

MAKING THE GRADE:

Schools Adopt Business Approach to Develop
The Next Generation of Manufacturing Workers



MANUFACTURING CTE'S ROLE IN JOB CREATION

From simulated workplaces to industry partnerships, progressive high school Career and Technical Education (CTE) programs, geared toward manufacturing, are implementing creative ideas to sustain and grow.

As the skills shortage continues to increase, these measures are critical for developing the next generation of manufacturing workers.

Moving toward a more business-oriented approach is a winning strategy for all:

CTE programs become sustainable while launching their students into successful careers.

- ◆ Students obtain real-life work experience, resulting in good jobs and salaries.
- ◆ Manufacturers gain access to a solid pipeline of skilled workers that will help their businesses grow well into the future.
- ◆ The economy strengthens from the resulting business growth.
- ◆ The bottom line is that CTE can, and should, play a larger role in solving the skills gap. This Tooling U-SME white paper outlines the challenges facing high school CTE programs, specifically related to manufacturing fields such as CNC Machining and Welding, and provides solutions in the form of tips and best practices.



HELP WANTED: FILLING THE PIPELINE

In the next decade, job seekers in manufacturing will find plenty of openings. It's projected that nearly 3.5 million manufacturing jobs will likely need to be filled in the next 10 years.¹

The challenge, however, is that there aren't enough qualified workers to fill the positions due to the growing skills gap. An aging workforce, changing advanced technologies, and misperceptions about the industry all contribute to the shortage.

This has serious consequences for the manufacturing industry, which is overwhelmingly not prepared.

In fact, nearly nine out of 10 (88 percent) say that their company is having problems finding skilled workers in manufacturing, according to Tooling U-SME's Workforce 2021 Assessment.

When it comes to filling this pipeline of workers, local high school CTE programs play an essential role.

Yet with continuing budget cuts, many CTE programs face financial challenges related to program funding for up-to-date curriculum, equipment and technology. This impacts their ability to develop the next generation of workers.

To sustain and grow, some high school CTE programs are thinking outside the education box by adopting a business approach.

By aligning externally with industry, and internally with others within the school network, many CTE programs are thriving, leading to greater student diversity in both gender and race. A bonus is that involving students in the process prepares them for the workplace by teaching accountability and real-life skills, a benefit to local employers.

¹ "The Skills Gap in US Manufacturing: 2015 and Beyond," Deloitte and The Manufacturing Institute, 2015.

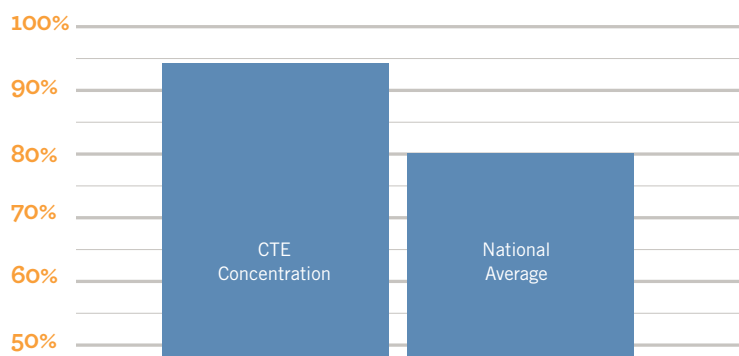
DOCUMENTED SUCCESS

The success of CTE programs in high schools is well documented with programs preparing students for seamless transitions to two-year or four-year college programs and/or entry-level jobs.

According to the Association of Career and Technical Education (ACTE), CTE serves 94 percent of all high school students.² More than 7.5 million secondary students took at least one credit of CTE credit.³

ACTE suggests that high school students involved in CTE are more engaged, perform better and graduate at higher rates.

For instance:



The average high school graduation rate for students concentrating in CTE programs is **93** percent, compared to an average national freshman graduation rate of **80** percent.⁴

CTE also benefits state economies: some states see significant returns in the form of revenue and benefits. In Tennessee, for instance, CTE returns \$2 for every \$1 invested. At the secondary level, CTE completers account for more than \$13 million in annual tax revenues.⁶

Yet despite these advantages, CTE programs still face funding hurdles. Typically, funding comes from existing school budgets supplemented by federal support such as Carl D. Perkins Career and Technical Education Act (Perkins) grants.

