RESEARCH AND EVIDENCE OR EXPERTISE CATEGORY

Aligning Youth Apprenticeship and Career and Technical Education

Present Connections and Future Opportunities

Deborah Kobes **Shruti Nayak**

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PARTNERSHIP TO ADVANCE YOUTH APPRENTICESHIP

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Expanding youth apprenticeship is a strategy for building a more inclusive economy by connecting the learning needs of students with the talent needs of industry. The Partnership to Advance Youth Apprenticeship (PAYA) is a multi-year, collaborative initiative that supports states and cities in their efforts to expand access to high-quality apprenticeship opportunities for high school age youth.

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Aligning Youth Apprenticeship and Career and Technical Education

Career and technical education (CTE) and apprenticeship share many common goals, combining workplace skills with academic knowledge. Yet, until recently, CTE and Registered Apprenticeship (RA) were entirely separate systems in the United States. CTE programs are embedded in secondary and postsecondary educational institutions, while RA has historically served adult workers. This began to shift a decade ago when several states began investing in youth apprenticeship programs, which was then amplified by the launch of the Partnership to Advance Youth Apprenticeship in 2018 and accelerated in 2019 by federal investments in Registered Apprenticeship Programs for youth. As governments increase investment in youth apprenticeship programs and school districts face mounting pressure to deliver both academic and workforce outcomes for young people, high-school-based RA programs are emerging as a promising solution. Critical questions remain regarding how these programs are designed, where they thrive, who they serve, and what it takes to scale them effectively.

This report examines the available, although limited, data from emerging high-school-based RA programs to see how they already align and could better serve CTE programming and goals. With further alignment, CTE-based apprenticeships can become a scalable model serving the goals of both systems and their students. We recommend that high-school-based (hereafter, HS-based) apprenticeship programs seek out CTE programs to support expansion into a wider range of occupations and to recruit a more diverse population of apprentices. CTE programs can benefit from the more in-depth career experiences available to HS-based apprentices, particularly in manufacturing and digital technology where HS-based apprenticeships already have a foothold. We also recommend two core data improvements to better track and analyze the performance of HS-based apprenticeship programs. First, the RA system should collect information on the following: whether programs are based at a high school; any credits, degrees, or credentials earned; and connections to postsecondary educational institutions. Second, states should establish structures to combine data from CTE participants with RA data and include these data within their statewide longitudinal data systems.

Overview of High-School-Based Apprenticeship Programs

Young people are a large part of the RA system: Of the almost 600,000 active apprentices in 2022, 40 percent were between 16 and 24 years old (Department of Labor 2025). They enrolled in a wide range of programs, many of which are available to youth and adults, as well to new workers and those who have been in the workforce for a long time. Although all apprenticeship programs combine on-the-job training with related instruction, programs vary in who delivers the related instruction, in what format, and whether that instruction provides secondary or postsecondary credit. These design choices greatly impact the experience of the apprentice. Yet only a small subset of programs in the RA system are designed specifically to serve students starting in high school, with students either completing the apprenticeship during high school or after graduation. We identified 1,867 apprentices active in 2022 who were participating in high-school-based programs. While this number remains small, it represents significant growth over the past decade, with a total of 2,843 high-school-based apprentices registered since 2015. We expect the growth to continue, as we have seen new programs continue to launch and expand since 2022, including large-scale, statewide efforts, such as Apprenticeship Maryland, which updated its youth apprenticeship program design to integrate students directly into the RA system.

Understanding the Data

Extensive centralized data are available on Registered Apprenticeship Programs (unlike many workforce programs) in almost every state through the Department of Labor's Registered Apprenticeship Partners Information Database System (RAPIDS). Unfortunately, because RAPIDS was designed before high-school-based programs were common in the United States, there is no specific indicator or variable to identify these programs. Using the age of apprentices at the start of their program, Kuehn and colleagues identified 7,545 apprentices in 2021 enrolled in programs that exclusively served 16- to-24-year-olds (Kuehn et al. 2023). This definition, however, includes not only HS-based programs but also community colleges targeting young adults, as well as programs led by community-based organizations and other providers. For this analysis, we identified high-school-based programs by manually reviewing apprentices through a combination of age restrictions and a variety of search terms in several key fields; for example, in Missouri, the term Registered Youth Apprenticeship, shortened in the dataset as RYA, identifies high-school-based programs (see Appendix for details).

This approach of combining systemic searches with judgment calls for individual cases is the only method currently available for identifying high-school-based programs. We believe it provides valuable

insight into trends in HS-based apprenticeship programs, but we also recognize that it has limitations. In particular, North and South Carolina deliver their high-school-based programs through community colleges, and so our only way to differentiate programs offered to community college students and high school partners was by analyzing the age of participants. Similarly, we distinguished high-school-based and adult programs based on age of apprentices in CTE schools, most commonly in New Jersey, that serve both high school students and adults. For this reason, this report serves as a preliminary analysis to be combined with insights gained through other research, such as case studies of early leading high-school-based programs, and as a starting point for identifying further areas of exploration. This kind of manual review will likely become more challenging as the number of HS-based apprenticeship programs grows.

