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AMERICAN COMPASS

POLICY

Learning By Doing

Case Studies in Building the Infrastructure for Career Pathways

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FOREWORD: BUILDING BLOCKS

By Oren Cass and Bruno Manno

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A startling transformation is underway, in the economy, in the culture, and among policy-makers. The ironclad, bipartisan belief in college as the “ticket to the middle class,” in former President Barack Obama’s preferred phrase, that every child should go to college, that the public education system’s primary task is to prepare everyone for college, has begun to crumble.

“For the first time in 50 years, college grads are losing their edge,” reported the *Washington Post* last month. “The unemployment gap between workers with bachelor’s degrees and those with occupational associate’s degrees — such as plumbers, electricians and pipe fitters — flipped in 2025, leaving trade workers with a slight edge for six months out of the past year, according to the Bureau of Labor Statistics. It’s the first time trade workers have had a leg up since the BLS started tracking this data in the 1990s.”

Commenting on the same trend in the *Wall Street Journal*, Allysia Finley observed, “unemployment among college grads age 22 to 27 rose to 5.6% in December, roughly what it was in February 2009 during the financial panic.”

“The real problem,” she suggested, “is a mismatch between labor supply and demand. Government subsidies and public schools have funneled too many young people to credential mills, which churn out grads who lack the skills that employers demand. Many would be better off training in skilled trades, for which demand is enormous.”

As America awakens to the costs of offshoring and begins the task of reindustrialization, and as the largest technology companies place their bets on an unprecedented expansion of physical infrastructure to support their plans for artificial intelligence, the private sector, too, has discovered that new paths for workforce development are critical to their own success. Unlikely bedfellows from Silicon Valley, Wall Street, school boards, and union halls are coming together in search of new approaches.

On one hand, the solution is straightforward: Stop funneling everyone toward college degrees that they

will not complete or use. Start providing exposure to in-demand careers and equipping young people with the skills to enter them. The rest of the world does this already, with better outcomes for young workers than we are achieving here, at much lower cost than we are paying.

On the other hand, that’s all much easier said than done. Politicians have been saying “apprenticeship” for years. But fundamental change is needed in the incentives, priorities, funding, and programs of American high schools, community colleges, employers, unions, and workforce development boards. Dollars have to shift, but so do mindsets. Curriculum needs to be developed, but so does pride in the essential jobs that can allow anyone to contribute productively to their community, support a family, and help move our country forward.

From coast to coast, a quieter story is unfolding. Institutions both public and private, both labor- and management-led, are building a range of “earn-and-learn” pathways that blend training with real work. These models differ in structure and governance, but they share a simple idea: skills are best learned on the job, in partnership with industry, and connected directly to wages and advancement.

These efforts point to something bigger than any single program. They illustrate what might be called *opportunity pluralism*—the idea that a healthy economy depends not on one dominant route to success, but on many credible pathways that allow people with different talents, timelines, and circumstances to reach good jobs.

Opportunity pluralism rejects the false choice between “college or career.” Instead, it builds a diversified system: employer training, apprenticeships, technical education, early college exposure, and work-based learning all operating side-by-side. The goal is not uniformity, but access—a range of on-ramps that meet young people and mid-career adults at whatever their starting point.

The case studies in this report are, quite intentionally, not focused on government training programs, which tend to deliver poor results. Developing strong career pathways is not a matter of constructing some new set

of institutions from scratch, but rather identifying institutions that are well-positioned to achieve the goal and redirecting their focus—or, in many cases, reprioritizing a focus they once had. Chief among these institutions are: public schools, community colleges, employers, and unions.

The first case study highlights the Fresno Unified School District, which begins career preparation while students are still in high school. Students choose themed pathways—health sciences, construction, manufacturing, and more—take sequenced courses, earn industry certifications, and participate in internships and other work-based learning. By graduation, they leave with not only strong academic grounding, but also tangible labor-market value and professional networks. The system does not ask teenagers to choose between academics and careers; it integrates the two.

The second case study, focused on Texas State Technical College, demonstrates how the formula for public funding shapes a public institution’s understanding of its own purpose, the decisions it makes, and the outcomes it achieves. Rather than receive taxpayer dollars for delivering hours of classroom instruction, TSTC receives a share of the taxpayer dollars it generates, through the higher earnings of its own graduates. That shift has led to sharper evaluation of program performance, reallocation of resources to departments that are delivering for students, and an institutional culture that prizes concrete results.

Third is Hadrian, an advanced manufacturing firm that hires technicians with no prior experience. Rather than searching for perfect résumés, the company hires for curiosity and work ethic, then invests heavily in structured training on the factory floor. New employees rotate across stations, learn to read blueprints, master safety and measurement, and receive coaching from dedicated workforce development staff. They are paid a competitive wage from day one. Within a year or so, many move into higher-skilled roles, and some reach six-figure earnings. Training is treated not as a cost, but as a capital investment.

The fourth case study, of Micron Technology’s apprenticeship program, blends employer-led, on-the-job training with learning in a technical classroom through a registered apprenticeship. Apprentices are hired as employees and split their time between paid work in semiconductor fabs and instruction at local community colleges. They earn a nationally recognized credential and steady wage increases as their skills grow. For career changers and recent graduates alike, it offers a middle ground between college and immediate employment: learning and earning at the same time.

Case study number five tells the story of the electrical training Alliance (etA), which shows how the apprenticeship model can scale. It provides standardized curriculum, instructor development, and modern training tools while leaving delivery to hundreds of local apprenticeship centers tied to union contractors. Tens of thousands of workers move through this system into skilled trades that power construction and infrastructure nationwide. National standards ensure quality; local partnerships ensure direct connection to the labor market.

Finally, in Central and Northern New York, the Building & Construction Trades Council underscores the value of regional coordination. As Micron builds the nation’s largest semiconductor campus, the council connects pre-apprenticeship programs, union training centers, and contractors so that local residents can access those jobs. It functions less like a school and more like an on-ramp—screening candidates, preparing them for jobsite expectations, and linking them directly to employers.

None of these examples is a policy. Nor is any a start-to-finish career pathway on its own. Each illustrates how a well-functioning node would look in a broader system that begins in high school and continues on through post-secondary education and early employment, supported by organizations focused on worker success. They are complementary pieces of a broader opportunity ecosystem. Together they embody opportunity pluralism in practice: different structures, shared outcomes, and a common commitment to linking learning with work. The question for policymakers is what policies would help the Fresnos, Hadrians, and IBEWs succeed, and ensure that many other schools, businesses, and unions follow in their footsteps.

The report’s final section attempts to answer that question. For policymakers and funders, the lesson is not to standardize on one “best” model. It is to create the conditions that allow many models to flourish: flexible funding for work-based learning, support for apprenticeship expansion, stronger ties between schools and employers, and recognition of industry credentials alongside academic degrees.

Earn-and-learn infrastructure is the connective tissue of a modern opportunity economy. It includes flexible funding streams that reward employment outcomes rather than seat time. It requires shared curriculum frameworks and industry-recognized credentials that travel with workers across employers and regions. It depends on intermediaries that knit together schools, unions, community colleges, and firms. And it demands governance structures that allow industry and education to operate not as strangers, but as partners.

Just as the nation is investing hundreds of billions in physical infrastructure—from semiconductor fabs to energy grids—we must invest with equal seriousness in the human infrastructure that prepares people to build, operate, and sustain those assets. Physical capital without human capital is idle capacity. Human capital without opportunity is wasted potential.

We therefore recommend policies that:

Build Earn-and-Learn Infrastructure

1. *Establish a general-purpose funding mechanism*
2. *Provide standard curriculum and credential frameworks*
3. *Install a revolving door between industry and education*
4. *Sponsor industry consortia*

Start Earlier and Broaden Access

5. *Embed career pathways in high schools*
6. *Normalize paid internships and co-ops*
7. *Nurture a pre-apprenticeship layer*

Align Incentives with Employment Outcomes

8. *Define data standards and share data*
9. *Restructure funding formulas*
10. *Tie tax incentives to job quality and workforce plans*

Proven pathways to good jobs already exist. Now the task is to make them visible, accessible, and scalable—not as isolated pilots, but as durable civic infrastructure. For millions of Americans, the best route to opportunity begins not in a lecture hall, but with a paycheck, a mentor, and the chance to learn by doing. And success at rebuilding American industry will depend on whether we build the systems that allow them to do exactly that.

AN INADEQUATE AMERICAN SYSTEM

The American commitment to “College for All” has been an unmitigated disaster for the majority of young people for whom a traditional college campus is not, in fact, the right next step after completing high school. Perhaps the best way to see this is to follow a representative cohort of students through the high-school-to-college-to-career pipeline and recognize that the vast majority fall out along the way.

For every 100 American students, only 86 will complete high school on time.

Of the 86 who earn their high school diploma, only 39 go directly to four-year colleges and 15 to two-year colleges.

