9 to 48 percent of all concentrators. Some New Era concentrations—such as engineering and computer science—had stably above-average scores, while others—communications, health care, and hospitality—showed signs of test scores rising over time.[45] Perhaps the most important distinction in Table 7 is that Traditional Vocational students scored well below average across time, while New Era CTE students were indistinguishable from all other high school students, remaining within one point of the 50th percentile from 2000 forward.

The drivers of the overall increase in CTE concentrators' scores are difficult to communicate in a single table because the constituent occupational concentrations change in terms of both their math scores and relative size. However, the broad pattern is clear. Traditional Vocational concentrators have been a stable group in terms of both their proportional size within all concentrators and their steadily low scores; the shifts in the overall percentile are attributable to business and New Era concentrators.

A portion of the overall rise is attributable to business concentrators, but as their scores increased, their proportion of all concentrators shrunk from 61 percent to 16 percent between 1982 and 2013.[46] Traditional Vocational concentrators made up a more stable percentage of all concentrators over this period (between 35 and 42 percent) and, even more stably, scored well below average on math assessments, at about the 38th percentile. There were not statistically significant differences in percentiles either over time within traditional occupational concentrations or across traditional concentrations within years.

Test scores show interesting patterns across occupational areas and explain where increases in concentrators' average percentile scores over time

Why Look at CTE Concentrators?

Examining CTE course taking over time gives a clear view on which courses are taken, but researchers have looked at concentrators to capture students with substantive intensity in CTE course taking. Since a single course in a CTE subject may not prepare a student for the labor market, looking at concentrators helps focus on career preparation.

In this report, concentrators are defined as graduates with three or more courses in the same occupational area, but there are other definitions. States have most often used two- and three-credit definitions or a percentage completion of a defined secondary CTE program of study.[41] For the first time, Perkins V defined CTE concentrators using a two-course threshold in a given occupational area. I chose to use the three-credit threshold to be consistent with previous research[42] and the prevailing

(continued on the next page)

Table 7. Average Percentile for Math Among CTE Concentrators by Occupational Area, 1982–2013

	1982	2000	2005	2009	2013
Concentrators	42*	43*	44*	44*	46
New Era	46	51	51	49	51
Computer Sciences	56	61	58*	55*	52
Communications	43	55	48	52	57
Health Care	33*	39*	44*	42*	52
Hospitality	26*	29*	30*	39*	44
Engineering	56	58	61*	58*	58
Traditional Vocational	38*	39*	37*	37*	38
Manufacturing	43	39	30	38	40
Public Service	27*	53	44	33*	37
Construction	37*	34*	34*	36*	35
Agriculture	39*	41*	43*	40*	38
Human Services	33*	38	36*	33*	39
Transportation	33*	33*	34*	34*	36
Business	44*	40*	43*	47	48

Note: *P < 0.05. Differences are from the 50th percentile. Standard errors are available in Table A5.
Source: National Center for Education Statistics, HSB, 1982; National Center for Education Statistics, HSTS; National Center for Education Statistics, NAEP, 2000, 2005, and 2009; and National Center for Education Statistics, HSLS, 2013.

(*continued from the previous page*)
historical definition used by states. Furthermore, the two-credit threshold risks including many students whose haphazard course taking makes them count as concentrators by chance, rather than by design.

Not all concentrators are equally focused. Some gather three or more courses in focused and coherent programs likely to provide benefits after graduation, as discussed earlier. Others become concentrators with less-focused programs in regular high schools. Still others, like many business concentrators from years ago, may be "accidental" concentrators, for example, by taking an introduction to business course and two typing courses for unrelated reasons.

Examples of disconnected courses within occupational areas comes from *The Modern CTE Student*, by Matt Giani,[43] who lists the three most popular courses in different occupational areas in Texas. The top courses in many concentrations are coherent. Others are dissonant. For example, agriculture's top course, "Principals of Agriculture, Food, and Natural Resources," comports poorly with the second most popular, "Principals and Elements of Floral Design." (See Table 4.) Not all occupational areas contain similar strands of career preparation, and thus some concentrators may do so accidentally.

Despite these possibilities, the three-credit definition of occupational concentrators is likely a better metric of the proportion of students taking focused and intentional sequences of CTE than alternatives.

Table 8. Graduates' Attitudes Toward School and Work in Ninth Grade, by CTE Concentration, 2013

	Positive Sense of Belonging at School	Positive School Engagement	Strongly Agree Getting Good Grades Is Important	Working Is More Important for You Than Attending College		
				Agree	Disagree	Strongly Disagree
All Graduates	45	54	61	12	52	36
Non-Concentrators	45	55	63	11	53	36
Concentrators	44	51	56	16	49	35
New Era	49	56	63	10	47	43*
Computer Sciences	43	52	62	11	39	50
Communications	51	60	62	7	53	41
Health Care	57*	62*	70*	6	43	51
Hospitality	38	45	50*	17	52	31
Engineering	47	53	62	15	52	32
Traditional Vocational	39*	46*	46*	22*	53	25*
Manufacturing	32*	40*	40*	31*	56	13*
Public Service	47	29*	54	6	71*	24
Construction	38	41*	44*	26*	52	22*
Agriculture	42	50	47*	24*	54	22*
Human Services	40	61	53	11	59	30
Transportation	32*	43*	35*	28*	41	31
Business	42	45	65	17	41	42

Note: *P < 0.05. Differences are measured against percentages for all graduates. Standard errors are available in Table A6.
Source: National Center for Education Statistics, HSLS, 2013.

are. The more important lesson that these differences illuminate is that, as a group, Traditional Vocational concentrators have been stably lower scoring, which meshes with the long-standing stigma surrounding vocational education. In contrast, New Era CTE concentrators score at about the average and have for some time. The stark contrast between these categories suggests that CTE is bifurcated, and the growing share of New Era concentrators means they disproportionately define CTE concentrators' average characteristics.

A Closer Look at 2013 Graduate CTE Concentrators

Across all years, the HSTS provides limited student characteristics to examine differences among CTE concentrators over time. Fortunately, the HSLS data from 2013 contain a wealth of additional data beyond transcripts and test scores. This section examines them to explore whether the divide I have drawn between Traditional Vocational and New Era concentrators stands scrutiny across a broader range of measures.

Table 9. Parents with a B.A. and Expectations in Ninth Grade for Graduate to Earn B.A., 2013

	At Least One Parent with a B.A.	Expect Student Will Earn a B.A.	
		Students	Parents
All Graduates	37	74	63
Non-Concentrators	39	77	64
Concentrators	32	63	60
New Era	39	77	66
Computer Sciences	35	73	66
Communications	40	79	60
Health Care	39	77	72*
Hospitality	36	75	47*
Engineering	45	81	70
Traditional Vocational	25*	42*	53*
Manufacturing	26*	35*	58
Public Service	31	38*	52
Construction	24*	39*	52*
Agriculture	24*	48*	51*
Human Services	22*	46*	60
Transportation	26*	30*	49*
Business	30	70	62

Note: *P < 0.05. Standard errors are available in Table A7.
Source: National Center for Education Statistics, HSLS, 2013.

These HSLS data, like the HSB and HSTS data, face small sample sizes—especially when looking at specific occupational areas—meaning that only truly large differences are statistically significant. Therefore, readers should interpret apparent differences with caution—again, especially for specific occupational areas—as some are not statistically valid, and also understand that statistically significant differences are not only measurable but substantial differences.

CTE Concentrators' Attitudes Toward High School. The distinctions between concentrators and non-concentrators, as well as those among concentrations, are evident in numerous aspects measured in 2009, when 2013 graduates were in ninth grade. These aspects are telling because they were measured before graduates became concentrators.

For instance, about 45 percent of all graduates, concentrators and non-concentrators, reported a positive sense of belonging at school in ninth grade (Table 8). There was variability among concentrators, however. There was no statistical difference between percentages of all graduates and New Era concentrators with a positive sense of belonging, but measurably lower percentages of all Traditional Vocational concentrators, as well as manufacturing and transportation concentrators specifically, felt they belonged at schools.