These data do not include high-school-based apprenticeship programs that are not registered. Although there is no tally of unregistered programs, a few notable examples indicate that these programs also have a significant presence across the country. Youth apprenticeship has been a long-standing high-school-based system in Wisconsin. Having developed over the past thirty years, Wisconsin's system is larger than all registered high-school apprenticeship programs nationally, with almost 10,000 active youth apprentices.[1] However, Wisconsin has developed this system in parallel to the Registered Apprenticeship system rather than within it. Another example of unregistered apprenticeship programs is CareerWise, a national intermediary that began launching apprenticeship programs in Colorado and has since expanded to multiple locations. Although some of these programs are registered and analyzed in this brief, many are not. More broadly, of the 30 states that define youth apprenticeship,[2] 8 states plus Washington, DC administer youth apprenticeship outside of the RA system and 2 more states offer youth apprenticeships both as registered and unregistered programs.

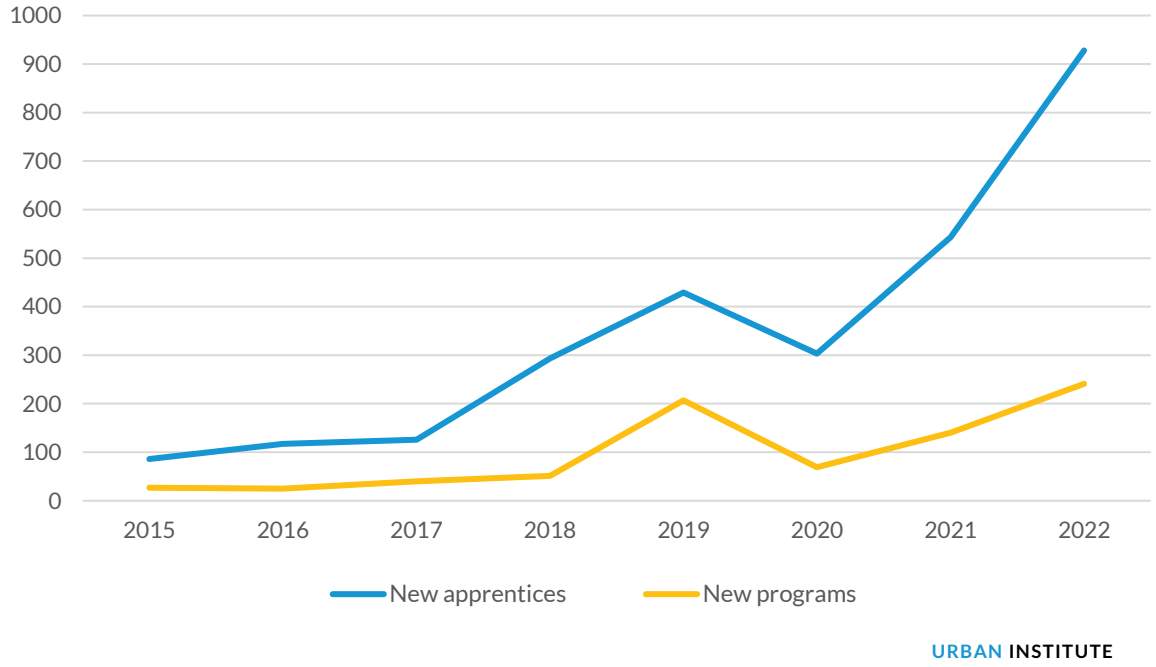
The CTE data used in this analysis is also limited by constraints in national data. Although many states have statewide longitudinal data systems to connect educational progress and workforce outcomes for students, CTE data are often not integrated into these systems (Pfeiffer and Klein 2019). Disjointed data collection and reporting make it difficult to track outcomes and understand the performance of CTE programs, particularly when adding in considerations such as racial equity (Elliott and Truong 2024). For this analysis, we rely on the Perkins Collaborative Resource Network's National Enrollment Profile (NEP) data, which provides national-level data that aligns with Advance CTE's definition of CTE Career Clusters, the standard framework for CTE structures used by the federal government and states.[3]

Emergence of High-School-Based Apprenticeships

Although high-school-based programs remain a small part of the RA system, the pace of their growth has been accelerating since they emerged a decade ago, with the exception of 2020 when the economy and school systems faced a shock from the COVID-19 pandemic. In fact, the number of new apprentices enrolled in high-school-based programs more than doubled between 2021 and 2022, with 543 and 928 new apprentices, respectively (see figure 1). The pace of new programs has mirrored the growth in apprentices, with a jump in new programs from 140 to 241 between 2021 and 2022, bringing the total number of high-school-based apprenticeship programs identifiable in RAPIDS to 704.

FIGURE 1

New Apprentices and High-School-Based Programs by Year



Source: Author analysis of Department of Labor RAPIDS database, 2015–2022.

National leaders in the youth and high-school-based apprenticeship programs emerged in the early years of this RAPIDS data. Eight 16- and 17-year-old apprentices were registered in programs for which Trident Technical College provided the related academic instruction in 2014, the year they launched their youth apprenticeship. By 2015, high-school-based apprentices in the Charleston Regional Youth Apprenticeship[4] appeared in RAPIDS as "SC Youth Apprenticeship Program Basic Industrial Technicians." In 2016, the Lebanon Technology and Career Center in Missouri and Central Campus Des Moines Public School in Iowa both registered high-school- based apprenticeship programs, paving the

way for more high schools from these two states in subsequent years. These three states now lead the country in scale: Iowa accounts for 19.35 percent of the country's HS-based apprentices, followed by South Carolina at 17.87 percent, and then Missouri at 11.04 percent. CareerWise first appears with Colorado high-school-based apprentices in 2017, with their nationally registered programs first appearing in 2020. By 2022, CareerWise accounted for 76 of 86 youth apprentices participating in programs registered nationally instead of as local programs.