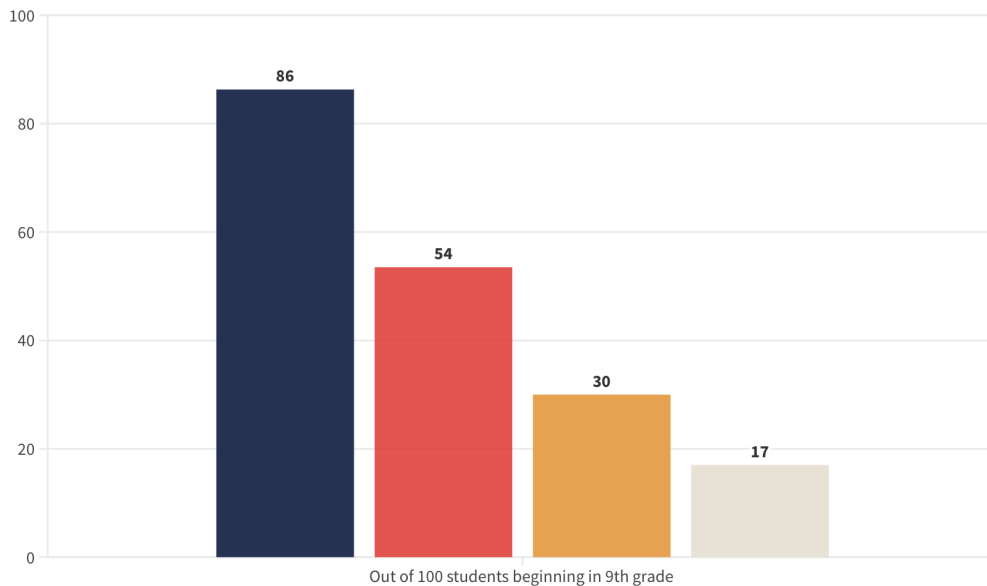
Of the 54 who enroll in college, only 30 will complete their degree within 150% of the expected time.

Of the 30 who complete, only 17 will find a job that requires a degree.

The Fortunate Fifth



■ Graduate high school ■ Enroll in college ■ Complete college ■ Jobs require degree



U.S. Dept. of Ed., National Digest of Education Statistics - tables 219.10 (data for 2022-23), 302.10 (2022), 326.10 (2017 cohort), 326.20 (2017 cohort); Federal Reserve Bank of New York, “The Labor Market for Recent College Graduates” (Q4 2025).

We can call these 17 students the “Fortunate Fifth,” for whom the system appears to be working as intended and delivering the results promised. But what does the system offer the 14 who cannot complete high school, the 32 who complete high school but do not go on to college, the 24 who cannot complete college, and the 13 who find their college degree was not worth what they expected? All of them would have been better served by access to other high-quality career pathways, yet few exist, and they receive a minuscule fraction of the hundreds of billions of public dollars dedicated each year to the conventional pipeline.

For young men, especially, the situation has become dire. Their outcomes are worse at every stage of the conventional pipeline, and their earnings have now stagnated for half a century. Research published by the American Enterprise Institute’s Scott Winship in 2022 found that men between the ages of 25 and 29 earned lower compensation in 2020 than in 1970, both pre- and post-tax.

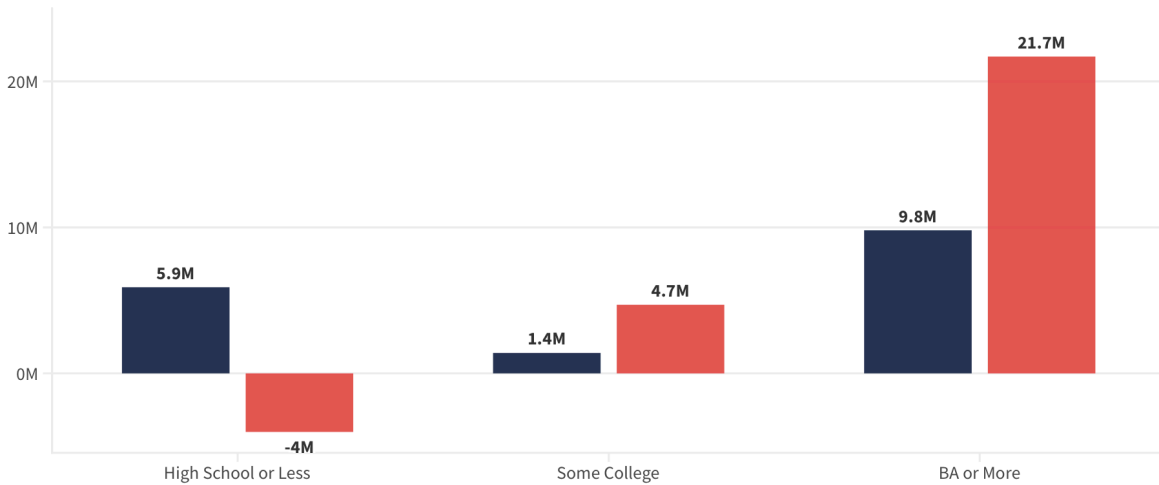
The education system is not entirely at fault. Broader economic trends have created a labor market poorly matched to the focus on college completion. From 2000 to 2019, the number of college graduates in the labor market increased more than twice as fast as the number of jobs requiring college degrees. Meanwhile, the nation has faced increasing shortages in a range of essential jobs for which other forms of preparation are more appropriate.

The Overproduction of College Degrees

Increase in U.S. labor market, 2000-19 (millions)



■ Jobs Requiring Degree ■ Workers Holding Degree



Oren Cass & Richard Oyeniran, The False Promise of Good Jobs, American Compass, February 2022 · Note: Job and worker data from different surveys; workers include only those over age 25.

If there is good news, it is that the American people have comprehended the challenge—and the opportunity—much better than their leaders. Politicians have long believed that you can speak about pathways besides college in theory, but you cannot move funding away from college in practice, or tell parents that their own children might be better off elsewhere. Similarly, conventional wisdom has held that you cannot embrace “tracking,” which would place students on different pathways during high school, better preparing them for a next step but potentially limiting their options.

In fact, American parents care far more about whether public education equips their children with the skills and values to build decent lives than about whether it prepares them for college. They support tracking overwhelmingly, by margins rarely seen in public polling. And they would rather have their own child receive a three-year apprenticeship that leads to a good job than a free ride to any college that will admit him.

In partnership with YouGov, American Compass asked 1,000 parents what they saw as the more important purpose of public education, offering two options:

1. *Help students develop the skills and values needed to build decent lives in the communities where they live.*
2. *Help students maximize their academic potential and pursue admission to colleges and universities with the best possible reputations.*

More than 70% of parents selected the first option, and that preference held across classes.

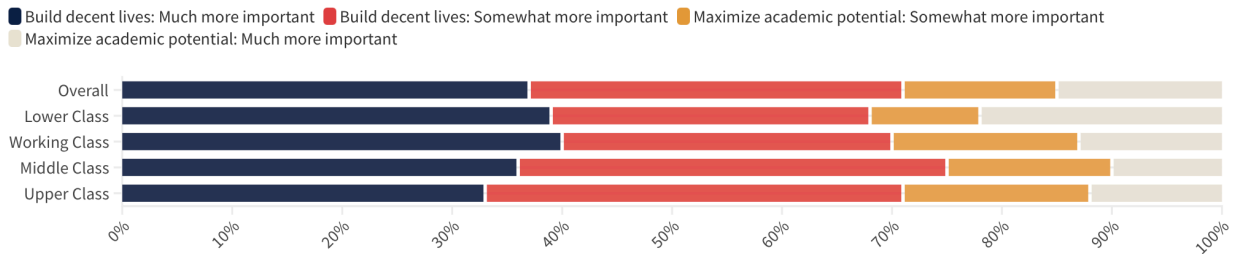
Educating for Life or Academic Success?



Parents, by class

Respondents were presented with two statements on the purpose of public education, in randomized order, and asked "Which is more important?":

1. *Help students develop the skills and values needed to build decent lives in the communities where they live.*
2. *Help students maximize their academic potential and pursue admission to colleges and universities with the best possible reputations.*



American Compass Failing on Purpose Survey (2021) · N=1,000
 Note: "Parents" refers to parents with at least one child between the ages of 12 and 30. Respondents were asked to answer questions in light of the experience of their eldest child age 30 or younger.

The survey also asked parents whether they supported tracking in high school. Half were shown the term "tracking" and half the term "diverse pathways" to test whether their reaction to the concept differed from their reaction to the term.

The survey explained: "Most people would agree that schools should treat students fairly and give them all the best possible chance at success. But people often disagree about how to do that. Some believe that schools should use '[tracking / diverse pathways]' to offer students different pathways based on their aptitudes and interests. Others reject the idea of [tracking / diverse pathways] and say that schools should set a goal of bringing all students along to the same end point, which is typically preparation for college."

It then offered two options:

1. *High schools should try to keep all students on the same [track / pathway] and in the same courses, with a goal of preparing all students for college.*
2. *High schools should offer families different [tracks / pathways] to choose from, which would place their children in different courses. For instance, one track might focus on college preparation, while another would focus on technical skills and workplace experience.*

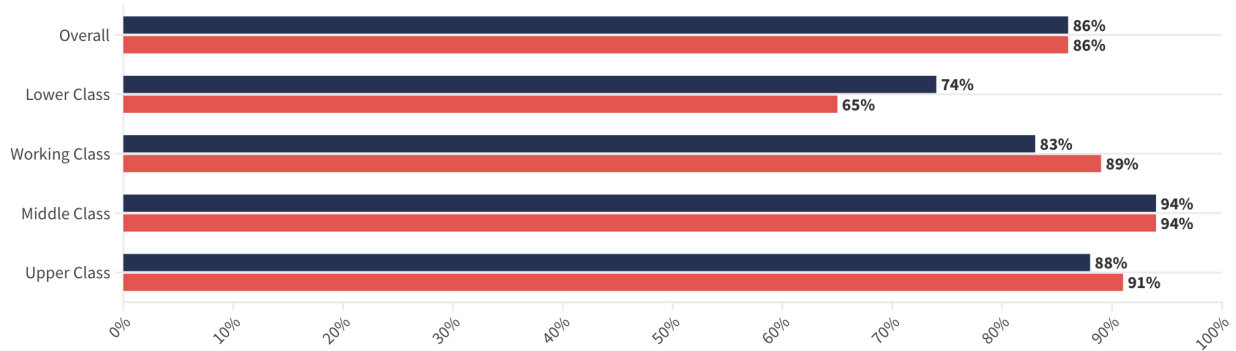
Parents preferred tracking by more than six-to-one, with no difference in response to the terms "tracking" and "diverse pathways." Analysis of public opinion surveys typically takes for granted that some small share of respondents will randomly choose any option. The 86% support for tracking overall, and especially the 94% in the middle class, essentially represents unanimity.