Table 10. Graduates' and Concentrators' Academic Progress During High School, 2013

	Grade Student Passed Algebra I			Standardized Ninth Grade Math Score	Cumulative Academic GPA
	Before Ninth Grade	Ninth Grade	After Ninth Grade		
All Graduates	33	56	12	4%	2.7
Non-Concentrators	34	55	12	4%	2.7
Concentrators	26	62	13	–10%	2.5
New Era	30	60	9	7%	2.7
Computer Sciences	29	62	9	4%	2.5
Communications	34	59	7*	19%	2.7
Health Care	32	60	8	5%	2.7
Hospitality	13*	72*	16	–26%*	2.5
Engineering	39	53	9	25%	2.7
Traditional Vocational	17*	63	19*	–31%*	2.4*
Manufacturing	21	59	20*	–32%*	2.2*
Public Service	11*	75*	14	–36%*	2.2*
Construction	13*	72*	16*	–46%*	2.2*
Agriculture	22*	56	22*	–25%*	2.5*
Human Services	18*	70*	12*	–28%*	2.6
Transportation	15*	69*	16*	–37%*	2.1*
Business	27	64	9	–7%	2.6

Note: *P < 0.05. Differences are from all graduates. Standard errors are available in Table A8.
Source: National Center for Education Statistics, HSLS, 2013.

This suggested difference between New Era CTE and Traditional Vocational concentrators gets stronger with other indicators. More than half of all graduates had a positive sense of school engagement (54 percent), and neither concentrators generally, New Era concentrators specifically, nor non-concentrators differed from the percentage of all graduates. Health care concentrators were the only New Era concentration to differ from all graduates, and they had a *higher* sense of positive school engagement. But compared to all graduates and New Era concentrators, the percentages were lower for Traditional Vocational concentrators overall and for four specific concentrations therein. The same basic pattern was evident for strong agreement that getting good grades is important.[47]

Again, the pattern is evident in the percentage of how students responded to the statement that work is more important than attending college. Overall, New Era CTE concentrators were more likely than all graduates to strongly disagree. Traditional Vocational concentrators, overall and for five of the six specific occupational areas within it, had higher percentages agreeing that work was more important than college. There were no significant differences across the board for business concentrators. All these patterns show that students who later earned Traditional Vocational concentrations were less comfortable in school and

Table 11. 2013 High School Graduates' Highest Level of Attendance, 2016

	High School	Two-Year College	Four-Year College
All Graduates	21	36	44
Non-Concentrators	20	36	45
Concentrators	25	35	39
New Era	19	36	46
Computer Sciences	20	41	39
Communications	19	30	50
Health Care	18	34	48
Hospitality	18	41	42
Engineering	16	34	49
Traditional Vocational	37*	37	26*
Manufacturing	51*	27	22*
Public Service	48*	29	23*
Construction	41*	43	16*
Agriculture	32*	38	30*
Human Services	29	36	34
Transportation	43*	34	23*
Business	17	37	47

Note: *P < 0.05. Differences are measured against all graduates. Standard errors are available in Table A9.
Source: National Center for Education Statistics, HSLS, 2016.

less academically oriented in ninth grade. Students who eventually concentrated in a New Era subject were indistinct from non-concentrators. These patterns demonstrate a clear division between these two categories of concentrators and a conspicuous lack of differentiation between New Era CTE concentrators and all other students.

The same patterns are plain in the percentages of graduates whose parents earned a B.A. or higher and the percentages whose parents and who themselves expected them to earn a bachelor's degree (Table 9). The percentages of New Era and business concentrators whose parents had at least a bachelor's degree, overall and for each specific category, had no statistical differences with the percentage for all graduates, at 37 percent.[48] For Traditional Vocational concentrators, both overall and for every specific concentration group except public service, a smaller percentage of graduates had parents with at least a bachelor's degree.

Student and parent expectations follow a similar pattern. In ninth grade, students' expectations showed no differences between New Era concentrators and those of all graduates. The percentage of Traditional Vocational concentrators, overall and in each concentration, who expected to earn a B.A. was markedly lower. Similarly, Traditional Vocational students overall—and construction, agriculture, and transportation concentrators specifically—were less likely than all graduates to have parents with a B.A.

Table 12. Percentage of 2013 Graduates with CTE Concentrations, by Sex and College Enrollment in 2016

	All Students	Male			Female		
		All	Enrolled in College		All	Enrolled in College	
			Yes	No		Yes	No
Any Concentration	20.3	23.0	19.8	25.1*	17.8	16.3	19.2
New Era	9.7	9.5	10.7	8.8	9.8	9.2	10.4
Computer Science	2.2	3.0	2.9	3.1	1.4	0.9	1.9
Communications	1.6	1.3	1.5	1.1	1.9	2.2	1.7
Health Care	3.2	1.2*	1.7	0.9	5.0	4.5	5.5
Hospitality	1.1	0.9	1.0	0.8	1.2	1.3	1.1
Engineering	1.8	3.3*	3.8	2.9	0.4*	0.5	0.3
Traditional Vocational	8.3	11.3*	6.0	14.7*	5.6	3.9	7.1*
Manufacturing	0.8	1.6*	0.7	2.2*	0.1*	0.0	0.1
Public Service	0.4	0.7	0.5	0.8	0.2	0.1	0.4
Construction	1.6	3.0*	1.3	4.1*	0.4*	0.2	0.6
Agriculture	2.7	3.4	2.2	4.2*	2.0	1.7	2.3
Human Service	1.5	0.1*	0.1	0.1	2.8*	2.0	3.6*
Transportation	1.6	3.1*	1.4	4.2*	0.2*	0.0	0.3*
Business	3.3	3.3	3.8	3.1	3.2	3.6	2.8

Note: "Enrolled in College" includes 2013 high school graduates who had earned a degree or were enrolled in a two- or four-year college in February 2016. Differences are between all graduates and all males or all females and between males and females who were enrolled or not in 2016. *P < 0.05. Standard errors are available in Table A10.
Source: National Center for Education Statistics, HSLS, 2013.

CTE Concentrators' Academic Progress Through High School. The divide between New Era and Traditional Vocational concentrators is again evident in students' academic progress in high school. Table 10 displays percentages of graduates who passed algebra I before, during, and after the ninth grade. While there were a few differences for specific New Era CTE occupational areas, Traditional Vocational occupational areas overall and every specific subgroup therein passed algebra later than average. In terms of ninth-grade standardized test scores, concentrators' scores overall and New Era concentrators' scores were not statistically different from the scores of all graduates. Again in sharp relief, Traditional Vocational students overall and in each category scored markedly lower than their peers. Finally, when looking at cumulative academic GPA, New Era CTE concentrators do not appear different in any systematic way from all graduates, while Traditional Vocational concentrators overall and for every occupational area but one had below-average GPAs.

Concentrators After High School. The differences apparent during high school are also apparent after high school. Table 11 shows 2013 graduates' highest level of postsecondary enrollment in February 2016, nearly three years after graduation, and provides powerful evidence that far fewer Traditional

Vocational CTE students attend four-year colleges after high school.

The modal category for all graduates is four-year colleges, which 44 percent of all students attended, followed by 36 percent who attended a two-year college and 21 percent who never attended a postsecondary school. Four-year college attendance estimates look lower among concentrators than non-concentrators, but they are not statistically different. The only significant differences are for Traditional Vocational concentrators: As an entire group and for each occupational area therein, they were far less likely to attend four-year college than all graduates were.

These gaps are consistent with the arguments that paths to careers for vocational concentrations run through postsecondary schools less often. New Era CTE concentrators' college attendance is nearly identical to that of non-concentrators, suggesting these two groups look indistinguishable on more than just test scores.

Additional wrinkles in occupational concentration become evident by examining sex and college attendance at the same time. Table 12 displays the percentage of all graduates, males, and females by CTE concentration and by college enrollment (defined as whether the graduate had earned a two- or four-year degree or was still enrolled in a two- or four-year college). For women, college attendance appears associated with CTE concentration, but the gap of nearly 3 percentage points (16.3 versus 19.2 percent) is not statistically significant. For males, college attendance is associated with concentrating, with a more than 5 percentage point gap—roughly a quarter of the overall male average. Substantially fewer male concentrators than non-concentrators were enrolled in college.

Again, this pattern is not consistent across concentrations. For males and females, New Era CTE concentrations showed no significant association with college attendance. Female graduates with traditional concentrations were less likely to be enrolled in college, but this was driven primarily by human service concentrators.