High-school-based apprenticeship programs remain largely concentrated in a few states, with 5 states accounting for over 65 percent of all HS-based apprentices. After Iowa, South Carolina and Missouri account for almost 30 percent of apprentices combined, and Texas and North Carolina each account for just over 8 percent of HS-based apprentices.[5] However, youth apprenticeship is starting to take hold in more states, with Illinois registering over 100 apprentices and another 15 states having at least 20 youth apprentices. An additional 12 states have at least one apprentice, although as noted above, the 71 apprentices in these states could reflect the limitations of how we identified youth programs in the data between 2015 and 2022.

The goals of HS-based apprenticeship programs are not as clear cut as for RA programs overall. Although RA programs focus on connecting workers to full-time employment and skilled jobs, HS-based programs also support educational goals, seeking to prepare students for both a career and college or further postsecondary training. Perhaps because of these different goals or the younger age of participants, high-school-based apprentices earn less through their programs than young people enrolled in other RA programs. According to analysis of RAPIDS data, 16–24 year holds in 2022 earned a mean starting wage of $17.54 and $24.82 by the time they exited their program. HS-based apprentices earn mean and median hourly starting wages of $11.22 and $12.00, respectively. While this may be in part explained by variations in the occupations pursued by each of these populations or other demographic patterns, even the 95th percentile of HS-based apprentices has a starting wage of $16.00, and so those occupational differences are not the primary driver of this wage gap. These wages also place HS-based apprentices below the average wages for 16- to 24-year-olds who worked full-time in 2022, earning a median of $16.92 per hour.[6] This suggests that while HS-based apprenticeships provide students with the benefit of earning while they are learning, they may need to consider alternate employment options after their apprenticeship for economic advancement. This would differ from the typical RA pathway in which over 90 percent of apprenticeship completers remain with their employer.

Because so many HS-based apprentices are still enrolled in their programs, we do not yet have robust enough equivalent data for exit wages. However, the large gap between the HS-based entrance

wages and these exit wages suggests that the difference exceeds the wage progression within a program.

Relationship between High-School-Based Apprenticeships and CTE Programs

While both apprenticeships and CTE programs serve youth in their career pathways, apprenticeships are much newer to high schools and smaller in scale. They vary in their primary industries and the populations they reach. We explore which career sectors have been targeted in HS-based apprenticeships and CTE programs, and how the two pathways compare in popularity by industry and geography. We also dig into these comparisons across racial, gender, and ethnic demographics.

Occupational Focus

The RA system has long been associated with the building and construction trades, but apprenticeship can be effective in a wide range of industries. Over the past decade, the federal government has expanded investments in apprenticeship to new occupations. In 2022, only 48 percent of all registered apprentices were in building and construction trades (Kuehn et al. 2024). HS-based apprenticeship programs remain more heavily concentrated in the building and construction trades than the system overall. 63.3 percent of HS-based apprentices are in occupations in the building and construction trades, and programs in this sector similarly account for 58.4 percent of all HS-based programs. However, this varies dramatically by state. CareerWise's national programs are entirely in nontraditional occupations, and the three largest HS-based states—South Carolina, Iowa, and Missouri—have programs that span a wide range of industries. However, Missouri has twice the number of apprentices in the building and construction trades than other occupations and only one of Texas' apprentices is not in the building and construction trades.

Distribution across occupations in the CTE system stands in stark contrast to HS-based apprenticeships. CTE programs use a narrower definition of construction occupations, which reduces the number of HS-based apprentices in construction to 40.42 percent as compared with the building and construction trades overall.[7] But, this is still much larger than the participation rate within the CTE system, with only 8.0 percent of concentrators taking classes in architecture and construction career cluster in the 2021–2022 school year (Perkins Collaborative Resource Network 2025). Beyond the trades, there is also not a strong correlation between enrollment in a career cluster for CTE programs

and HS-based apprenticeships (see table 1). However, several of the most popular CTE career clusters have been the focus of RA expansion among the federal government, states, and apprenticeship intermediaries, including health care and IT (or digital technology), discussed in more detail below. Management, hospitality, finance, and education have also been targets for RA expansion. Lessons from scaling CTE programs in these clusters could support their adoption as HS-based apprenticeship programs.

TABLE 1

Enrollment by Career Cluster and CTE Courses and HS-Based Apprenticeships

With career cluster definitions after and before October 2024 redefinition

New Cluster	Previous Career Cluster	Percentage (%) of Students Enrolled	Percentage of HS-Based Apprentices
Healthcare and Human Services			11.33
	***Health Science**	15.64	
	***Human Services**	9.82	
Agriculture	**Agriculture, Food & Natural Resources**	14.17	0.35
Management and Entrepreneurship	**Business Management & Administration**	13.31	1.41
Arts, Entertainment, and Design	**Arts, A/V Technology & Communications**	11.00	1.27
	STEM	9.98	
Hospitality, Events, and Tourism	**Hospitality & Tourism**	9.45	3.73
Digital Technology	**Information Technology**	8.59	5.84
Construction	**Architecture & Construction**	7.98	40.42
Financial Services	**Finance**	7.44	1.09
Marketing and Sales	**Marketing**	7.20	0.42
Advanced Manufacturing	**Manufacturing**	6.66	36.16
Supply Chain and Transportation	**Transportation, Distribution & Logistics**	5.51	7.35
Public Service and Safety			0.98
	***Law, Public Safety, Corrections & Security**	4.56	
	***Government & Public Administration**	0.90	
Education	**Education & Training**	4.50	3.8
	Other	0.12	1.74
Energy and Natural Resources			12.77
Total		136.83	126.89