Unfortunately, support from these grants is not guaranteed. In fact, the U.S. Government's most recent proposed budget would fund Perkins grants to states at almost \$170 million below its FY 2007 level — one of the program's lowest funding levels in a decade.⁷

² Association of Career and Technical Education website (<https://www.acteonline.org/cte/#.VsIDvVJqkq9>).

³ Ibid.

⁴ Ibid.

⁵ Ibid.

⁶ Ibid.

⁷ NASDCTEC and ACTE press release, "Obama Administration Emphasizes Skills Training in Final Budget Request, CTE Leaders Say More Needs to Be Done," Feb. 9, 2016 (http://www.acteonline.org/general.aspx?id=9488#.VsIB6VJqkq_).

INTERNAL COMMUNITY: FIVE STEPS TO GET STARTED

The most sustainable CTE programs turn to business practices for success. Here are five steps to get started:

1

Create a strategy that aligns with central administration goals.

It is important to create a five-year education and growth strategy for the advanced manufacturing career cluster within the CTE program. A plan outlines goals related to student achievement and well-being, as well as metrics for measurement and management of external partners. This includes identification of key stakeholders (i.e., both internal and external) and their roles. CTE teams must understand the big-picture view of the school operating plan, and how their piece of the CTE program fits into and supports that plan.

2

Build champions.

While it is critical to engage the ultimate decision-maker—such as an administrator or board of education—in development of goals and strategy, think more broadly. How can other teachers and counselors collaborate and contribute? CTE instructors should discuss with administrators how the CTE program supports its goals. Together, the parties can agree on metrics for measurement of CTE program success (e.g., number of students enrolled, graduation rate, job placement, state and national standards). Aligning all parties will build a team of loyal and knowledgeable supporters who understand the rewarding career pathways provided by the manufacturing industry.

3

Create an annual business plan.

CTE program instructors should explain their business to administrators as if pitching an investor. A business plan helps tell a compelling and succinct story. Input from industry and other partners at the school can ensure that the plan is aligned with the market. Sections may include:

- ◆ Executive summary
- ◆ Program description
- ◆ Market analysis (i.e., define market need, description of target students, size of market, demographics, local job market)
- ◆ Goals/objectives (e.g., increase enrollment, purchase new equipment, align to state and national standards, update curriculum with current and relevant content)
- ◆ Marketing strategy (i.e., plans for recruiting students or selling services)
- ◆ Staffing (i.e., organization chart, training)
- ◆ Operating budget (i.e., existing budget, projected increases, revenue sources such as fundraisers or profit from school's machine shop)
- ◆ Measurement (e.g., metrics for measuring success)

To coincide with the budget cycle, teams should present their business plan before budgetary and board meetings.

4

Make a business case for funding.

CTE teams should be prepared to defend their budget, whether covering personnel, professional development, equipment, online training, technical certifications or supplies. If asking for an increase, they should clearly explain why. For instance, if it is necessary to update from a manual piece of equipment to new technology in automation, explain how it more closely aligns with the needs of local manufacturers. Indicate how the expense will be funded (e.g., fundraiser, corporate donation, grant). It is critical to show expected return on investment (e.g., higher scores, increased job placement rate). Schools should look at securing equipment as a capital investment. Considering the number of students using the technology, per class, multiplied by an average 10-year life cycle, it's actually a low-cost investment in the future.

5

Showcase student success and opportunities.

The best way to get students into seats is to demonstrate the end result of their time in the CTE program. It is important that students and their parents see that CTE will launch students on a career path, providing opportunities for students to gain credentials and certifications that are tied to their specific skill set and that lead to employment. For example, holding student showcases is a valuable way to put students and their work out front to “sell” the program to internal and external stakeholders. Allowing students to discuss their work, including challenges and successes, will encourage other students to explore—and hopefully to join—the program.

A BUSINESS APPROACH

Successful CTE programs focused on manufacturing need to align with two key communities:

- ◆ External: Industry/Local Community
- ◆ Internal: School Community

External: Industry/Local Community

Many CTE programs across the country related to manufacturing fields, such as CNC Machining and Welding, are burdened with outdated curriculum and technology.