Male graduates showed a starker pattern. For male New Era concentrators, the pattern was uniform (except for computer science), though differences were not significant: The estimates for enrolled students were higher than for unenrolled. The pattern for male Traditional Vocational concentrators was just as uniform, but in the opposite direction. Among male Traditional Vocational concentrators, estimates for unenrolled were much larger overall, and for four of the six areas, than for enrollment in college. Interestingly, this pattern ran counter to the pattern for New Era concentrations. Taken together, Traditional Vocational concentrators made up a much larger share of non-college-going male graduates than their college-going peers, 15 versus 6 percent, respectively, a gap of more than 8 percentage points. That gap was large enough to compensate for the opposite patterns for both business and New Era CTE concentrations.

The patterns of concentration by sex and college attendance reveal a few important underlying patterns. First, college attendance is not a clear differentiator for concentrators in business and New Era CTE subjects, and while the sex differential is evident for health care and engineering in opposite directions, it is not overall. Traditional Vocational concentrations among males drive college-going differentiation among all concentrators. Again, the divergence between Traditional Vocational and New Era CTE concentrations is highlighted by the countervailing college-attendance patterns across these categories.

Discussion

Getting a nuanced picture of high school CTE course taking requires looking beneath topline CTE trends. This detailed and longer look shows that the overall decline in CTE course taking is greater than previously thought, but it also puts that decline in a sensible context.

Overall declines are driven overwhelmingly by business courses, and more specifically by keyboarding and office procedure courses that may be of little value to today's graduates. Most graduates gain facility with computers without such classes, which suggests the overall CTE decline might not be a loss at all. While the disproportionate decline in business courses has been previously noted,[49] this longer look shows the decline

is more extensive than previously documented and explains why it may actually be a good thing.

Examining these trends by occupational areas reveals important compositional shifts. The rise of New Era CTE courses as a relative share of CTE course taking in high school and the relative decline of Traditional Vocational courses have received perhaps too little attention. This changing composition of CTE concentrators is part of the transition from vocational education to CTE and is not necessarily a bad thing. However, it is potentially confusing, as it may serve to improve the markers of student progress, such as overall graduation rates and test scores of CTE concentrators, even if programs are not driving additional benefits to students.

Some CTE programs are benefiting students, as discussed earlier, but the majority of CTE concentrators graduate from regular high schools, not the more specialized programs that have proven benefits. The data in this report cannot evaluate the quality of CTE programs broadly, but the evidence that more specialized programs can work suggests that larger-scale improvement is possible.

What Is Driving CTE's Improving Statistics? These data do support a circumstantial case—and a persuasive one—that CTE concentrators' overarching statistical progress is likely to be more compositional than instrumental. That is, average test scores, graduation rates, and other indicators are rising by adding more academically oriented and otherwise college-going students to the CTE tent, rather than CTE programs broadly improving. There is a tempting, but errant, logic here: Quasi-experimental evidence that coherent and specialized CTE programs improve student outcomes, combined with observed improved outcomes across all CTE concentrators over time, *seems* to warrant a conclusion that all CTE programs are improving participants' outcomes. That conclusion very well may not be the case.

Traditional Vocational concentrators appear to have changed little over time. These students tend to fare poorly in traditional academic high school programs and are relatively unlikely to take advantage of postsecondary options, at least in the immediate years following graduation. For most of the past century, vocational education was focused on these students.

But these analyses suggest that today the majority of concentrators are in New Era occupational areas, and those concentrators are indistinguishable from non-concentrators in many ways. This constitutes a significant break from the past because today the majority of CTE programs focus on students across the academic spectrum, with less focus on academically weaker students than ever before. Thus, the transformation from vocational education to what we call CTE today might appear to have solved the problems of vocational education and the stigma surrounding it.

However, the steady profile of Traditional Vocational CTE concentrators suggests that this transformation has hidden, rather than solved, the problem of vocational education. Today's CTE programs need not focus solely on students with weaker academic achievements. But if these CTE programs do not keep a substantial focus on these students, will any programs?

CTE's Current Opportunities. The current focus and popularity of CTE is an opportunity. It is an opportunity for school systems to rightsize the balance of policies centered on the college-for-all movement, including their myopic focus on getting high school graduates into college, even though college completion rates are below 50 percent.[50] It is an opportunity to improve the coherence and performance of CTE programs to ensure that graduates leave schools ready for a job that is ready for them. This opportunity is particularly important for Traditional Vocational concentrators, who may have fewer prospects in postsecondary education than their peers. It is also an opportunity to counter the stigma of vocational education by delivering on its long-held promise: viable pathways from high school to careers.

Of course, the opportunity for success is also an opportunity for failure, and the graduates most likely to bear the brunt of such a failure are academically disinclined students. Accepting Pyrrhic

victories where broad statistics for CTE concentrators are trumpeted as success, even when a substantial portion of improvements are likely driven by adding more college-bound students into the CTE tent, will paper over the problems faced by students for whom immediate postsecondary education is a dim prospect. This potentially pernicious pattern can be self-perpetuating if it rewards CTE programs for selection effects that improve statistics *because* they serve fewer Traditional Vocational students. The shifting patterns of concentrators over the past 30 years are clear; they will continue to funnel more CTE investments toward college-bound students and away from lower academic performers, unless the portfolio of CTE programs is purposefully structured to assist them.

Developing State Perkins Plans for CTE. State teams that are currently developing Perkins state plans[51] should note these patterns and ensure that CTE programs retain an appropriate focus on less academically inclined students. Certainly, it is appropriate that CTE programs are aligned with the labor market demand such that programs of study will prepare graduates for jobs that need to be filled, and the required needs assessments and broad swath of representatives will help ensure this. However, if plans do not go out of their way to ensure that academically disinclined students have functional CTE pathways, ones that do not depend heavily on postsecondary education—particularly four-year colleges—CTE programs will continue to shift further away from these students.

Perkins requires an array of accountability indicators for CTE programs and that the reports be disaggregated by a number of student characteristics and by programs of study.[52] These sensible accountability requirements are designed to reflect the outcomes of CTE participants, which is good, but they will not reflect selectivity into CTE programs. By using CTE participants as the denominator, there is no way to tell what proportion of all students in a given subgroup are served by CTE programs. Simply put, these requirements can describe whether the test scores of CTE participants are rising or falling, but not whether the proportions of students with lower test scores concentrating in CTE are rising or falling.

Under Perkins, states can include an additional indicator of CTE quality in their state plans, but the restrictions on that option may make it difficult to function as a check on shifting away from academically disinclined students or Traditional Vocational concentrators. That optional indicator is supposed to take the form of a "percentage of CTE concentrators achieving on any other measure of student success in [CTE] that is statewide, valid, and reliable, and comparable across the State."[53] This design is difficult to employ in a way that will both avoid selection biases and capture whether programs focus on students who might need CTE most.[54]

A potential solution to this problem could be to track the proportion of academically disinclined students who become CTE concentrators. Exactly what this student indicator should be is a tricky decision, but states could choose to use existing indicators of students who are at risk of dropping out of school or the proportion of students who score below the 25th percentile on eighth-grade assessments.

Getting this indicator right may be difficult, but if it adequately captures students who may particularly benefit from CTE because their postsecondary prospects are below average, then it would be useful as a check on other CTE outcomes. For instance, if CTE concentrators' test scores increase over time and the proportion of at-risk concentrators remains stable, the test score improvements likely reflect real progress. On the other hand, if scores increase while the percentage of at-risk concentrators falls, then that progress may need to be investigated more carefully.

Purpose-Driven CTE Investment. Given this context, states should be cautious about where their marginal CTE dollars go. The more CTE programs serve students who—with or without the CTE programs—are more likely to take advantage of postsecondary education, the more educational systems will continue the college-for-all-ization of CTE. As the historical trends documented here continue, more and more CTE dollars, which once would have been clearly focused on students not academically inclined, will

flow to the general population of students who are already as likely as non-CTE concentrators to benefit from postsecondary education programs. Every marginal dollar that goes to New Era CTE programs (to the degree that they are serving students who look as academically inclined as the average student) is one that is not focused on academically disinclined students or on the historic vocational-education problem that still exists today.