Source: Author analysis of RAPIDS data, 2015–2022; "National Enrollment Profile," Perkins Collaborative Resource Network (Washington, DC: Office of Career, Technical, and Adult Education, https://cte.ed.gov/pcrn/profile/national/enrollment/2025/concentrator/secondary/gender/allstudents); "Crosswalk: Original and Modernized Career Clusters Framework," Advance CTE (Silver Spring, MD: 2024, https://careertech.org/resource/crosswalk-original-and-modernized-career-clusters).
Notes: HS-based apprentices are categorized using the crosswalk with SOC occupational codes for the new CTE Career Clusters (see https://careertech.org/career-clusters). In the table they are aligned with CTE concentrator data from the closest career cluster in 2021–2022. CTE concentrators can take courses in multiple career clusters, so enrollment numbers are above 100 percent. In addition, the new career cluster definitions include overlapping occupations; apprentice numbers by cluster total more than 100 percent. Because IT Digital Technology was a cluster of interest, we removed these occupations from other clusters, but did not remove all overlapping occupations for other clusters. Asterisks (*) indicate two clusters now combined into one.

Program Variation across States

The geographic distribution of HS-based apprenticeship programs and CTE concentrators, or students who have completed at least three courses in a single CTE cluster, does not show a consistent pattern. As noted above, five states drive the bulk of HS RA programs. In contrast, all fifty states plus DC and Puerto Rico offer CTE programs of study. Although they do vary in their scale of CTE delivery, they are not clustered like HS-based apprenticeships. Nationwide, 22 percent of all 9th-to-12th grade public school students are CTE concentrators. In all states and Washington, DC, CTE concentrators account for at least 5 percent of the students enrolled in public secondary schools, steadily rising to 35 percent of enrollment in Connecticut, with only four states exceeding that rate.[8]

Several states stand out in terms of scale for CTE programming. Texas accounts for 34.1 percent of all CTE concentrators nationally. Not only does Texas have a large population, but at 70.1 percent, it has 15 percentage points more CTE concentrators per capita than the second most CTE-dense state (Nebraska) and 28 percentage points more than the third ranking state (South Dakota). Although not the top state, Texas also has a strong presence of HS-based apprenticeship, with 8.48 percent of apprentices. All but three of the state's 241 apprentices are in a school-to-apprenticeship program at the Northside Independent School District Construction Careers Academy,[9] which began registering students in 2018. The school is a CTE magnet school, demonstrating how these two systems can be integrated into an aligned program for students. This model, however, is an outlier among states with the most HS-based apprentices.

Like Texas, Illinois is a leader in both CTE and HS-based apprenticeship enrollment. The state is the fourth largest CTE provider, at 3.68 percent of all CTE concentrators. This scale is driven largely by state size, as it ranks one above the median in terms of CTE density. Illinois is the sixth largest provider of HS-based apprenticeships, at 3.73 percent of the national total apprentices. The approach to growing HS-based apprenticeships has been quite different in Illinois than in Texas, with six different school

districts offering apprenticeship programs in occupations ranging from cybersecurity to nurse assistant to welding. Some of these districts partner with community colleges to deliver related instruction, such as the partnership between Township High School in District 214 and William Rainey Harper College. Wisconsin is another state with an above-average density of CTE concentrators. Although it does not appear in the RAPIDS data, it delivers unregistered HS-based programs to more apprentices than the rest of the country combined.

Some states with large-scale CTE programs have not established a strong presence of HS-based apprenticeship programs. Florida and Georgia have above average numbers of CTE concentrators per capita and the second and third largest CTE providers by total number served, with 5.86 percent and 3.82 percent of CTE concentrators, respectively. Florida has only three HS-based apprentices in RAPIDS and Georgia has only 64 registered HS-based apprentices through technical colleges, although they do deliver unregistered youth apprenticeships at a larger scale.

Conversely, Iowa does not stand out in CTE delivery—at 23.2 percent, it is just above the national average in terms of per capita concentrators but ranks in the bottom half of states in terms of total concentrators because of its small size. In contrast, it leads the country with almost 20 percent of all HS-based apprentices. In Iowa, fifty high schools or school districts have registered 550 HS-based apprentices. Similarly, South Carolina and Missouri rank just below the median state in terms of CTE concentrators per capita, but over 100 sponsors provide HS-based apprenticeship programs to 508 apprentices in South Carolina and 22 high schools and colleges provide HS-based apprenticeship programs to 314 apprentices in Missouri. North Carolina is also below average for CTE density while ranking 5th in HS-based apprentices. Each of these states also rely on numerous program sponsors and related instruction providers across high schools, community colleges, and employers.

Demographic Comparison

The CTE programs serve a more racially, ethnically, and gender diverse population than HS-based apprenticeships do. HS-based apprenticeship programs serve a significantly higher share of white (non-Hispanic) students than CTE programs, at 59.23 percent and 49.01 percent, respectively. Almost every other race and ethnicity is less represented in HS-based apprenticeships as compared with CTE programs (see table 2). The racial and ethnic breakdown of HS-based apprentices is more similar to that of 16-to-24-year-old apprentices overall, although high-school apprentices have a lower share of Hispanic apprentices and a higher share of white (non-Hispanic) apprentices. A higher share of CTE concentrators are female students, at 46.74 percent as opposed to 24.31 percent of HS-based apprentices.