Support for Tracking in High School

Parents, by class, with respondents randomly shown one of two different terms



■ Term Used: "Tracking" ■ Term Used: "Diverse Pathways"



American Compass Failing on Purpose Survey (2021) · N = 999

But do Americans like non-college career pathways *in theory*, or would they actually choose one for their own children? The survey put this question to families directly, asking, “If policymakers would have created, or would create, one of the following options for your child upon their graduation from high school, which do you most wish would have been, or would be, available?”

The options offered were:

1. *3-year apprenticeship program after high school that would lead to a valuable credential and a well-paying job.*
2. *Full-tuition scholarship to any college or university that your child was admitted to.*

Most parents preferred a 3-year apprenticeship, with preferences especially strong among lower- and working-class families that had lower levels of educational attainment and income themselves. Even middle class families leaned slightly toward the apprenticeship.

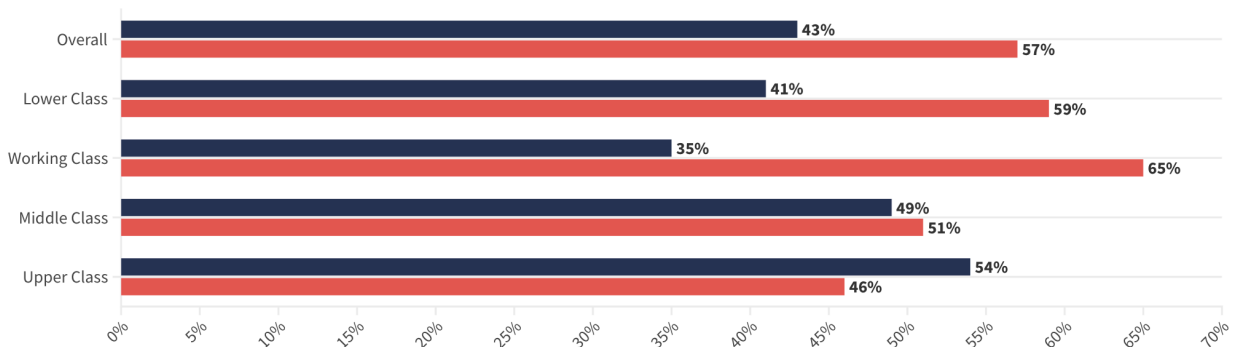
Most Parents Prefer Apprenticeship



Parents, by class

If policymakers would have created, or would create, one of the following options for your child upon their graduation from high school, which do you most wish would have been, or would be, available?

■ Full-tuition scholarship to any college or university that your child was admitted to
 ■ 3-year apprenticeship program after high school that would lead to a valuable credential and a well-paying job

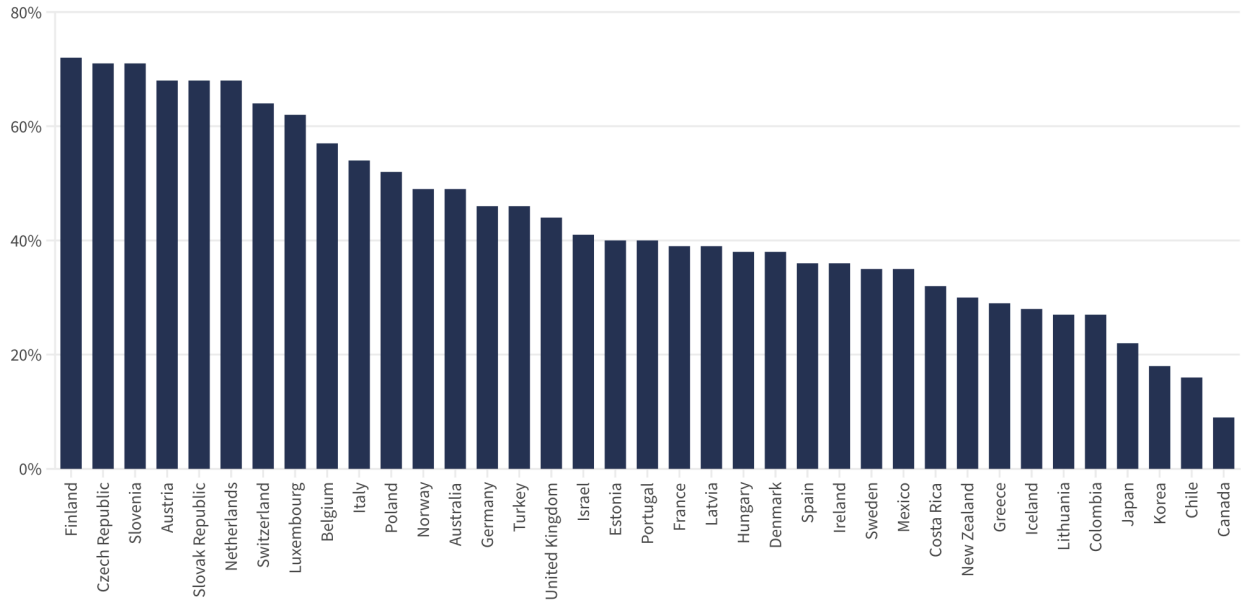


American Compass Failing on Purpose Survey (2021) · N = 1,000

Such results surprise most American policymakers. But they are common sense everywhere else in the developed world, where the folly of the American obsession with college is well understood. The Organisation for Economic Co-operation and Development reports that *every single member country but one* places a substantial share of upper secondary school students on non-college pathways, with most placing at least 40% of students there. The single outlier, of course, is the United States. We are so far outside the norm that we are excluded from the data entirely and consigned to a footnote.

OECD Countries Offer Pathways

Share of upper secondary students enrolled in vocational education



Education at a Glance: OECD Indicators 2020, table B7.1 · Note: The United States is the only country that the OECD excludes from its statistics on vocational education. It reports, "All countries except the United States have some students enrolled in vocational upper secondary education. In the United States, there is no distinct vocational path at upper secondary level, although optional vocational courses are offered within the general track and VET programmes start at the post-secondary level."

An education and workforce development system offering a robust range of career pathways is not magic, it is table stakes around the globe. And as this report shows, it exists in the United States too. Our failure has been in consigning it to the margins, depriving it of resources, and promoting a culture that treats every option except college as inferior. These case studies show the way toward a better model for American students and workers.

CASE STUDY: FRESNO UNIFIED SCHOOL DISTRICT

The Fresno Unified School District is California's third largest, enrolling just under 70,000 students, of whom 86% are socioeconomically disadvantaged. Across seven comprehensive high schools and seven specialty high schools, the district offers 81 different career pathways. Last year, 12,000 participating students earned 32,000 industry certifications.

Students who complete a Career and Technical Education (CTE) pathway (finishing 300 hours or more within the same sector and pathway) have a higher four-year graduation rate than other students. Close to 90% continue into post-secondary education or training or report that they are competitively employed within six months of high school graduation.

THE FRESNO MODEL

The individual schools are the heart of the Fresno program, with each developing its own pathways tailored to its location, demographics, and industry connections. A dedicated CTE coordinator at each school is responsible for developing new pathways and overseeing operation of existing ones. Those site-based coordinators are supported by a central office team that includes an assistant superintendent for college and career readiness, a CTE director, six program managers, a work-based learning coordinator, and a business engagement coordinator.

Development of a pathway begins with identification of a theme, for instance "biomedicine" or "residential construction technology." That theme must then be validated against evidence of student interest, labor demand, and available industry partners. The pathway itself is defined by a sequence of courses that students must complete from 9th through 12th grade. Many of these will be standard offerings already available, others must be developed specifically to support the pathway. The district offers more than 250 different CTE courses and employs more than 150 teachers with CTE-specific credentials.

In addition to coursework, each pathway offers some form of work-based learning, which can include paid and unpaid internships, off-site industry visits and job shadowing, and guest speakers. Overall, the pathway must provide relevant experiences and learning to students in each year of high school across five dimensions,

only one of which encompasses technical skills and certifications. Pathways must also provide a focus on career exploration, soft skills and employability, leadership skills, and social and emotional learning. Each pathway is affiliated at the state level with one of California's 15 CTE industry sectors, which provide curriculum and pathway development, technical assistance, professional learning, advisory structures, and support to student organizations.

The district's CTE department has an annual budget of \$25 million, covered in part by general district funds and in part by 17 state and federal grants. Some programs have unique capital costs: for instance, a heavy-truck classroom that includes a fully functional repair bay requires more funding and space than a typical classroom. Some have unique operating costs: for instance, a construction or welding course will go through many more consumables than a computer science course. CTE teachers have their own pay scale, which acknowledges and rewards their industry experience, but most still take a pay cut to leave industry and pursue teaching. The scale is designed so that, over time, a CTE teacher's salary aligns to those of their colleagues.

DUNCAN POLYTECHNICAL

Duncan Polytechnical is one of Fresno's seven specialty high schools and offers eight pathways within two broad tracks. The Innovative Design & Applied Technology Academy (IDATA) offers pathways in automotive technology, residential construction technology, medium/heavy trucking technology, manufacturing and product development, and welding fabrication. The Medical Academy of Science & Health (MASH) offers pathways in nursing services, pharmacy technician, and rehabilitation therapy.

Each student applies and is selected into one of these two academies at the start of 9th grade and spends two years in a typical high school curriculum supplemented with CTE courses that build general skills and expose them to opportunities in the various pathways. By the start of 11th grade, the student selects a specific career pathway. Over the next two years, along with typical high school coursework designed to prepare them for both college and career, focused CTE courses give them a head start toward the particular career. Throughout all four years, students gain hands-on industry experience and have

the opportunity to earn more than 90 industry-specific and professional certifications.