CTE advocates are not necessarily wrong to have advocated for New Era CTE expansions. These expansions may benefit students, and the multiple pathways these programs open up for students may help them. But the fact remains that many of these students go to college, at least as many as non-concentrators, and that postsecondary access means they have more options and more aggregate resources expended on them than academically disinclined students who are overrepresented in Traditional Vocational concentrations. Despite this, New Era CTE programs may still be worthwhile investments.

However, sound individual investments do not necessarily make a coherent system, and a coherent CTE system requires a system-wide view. Such a view does more than evaluate whether a certain CTE program is beneficial. It also accounts for who is served by CTE programs and who should be. Of course, key to developing a functionally beneficial system is ensuring programs actually benefit students. Again, this may take a disciplined system-wide view if the system is maintaining or increasing a focus on Traditional Vocational students. A more piecemeal approach will inevitably support current trends because CTE programs aimed at academically average students are bound to appear more productive in terms of student outcomes than those that serve academically disinclined students. Certainly, it is reasonable to test CTE programs to ensure they benefit the students they serve, but that is not a sufficient test of a CTE system. If we intend those systems to particularly benefit students unlikely to go to college, we will have to contend with a selectivity issue and determine whether the system delivers benefits to all such students, not just those who enter CTE programs.

For most of the past century, vocational education has been focused on academically disinclined students, at times proving to be an asset and too often a liability for them. Trends in the past 30 years show a shift away from these students in the transition from vocational education to CTE. For state CTE to be successful, state leaders must grapple with whether their currently developing plans adequately address not simply whether CTE programs are sensible but whether their CTE system targets the students who might need it the most.

It is worth reiterating that the dead-end vocational education of the ’70s and ’80s is not the solution for academically disinclined students or those who are concentrating or could concentrate in Traditional Vocational subject areas. Nor will simply expanding offerings for Traditional Vocational occupational areas be a solution. Functional programs that put students into viable jobs without additional postsecondary education are. Such programs are not necessarily the low-hanging fruit of CTE, and they require substantial investment and coherence if they are to benefit students.

However, this remains the challenge of vocational education—and now its successor, CTE—as long as there is a large population of academically disinclined students. For them, CTE may be the last best chance to find a viable career path, and CTE systems will ultimately be a failure if they cannot deliver opportunity specifically to these students.

About the Author

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Appendix A. Supplemental Tables

Table A1. Total, Academic, and CTE Credits Earned by Graduates in Selected Years, 1982–2013

	Total Credits	Academic Credits, Total	CTE Credits, Total
1982	22.1	14.4	4.6
1990	23.6	16.6	4.2
1994	26.0	17.4	4.0
2000	26.2	18.8	4.1
2005	27.0	19.0	4.0
2009	27.1	19.9	3.7
2013	26.6	19.6	3.4

Source: National Center for Education Statistics, HSB, 1982; National Center for Education Statistics, HSTS, 1990–2009; and HSLS, 2013.

Table A2. Standard Errors for Tables 2 and 3: CTE Course Taking Among All, Male, and Female Graduates by Occupational Areas, 1982–2013

						Occupational Areas													
							Traditional Vocational							New Era					
		Total Credits	Academic Course Credits	Nonacademic and Non-CTE Credits	All CTE Course Credits	Business	Total	Manufacturing	Public Service	Construction	Agriculture	Human Services	Transportation	Total	Communications	Health Care	Hospitality	Engineering	Miscellaneous CTE Credits
All Students	1982	0.13	0.10	0.05	0.07	0.04	0.04	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.02
	1990	0.12	0.11	0.08	0.07	0.04	0.05	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.03
	1994	0.17	0.09	0.07	0.07	0.04	0.04	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.03
	2000	0.20	0.14	0.07	0.13	0.04	0.07	0.02	0.01	0.02	0.03	0.02	0.01	0.05	0.02	0.02	0.01	0.02	0.03
	2005	0.11	0.07	0.05	0.06	0.02	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.01	0.02
	2009	0.10	0.07	0.05	0.07	0.02	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.01	0.02
	2013	0.13	0.10	0.06	0.07	0.03	0.04	0.01	0.01	0.02	0.02	0.01	0.01	0.04	0.01	0.02	0.01	0.01	0.02
Male	1982	0.17	0.14	0.05	0.08	0.04	0.07	0.04	0.01	0.03	0.04	0.01	0.03	0.03	0.02	0.00	0.01	0.02	0.02
	1990	0.13	0.12	0.09	0.08	0.04	0.07	0.03	0.01	0.02	0.04	0.01	0.03	0.03	0.01	0.00	0.01	0.02	0.02
	1994	0.18	0.09	0.08	0.07	0.03	0.06	0.03	0.01	0.02	0.04	0.00	0.02	0.03	0.01	0.00	0.01	0.02	0.03
	2000	0.21	0.15	0.08	0.16	0.04	0.09	0.04	0.01	0.03	0.04	0.01	0.03	0.05	0.02	0.01	0.01	0.03	0.03
	2005	0.11	0.08	0.05	0.06	0.02	0.04	0.02	0.01	0.02	0.02	0.01	0.02	0.03	0.01	0.01	0.01	0.02	0.02
	2009	0.11	0.08	0.05	0.08	0.02	0.06	0.02	0.01	0.02	0.02	0.01	0.02	0.03	0.01	0.01	0.01	0.02	0.02
	2013	0.12	0.10	0.07	0.08	0.02	0.06	0.02	0.01	0.03	0.03	0.01	0.02	0.04	0.02	0.02	0.01	0.02	0.02
Female	1982	0.12	0.11	0.06	0.09	0.07	0.04	0.01	0.01	0.01	0.01	0.03	0.01	0.03	0.01	0.01	0.01	0.00	0.02
	1990	0.12	0.11	0.08	0.08	0.06	0.04	0.02	0.01	0.01	0.01	0.02	0.00	0.02	0.01	0.01	0.00	0.01	0.04
	1994	0.16	0.11	0.08	0.08	0.05	0.03	0.01	0.01	0.00	0.01	0.02	0.00	0.03	0.02	0.01	0.01	0.00	0.03
	2000	0.21	0.15	0.07	0.12	0.05	0.05	0.01	0.01	0.01	0.02	0.03	0.00	0.05	0.02	0.02	0.01	0.01	0.03
	2005	0.11	0.08	0.06	0.07	0.03	0.02	0.01	0.01	0.00	0.01	0.02	0.00	0.03	0.02	0.02	0.01	0.01	0.02
	2009	0.09	0.08	0.05	0.07	0.02	0.03	0.00	0.01	0.01	0.01	0.03	0.01	0.03	0.01	0.02	0.01	0.01	0.02
	2013	0.15	0.11	0.06	0.08	0.04	0.04	0.00	0.01	0.01	0.02	0.02	0.00	0.04	0.02	0.03	0.02	0.01	0.03

Source: National Center for Education Statistics, HSB, 1982; National Center for Education Statistics, HSTS, 1990–2009; and National Center for Education Statistics, HSLS, 2013.

Table A3. Standard Errors for Tables 5 and 6: Percentage of All Graduates in CTE Concentrations by Occupational Areas, by Sex, 1982–2013