TABLE 2

Race and Ethnicity for HS-Based Apprenticeships and CTE Concentrators

	Percentage (%) of High-School-Based Apprentices	Percentage (%) of Youth Apprentices	Percentage (%) of CTE Concentrators
American Indian or Alaskan Native	1.02	1.35	0.90
Asian	1.69	2.55	4.56
Black or African American	10.09	10.32	13.06
Hispanic/Latino	18.01	22.08	27.94
Native Hawaiian or Other Pacific Islander	0.35	1.17	0.35
White (Non-Hispanic)	59.23	56.51	49.01
Two or More Races	1.83	1.75	3.96

Source: Author analysis of RAPIDS data, 2015–2022; CTE National Enrollment Profile, 2021–2022.
Note: In order to match the CTE data, we have included all Hispanic/Latino apprentices together. For each race, we have only included those who did not identify as Hispanic/Latino by either saying they were not or declining to indicate ethnicity.

The differences in demographics can be at least partially explained by the occupational and geographic concentrations of HS-based apprenticeship programs. As described above, construction and manufacturing account for the vast majority of HS-based apprenticeship programs and apprentices, which are predominantly male occupations in apprenticeship, HS-based programs, and CTE. When examining specific career clusters (below), the gender gap between the two types of programs changes, sometimes disappearing or reversing. In addition, despite the overconcentration of HS-based programs in traditional apprenticeship occupations relative to the RA system as a whole, HS-based programs actually serve a higher share of female apprentices than the RA system, which was 13.97 percent women in 2022 (Department of Labor 2025).

HS-based apprenticeships are also more concentrated in states with a higher share of white residents relative to CTE programs. Almost a third of all HS-based apprentices live in Iowa and Missouri, which are 83.1 and 77.9 percent non-Hispanic white, respectively [10] Colorado also has a higher share of white residents than the HS-based programs, while Illinois, North Carolina, Virginia are close, at approximately 59 percent. The only outlier among states where HS-based programs are popular is Texas, with only 39.6 percent of its population being non-Hispanic white, and a similar share being Hispanic/Latino. Mapping the zip codes of HS-based apprenticeship programs on rural, suburban, and urban definitions could provide further insight into the drivers of the racial and ethnic composition of apprentices.

Examining CTE Clusters

Digging into specific CTE clusters can provide insight into how HS-based apprenticeships align with CTE offerings. We examine three CTE career clusters with a strong presence in HS-based apprenticeship programs and that also highlight programs along a spectrum of gender representation: advanced manufacturing, digital technology, and health and human services.

Although this descriptive research highlights demographic differences across CTE clusters, the relatively small number of HS-based apprentices within a cluster makes it difficult to draw conclusions about occupational segregation or the drivers of these differences. This will be an important area of future research, particularly as the adoption of HS-based apprentices increases.

Advanced Manufacturing

According to BLS, the manufacturing sector is the sixth largest of the 17 sectors in the economy, but its job growth has been slower over the past decade than the economy overall and it is projected to have among the slowest job growth over the next decade.[11] At the same time, reshoring and expanding advanced manufacturing has been a priority of administrations from both parties, and ties into other goals, such as expanding domestic production through the CHIPS and Science and Infrastructure Investment and Jobs Acts. The new administration has similarly touted tariffs as a reshoring strategy and so far, the anticipated job demand has created a push for training in manufacturing, particularly advanced manufacturing.

The manufacturing sector is more of a focus for HS-based apprenticeship programs than for CTE programs. The sector is second only to the building and construction trades in terms of scale, with 203 HS-based manufacturing apprenticeships programs that have enrolled 1,028 manufacturing apprentices. In contrast, only 6.66 percent of CTE high-school concentrators were enrolled in the manufacturing cluster in 2021–2022, putting it in the bottom third of popularity for CTE clusters.

HS-based apprenticeship programs align primarily with two subclusters of advanced manufacturing. Over a third of manufacturing apprentices are in welding occupations, which fits within the Production and Automation subcluster.[12] An additional 88 apprentices are also in this subcluster as Machine Operators. The other predominant subcluster for HS-based apprenticeships is Industrial Machinery, which includes 77 industrial maintenance mechanic apprentices and 70 line maintenance mechanic apprentices. Small numbers of apprentices are also spread across several occupations within these subclusters, such as mechatronics technician and fixture makers. Outside of these two

subclusters, there is limited traction in HS-based apprenticeships. Only seven apprentices are registered in the Safety and Quality Assurance and Robotics clusters. There are 19 aerospace engineering technicians that could fit under the Engineering or Robotics subclusters, along with a handful of others in related occupations.

Both CTE programs and HS-based apprenticeship programs in manufacturing face challenges with gender, racial, and ethnic diversity, although CTE programs are faring slightly better along each of these dimensions. CTE programs have twice as many female manufacturing students as compared with HS-based programs, at 15.7 percent and 8.5 percent, respectively. Similarly, 58.85 percent of CTE concentrators are non-Hispanic white students, making it the third whitest cluster after agriculture and architecture (which has since been combined with construction). In comparison, 68.48 percent of HS-based manufacturing apprentices are non-Hispanic white apprentices. The difference between the two systems stems primarily from the difference in participation among Hispanic/Latino apprentices, who make up 25.85 percent of CTE manufacturing concentrators but only 11.58 percent of HS-based apprentices. All other races and ethnicities are underrepresented in manufacturing compared with their participation in CTE and HS-based apprenticeships overall.