To ensure students are prepared to work at modern manufacturing facilities, it is important for industry and education to work together to bring industry-relevant knowledge and skills to the classroom, according to Josh Cramer, senior educational programs officer, SME Education Foundation. Cramer manages the Partnership Response In Manufacturing Education (PRIME®) program that works with high schools across the country (see sidebar on page 13).

“Schools need to think like manufacturing companies,” said Cramer. “Is your school delivering employees with the skills that manufacturers need and want?”

Classroom is only part of the equation. Manufacturers want to hire students who know how to perform a task, understand why they need to do it that way and think about how to do it better. In short, students need practical, hands-on experience.

“In high school, students are asking, ‘What am I going to do the rest of my life?’” said Cramer. “They want to know if the path they are on propels them into a meaningful job or career. Practical experience allows them to see manufacturing as a way to solve problems, increase the quality of life and contribute to solving humanity’s problems.”

One approach to CTE education—called “simulated workplace”—is gaining popularity across the country. With the help of local manufacturers, schools transform classrooms into businesses, providing real-life work experience. These in-school businesses solicit work, prepare estimates and complete projects. Students also learn the importance of attendance, teamwork, punctuality and more.

Building relationships with business leaders can also provide other opportunities: on-site tours, mentoring, equipment donations, internships, jobs and even funding. Elected officials and association groups such as SME are also valuable advocates.

**Internal: School Community —
Administration/Counselor/Instructors**

The other community that is essential to a thriving program is the one inside the school. A collaborative approach, aligning with the principal, counselor, district administrator, other instructors and even parents, can build a team of champions.

A first step is often educating this community about the opportunities in the manufacturing field. Currently, many high schools promote the idea that graduation from a four-year college is the preferred pathway to success. However, it is clear that this is not the path for all students. Effective career development can, and should, include a variety of options for students.

In fact, the National Coalition for Career Development has spurred a movement to elevate career development to help students decide which career is best for them and build a pathway to get there. CTE instructors can support this effort by educating counselors and parents about rewarding careers in manufacturing.

In addition, the best programs blur the lines between classes, integrating with other teachers and staffers. Just as people with different areas of expertise within a company need to work together (e.g., marketing,

accounting, design, engineering), the same is true for schools.

For instance, a science teacher may come in to teach with the welding instructor. Or, leveraging a marketing or media class can help drive branding and promotion of the product being manufactured. Inviting a counselor to become a student for a day is another way to introduce insiders to the program, building awareness, understanding and support.



BEST PRACTICES

High schools that have successfully adopted a proactive stance to ensure the ongoing strength of their CTE programs have implemented best practices.

CTE Program Instructor As Leader

A critical role for the CTE program instructor is to serve as a community leader of the initiative. To gather support for the program, it is important to share its benefits with students, parents, local manufacturers, economic development agencies and others.

This is an excellent professional development opportunity for the instructor, and some schools may provide training. Instructors will build strong relationships with the community, often leading to opportunities for them, their students and their school. These may include: invitations for students to tour local manufacturing facilities, notification of job openings and job placement, procurement of guest speakers, invitations to serve on local task forces, collaborations to complete paying production projects, internships/apprenticeships and monetary/equipment donations.



Advisory Board with Local Manufacturers

Along with students and parents, manufacturers are the most important customers of CTE programs. Ideally, manufacturing companies will hire the school's students as apprentices, interns and/or employees.

It's critical to have an advisory board — composed of school-level stakeholders, industry, and postsecondary partners such as technical schools and community colleges — to inform and validate the integrity of the program's design and content as they relate to preparing students for college and careers. This board can provide input for program improvements, postsecondary training and apprenticeships, and/or employment opportunities for students, professional development for staff and technical assessment reviews.

Most importantly, bringing local manufacturers into the education process can ensure the curriculum aligns with their needs. Ask questions such as: What is the market need? Which positions need to be filled? Which machines are you using? Which skills do you require? Which type of training programs do you use? Which certifications do you need?

Matching the school's program to its needs will ensure well-trained students from the school are in demand, helping to launch them into successful careers.

When selecting advisory board members, look for those who are enthusiastic and willing to offer the time and talent. When business leaders feel invested in a program, it can lead to other benefits such as funding opportunities and/or equipment donations.