		Any Concentration	Occupational Areas													
				Traditional Vocational							New Era					
			Business	Total	Manufacturing	Public Service	Construction	Agriculture	Human Services	Transportation	Total	Computer Sciences	Communications	Health Care	Hospitality	Engineering
All Students	1982	1.07	0.77	0.76	0.34	0.03	0.31	0.31	0.23	0.33	0.31	0.08	0.19	0.14	0.09	0.13
	1990	1.09	0.91	0.66	0.36	0.01	0.22	0.22	0.17	0.27	0.32	0.07	0.15	0.10	0.13	0.12
	1994	0.93	0.67	0.59	0.24	0.02	0.22	0.22	0.17	0.14	0.27	0.07	0.19	0.12	0.08	0.14
	2000	1.39	0.75	0.75	0.26	0.10	0.22	0.22	0.17	0.17	0.66	0.19	0.25	0.37	0.10	0.18
	2005	0.77	0.40	0.42	0.15	0.14	0.17	0.17	0.25	0.18	0.46	0.18	0.19	0.20	0.10	0.15
	2009	0.82	0.28	0.52	0.15	0.08	0.17	0.17	0.19	0.22	0.42	0.20	0.16	0.25	0.10	0.13
	2013	0.98	0.52	0.56	0.14	0.08	0.21	0.21	0.19	0.20	0.61	0.36	0.18	0.40	0.18	0.19
Male	1982	1.59	0.94	1.36	0.69	0.03	0.63	0.63	0.17	0.64	0.44	0.13	0.28	0.08	0.10	0.29
	1990	1.22	0.80	1.15	0.59	0.01	0.46	0.46	0.05	0.53	0.40	0.11	0.20	0.07	0.19	0.23
	1994	1.09	0.59	0.95	0.46	0.04	0.44	0.44	0.03	0.29	0.35	0.09	0.19	0.05	0.10	0.25
	2000	1.56	0.82	1.14	0.46	0.09	0.43	0.43	0.09	0.35	0.68	0.32	0.25	0.23	0.09	0.35
	2005	0.87	0.40	0.52	0.26	0.13	0.33	0.33	0.15	0.35	0.56	0.30	0.23	0.10	0.09	0.27
	2009	1.01	0.36	0.75	0.30	0.08	0.34	0.34	0.06	0.38	0.46	0.29	0.16	0.17	0.11	0.24
	2013	1.10	0.50	0.76	0.27	0.15	0.38	0.38	0.04	0.38	0.59	0.49	0.23	0.26	0.19	0.33
Female	1982	1.36	1.27	0.51	0.12	0.05	0.11	0.11	0.41	0.08	0.40	0.09	0.24	0.26	0.15	0.05
	1990	1.39	1.23	0.51	0.29	0.02	0.03	0.03	0.31	0.06	0.35	0.07	0.18	0.18	0.09	0.09
	1994	1.00	0.93	0.44	0.07	0.01	0.05	0.05	0.32	0.03	0.36	0.06	0.27	0.21	0.09	0.05
	2000	1.44	0.83	0.53	0.13	0.14	0.06	0.06	0.29	0.05	0.78	0.14	0.31	0.52	0.13	0.07
	2005	0.88	0.49	0.48	0.10	0.17	0.06	0.06	0.37	0.05	0.52	0.16	0.25	0.33	0.14	0.07
	2009	0.73	0.29	0.40	0.04	0.10	0.04	0.04	0.34	0.08	0.46	0.16	0.21	0.36	0.12	0.05
	2013	1.11	0.62	0.60	0.04	0.07	0.15	0.15	0.36	0.07	0.83	0.31	0.23	0.63	0.27	0.12

Source: National Center for Education Statistics, HSB, 1982; National Center for Education Statistics, HSTS, 1990–2009; and National Center for Education Statistics, HSLS, 2013.

Table A4. Percentage of All Graduate Concentrators by Occupational Area and Sex, 1982–2013

			Traditional Vocational							New Era					
		Business	Total	Manufacturing	Public Service	Construction	Agriculture	Human Services	Transportation	Total	Computer Sciences	Communications	Health Care	Hospitality	Engineering
All Students	1982	61	35	11	0.1	7	8	4	6	9	1	3	2	1	2
	1990	58	35	10	0.1	7	9	5	7	11	1	4	2	2	3
	1994	57	33	7	0.2	6	11	5	5	14	1	5	3	1	3
	2000	42	37	8	1	7	11	6	6	28	6	9	6	2	5
	2005	27	42	6	2	8	12	8	8	37	10	11	9	3	5
	2009	22	41	6	2	7	12	8	8	41	10	12	11	3	6
	2013	16	41	4	2	8	13	7	8	48	11	8	16	5	9
Male	1982	29	66	25	0.1	15	16	1	14	11	1	4	1	0.4	5.1
	1990	33	58	18	0.0	14	15	0.4	15	13	2	4	1	2	6
	1994	38	53	15	0.3	13	19	0.5	11	14	1	5	1	1	5
	2000	32	49	14	1	12	14	1	11	26	8	7	2	1	8
	2005	22	50	9	2	13	15	1	14	33	14	8	2	2	7
	2009	19	50	10	2	12	14	1	14	36	13	9	3	3	9
	2013	15	49	7	3	13	15	0.4	13	41	13	6	5	4	14
Female	1982	86	11	0.5	0.1	1	2	7	0.3	7	1	3	2	1	0.2
	1990	79	16	3	0.1	0.2	3	9	1	10	1	4	3	1	1
	1994	75	16	1	0.1	0.4	5	9	0.3	14	1	6	6	1	1
	2000	54	22	2	1	1	7	11	1	29	3	11	12	3	1
	2005	33	30	1	2	1	8	17	1	41	5	14	17	4	2
	2009	25	31	1	2	1	8	17	2	48	6	16	21	4	2
	2013	18	31	0.4	1	2	11	16	1	55	8	11	28	7	2

Note: Concentrations are not exclusive; percentages may not sum to 100.
Source: National Center for Education Statistics, HSB, 1982; National Center for Education Statistics, HSTS, 1990–2009; and National Center for Education Statistics, HSLS, 2013.

Table A5. Standard Errors for Table 7: Average Percentile for Math Among CTE Concentrators by Occupational Area, 1982–2013

	1982	2000	2005	2009	2013
Concentrators	1.2	1.4	1.0	0.8	1.3
New Era	4.3	2.7	1.6	1.6	1.0
Computer Sciences	8.1	5.6	3.0	2.2	2.8
Communications	3.8	2.8	2.6	1.4	2.6
Health Care	3.4	3.9	2.1	3.0	3.6
Hospitality	4.8	4.8	4.5	2.8	4.1
Engineering	6.5	4.1	3.3	2.5	4.4
Traditional Vocational	2.0	2.2	1.3	0.8	1.2
Manufacturing	3.0	5.4	4.1	1.8	3.6
Public Service	10.7	5.6	4.4	3.3	3.6
Construction	3.4	3.3	3.5	2.2	2.1
Agriculture	2.9	2.9	1.8	1.8	2.2
Human Services	2.5	6.0	2.9	2.0	2.1
Transportation	3.4	3.2	2.9	1.9	2.5
Business	1.1	1.5	1.7	1.4	1.8

Source: National Center for Education Statistics, HSB, 1982; National Center for Education Statistics, HSTS, 1990–2009; and National Center for Education Statistics, HSLS, 2013.

Table A6. Standard Errors for Table 8: Graduates' Attitudes Toward School and Work in Ninth Grade, by CTE Concentration, 2013

	Positive Sense of Belonging at School	Positive School Engagement	Strongly Agree Getting Good Grades Is Important	Working Is More Important for You Than Attending College		
				Agree	Disagree	Strongly Disagree
All Graduates	0.85	0.74	0.93	0.57	0.77	0.76
Non-Concentrators	0.92	0.88	0.94	0.58	0.87	0.91
Concentrators	1.57	1.62	1.88	1.27	1.82	1.40
New Era	2.27	2.38	2.78	1.34	2.49	2.51
Computer Sciences	4.38	6.89	7.89	3.32	8.70	10.36
Communications	5.48	4.92	5.86	2.26	5.45	5.51
Health Care	4.00	3.73	4.03	2.10	3.80	4.02
Hospitality	5.92	6.39	5.66	4.10	5.29	6.02
Engineering	4.25	5.07	4.22	3.92	4.59	4.09
Traditional Vocational	2.29	2.00	2.76	1.96	2.33	1.87
Manufacturing	5.46	5.51	6.18	6.41	6.70	4.07
Public Service	9.92	6.09	8.91	2.69	6.73	6.06
Construction	5.90	4.39	5.84	4.27	5.37	3.64
Agriculture	4.45	4.26	4.67	3.66	3.63	2.84
Human Services	5.88	4.49	5.55	3.00	4.87	4.79
Transportation	5.31	4.87	4.98	5.74	5.65	5.64
Business	4.28	7.68	2.73	4.09	7.23	4.40

Source: National Center for Education Statistics, HSLS, 2013.