HS-based apprenticeships in manufacturing show promise as a rigorous complement to CTE coursework. With a median program length of 2,736 hours, and the longest program even reaching 10,000 hours, high-school-based manufacturing apprentices spend more time gaining on-the-job experience than in many other industry sectors. This translates into slightly higher wages for HS-based apprentices, with a median start wage of $12.00 and mean wage of $12.48 per hour that will increase during the program, with a mean exit wage of $14.55, although that includes the exit wages of apprentices who exit before completing their program.

Digital Technology

The new digital technology CTE career cluster is designed to cut across each of the other career clusters, reflecting how these occupations cut across industries in the labor market. Digital technology aligns with information technology occupations, which have generally grown over the past decade. Despite recent prominent layoffs among major tech companies, according to BLS, employment in information technology is projected to grow more rapidly than the average for all occupations in the next decade.[13]

The digital technology cluster is more of a focus for HS-based apprenticeship programs compared with CTE programs. Digital technology is the sixth largest cluster for HS-based apprenticeships, with

166 apprentices (5.8 percent) across 56 programs. For CTE programs, digital technology is the eleventh most popular cluster, with 8.59 percent of students enrolled. The top occupations for HS-based apprentices in digital technology are IT Generalist and Computer Support Specialist, accounting for 41 and 25 apprentices, respectively. Both fall into the IT and Support Services subcluster, which contains 54 percent of all digital technology apprentices. Application Developers are the third largest group, with 21 apprentices in the Software Solutions subcluster. The remaining three subclusters—Network Systems & Cybersecurity, Web & Cloud, and Data Science & AI—all have registered HS-based apprentices.

For both HS-based apprenticeships and CTE programs, women make up less than a third of participants in the Digital Technology cluster (12.05 percent for HS-based apprentices and 28.75 percent for CTE programs). CTE programs have twice as many Hispanic/Latino concentrators (22.67 percent) compared with HS-based apprentices (10.24 percent). Asian participants are slightly more represented among CTE concentrators than HS based programs, at 8.96 and 7.23 percent, respectively. Similarly, 15.06 percent of apprentices in this cluster are Black—slightly higher than the 13.51 percent of CTE students in the same cluster. Finally, there are 52.41 percent non-Hispanic white apprentices in HS based apprenticeships, compared with just under 50 percent of CTE concentrators.

HS-based apprenticeships in Digital Technology are among the shorter RA programs, with a median program length of 2,000 hours, which is the minimum allowed in the RA system. Programs have a mean length of 2,383 hours, with programs for more advanced roles extending to 5,115 hours. HS-based apprentices in digital technology also earn higher than average wages, with $12.00 as the median and $12.06 for the mean wage at the start of the program.

Healthcare and Human Services

According to BLS, jobs in health care and social assistance grew by 21.4 percent between 2013 and 2023, which was the fourth fastest pace of growth of the 17 major industry sectors. Moreover, it is projected to have the highest percent change in jobs by 2033, at 10.4 percent.[14]

Healthcare and Human Services (HHS), previously divided between the Health Science and Human Services clusters, is the top CTE pathway, with a fourth of concentrators enrolled in 2021–2022. Although Healthcare and Human Services is less of a focus of HS-based apprenticeships and only accounts for 11.3 percent of HS-based apprentices, it is in the top five clusters, just after the energy cluster. In our dataset, there are 322 apprentices across 80 programs in this cluster. The top apprentice occupation is nurse assistant, which comprises 192 out of the 322 apprenticeships and falls into the

Physical Health subcluster. An additional 85 apprenticeships are in IT occupations under the Health and Data Administration subcluster. Another handful of apprentices and programs fall into the Community & Social Services and Personal Care Services subclusters. Two subclusters, Behavioral & Mental Health and Biotechnology Research & Development, do not have any registered apprentices. This may be an area of future growth, as unregistered youth apprenticeships programs are available for occupations in these clusters in Wisconsin and Massachusetts.

Women in HS-based apprenticeship programs are overrepresented in this cluster: 69.9 percent of HS-based apprentices are women, similar to the 74.1 percent of concentrators in the equivalent CTE cluster. Hispanic/Latino apprentices are underrepresented, with 14.29 percent of HS-based apprentices identifying as Hispanic/Latino and 28.69 percent of CTE concentrators sharing this identity. Representation of non-Hispanic white and Asian participants among both groups is similar, but HS-based apprenticeship programs fare slightly better in serving Black participants (16.15 percent vs. 14.8 percent).

HS-based apprenticeships in Healthcare and Human Services are, on average, 2,611 hours with a median length of 2,000 hours, falling between typical Manufacturing and Digital Technology apprenticeship lengths. The longest programs can reach double this length at 6,000 hours. However, wages are below the average for HS-based apprentices overall: Starting wages in the HHS cluster average $11.75, with a median wage of $11.

Recommendations

A comparison of the composition and trends of HS-based apprenticeship programs with those of CTE programs shows little alignment between the two systems. Although the CTE system has some variation, it is a nationally scaled program, while HS-based apprenticeships continue to remain concentrated in a few leading states. As RA stakeholders look to grow high-school programs in those states and expand to new states, they can benefit from tapping into the CTE system's infrastructure, career cluster frameworks, and associated instructional designs to provide training for a common core of skills and competencies. We recommend that HS-based apprenticeships align work with CTE programs to:

- ***expand HS-based apprenticeship into a wider range of occupations.*** HS-based apprenticeships more closely mirror the occupations in the RA system overall, with a heavy concentration in the building and construction trades and manufacturing, than they do the popular CTE programs.