For instance, on the manufacturing and product development pathway, students earn certifications in Safety and Pollution Prevention (S/P2), OSHA-10 for Machinists, and National Institute for Metalworking (NIMS) Certifications for CNC Operation. In 9th and 10th grade, students complete projects and tasks to expose them to industry expectations for safety and employability skills, and instructional units include basics of electricity, circuits, CAD, and industry-applied math and measurement. During their junior and senior years, students get hands-on training and internships at several local facilities that focus on CAD, machining, product development, fabrication, CNC operation, PLCs, and manufacturing shop equipment use and maintenance. Graduates are ready to work in an entry-level position in the manufacturing and machining industry and can also obtain local internships and apprenticeships.

The construction technology pathway focuses on residential construction trades and gives students real-life experience in all aspects of interior and exterior construction. Students can earn certifications in S/P2 Safety and Pollution Prevention, OSHA-10 Construction Safety, National Center for Construction Education and Research (NCCER) in various trades, and Multi-Craft Core Pre-Apprenticeship (MC3). Students gain experience in areas such as framing, electrical, plumbing, drywall installation, roofing, flooring, and more both in their CTE classroom as well as during offsite internships.

INDUSTRY PARTNERS

One distinguishing feature of the Fresno model is the deep integration and commitment of the city's local businesses, which have participated in building the program from the beginning and take considerable pride in what the community has accomplished. "You have to have a community where people have a deep care for lifting it up at all levels," says Mike Betts, CEO of the Betts Company, which manufactures industrial springs and relocated to Fresno in 2009. "Nothing is more important than education and, for education, career and technical education is the game changer for sure."

Each pathway is supported locally by one of seven subcommittees, consisting of industry partners in related fields. Districts traditionally have industry advisory committees that must meet annually to fulfill the requirements for receiving federal Perkins Grant funding. But in Fresno, "they are actually driving the program," says Betts, meeting regularly with teachers and students to share opportunities and ensure

alignment. Employers provide the various forms of work-based learning as well as externship opportunities for teachers to spend time working in the fields they teach and then bringing up-to-date experience back to the classroom.

KEY LESSONS

- A strong CTE pathway combines traditional academic coursework, an emphasis on soft skills that benefit all students, sector-specific technical training, and workplace experience.
- High-quality CTE is often more expensive than traditional classroom learning, and launching programs often comes with high up-front costs. For local districts to expand their offerings quickly, they need support from federal or state funding.
- While districts can, and should, tailor career pathways to their specific needs and resources, they should not each be re-inventing the wheel. Federal, state, and industry guidance on curriculum frameworks, materials, standards, and credentials ease the process of launching pathways, improve their quality, and increase their value.
- Existing infrastructure for assessing school performance is biased overwhelmingly toward academic outcomes and districts have little ability on their own to "follow" students after graduation. State or federal systems are necessary to provide data on where students go next and whether they succeed.

CASE STUDY: TEXAS STATE TECHNICAL COLLEGE

Debates too often ignore the institutional incentives at the root of workforce development. When the public subsidizes higher education, it typically pays for current enrollment, measured by the “credit hour.” More students enrolled in more courses means more funding, regardless of any relationship to course completion, graduation, or employment success.

For decades, Texas State Technical College (TSTC) operated on that basis, mustering extraordinary effort every term to maximize its enrollment numbers. When Mike Reeser became chancellor and CEO of TSTC in 2010, some states were pivoting toward formulas that rewarded outcomes-based measures such as credit completion, persistence, and graduation rate. Those were an improvement, but struck him as still too far removed from his vision as a workforce college. The single objective was supposed to be training and placing a skilled workforce with Texas employers.

Through two years of collaboration with Texas policymakers and the Texas Higher Education Coordinating Board, Reeser and his team developed the nation’s first “value-added accountability funding formula.” In 2013, the legislature adopted the model.

THE VALUE-ADDED FUNDING FORMULA

Under the new model, 100% of the formula-driven portion of the state funding allocation to TSTC would be informed by the following process:

1. **List of eligible students:** TSTC would generate a list of all students who had completed at least nine semester credit hours as part of a given cohort, regardless of whether they had graduated.
2. **Generation of workforce data:** Using the Automated Student and Adult Learner Follow-Up System authorized by the Texas Legislature in 2003, which allows institutions to monitor student workforce outcomes while complying with *Family Educational Rights and Privacy Act* regulations. Wage information for each student is analyzed to determine annual wages over the past five years, adjusted for inflation. Typically, data for 75–80% of students are available; the remainder are predominantly students who have moved out of state.
3. **Direct and indirect value-added calculation:** Direct value-added is defined as the incremental state tax revenue attributable to former TSTC students’ earnings, calculated as 7% of the difference between a student’s annual income and a base wage representing a full-time employee earning minimum wage. Indirect value is calculated as 1.5 times direct value. Direct and indirect value-added are summed together for the five years following each student’s departure from campus.
4. **Division between the state and TSTC:** Value-added is divided 50–50 between the state and TSTC, with TSTC’s funding based on its share. TSTC then generates a value-added score for each campus based upon the proportion of TSTC’s total value-add generated by students from that campus, driving the proportion of total TSTC funding assigned to a given campus.

In colloquial terms, TSTC campuses receive funding based on the incremental tax revenue generated by TSTC students in the five years after they depart.

A TRANSFORMATIONAL MODEL

This funding formula has transformed the operations of TSTC. For example, decision making at every level is now driven by the primary question, “How can we put more Texans to work in great-paying jobs?” Faculty and administrators alike understand that TSTC students who do not have well-paying jobs do not generate funding for the college. This new reality created new priorities and practices.

Each academic program now tracks its performance in relation to the common objective using a real-time dashboard of key performance indicators. A central business intelligence unit guides the college in seeing the relationships among the skills requirements of the labor market, the learning outcomes contained in various credentials, and the employment and wage outcomes of students. Each degree or certificate program is subject to the same standard: “Are you earning your keep?” The administration sunsets bottom-ranked programs and reallocates the recovered resources to create programs that offer more promising career pathways for students.

In the past decade, 12 programs have closed due to poor earnings and placement outcomes, including in agriculture, computer maintenance, pharmacy tech, and dental assisting. The act of closing a program is rare in higher education and certainly not without controversy. Phasing out one program while ramping up another is also hard work and can adversely affect enrollment. Program closure led to a 25% enrollment decline, from 12,000 to 9,000 students. But TSTC would rather take a temporary reduction in enrollment than offer programs lacking a strong employment value for students. Today, enrollment is 12,368.

Under the enrollment-based funding formula, the financial incentive was to make every credential require as many credits as possible. After all, more contact hours meant more funding. Today, credential length is determined by the hiring preference of Texas employers. In a growing number of cases, shorter credentials with deeper specialization were preferred over longer, generalized credentials, like associate's degrees. For example, some students are opting for fast-to-work credentials that take a semester or less to complete.

KEY LESSONS

At the start, internal and external critics abounded. As TSTC Vice Chancellor Michael Bettersworth reflects, "Our administrators are zealously entrepreneurial, and many bring business sector experience and recognition that successful operations must constantly change to stay relevant in evolving environments. That often means calculated risks aimed toward innovative change."

Since implementing the new funding method, TSTC graduates have seen a 34% increase in starting wages (\$42,341 in 2010 to \$56,740 in 2023), and the number of students placed in jobs each year is up 56%, growing from 1,393 to 2,173 for the same period. Placing more students in higher-paying jobs has generated a 79% increase in combined, 5-year graduate earnings from 2010 to 2019 and a 156% increase in administration and instruction formula funding (from the 2014/2015 biennium to the 2022/2023 biennium at 100%).

Important lessons from the TSTC experience include:

- States must collect the data. Without an Unemployment Insurance wage record-based student follow-up system, the TSTC funding formula would not have been possible. Practically every state has this capacity, the magic is less in the collection and more in the policy-focused application.

- Everyone must accept that the data is imperfect. Students make use of programs in unconventional ways or move out of state for work. The job that they accept may not be in the same field of study as their credential, and wages can never be attributed directly to the education that they received. A perfect system? Absolutely not. But it achieves its objective: capturing the direction of change in how TSTC contributes economic value to Texas.
- Long-time stakeholders may struggle with the changes. The swift, deep institutional pivot profoundly changed the TSTC ethos. During the early years, some employees who had been with the college for decades struggled with the new expectations. For a time, turnover increased and morale declined, says Reeser. The immutable commitment of the college's administration and board, and constant communication throughout the institution, was vital for long-term success.

TSTC is continuing to innovate, moving from time-bound classes and schedules to competency-based pathways with multi-entry, multi-exit calendars and open labs. Soft skills embedded in the training curriculum and training labs are taught and assessed. Form follows the function of connecting Texans with good jobs.

CASE STUDY: HADRIAN

Hadrian was founded in 2021 to provide vertically integrated, highly automated manufacturing for defense and aerospace parts, components, and full systems. Hadrian designs, builds, and runs semi-autonomous, AI-driven production cells using advanced machinery and relying on a frontline workforce of more than 100 technicians, many of whom are hired with little or no prior experience. The company invests intensively in a comprehensive and ongoing training program to equip entry-level workers with the necessary skills to succeed and progress in their careers.

HOW HADRIAN HIRES

As Hadrian describes the factory technician role in its job postings, “The ideal candidate will be someone who is passionate about aerospace or defense manufacturing with a curiosity for how things are made. In this role you receive thorough on the job training for various stations throughout the factory therefore willingness to learn and follow training procedure is more important than industry experience.”