Table A7. Standard Errors for Table 9: Parents with a B.A. and Expectations in Ninth Grade for Graduate to Earn a B.A., 2013

	At Least One Parent with a B.A.	Expect Student Will Earn a B.A.	
		Students	Parents
All Graduates	1.09	0.89	0.68
Non-Concentrators	1.15	0.94	0.81
Concentrators	1.76	1.91	1.60
New Era	2.51	2.49	2.30
Computer Sciences	4.06	7.03	6.51
Communications	5.23	4.65	5.09
Health Care	4.68	3.82	3.65
Hospitality	6.51	5.95	7.75
Engineering	5.44	3.91	4.73
Traditional Vocational	1.79	3.25	2.45
Manufacturing	4.93	8.85	5.84
Public Service	10.17	10.28	7.76
Construction	3.32	5.11	4.99
Agriculture	2.75	5.10	4.07
Human Services	4.36	6.50	5.51
Transportation	4.08	7.55	5.49
Business	4.14	4.11	3.31

Source: National Center for Education Statistics, HSLS, 2013.

Table A8. Standard Errors for Table 10: Graduates' and Concentrators' Academic Progress During High School, 2013

	Grade Student Passed Algebra I			Standardized Ninth Grade Math Score	Cumulative Academic GPA
	Before Ninth Grade	Ninth Grade	After Ninth Grade		
All Graduates	1.0	1.0	0.7	2%	0.01
Non-Concentrators	1.1	1.0	0.8	3%	0.01
Concentrators	1.6	1.8	1.1	4%	0.02
New Era	2.3	2.3	1.2	6%	0.04
Computer Sciences	3.9	4.7	2.3	9%	0.10
Communications	4.5	4.3	2.1	9%	0.05
Health Care	5.0	4.4	2.0	10%	0.06
Hospitality	3.5	5.9	4.7	14%	0.08
Engineering	4.6	4.4	2.3	12%	0.10
Traditional Vocational	2.2	3.0	1.9	5%	0.03
Manufacturing	5.6	7.2	5.1	12%	0.06
Public Service	5.0	6.9	6.1	12%	0.09
Construction	3.2	4.6	3.4	8%	0.05
Agriculture	4.3	4.2	3.4	8%	0.05
Human Services	4.5	4.8	3.0	10%	0.06
Transportation	4.0	5.9	3.6	11%	0.07
Business	3.4	4.3	2.3	6%	0.09

Source: National Center for Education Statistics, HSLS, 2013.

Table A9. Standard Errors for Table 11: 2013 High School Graduates' Highest Level of Attendance, 2016

	High School	Two-Year College	Four-Year College
All Graduates	0.7	0.8	1.0
Non-Concentrators	0.8	0.9	1.1
Concentrators	1.5	1.8	2.1
New Era	2.0	2.5	3.0
Computer Sciences	5.6	6.2	5.0
Communications	4.3	5.2	5.7
Health Care	3.7	4.1	5.8
Hospitality	4.3	8.3	8.3
Engineering	4.3	5.5	5.4
Traditional Vocational	2.4	3.3	2.6
Manufacturing	6.8	6.6	7.0
Public Service	9.8	9.4	7.7
Construction	6.4	7.9	4.9
Agriculture	3.9	4.2	4.9
Human Services	5.6	6.7	4.7
Transportation	6.1	6.8	5.4
Business	3.4	3.8	3.8

Source: National Center for Education Statistics, HSLS, 2013.

Table A10. Standard Errors for Table 12: Percentage of 2013 Graduates with CTE Concentrations, by Sex and College Enrollment in 2016

	All Students	Male			Female		
			Enrolled in College			Enrolled in College	
		All	Yes	No	All	Yes	No
Any Concentration	0.98	1.10	1.27	1.40	1.11	1.30	1.35
New Era	0.61	0.59	0.96	0.89	0.83	1.04	0.92
Computer Science	0.36	0.49	0.41	0.63	0.31	0.21	0.52
Communications	0.18	0.23	0.38	0.32	0.23	0.33	0.31
Health Care	0.40	0.26	0.53	0.20	0.63	0.83	0.77
Hospitality	0.18	0.19	0.36	0.22	0.27	0.39	0.26
Engineering	0.19	0.33	0.44	0.52	0.12	0.19	0.12
Traditional Vocational	0.56	0.76	0.79	0.99	0.60	0.58	0.83
Manufacturing	0.14	0.27	0.23	0.36	0.04	0.02	0.07
Public Service	0.08	0.15	0.17	0.20	0.07	0.06	0.12
Construction	0.21	0.38	0.33	0.52	0.15	0.10	0.27
Agriculture	0.33	0.47	0.54	0.61	0.37	0.36	0.48
Human Service	0.19	0.04	0.05	0.06	0.36	0.41	0.50
Transportation	0.20	0.38	0.45	0.51	0.07	0.01	0.13
Business	0.52	0.50	0.60	0.65	0.62	0.68	0.70

Source: National Center for Education Statistics, HSLS, 2013.

Appendix B. Differences Between CTE Occupational Classification Approaches

This report relied on the SCED Classification System 2.0, which provides a five-digit code and course description to capture more than 1,700 courses and allow for the efficient exchange of transcript data across schools. According to NCES, "SCED is updated and maintained by a working group of federal, state and local education agency representatives who receive suggestions and assistance from a wide network of subject matter experts at the national, state, and local levels."[55] The SCED uses the first two digits of the course code to place courses into subject-area groups, 12 of which correspond to the occupational areas used in this report.

The SCED 2.0 was cross walked with the CSSC—which was used in the HSTS studies and in the HSB data from 1982—so the occupational areas were consistent. Two analysts reviewed the crosswalk course by course using course titles and descriptions, for all courses in the HSTS and HSB transcript files, starting with the 2009 HSTS and moving backward in time. Most of these matches were straightforward since the SCED provided a large number of courses to match onto.

As this report was headed to publication, NCES released data on CTE over three administrations of longitudinal data files, the last of which was the HSLS. NCES used a different taxonomy and classification system, the 2018 Secondary School Course Taxonomy (SSCT), and cross walked it to the SCED. The SSCT used 10 major occupational groupings (agriculture and natural resources; business, finance, and marketing; communication and communication technologies; computer and information sciences; construction; consumer services; engineering, design, and production; health care; mechanical repair and operation; and public services), which differed substantively from the 12 used in this report.

By using the SSCT grouping rather than the SCED 2.0 categories, seeming similar categories in the most recent NCES tables differ from my tabulations because they include different courses under each heading—detailed below—and because some of their areas included different numbers of courses than those in the SCED.

Because some of the SSCT grouping included a larger number of courses than the SCED occupational areas, there were more combinatorial opportunities for students to be concentrators. Conversely, smaller numbers of courses for certain occupational groups when using the SSCT versus the SCED result in fewer concentrators, which is why the differences in the percentages of concentrators appear larger than differences in average credits. In addition, the most recent NCES tables measured overall concentrators as graduates with three or more CTE courses, while consistently through all the tables in this report, concentrators are graduates with three or more credits in specific occupational areas.

Note that differing classifications may imply different statuses. For instance, a similar categorization of Traditional Vocational and New Era concentrations using the SSCT (based on NCES published numbers) suggests that the majority of concentrators in 2013 would still be in Traditional Vocational areas, not New Era concentrations, as the SCED classification used in this report suggests. Neither of these is necessarily right or wrong because there is no "correct" classification. Importantly, the trends captured in this report—dramatic decreases in business, small decreases in Traditional Vocational areas, and dramatic growth in New Era subjects—are clearly evident in the overtime changes examined using the SSCT.

The SCED continues to be a valid classification for those transcripts. Little modifications were made to the SCED classification and only when the course

descriptions clearly warranted a change. In addition, it makes some sense to classify these transcript data according to the SCED system since it was the collective wisdom of working-group members at the time the most recent data were collected.

Compared to this classification using the SSCT, the SCED classification used in this report (henceforth simply SCED) moved the following non-exhaustive list of courses (SCED course code in parentheses).