CTE programs are strong in the sectors where federal and state RA leaders have been working to grow, including health care, IT or digital technology, and business and finance occupations.

- ***recruit a more diverse population of apprentices.*** CTE programs are more racially, ethnically, and gender diverse than HS-based programs, likely in part because of their national footprint of CTE programming. Although some of this is based on geography and occupation, CTE programs serve more women in some careers that are traditionally male dominated, like manufacturing, and those that are predominantly women, like health care. Similarly, CTE programs reach more Hispanic/Latino students both overall and within individual career clusters. In the field, we hear many employers interested in youth apprenticeship as a strategy to diversify their workforce, and CTE programs appear well positioned to be able to help with this goal.
- ***deepen the career experiences of CTE concentrators.*** Although CTE programs of study vary by school and state, the national data on CTE concentrators includes students taking as few as two courses in the same program of study. HS-based apprenticeship programs offer at least 2,000 hours of on-the-job experience, with the median program offering 4,000 hours and the top 10 percent of programs offering 8,000 hours or more. With the median wage of $12.00 per hour, a typical student could earn $48,000 by the time they complete their CTE and HS-based apprenticeship program. Manufacturing and digital technology may serve as good starting points for this connection, because they already have a successful foothold in HS-based apprenticeships.
- ***explore the creation of CTE-based apprenticeships.*** As a subset of HS-based apprenticeships, apprenticeships that are housed within CTE centers can serve the goals of both systems and their students. Becoming a scalable model requires not only pursuing programmatic strategies, but also support from policymakers to align the education and workforce systems to enable co-delivery of CTE programs of study and RA requirements.

The challenges in providing this simple analysis illustrate the need for data improvements for HS-based apprenticeships, CTE programs, and their intersection. We recommend that:

- ***RAPIDS include variables to identify youth apprenticeship programs.*** Variables that distinguish between HS-based, community college-based, and other youth-focused would be particularly valuable, because each entails different program designs. Identifying HS-based apprenticeship programs is already a messy process and will only become more difficult as these programs continue to grow.

- ***integrate HS-based apprenticeship and CTE data into statewide longitudinal data systems.*** RAPIDS and CTE data do not track long-term outcomes for students. Integrating RAPIDS and CTE data tracking into statewide, longitudinal data systems will allow researchers, policymakers, and practitioners to better understand whether HS-based apprenticeships help CTE students more successfully access jobs and improve their wage outcomes. It would also allow us to examine whether HS-based apprenticeships achieve academic goals, such as higher rates of high-school graduation and continuation into postsecondary programs, that are not tracked in RAPIDS.
- ***track how HS-based apprenticeships support work-based learning goals.*** Driven in part by Perkins accountability requirements and states' goals under the Every Student Succeeds Act, states are increasingly seeking to expand work-based learning opportunities in high school. HS-based apprenticeships provide a structured, rigorous, and paid way to achieve these goals. Although some states track work-based learning, none specify the type of experience or distinguish registered apprenticeship programs from shorter-term models. Tracking HS-based apprenticeships and other clearly defined models will help states understand which types of programs have the greatest impact on students' near and long-term academic and labor market outcomes.

Although high-school-based apprenticeships are just emerging, an analysis of national data can facilitate the transition from supporting a few leading programs and school districts to creating an infrastructure that enables widespread implementation of youth apprenticeships across the country.

Appendix

High-school-based programs were identified in RAPIDS public datasets from 2015 to 2022. We identified observations at the apprentice level, because there is no program-level ID in RAPIDS. The closest potential variable is the program sponsor ID, but because sponsors can offer both high-school- and adult-based programs, that would be too expansive. We identified high-school-based apprentices by:

- constraining the universe of observations to those where the starting age of apprentices was 16 to 19 and excluding any apprentice who already had a high-school education level or higher.
- using the following search terms in the variables for program name, related instruction provider, and other organization type (of the sponsor): school, high school, HS, district, independent school district (ISD), special school district (SSD), registered youth apprenticeship (RYA), CareerWise, Reach, Higher, and intermediary. For many of these terms, we included capitalization and spelling variations. We also searched youth in the occupational title variable, which a few programs use to identify these programs.
- manually reviewing entries to determine high-school status. In many cases, this was a straightforward process, with high schools and districts explicitly named, or high school programs explicitly indicated as a program type. In other cases, observations were straightforward to drop, because "district" referred to a union district or water district rather than a school district. In other cases, we identified the program sponsor or related instruction provider online to determine whether they serve high school students. We excluded adult CTE programs and trade schools.

The least reliable observations that we included are for CTE or vocational schools that have both high-school and adult programs, particularly when they serve older youth. For this analysis, we have included 16-to-19-year-olds as long as they have high-school programming, which may lead to an overinclusion of programs, particularly in New Jersey, but we continue to refine our knowledge of these programs.