In 2025, Hadrian hired 45 technicians from 893 applicants. New employees find the company through traditional job postings as well as its strong presence at local community colleges and high schools. In Los Angeles, the location of its first factory, Hadrian’s most successful partnerships have been with high schools, but building those relationships has required a major investment in showing seriousness and establishing credibility with school leaders, who are rightly protective of their students. Hadrian offers students paid summer internships.

As of today, all factory technician positions start between \$18 and \$20 per hour plus comprehensive benefits, regardless of prior experience.

HOW HADRIAN TRAINS

Hadrian regards its Workforce Development Program (WDP) as a core investment and a competitive advantage. The program’s backbone is its full-time staff of 11, of which half have teaching backgrounds and half come from other sectors where training and development are a primary focus—the military, in many cases, and also fast food, an industry known for instilling an emphasis on consistency and quality in large numbers of

entry-level workers. Mike Stopper, who leads training at Hadrian’s Los Angeles factory, joined the company after serving as a marksmanship instructor in the U.S. Army. “I loved working with new recruits in boot camp, and I was looking for that same kind of role post-military,” he says. “My specialty was teaching, not manufacturing.”

New technician hires initially report to a member of the workforce development team, all of whom are present on the shop floor and work alongside the production supervisors. As Hadrian scales rapidly, the volume of new hires—each requiring cultural adjustment to a manufacturing environment—places significant demand on operational leaders already balancing intense technical workloads and troubleshooting. Technicians and engineers are highly skilled in manufacturing, but not necessarily in coaching or in dealing with the kinds of personal issues that often prevent new hires from succeeding. “Workforce development acts as a true partner to both people ops and operational leadership,” explains Armand Latreille, a senior director with Hadrian. “We’ve hired them for their emotional intelligence and their backgrounds in education and that pedagogical experience lets them apply real structure to the onboarding process and tackle cultural challenges head-on, like helping someone understand why showing up on time matters.”

For Hadrian, the “skills gap” that it encounters with new employees is not the ability to program machines—that can be taught—but a more fundamentally flawed understanding of the workplace itself, which is often intensified by social media. “The skills gap comes down to seeing the workplace as a learning environment,” says Latreille. “You have to be willing to engage with the society that your workers live in, and build trust.” Stopper agrees. “I care more about your soft skills post-training than your ability to work some machine,” he says. “That takes care of itself. I know we can teach you to be an effective operator.”

Technicians spend their first 30 days in on-the-job learning, rotating through major stations of the factory and attending mandatory classroom sessions that cover skills like reading blueprints and measuring. Frequent rotation helps to set the expectation that all workers will be pushed hard and out of their comfort zone, ensuring that all come to see the workplace as a place for continual

collaboration and growth. The team leverages a formal process to help identify potential top performers, but they are not the program's primary concern, notes Latreille. "They'll figure it out. What I care about is the middle 60%; that's where investing resources makes the difference between success and failure." After the initial instruction period of 30 days, the typical technician moves into a role reporting directly to a production supervisor.

Hadrian recently opened its second factory, a 290,000-square-foot facility in Mesa, Arizona that will employ 350 full-time workers once fully operational. It is currently hiring between 10 and 20 new technicians each month and expects to double the size of the WDP team this year. Brian Rocco, a technician hired in December, describes the dramatic difference between his prior experience in the construction industry and the environment at Hadrian. "I'm always looking for opportunities to advance and they've opened so many doors," he says. "I've always considered situations like this an investment on both sides. It gets me fired up every day."

KEY LESSONS

- Innovative manufacturers treat workforce development as a competitive advantage and invest in training processes in the same way as cutting-edge production processes.
- Recruiting begins with high-quality engagement in the public education system and creation of challenging environments for upper-secondary and community-college students; workforce development boards can be most helpful in facilitating direct engagement between employers and schools.
- An effective training and development program puts experienced teachers and trainers in charge of hiring and then supervising new hires.
- Public incentives should always be tied to job quality, not just number of jobs, and implementation by participating employers of comprehensive talent plans.

CASE STUDY: MICRON TECHNOLOGY

In 2022, as the landmark *CHIPS and Science Act* worked its way through Congress, Micron executives huddled at company headquarters in Boise, Idaho to consider the potential impact of the law and its semiconductor chip manufacturing incentives. The team quickly determined that one immediate priority was a plan to recruit and train more entry-level skilled workers for their U.S. semiconductor manufacturing facilities (“fabs”). Soon after, they launched the Micron Registered Apprenticeship Program as a structured pathway to train entry-level technicians for the company’s Idaho and Virginia fabs.

Micron’s choice to create its own program reflected a conscious decision to focus primarily on a skills-based hiring system that values on-the-job experience, as opposed to a credentials-based hiring system that places a higher value on academic or industry credentials. For this reason, starting an in-house apprentice program seemed like a natural fit. Pursuing U.S. Department of Labor (DOL) recognition for its program helped validate the program for potential participants and best position them to benefit from any eligible assistance and/or grant programs. To ensure compliance with all program requirements, Micron chose to partner with an experienced external organization as their “sponsor,” for help with both designing the program and registering it with the DOL. In Idaho, Micron chose the Idaho Manufacturing Alliance as its sponsor, and in Virginia, the National Institute for Innovation and Career Advancement.

Like other apprenticeships, Micron’s program uses an “earn and learn” model. Apprentices are hired as employees and receive paid, hands-on training at Micron’s facilities under the supervision of an employee mentor while also completing formal technical instruction with an external accredited educational partner. In Idaho, that institution is the College of Western Idaho. In Virginia, it’s Northern Virginia Community College. This approach ensures participants gain practical experience and academic credentials simultaneously, preparing them not just for a single job, but for a high-demand career in the semiconductor industry. At the end of the program, participants earn a U.S. DOL-recognized journeyman certification as an Industrial Manufacturing Technician or Nanotechnology Engineering Technician. And like all registered apprenticeship programs, participants are paid according to a wage schedule that

ensures pay increases throughout the life of the program as apprentices gain skills and productivity.

PROGRAM STRUCTURE

The program requires no prior work experience or education beyond a high school degree or GED. Micron recruits directly at local area high schools and markets the program to older individuals who lack industry work experience or a college degree but are looking for a career change. Past program participants have included bartenders and grocery store workers.

Apprentices are hired as full-time employees with a full benefits package and a starting wage of approximately \$20 per hour in Idaho and \$23 per hour in Virginia. Participants work a minimum of 32 hours per week with flexibility to design a part-time school instruction schedule that fits their work and home schedules. Time spent in school-based instruction is paid up to a maximum of 15 hours per week. Micron also pays 100% of the cost of education for program participants. To complete the apprentice program, participants must complete 2,746 hours of on-the-job training and 216 hours of school-based instruction.

With this flexibility, participants typically complete the program in two years but can complete it in as few as 18 months or as many as 36 months. Upon successful completion, apprentices are promoted to full-time technicians at an average wage of \$29 to \$30 per hour in Idaho and \$31 to \$32 per hour in Virginia (approximately \$60,000 per year). The positions tend to have substantial job security and opportunities for long-term career advancement; 80% of apprentices who completed the program in its first three years still work at Micron. But the program does not require apprentices to “pay back” a certain number of hours or work for a certain amount of time after completing the program. An apprentice who completes the program and for some reason wishes to accept an outside employment offer can immediately do so without any financial repercussions.

Olivia Zierenberg graduated from a local high school in 2022 and joined Micron in April 2023 as part of the first cohort of apprentices. With a passion for working on cars in her free time, she became interested in studying mechatronics at the College of Western Idaho. Zierenberg trained as a process technician apprentice and

was promoted to a full-time technician role in the fall of 2025 after successfully completing the program. She chose the apprenticeship to gain an early start in her career while continuing her education. The opportunity provided her with hands-on industry experience as a young professional and strengthened her confidence that she is on the right career path. Now that she has completed the program, Zierenberg is focused on expanding her technical knowledge in her role as a process technician while finishing her bachelor's degree at Boise State University. She aspires to take on additional responsibilities and explore future leadership opportunities within Micron.

“My life completely changed when I enrolled in Micron’s Registered Apprenticeship program,” says Zierenberg. “It enabled me to gain practical experience, boost my confidence, and enter my first professional setting where learning and working went hand in hand.”

PROGRAM SCALE

The program’s inaugural 2023 cohort had ten apprentices. Subsequent cohorts have varied between one- and two-dozen apprentices, fluctuating based on Micron’s anticipated needs. As of early 2026, Micron had hired nearly 100 apprentices across seven cohorts and recently hired its fourth cohort in Virginia and fifth in Idaho. With the CHIPS Act and the AI boom fueling a boost in demand for domestic semiconductor manufacturing, Micron expects to hire approximately 1,700 technicians in Idaho over the next decade, with this apprenticeship program a key part of the recruiting strategy the company will use to find those technicians. The program is poised for expansion, which is fortunate, considering the company’s New York project.

In January 2026, Micron officially broke ground on construction of the largest-ever semiconductor facility in the United States, their new \$100 billion “superfab” project in upstate New York. Micron expects chip production at the first New York fab to commence in 2030, with production at additional fabs starting throughout the decade. Overall, Micron projects the New York project will create 9,000 direct new jobs, split nearly evenly between engineers and technicians. And according to Melanie Lewis, director of workforce strategies at Micron, the company’s long-term goal is to use the apprenticeship program for 20% of new technician hires, which will require a New York program capable of adding 50 new apprentices annually, or nearly a thousand over the span of the 20-year project.