Organize Fundraisers

Gone are the days when school funding was enough to sustain a CTE program. Today, Manufacturing CTE instructors must take an active role in fundraising efforts. While asking for donations may be uncomfortable, a fun event can do the heavy lifting and gather momentum from one year to the next.

Pathfinder Regional Vocational Technical High School in Palmer, Mass., has found a formula that works with its Annual Poker Run (see sidebar). Now in its ninth year, the event raises funds for the school's Machine Technologies program, allowing it to acquire needed CNC machinery.

This type of annual event helps build awareness for the CTE program and gets the community involved in its success, while bringing in valuable funds.

Engage Students

Current and past students can help grow the program, resulting in a win-win situation: Students help support the program and, in return, gain essential real-life work experience.

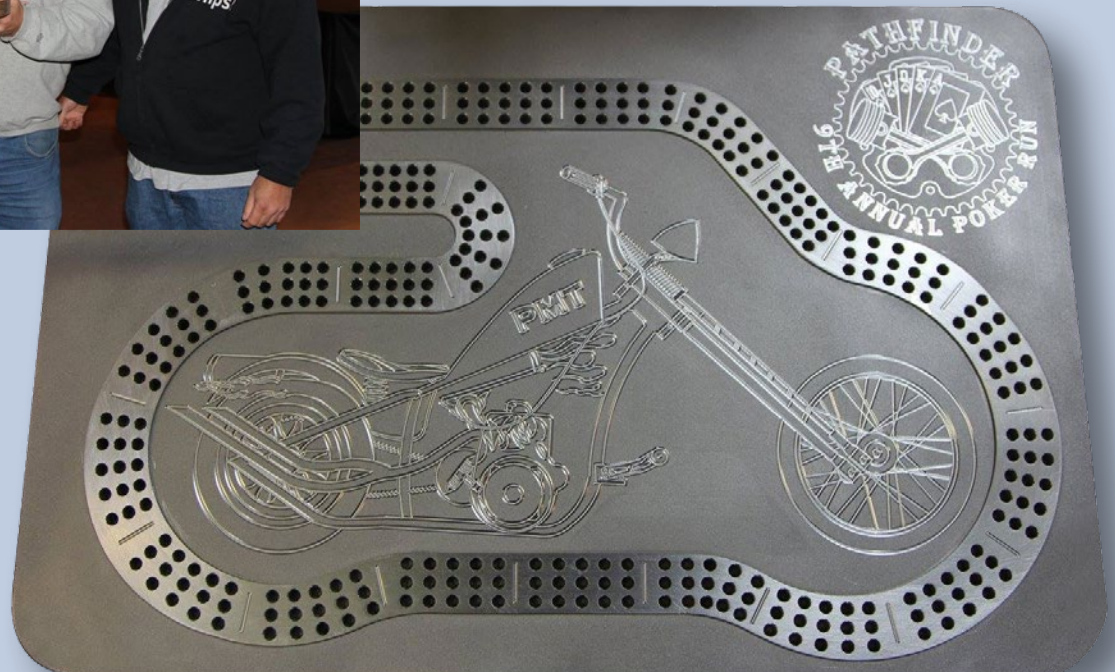
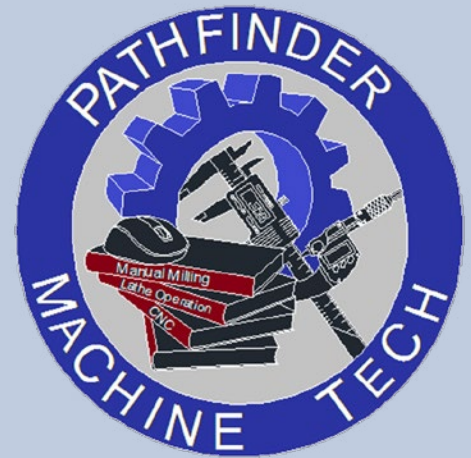
Students can assist by participating in planning meetings, creating marketing materials, conducting social media outreach, connecting with potential students, organizing events and fundraisers. They can also serve as camp counselors and workshop leaders for younger children.

Through simulated workplaces, where students run the school shop like a business, students learn accountability and solid skills.