High-school-based programs that we are most likely to miss are ones where the program sponsor and/or related instruction provider is a community college. Unless these programs specifically identify when they are serving high-school students, we cannot distinguish between high-school-based programs and apprenticeships available to community college students. We identified the broader universe of programs with a college as sponsor or related instruction provider and then manually

reviewed whether they had a strong presence of 16- and 17-year-olds to determine if they were likely to offer high-school-based programs. Within these programs, we included all 16- to 19-year-olds. We may have missed some high-school-based programs in this way, but also may have overcounted 18- and 19-year-olds attending college-based rather than high-school-based programs. These programs were especially popular in North and South Carolina.

This methodology was first developed by Jobs for the Future and the Urban Institute, and then further refined by Urban for this analysis. As we continue to refine this dataset, we welcome any high-school-based programs to provide us apprentice ID numbers for their high-school-based apprentices to be included in the dataset.

Notes

[1] "DWD Celebrates Success of Youth Apprenticeship Program During Inaugural Youth Apprenticeship Week," Department of Workforce Development, Wisconsin.gov, May13, 2024, https://dwd.wisconsin.gov/press/2024/240513-ya-week.htm.

[2] Mandy Dean, "What Does 'Youth Apprenticeship' Mean? The Answer, According to Each State," New America (blog post), November 21, 2024, https://www.newamerica.org/education-policy/edcentral/what-does-youth-apprenticeship-mean-the-answer-according-to-each-state.

[3] Since 2002, Advance CTE has defined CTE career clusters to help build consistency in the skills and pathways offered through CTE programming. Advance CTE updated its CTE Career Clusters in October 2024 and translated the original 16 clusters into 14. We found that the HS-based apprenticeship offerings aligned more with the updated definitions, and so we use those clusters for our analysis of HS-based programs. However, the Perkins Collaborative Resource Network's National Enrollment Profile of Secondary CTE Concentrators from prior years uses the old definitions, and we cite data from the 2021–2022 academic year (see https://cte.ed.gov/pcrn/profile/national/enrollment/2022/concentrator/secondary/clusters/allcareerclusters). To maximize our number of observations, we draw on RAPIDS data from 2016 to 2022, although the 64.4 percent of observations are from apprentices who began in 2021 or 2022. In addition, the NEP data is available either for all students who took any CTE courses or for CTE concentrators, defined as students who have taken at least two courses within a single career pathway. This paper draws on the data about CTE concentrators. We believe this is more equivalent to HS-based apprentices, because they are required take multiple courses within a single career pathway.

[4] "Charleston Regional Youth Apprenticeships at Trident Technical College," Trident Technical College, accessed May 12, 2025, https://www.tridenttech.edu/career/workforce/car_youth_apprentice.htm.

[5] This includes the 78 national programs registered by CareerWise within Colorado's tally.

[6] This number is actually the weighted average of the median wages for men and women. "37. Median Weekly Earnings of Full-Time Wage and Salary Workers by Selected Characteristics," Labor Force Statistics from the Current Population Survey, US Bureau of Labor Statistics, accessed May 15, 2025, https://www.bls.gov/cps/aa2022/cpsaat37.htm.

[7] The apprenticeship building and construction trades definition of for this and other Urban Institute papers includes all SOC6 codes under the SOC2 of 47, 49, and 51, which describes the traditional occupations in comparison to the rest of the Registered Apprenticeship system. The CTE cluster defines 93 distinct SOC6 codes that fall under "construction," with most falling into SOC2 of 47, 49, and 51, with some additional under 53 and 17. For comparison to the CTE system, we use this narrower definition for the HS-based apprentices in construction.

[8] Public school enrollment for Fall 2022 taken from Digest of Educational Statistics, 2023: Table 203.30. Public school enrollment in grades 9 through 12, by region, state, and jurisdiction: Selected years, fall 1990 through fall 2031, https://nces.ed.gov/programs/digest/d23/tables/dt23_203.30.asp.

[9] "Career & Technical Education,"Northside Independent School District Construction Careers Academy, accessed May 15, 2025, https://www.nisd.net/district/cte.

[10] US Census Bureau 2025, "QuickFacts: Missouri; Iowa," accessed June 16, 2025, https://www.census.gov/quickfacts/fact/table/MO,IA/PST045224.

[11] "Computer and Information Technology Occupations," Occupational Outlook Handbook, US Bureau of Labor Statistics, accessed May 15, 2025, https://www.bls.gov/ooh/computer-and-information-technology.

[12] The CTE Cluster crosswalk maps some occupations into multiple clusters, and so many welding occupations are included in both the manufacturing and construction clusters.

[13] "Computer and Information Technology Occupations," Occupational Outlook Handbook, US Bureau of Labor Statistics, accessed May 30, 2025, https://www.bls.gov/ooh/computer-and-information-technology.

[14] "Employment Projections by Major Industry Sector," US Bureau of Labor Statistics, accessed May 30, 2025, https://www.bls.gov/emp/tables/employment-by-major-industry-sector.htm.

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About the Authors

Deborah Kobes is a senior fellow and practice area lead for apprenticeships and labor markets at the Urban Institute, where she advances the expansion of diverse, inclusive, and high-quality registered apprenticeship programs. Kobes has testified before Congress about youth apprenticeship programs, supported state apprenticeship leaders, community-based organizations, and employers in delivering apprenticeship and training programs, and authored numerous reports and book chapters on innovations in apprenticeship and workforce development.

Shruti Nayak is a policy analyst in the Workforce, Education, and Labor Division at the Urban Institute, where she focuses on apprenticeships and workforce development. Nayak graduated summa cum laude with honors from the Ohio State University, earning a BA in political science and public policy analysis.

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