KEY LESSONS

- **Federal Funding for Registered Apprenticeships:** In April 2025, President Trump signed an executive order setting a goal of expanding the apprenticeship program to over one million active apprentices. Since then, the DOL has released a series of grants that are open for program participants. Melanie Lewis notes this public relations push has helped, while also noting how additional financial incentives and support are critical. Stipends and scholarship funds play an important role in supporting individuals enrolled in apprenticeship programs and encouraging program completion. Micron is working to build a structured support model to ensure apprentices with demonstrated need have access to assistance and is looking into a recently announced DOL grant opportunity, which would offer \$3,500 for each new apprentice hired.
- **Avoiding Onerous Program Requirements:** Apprenticeship programs can operate directly under DOL rules or state-level complements. In Idaho, apprenticeship programs are run by the U.S. DOL. In Virginia and New York, the programs are run by the state. This is important because, upon request, the U.S. DOL has approved a 2:1 mentor-to-apprentice ratio while New York requires 1:1. That ratio may significantly slow hiring and place limitations on program enrollment.
- **Availability of Community or Technical College Courses:** Finding available community or technical college programs and students other than Micron apprentice students to populate the required classes has been an issue. Broader adoption of standardized curriculum, participation by other employers, or more general support for community and technical colleges might help alleviate this pressure point and enable further scaling.

CASE STUDY: ELECTRICAL TRAINING ALLIANCE

The electrical training ALLIANCE (etA) is a non-profit national training organization associated with the joint apprenticeship system created by the International Brotherhood of Electrical Workers (IBEW) and the National Electrical Contractors Association (NECA). Founded in 1941, the partnership was established to create a shared training pipeline to meet industry demand and promote safe, consistent workmanship across employers and job sites. etA develops the official IBEW–NECA apprenticeship courseware, supporting a network of more than 300 local apprenticeship and learning centers (often Joint Apprenticeship and Training Committees, or JATCs) that deliver apprenticeship instruction and coordinate on-the-job training. The system has trained more than 350,000 apprentices to journeyman status.

PROGRAM STRUCTURE

Unlike firm-based training programs, etA is not a single employer and does not operate a single hiring pipeline. It functions as a national administrator and support organization for a decentralized network of local JATC apprenticeship trusts and their training centers. Local trusts and centers recruit applicants, administer selection processes, place apprentices with participating electrical contractors for work-based learning, and provide classroom and lab instruction. etA's work focuses on the upstream, by setting training standards, developing and updating curricula, and building instructional capacity by developing instructors and training directors. In addition, it supports local training center governance through committee member training and selection-process guidance, convenes stakeholders through the National Training Institute and periodic webinars and briefings on curriculum and partner-related topics, and supports recruitment and public-facing outreach through national communications and the Construct Your Future campaign.

TRAINING PATHWAYS AND DELIVERY

The etA-supported apprenticeship model combines paid on-the-job training (OJT) with related instruction delivered through local centers. The system offers multiple apprenticeship classifications, including Inside Wireman, Outside Lineman, Installer Technician, and Residential Wireman, among others, which correspond to distinct segments of electrical work. Inside Wireman

and Residential Wireman focus on building wiring and electrical systems, Outside Lineman focuses on transmission and distribution lines, and Installer Technician focuses on low-voltage and communications systems. In the Inside Wireman apprenticeship classification (one segment within the broader etA-supported network), etA reports applications increased from about 80,000 in 2023 to more than 137,000 in 2025, with more than 14,000 new indentures and 41,000 active apprentices reported that same year, suggesting rising interest in apprenticeship entry alongside higher demand for electrical labor.

Apprentices enter through local JATCs, which typically require a high school credential (including completion of at least one year of high school algebra coursework) and aptitude screening, with additional requirements set locally. Apprentices are employed and paid by participating signatory electrical contractors during training and typically do not pay tuition, though out-of-pocket costs vary by local program. Multiple entry pathways operate alongside the standard application route, including the Veterans Electrical Entry Program for eligible veterans and service members and Interim Credentials, an early-exposure pathway for high school or pre-apprenticeship engagement.

Training content is organized around occupational tasks. Trade profiles enumerate key duties and provide task-oriented descriptions of what journey-level workers do in each classification, detailing the work processes apprenticeship instruction covers. Installer Technician training aligns with recognized industry standards, such as the TIA structured cabling standards (e.g., the ANSI/TIA-568 series) for telecommunications infrastructure, and incorporates partnerships with manufacturers, including training for manufacturer-warranted installations.

The National Guideline Standards—jointly developed by the IBEW, the NECA, and etA, and approved by the U.S. DOL—provide a template for program length and the required OJT and related supplemental instruction (RSI) (i.e., classroom and lab work) hours. They are published for local JATCs to use as the registered apprenticeship standards under which they operate. Each OJT and RSI requirement varies by classification. Public descriptions from local JATCs commonly cite multi-year programs with substantial OJT—often including

8,000 hours—paired with several hundred hours of related instruction, along with defined progression milestones and periodic evaluations.

etA maintains an extensive repository of training content to support standardized instruction, including more than 700 courses, 10,000 modules, 2,900 QR-linked resources, and 3,400 videos. Instructional methods include classroom teaching, labs, interactive simulations, and virtual reality training modules. Computer Mediated Learning (CML) is used as a blended-learning approach that shifts some coursework outside scheduled classroom time and reserves in-person time for hands-on work. CML uses proficiency-based modules that unlock as apprentices demonstrate mastery (with proctored testing at the training center), preserving in-person time for laboratory work and applied training.

The training ecosystem includes certifications and specialty programs in areas such as instrumentation, cable splicing, craft certification, solar PV, and standardized task evaluation. Safety and specialty credentials are commonly delivered through local centers, including OSHA 10/30 training and NFPA 70E electrical safety training, as well as specialized credentials such as training for rigging and crane-related certifications. The system also includes technical specialty training, such as medium-voltage cable splicing.

FUNDING STRUCTURE AND EXTERNAL SUPPORT

Funding for the system comes from multiple sources. At the national level, etA operated a budget of more than \$40 million in fiscal year 2024, a sum that reflects the national nonprofit and does not account for the budgets of local JATC trust and training centers. It is primarily financed through program service revenue from developing and distributing curriculum and training platforms, including licensed course access and related services. At the local level, apprenticeship instruction is typically funded through jointly administered apprenticeship and training trusts supported primarily by signatory contractors' contributions (often assessed on a per-hour basis under collective bargaining agreements), with additional support in some locations from state or federal workforce funding. Apprentices generally do not pay tuition for the core program, but commonly incur out-of-pocket costs for items such as books, course materials, tools, and required equipment, which vary by local program. etA has also received federal grant funding for specific initiatives, including an approximately \$6 million award in 2020 under the DOL's H-1B Skills Training Grants program—which is funded by employer-paid H-1B visa fees and awarded

competitively to support workforce training for U.S. workers—and an approximately \$3 million Labor Apprenticeship Building America award announced in July 2022.

Grant and philanthropic funding may support expansion and modernization efforts. In April 2025, Google announced support for etA to train 100,000 electrical workers and 30,000 new apprentices in the United States, integrate AI tools into the training curriculum, and provide apprentices access to Google's AI Essentials course, with a stated aim of increasing the electrical workforce pipeline by 70% within five years. etA says the partnership with Google will provide \$15 million over three years, including \$7.5 million in subawards to identified JATCs and \$7.5 million for development of tools and resources intended to support expansion across the broader network. Among other allocations, Google announced in July 2025 that it would provide funding to increase the projected pipeline of new electricians in Pennsylvania by 64%, and, in November 2025, it announced an initiative in Texas to train more than 1,700 apprentices by 2030, increasing the projected pipeline of new electricians by nearly 110%. Additional allocations are forthcoming.

KEY LESSONS

- Cooperation among employers in the form of industry consortia or trade associations provide an effective way for the private sector to contribute funding and establish common standards.
- The etA model separates national training infrastructure from local delivery: a single curriculum-and-standards organization supports many locally governed JATC trusts and training centers. This structure highlights the role of intermediary capacity (curriculum development, instructor development, learning platforms, and quality supports) within decentralized apprenticeship networks.
- The system's emphasis on instructor development and blended delivery (e.g., CML that preserves lab time) underscores that training scale depends on instructional throughput. Public support and grants can be structured around expanding teaching capacity, lab infrastructure, and delivery tools rather than focusing only on participant subsidies.

CASE STUDY: MICRON TECHNOLOGY & NORTH AMERICA'S BUILDING TRADES UNIONS

The Central–Northern New York Building & Construction Trades Council (CNNYBTC) is a regional building-trades council that coordinates multiple union construction crafts in Central and Northern New York. It is a local Building Trades council affiliated with North America's Building Trades Unions (NABTU) and aligned with the New York State Building & Construction Trades Council.

In the Syracuse metro area, CNNYBTC plays a central role in the workforce training ecosystem and is supporting construction of Micron's semiconductor campus in Clay. The Clay campus is a long-horizon investment of up to \$100 billion over more than 20 years, with up to four fabrication facilities planned on a complex totaling over 4 million square feet. An official groundbreaking ceremony took place in January 2026. While early planning anticipates the region will need to draw from out-of-area “travelers,” Micron, CNNYBTC, and other partners are working to build a “homegrown” workforce as regional apprenticeship and pre-apprenticeship pipelines mature. As former CNNYBTC president Greg Lancette put it, “What I sold to Micron was that we're going to make the Micron construction workforce here in central New York.”

PROGRAM STRUCTURE AND AFFILIATED PROGRAMS

CNNYBTC functions as a cross-craft coordinator. It aligns and connects the region's craft-specific, joint labor-management-sponsored registered apprenticeship programs to regional workforce partners and project needs, including through multi-craft pre-apprenticeship pathways that prepare candidates to enter union-sponsored registered apprenticeships. Registered apprenticeships operate within the federal framework authorized by the National Apprenticeship Act. In New York, registered apprenticeship programs are also subject to state registration and oversight standards administered by the New York State Department of Labor.