Added to SSCT "Business, Finance, and Marketing" from SCED "Transportation, Distribution, and Logistics":

- Warehouse Operations (20152)
- Distribution and Logistics—Independent Study (20197)
- Distribution and Logistics—Workplace Experience (20198)
- Distribution and Logistics—Other (20199)

Also added to SSCT "Business, Finance, and Marketing" from SCED "Information Technology":

- Business Programming (10151)

Added to SSCT "Miscellaneous" from SCED "Information Technology":

- Introduction to Computer Technology (10001)
- Computer and Information Technology (10003)
- Computer Applications (10004)

Added to SSCT "Social Science" from SCED "Information Technology":

- IB Information Technology in a Global Society (10007)

Added to SSCT "Engineering and Design":

- From SCED "Manufacturing": Energy/Power (20101)
- From SCED "Science": IB Design Technology (03206)
- From SCED "Arts": Industrial Design (05191) and Architectural Design (05192)

Added to SSCT "Manufacturing and Technology" from SCED "Engineering and Technology":

- Technological Literacy (21051)
- Technological Processes (21052)
- Emerging Technologies (21053)
- Technology Innovation and Assessment (21054)
- Aerospace Technology (21055)
- Particular Topics in Technology Applications (21056)
- Laser/Fiber Optics (21057)
- Geospatial Technology (21058)
- Modeling and Simulation Technology (21059)
- Wind Energy (21060)
- Wind Turbine Construction and Operation (21061)
- IB Technology, Middle Years Program (21062)
- Technology—Independent Study (21097)
- Technology—Workplace Experience (21098)
- Technology—Other (21099)

Added to SSCT "Mechanical Repair and Operation" from SCED "Manufacturing":

- Appliance Repair (13301)
- Equipment Maintenance and Repair (13302)
- Industrial Maintenance (13303)
- Repair—Independent Study (13347)
- Repair—Workplace Experience (13348)
- Repair—Other (13349)

Added to SSCT "Science" (non-CTE) from SCED "Health Care Sciences":

- Health Science (14251)
- Biotechnology (14252)
- Pharmacology (14253)
- Particular Topics in Health Sciences (14254)
- Biomedical Innovation (14255)
- Health Sciences—Independent Study (14297)

- Health Sciences—Workplace Experience (14298)
- Health Sciences—Other (14299)

The SSCT added to "Public Services" almost all education courses, which this report's SCED classified under "Human Services":

- Teaching Profession (19151)
- Educational Methodology (19152)
- Teaching—Early Childhood Education (19153)
- Particular Topics in Education (19154)
- Instructional Technology (19155)
- Education—Independent Study (19197)
- Education—Workplace Experience (19198)
- Education—Other (19199)

The SSCT also moved SCED "Hospitality and Tourism" courses under its "Consumer Servicers."

Notes

1. Frederick M. Hess and Sofia Gallo, "What Do Would-Be Governors Have to Say About Education?," RealClearPolicy, February 21, 2018, https://www.realclearpolicy.com/articles/2018/02/21/what_would-be_governors_have_to_say_about_education_110518.html.

2. Unpublished AEI survey of 2018 "State of the State" addresses. Available upon request.

3. Education Commission of the States, "State Education Policy Tracking," February 17, 2017, https://www.ecs.org/state-education-policy-tracking/.

4. For 2016, see Education Commission of the States, "State Legislation: By Topic," https://www.ecs.org/state-legislation-by-topic. For 2017 legislative activity, see Education Commission of the States, "State Education Policy Tracking," February 17, 2017, https://www.ecs.org/state-education-policy-tracking/.

5. Association for Career and Technical Education, "CTE Works!," January 2018, https://www.acteonline.org/wp-content/uploads/2018/03/CTE_Works_Research-January2018.pdf.

6. US Department of Education, National Center for Education Statistics, "Table 104.10 Rates of High School Completion and Bachelor's Degree Attainment Among Persons Age 25 and over, by Race/Ethnicity and Sex: Selected Years, 1910 Through 2017," https://nces.ed.gov/programs/digest/d17/tables/dt17_104.10.asp.

7. National Commission on Excellence in Education, "A Nation at Risk: The Imperative for Educational Reform," *Elementary School Journal* 84, no. 2 (1983): 113–30.

8. James D. Anderson, "The Historical Development of Black Vocational Education," *Work, Youth, and Schooling: Historical Perspectives on Vocationalism in American Education*, ed. Harvey Kantor and David B. Tyack (Stanford, CA: Stanford University Press, 1982), 180–222; W. Norton Grubb and Marvin Lazerson, "Education and the Labor Market: Recycling the Youth Problem," in *Work, Youth, and Schooling: Historical Perspectives on Vocationalism American Education*, ed. Harvey Kantor and David B. Tyack (Stanford, CA: Stanford University Press, 1982), 110–41; Jeannie Oakes, "Limiting Opportunity: Student Race and Curricular Differences in Secondary Vocational Education," *American Journal of Education* 91, no. 3 (May 1983): 328–55, https://www.journals.uchicago.edu/doi/abs/10.1086/443693; Jeannie Oakes, "Beneath the Bottom Line: A Critique of Vocational Education Research," *Journal of Vocational Education Research* 11, no. 2 (Spring 1986): 33–50; Jeannie Oakes and Gretchen Guiton, "Matchmaking: The Dynamics of High School Tracking Decisions," *American Educational Research Journal* 32, no. 1 (March 1995): 3–33; Jeannie Oakes et al., "Educational Matchmaking: Academic and Vocational Tracking in Comprehensive High Schools," National Center for Research in Vocational Education, September 1992, http://www.nrccte.org/sites/default/files/publication-files/educational_matchmaking.pdf; and Amy Stuart Wells and Irene Serna, "The Politics of Culture: Understanding Local Political Resistance to Detracking in Racially Mixed Schools," *Harvard Educational Review* 66, no. 1 (April 1996): 93–118.

9. D. Boesel et al., *Participation in and Quality of Vocational Education, National Assessment of Vocational Education, Vol. II*, US Department of Education, Office of Educational Research and Improvement, 1994; and Matt S. Giani, *Who Is the Modern CTE Student? A Descriptive Portrait of Career and Technical Education Students in Texas*, American Enterprise Institute, March 26, 2019, https://www.aei.org/publication/who-is-the-modern-cte-student-a-descriptive-portrait-of-career-and-technical-education-students-in-texas/.

10. These changes are detailed in transcripts here and elsewhere. Other changes are evident in tracking expectations and the transformation of vocational education. Theodore Lewis and Shih-Yu Cheng, "Tracking, Expectations, and the Transformation of Vocational Education," *American Journal of Education* 113, no. 1 (November 2006): 67–99, https://www.journals.uchicago.edu/doi/10.1086/506494; and Matt S. Giani, "Does Vocational Still Imply Tracking? Examining the Evolution of Career and Technical Education Curricular Policy in Texas," *Educational Policy*, 2017, https://journals.sagepub.com/doi/abs/10.1177/0895904817745375.

11. See Giani, *Who Is the Modern CTE Student?*; and Dougherty, *Career and Technical Education in High School*.

12. See Dougherty, *Career and Technical Education in High School*.

13. See Shaun M. Dougherty, "The Effect of Career and Technical Education on Human Capital Accumulation: Causal Evidence from Massachusetts," *MIT Press Journals* 13, no. 2 (Spring 2018): 119–48, https://www.mitpressjournals.org/doi/full/10.1162/edfp_a_00224;

and Daniel Kreisman and Kevin Stange, "Vocational and Career Tech Education in American High Schools: The Value of Depth over Breadth," *Education Finance and Policy* (2017): 1–72.

14. Brian A. Jacob, "What We Know About Career and Technical Education in High School," Brookings Institution, October 5, 2017, https://www.brookings.edu/research/what-we-know-about-career-and-technical-education-in-high-school/.

15. Kevin Hollenbeck and Wei-Jang Huang, "Net Impact and Benefit-Cost Estimates of the Workforce Development System in Washington State," W. E. Upjohn Institute for Employment Research, 2014, http://research.upjohn.org/up_technicalreports/29/; David Stern, Charles Dayton, and Marilyn Raby, *Career Academies: A Proven Strategy to Prepare High School Students for College and Careers*, Career Academy Support Network, 2010, https://files.eric.ed.gov/fulltext/ED524061.pdf; James J. Kemple, *Career Academies: Long-Term Impacts on Labor Market Outcomes, Educational Attainment, and Transitions to Adulthood*, MDRC, June 2008, https://www.mdrc.org/publication/career-academies-long-term-impacts-work-education-and-transitions-adulthood; and Steven Hemelt, Matthew Lenard, and Colleen Paeplow, "Building Bridges to Life After High School: Contemporary Career Academies and Student Outcomes (Update)" (working paper, National Center for Analysis of Longitudinal Data in Education Research, August 2018), https://caldercenter.org/publications/building-bridges-life-after-high-school-contemporary-career-academies-and-student.