CNNYBTC coordinates across multiple craft unions and registered apprenticeship sponsors and serves as a convening point for cross-trade workforce planning, project coordination, and partnerships with

government agencies, employers, and intermediaries, including through the Future Ready Workforce Innovation Consortium—a regional coordinating body for educators, workforce development partners, employers, and other stakeholders working on Micron-related workforce needs. Its affiliated and partner craft unions span the core building trades needed for a semiconductor megaproject, including structural steel and reinforcing work, electrical construction, heavy-equipment operation, mechanical and process piping, carpentry systems, industrial coatings, and industrial equipment installation. The CNNYBTC's 14 partner unions include:

- Iron Workers (Local 60) — structural steel and reinforcing ironwork
- IBEW (Local 43) — electrical construction, power distribution, and systems installation
- Operating Engineers (Local 158) — heavy-equipment operation (earthmoving, cranes, hoisting) for site and civil work
- United Association (UA) of Plumbers & Steamfitters (Local 81; UA Local 267) — mechanical and process piping, plumbing, and steamfitting
- Carpenters (Local 277 / regional council) — framing, formwork, and interior systems
- Painters & Allied Trades (District Council 4 / Local 31) — coatings, finishing, and specialty painting

CNNYBTC's workforce development efforts are organized through a set of affiliated programs and partner pipelines, including:

- ON-RAMP: A New York State-backed workforce hub in Syracuse led locally by CenterState CEO, designed to coordinate training providers, employers, and support services into a single front door for jobseekers to build pipelines for advanced manufacturing and construction careers (including apprenticeship-connected pathways).

- **Syracuse Build:** A regional construction workforce initiative that coordinates recruiting, screening, and referrals among unions, training providers, employers, and public partners. It functions as a front door into construction career pathways and a mechanism for connecting candidates to contractors and apprenticeship sponsors.
- **Pathways to Apprenticeship:** A pre-apprenticeship/apprenticeship-readiness program that prepares participants to apply to union-sponsored registered apprenticeships. It is cohort-based and paid, and is structured around jobsite readiness and navigation into apprenticeship selection processes, with exposure to multiple crafts and direct engagement with participating unions.
- **Helmets to Hardhats:** A veteran-focused pathway that connects service members and veterans to building trades employment and apprenticeship opportunities.

TRAINING PATHWAYS AND DELIVERY

Apprentices are hired and paid by signatory contractors, work under the supervision of journeyman-level craft workers, and progress through defined training periods that typically span four to five years and include thousands of hours of supervised work experience plus a set amount of related technical instruction delivered in classrooms and labs. To help apprentices stay on track as the Micron project ramps up, New York has allowed apprentices to “bank” related instruction hours even when they are not working, reducing conflicts when projects shift to extended workweeks (e.g., ten- and 12-hour days). Training is delivered through craft-specific apprenticeship sponsors— i.e., joint labor-management committees—rather than through CNNYBTC itself; the Council coordinates across sponsors and crafts to align capacity with regional demand and project schedules.

Training content and delivery are established at the craft level, with each affiliated trade operating a distinct curriculum and progression aligned to its scope of work. For example, for IBEW electrical workers, apprenticeship training typically centers on electrical theory and code application; conduit bending and raceway installation; wire pulling and termination; grounding and bonding; installation of switchgear, panels, and distribution systems; and troubleshooting and testing procedures. Large industrial projects also may require familiarity with controls, instrumentation interfaces, and documentation practices that support quality assurance and safe energization. For the UA Plumbers & Steamfitters, apprenticeship training typically

centers on layout and installation of piping systems; reading isometric drawings and specifications; welding and joining methods; rigging and handling pipe and valves; pressure testing; and commissioning practices. In industrial and semiconductor-related construction, this craft training also aligns with high-purity and process-system expectations, where installation quality, cleanliness practices, and documentation requirements are integral to jobsite performance. To prepare for semiconductor construction demands, UA training in Syracuse has added specialized skill modules—such as polyfusion, orbital welding, and clean-room tube bending—and has treated instructor development as a multi-year pipeline, with Syracuse designated as a UA regional training center.

Across crafts, instruction commonly includes safety and health training; construction math and blueprint reading; tool and equipment use; installation methods and quality standards; and trade-specific technical modules. Programs often use dedicated training centers with classrooms, simulated jobsite labs, and specialized equipment that mirrors current field conditions. Apprentices are evaluated through a mix of course assessments, on-the-job performance tracking, and periodic advancement requirements.

MICRON AND CNNYBTC

Micron’s Clay megafab development has been awarded federal support under the CHIPS and Science Act and a large New York State incentive package tied to job creation, capital investment, sustainability standards, and community-benefit commitments. Direct federal funding via CHIPS totals roughly \$6.1 billion across Micron’s New York and Idaho projects, in addition to a \$65 million workforce development grant, with preliminary terms announced in April 2024 and a finalized award disclosed in December 2024. New York’s incentive package was announced in October 2022 and includes up to \$5.5 billion in performance-based Green CHIPS Excelsior tax credits over 20 years, along with a \$200 million state commitment for road and other infrastructure improvements surrounding the campus and \$100 million in state funding for community benefits as part of the \$500 million Green CHIPS Community Investment Fund. The project is structured as a multi-decade, multi-fab campus build with overlapping phases—site and civil work, major structures, utilities, and highly specialized mechanical and electrical scopes—delivered through multiple prime contractors and subcontractor tiers.

Micron’s construction workforce approach is organized around a project labor framework that enables multiple contractors and subcontractors to draw from common

labor pools and training pathways. The project structure includes a project labor agreement (PLA) with local trade unions, a project-specific collective bargaining framework that sets common jobsite terms across participating contractors and crafts, covering wages and benefits, work rules and scheduling, safety expectations, apprenticeship utilization provisions, and dispute-resolution procedures intended to reduce the risk of work stoppages and coordinate labor supply on a complex, multiemployer site. Micron requires prime contractors on the project to enter the PLA.

Micron's workforce plan incorporates two mechanisms that connect directly to the CKNYBTC ecosystem, including a project-linked contractor funding contribution stream tied to craft-hours worked—one cent per craft-hour worked—to support the Pathways to Apprenticeship pipeline and a first-source referral approach that encourages contractors and subcontractors to use Syracuse Build to identify and connect candidates to job opportunities. Together, these elements link project activity to a local pipeline built around pre-apprenticeship readiness, entry into registered apprenticeship programs, and placement with union contractors.

FUNDING STRUCTURE AND EXTERNAL SUPPORT

Financing for apprenticeship programs sponsored by locals in the CKNYBTC network is commonly structured through jointly managed training trust funds and related labor-management funds established by collective bargaining agreements. Contractors contribute a negotiated amount—often calculated on an hours-worked basis—into training funds that support apprenticeship operations. On the Micron project, signatory contractors contribute an hourly amount to craft training funds; once the project is fully ramped up, the volume of craft hours can make training programs self-sufficient and expand training capacity while work is underway. In a multiemployer structure, multiple signatory contractors contribute into the same fund and draw from the same pool of trained workers, which spreads training costs across the contractor base and sustains capacity even as individual projects and employers cycle in and out of the local market.

This structure can support standardized skill development across contractors, predictable upgrade schedules for apprentices, and a scalable supply of craft labor for peak phases. Employers may also view the model as a mechanism to share training costs across the market, reduce recruitment burdens during periods of rapid expansion, and strengthen jobsite readiness and safety practices through consistent training and supervision

structures. Lancette, the former CKNYBTC president, framed this as part of the proposition to Micron: a way to build and continuously replenish a local, Micron-ready workforce over multiple fab phases, reducing dependence on travelers over time and supporting more predictable staffing as schedules peak.

The typical participant experience is “earn while you learn”: apprentices receive wages for on-the-job training, and the direct cost of classroom instruction is commonly covered by the training system rather than charged as traditional tuition. Apprentices may still face personal costs that vary by craft and local practice—such as tools, boots, transportation, union initiation fees, or dues—while the core instructional infrastructure is sustained through union and employer contributions.

KEY LESSONS

- A dedicated pre-apprenticeship layer—short, structured bridge programs that build jobsite readiness (e.g., safety, basic construction skills, and work habits) and help participants navigate entry requirements and selection into registered apprenticeship programs—expands the pool of apprenticeship-ready local applicants. In Central and Northern New York, NABTU and TradesFutures—a NABTU-created nonprofit that supports and scales apprenticeship readiness programs—have worked with Syracuse Build to expand apprenticeship readiness beyond Syracuse to include Oswego Build, Ithaca Build, and Utica Build, and partners are developing a new apprenticeship-readiness program in Binghamton with CenterState CEO and the Binghamton-Oneonta Building Trades Council.
- Registered apprentices earn progressively increasing wages while in their apprenticeship programs, and are not charged tuition.
- Project-level labor frameworks like PLAs help to connect megaproject hiring demand to local workforce intermediaries and training pathways and ensure an equitable source of funding for such programs.
- A regional building-trades council can function as a cross-craft coordinating body while relying on craft-specific apprenticeship sponsors for registered training.

POLICY RECOMMENDATIONS

If the case studies in this report teach one lesson, it is that effective workforce development does not come from designing a single national program. It comes from enabling many institutions—schools, colleges, employers, unions, and regional intermediaries—to build pathways that fit their local economies. The task for policymakers is not to prescribe a model, but to create the conditions in which multiple models can flourish.

The following ten recommendations aim to build and support that infrastructure. Together they advance what this report calls opportunity pluralism: a diversified system of credible, work-connected pathways that meet people where they are and lead to good jobs.

BUILD EARN-AND-LEARN INFRASTRUCTURE

1. Establish a general-purpose funding mechanism

Opportunities: federal legislation; federal agency action

In an effort to provide college access for all, policymakers established open-ended funding streams to subsidize any and all attendance in a college classroom. Meanwhile, people pursuing other pathways to careers—and the employers and unions supporting them—generally receive nothing or, at best, limited compensation tied to onerous bureaucracy.

Both federal and state governments should attempt to equalize the resources available on a wide range of pathways, by establishing a robust model for “trainees” that mirrors the funding for “students” and reallocating substantial funding from the latter to the former. American Compass’s “Workforce Training Grant” is the leading example for this model, and has been introduced as the *American Workforce Act* (AWA) by Senators Tom Cotton and JD Vance in the Senate and by Congressmen Max Miller, Derrick Van Orden, and Anthony D’Esposito in the House of Representatives. Under the AWA, employers would receive \$9,000 per employee per year for workers holding a “trainee” status.

The federal government should also strengthen its registered apprenticeship program, which effectively combines wages, training, and credentials, by simplifying requirements and accelerating the approval process for interested employers. One advantage of AWA funding would be to immediately provide substantial economic rewards for the establishment of apprenticeships. The

goal should be normalization: apprenticeships as common as internships.

2. Provide standard curriculum and credential frameworks

Opportunities: federal agency action; state agency action; employer and union engagement

The many institutions eager to advance new career pathways face a straightforward challenge: developing curriculum, defining achievement, and creating recognized credentials is hard to do. By default, many individual high schools, community colleges, employers, and unions working in isolation are inventing and re-inventing various versions of the same programs, duplicating effort and failing to learn from each other’s experience. Everyone has different expectations and uses different vocabulary.

States must play a leading role in defining pathways and developing curriculum for widespread adoption. The federal government can help as well, by compiling state-level materials for reference and engaging with states and employers to establish voluntary national standards and best practices. Employers and unions should be encouraged to collaborate with each other and share their own materials with public agencies.

Importantly, educators and trainers at all levels should give greater emphasis to so-called “soft skills” that help prepare people for the workplace, improve their communication and teamwork, and accustom them to learning on the job. Employers consistently report that these skills matter at least as much as technical skill; when they speak of a “skills gap,” they are more often thinking of reliability than familiarity with some piece of equipment. These soft skills also have the benefit of being universally applicable across all pathways, and indeed may be as valuable for students planning to pursue college as for those headed directly into the workforce.

3. Install a revolving door between industry and education

Opportunities: state legislation; local action; employer and union engagement

Scaling work-based learning requires more qualified instructors and workplace mentors. At the level of public policy, states must ensure that technical professionals can earn the necessary credentials for quick transitions into the classroom, and that school districts can provide sufficient compensation to attract them. School

districts must implement pay scales accordingly and build relationships with local industry that allow talent to flow in both directions: not only new teachers entering education, but also experienced ones spending time in the field gaining experience that they can bring back to their students.

Employers have an important role to play themselves. Neither providing support to teachers nor sending employees into teaching is the sort of activity that can be compensated via tax credit or will show up quickly on the bottom line. But such engagement is likely to be highly valued by the broader workforce, help in recruiting and retention, and pay dividends in contributing to a stronger talent pipeline. Both employers and unions should consider incorporating related programs into their collective bargaining agreements, for the benefit of both parties.

4. Sponsor industry consortia

Opportunities: federal legislation; state legislation; employer and union engagement

Organizations like the electrical training ALLIANCE underscore the importance of “middle infrastructure”; partnerships among workforce development boards, employers, and unions that can coordinate on curriculum development, instructor training, and recruiting. Public funding often focuses only on students; it should also support these backbone organizations that make systems work at scale. A useful analog exists in R&D policy, where the federal government has sometimes sponsored industry consortia to partner on development of intellectual property that all participants can then use. Matching federal funds for union and industry consortia dedicated to workforce development would create a powerful incentive to invest in human capital upstream of each individual employer’s workforce.

START EARLIER AND BROADEN ACCESS

5. Embed career pathways in high schools

Opportunities: state legislation; state agency action; local action

Treating all students as if they should be headed straight to college until after they have crossed the stage to receive their high school diplomas does a great disservice both to the many who already pursue other paths and to the many who would benefit from other paths if strong ones that began during high school were available. Policymakers tend to assume that a serious tradeoff exists and time spent on a career pathway sacrifices the academics necessary for college preparation, but the evidence suggests otherwise. If anything, access to career pathways, technical training, and on-the-job experience will often engage students

more effectively than a generic academic curriculum and leave them better prepared for any and all next steps.

After decades spent neglecting other pathways and holding schools accountable only for their test scores, states have a wide range of opportunities for recalibration. As noted above, they can develop curriculum and credential frameworks and promote new teacher pipelines. They also need to provide districts that commit to high-quality technical education with additional funding that accounts for the higher cost of launching and delivering those programs. And they need to refine their accountability standards to balance required classroom hours with time in the workplace, academic achievement with industry credentials, and college enrollment with successful entry into good jobs.

Ultimately, responsibility for delivering access to new pathways will rest with local school districts. They must choose to make pluralism a core value and a budget priority, and to embrace collaboration with the private sector. Sometimes the decision will be as simple as honoring more types of success than just national merit scholarships and college admissions. Other times it will be as difficult as reallocating capital spending toward new kinds of facilities. The successful districts will be those who align their mission to what most parents want for their own children: developing the skills and values to build decent lives.

6. Normalize paid internships and co-ops

Opportunities: federal agency action; state agency action; employer and union engagement

Work experience shouldn’t be a luxury. Employers should partner with school districts on cooperative education placements and offer paid internships. Paid learning levels the playing field and accelerates skill development. Public funding should support the effort, and public schools should build their schedules and requirements to accommodate it. Unions should welcome the creation of such roles as vital to their future members and the health of their professions, rather than resist them as possible substitutes for existing jobs.

One major obstacle is outdated labor regulations that often prevent high school students from participating in safe, supervised technical work experiences. Both states and the federal government should update regulations to allow structured, education-connected employment in fields like manufacturing, healthcare, and construction, while maintaining strong safety standards. Inflexible time-in-classroom requirements are obstacles as well. States should allow districts to substitute time on the job up to a substantial share of an upper secondary student’s credit hours, provided that work builds toward recognized credentials.

7. Nurture a pre-apprenticeship layer

Opportunities: state agency action; local action

Many young people and adults need preparation before entering formal apprenticeships. Along with efforts to reform high school career pathways and promote internships, state and local policymakers should focus on building and growing pre-apprenticeship and youth apprenticeship programs, which provide an increasingly important foundation for apprenticeship programs. Often housed at high schools or community colleges, these programs provide instruction in general education (e.g., math or science) or vocational fields and, upon completion, facilitate the entry of students into Registered Apprenticeship Programs. Although the U.S. DOL does not regulate and register pre-apprenticeship and some youth apprenticeship programs, it has issued guidance on the characteristics of what it considers a “quality” pre-apprenticeship program.

For high school students and adults, these programs are valuable because they teach foundational skills, safety, and workplace expectations, provide exposure to career options, and then offer an official on-ramp into the apprenticeship pathway. For employers, the programs broaden participation and help them hire more confidently.

ALIGN INCENTIVES WITH EMPLOYMENT OUTCOMES

8. Define data standards and share data

Opportunities: federal agency action; state agency action

Holding schools at every level accountable for outcomes, and even helping them to understand what outcomes they achieve, requires significant upgrades to data collection and sharing. Most school districts and community colleges genuinely do not know what happens to their students after graduation and have no way to find out. Basic employment measures, even up to the level of national job creation, rarely make any distinction in job quality.

The U.S. DOL should establish criteria for job quality (e.g., income level, income variability, benefits, and schedule) and assess job growth and employment rates accordingly. Those same criteria should then be applied to qualify jobs and career paths for registered apprenticeship status and funding streams like the workforce training grant. At both the state and federal level, existing systems for recording income like Social Security and Unemployment Insurance programs should be leveraged to provide aggregate data back to high schools and colleges on the outcomes achieved by their students. States should publish accessible dashboards showing employment rates, earnings, and credential

outcomes by institution and program, empowering students, families, and providers to focus on programs that deliver real value.

9. Restructure funding formulas

Opportunities: state legislation; state agency action

Public funding should reward results, not seat time. Texas State Technical College’s value-added funding formula offers a model: tie institutional funding to the wage gains and employment outcomes of students. States should move away from credit-hour or enrollment formulas and toward performance systems that measure whether graduates actually proceed into good jobs. When funding depends on outcomes, institutions naturally align curriculum, advising, and program design with labor-market demand.

10. Tie tax incentives to job quality and workforce plans

Opportunities: state legislation; state agency action

States routinely offer billions of dollars in tax abatements and subsidies to attract employers. Those incentives should come with workforce expectations, not only the quantity but also the quality of jobs. Well-defined criteria for job quality, described above, would be an important first step.

Before qualifying large projects for incentives, states should ask a simple question: *How will you develop the workers you need?* Companies receiving public support should demonstrate credible training plans, an apprenticeship strategy or other engagement with local education systems, and pathways to family-supporting wages. Good employers make recruiting and training a core business strategy, ensuring that public investments translate into local opportunity.

CLOSING PERSPECTIVE

Taken together, these recommendations do not prescribe a single blueprint. That is intentional. The goal is not uniformity, but diversity with accountability.

An opportunity-pluralist system recognizes that different people thrive in different settings: a high-school pathway in Fresno, an employer academy at Hadrian, an apprenticeship at Micron, a union training center in Syracuse, or local programs for electricians coordinated by a national consortium. Public policy should make it easier to start, scale, and sustain these initiatives.

The test of success is simple: more Americans learning by doing, earning while they learn, and stepping into jobs that support families and strengthen American industry.



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