16. See Dougherty, "The Effect of Career and Technical Education on Human Capital Accumulation."

17. Ruth Curran Neild, Christopher Boccanfuso, and Vaughan Byrnes state, "It is important to be clear that, in general, the CTE programs that Philadelphia's students experienced did not garner any award or notice for being exemplary, nor were they cutting edge models of excellence." Ruth Curran Neild, Christopher Boccanfuso, and Vaughan Byrnes, "Academic Impacts of Career and Technical Schools," *Career and Technical Education Research* 40, no. 1 (2015): 28–47.

18. Jacob, "What We Know About Career and Technical Education in High School."

19. US Department of Education, Institute of Education Sciences, National Center for Education Statistics, "Table 104.10 Rates of High School Completion and Bachelor's Degree Attainment Among Persons Age 25 and over, by Race/Ethnicity and Sex."

20. J. W. Ainsworth and V. J. Roscigno, "Stratification, School-Work Linkages and Vocational Education," *Social Forces* 84, no. 1 (2005): 257–84.

21. Carl D. Perkins Career and Technical Education Improvement Act of 2006, Pub. L. No. 109-270.

22. Shaun M. Dougherty, *Career and Technical Education in High School: Does It Improve Student Outcomes?*, Thomas Fordham Institute, April 7, 2016, https://fordhaminstitute.org/national/research/career-and-technical-education-high-school-does-it-improve-student-outcomes; Giani, "Does Vocational Still Imply Tracking?"; and Olga Rodriquez, Katherine L. Hughes, and Clive Belfield, "Bridging College and Careers: Using Dual Enrollment to Enhance Career and Technical Education Pathways," National Center for Postsecondary Research, July 2012, https://ccrc.tc.columbia.edu/media/k2/attachments/bridging-college-careers.pdf.

23. US Department of Education, Office of Career, Technical, and Adult Education, "The Carl D. Perkins Career and Technical Education Act of 2006, as Amended by the Strengthening Career and Technical Education for the 21st Century Act (Perkins V): Guide for the Submission of State Plans," 2019, https://www.regulations.gov/contentStreamer?documentId=ED-2018-ICCD-0121-0003&attachmentNumber=1&contentType=pdf.

24. Much of this section is borrowed from US Department of Education, Office of Career, Technical, and Adult Education, "The Carl D. Perkins Career and Technical Education Act of 2006, as Amended by the Strengthening Career and Technical Education for the 21st Century Act (Perkins V): Guide for the Submission of State Plans."

25. These include representatives from secondary and postsecondary CTE programs; the community; the state workforce development board; labor and industry; special populations, students with disabilities, and agencies serving them; and the governor's office.

26. US Department of Education, Office of Career, Technical, and Adult Education, "The Carl D. Perkins Career and Technical Education Act of 2006, as Amended by the Strengthening Career and Technical Education for the 21st Century Act (Perkins V): Guide for the Submission of State Plans."

27. Multiple entry and exit points mean the plans allow learners to enter and exit programs at varied points in the secondary and postsecondary progression, be they out of high school, in a credentialing program, or in a two- or four-year degree program.

28. US Department of Education, Office of Career, Technical, and Adult Education, "The Carl D. Perkins Career and Technical Education Act of 2006, as Amended by the Strengthening Career and Technical Education for the 21st Century Act (Perkins V): Guide for

the Submission of State Plans."

29. Perkins V uses a two-credit definition for CTE concentrators. See "Why Look at CTE Concentrators?"

30. Strengthening Career and Technical Education for the 21st Century Act, Pub. L. No. 115-224, § 113.

31. Strengthening Career and Technical Education for the 21st Century Act, Pub. L. No. 115-224, § 113.

32. Elementary and Secondary Education Act of 1965, Pub. L. No. 89-10, § 1111.

33. US Department of Education, Institute of Education Sciences, National Center for Education Statistics, "High School & Beyond (HS&B)," https://nces.ed.gov/surveys/hsb/.

34. US Department of Education, Institute of Education Sciences, National Center for Education Statistics, High School Transcript Study, https://nces.ed.gov/nationsreportcard/hsts/.

35. US Department of Education, Institute of Education Sciences, National Center for Education Statistics, "High School Longitudinal Study of 2009 (HSLS:09)," https://nces.ed.gov/surveys/hsls09/.

36. The coverage of the HSTS differs slightly from both the HSB and the HSLS because these longitudinal studies exclude graduates in each respective year who were not in the expected grade in the base year (e.g., 2013 graduates who were in 10th grade in 2009). The results should be interpreted with these minimal differences in coverage in mind. However, in my judgment, the advantage of looking at CTE course takers at a much earlier time using the HSB and a much more recent time using the HSLS outweighs concerns over precisely matched representativeness.

37. National Center for Education Statistics, "2000 High School Transcript Study Tabulations Report: Appendix A: The HSTS Sample," June 12, 2007, https://nces.ed.gov/nationsreportcard/hsts/tabulations/appendixa.aspx.

38. NAEP scores were collected for the 1994 HSTS, but the linking variables between NAEP assessments and the HSTS records were destroyed, so no percentile scores are available for 1994.

39. Additional detail on these clusters can be found at US Department of Education, Institute of Education Sciences, National Center for Education Statistics, "School Courses for the Exchange of Data (SCED)," https://nces.ed.gov/forum/sced.asp.

40. Miscellaneous CTE credits, which were not assigned to any occupational area, made up roughly 14 percent of CTE credits in each year.

41. Association for Career and Technical Education and National Alliance for Partnerships in Equity, "CTE Investors, Explorers, and Concentrators: What Does the Research Say?," https://blogs.edweek.org/edweek/campaign-k-12/AdvanceCTE-ACTE-NAPE_Concentrator_Final.pdf.

42. For example, Ben Dalton, "From Track to Field: Trends in Career and Technical Education Across Three Decades," National Assessment of Career and Technical Education, February 9, 2013, http://www.rti.org/sites/default/files/resources/cte-trends_final.pdf; and US Department of Education, "Data Point," https://nces.ed.gov/pubs2018/2018043.pdf.

43. Giani, *Who Is the Modern CTE Student?*

44. Communications concentrators did not increase from 1982 to 2013, but there were statistically significant gains from 1982 as measured in 2000, 2005, and 2009. The estimate for communications in 2013 breaks with this trend, but the broader trend remains.

45. It is important to interpret these data with care because individual concentrations have small sample sizes, but more confidence can be placed in the subtotal categories that have larger samples.

46. See Table A4 for proportions of all concentrators in each occupational area.

47. The exception was that the hospitality concentrator in the New Era group also had a lower percentage than all graduates.

48. Although there is a large estimated difference for business concentrators, it was not statistically significant at the $p < 0.05$ level, but it is at the $p < 0.1$ level.

49. US Department of Education, "Data Point: Trends in CTE Coursetaking," November 2013, https://nces.ed.gov/pubs2014/2014901.pdf.

50. Bridget Terry Long, *The College Completion Landscape: Trends, Challenges, and Why It Matters*, American Enterprise Institute, May 30, 2018, http://www.aei.org/spotlight/the-college-completion-landscape/.

51. See "Overview of Perkins V."

52. Perkins V requires reports by program of study or, when that is impractical, by career cluster. Strengthening Career and Technical

Education for the 21st Century Act, Pub. L. No. 115-224, § 113.

53. US Department of Education, Office of Career, Technical, and Adult Education, "The Carl D. Perkins Career and Technical Education Act of 2006, as Amended by the Strengthening Career and Technical Education for the 21st Century Act (Perkins V): Guide for the Submission of State Plans."

54. The consolidated reports required under Perkins do require states to explain population swings in CTE enrollment, but only at an overall level, and again not by student characteristics. The consolidated reports require states to: "Review your State's enrollment data in section B.1 of this report. If your State's enrollment for CTE participants and/or concentrators has increased or decreased by 25 percent, please provide an explanation for the changes." US Department of Education, Office of Career, Technical, and Adult Education, "The Carl D. Perkins Career and Technical Education Act of 2006, as Amended by the Strengthening Career and Technical Education for the 21st Century Act (Perkins V): Guide for the Submission of State Plans," 11.

55. US Department of Education, Institute of Education Sciences, National Center for Education Statistics, "School Courses for the Exchange of Data (SCED)," https://nces.ed.gov/forum/sced.asp.