Manufacturers (aka future employers) like to see this type of practical experience along with academic performance. They also appreciate the soft skills that students learn, such as the ability to arrive on time, stick to deadlines and work in a team.

KICKSTANDS UP!

The Pathfinder Regional Vocational Technical High School Machine Technologies Annual Poker Run takes place each fall. Funds raised help the school acquire the CNC machinery it needs to compete. The cost to attend the event — which includes an 80-mile motorcycle ride followed by a barbecue dinner with music — is \$20 per driver and \$15 per rider/passenger. At various stops along the motorcycle route, participants play a hand of poker. A trophy — created by students in the school's Carpentry, Auto Refinishing and Electronics shops — is awarded to the poker game winner. At the 2015 event, celebrity guest Doug Danger completed legendary daredevil Evel Knievel's failed attempt to jump 22 cars on a motorcycle. He made the successful jump on Evel's own 1972 Harley-Davidson XR750.



SIMULATED WORKPLACE RUNS LIKE A BUSINESS

The West Virginia Department of Education Simulated Workplace was designed by a committee of experts from business and industry throughout the state. The initiative creates an authentic work environment where students learn accountability and career skills. The program, which is run like a real business, aligns with West Virginia workforce requirements, including random drug testing, professionalism, attendance and safety.⁸

More than 13,000 students in over 500 CTE classrooms are participating in the pilot phase of Simulated Workplace, which encourages local business and industry experts to join on-site review teams that assist schools in meeting their workforce needs and expectations.

One of the participating schools—United Technical Center (UTC) in Clarksburg, W. Va.—ensures students are career-ready through its Precision Machining Company. The UTC Simulated Workplace operates like a machine shop and puts students in charge. They rotate through job roles such as foreman, project manager and tool room attendant.

Students learn professional work habits in the simulated workplace. For example, they learn punctuality by having to punch in and out. And to spread the word, they carry business cards.



⁸ <http://wvde.state.wv.us/simulated-workplace/>.

EXTERNAL COMMUNITY:

SIX TIPS FOR EFFECTIVE OUTREACH

- 1 Reach out to industry representatives.** Open a conversation with local manufacturers about the knowledge and skills they need for their businesses to grow. What is the market need? Take the feedback and integrate it into a practical curriculum with practical hands-on skills. Tapping into human resources managers, retired manufacturing practitioners or local SME members can provide additional expertise to strengthen a program.
- 2 Standardize training.** Often CTE programs are built around an instructor's expertise versus what is needed by industry. Recently, more programs are looking at standardization of content and a framework built on competencies. Some of this is now dictated by states themselves. It is important to liaise with workforce and training agencies to understand the latest criteria, which vary from place to place. These relationships can also provide important updates related to funding from state and federal grants.
- 3 Welcome the local community.** Rather than approaching a company or community leader with an open hand, asking for money, a warm invitation to get involved with the program can be a better introduction. A first step could be inviting business leaders to visit the classroom and review recent projects. Surprising opportunities — facility tour offers, donations and even jobs — can come from this grassroots effort.
- 4 Re-educate the community.** Manufacturing remains a misrepresented industry. It is important to educate parents and counselors as well as students about the many rewarding and lucrative career opportunities in the field. The nationwide celebration of Manufacturing Day, officially held on the first Friday in October, provides an excellent opportunity to show visitors what present-day manufacturing looks like and debunk common myths about the industry. A local event can help with recruiting by showcasing program success with students, parents, counselors, local government officials, the local media and others. A bonus: attracting more students to the school's manufacturing track can result in increased funding for the program.
- 5 Engage students.** Students are perfect ambassadors for the program. Introducing ways for them to gain valuable experience while sharing their expertise offers mutual benefits. For instance, start a summer manufacturing camp with students as counselors or arrange after-school workshops with the local Boys and Girls Club or other youth groups, where students act as mentors. Students can also help on the marketing side. If recruiting middle or high school age children, enlist current students to brainstorm ideas, design a brochure or participate in outreach.
- 6 Share, share, share.** Every meeting is an opportunity to share stories about students and the program, which can lead to offers of support. Talk about the student who won Gold at this year's SkillsUSA Competition, discuss positive student experiences with local employers, and publicly thank sponsors for their support. Share successes and challenges to ensure the public learns about the program and supports it.

DON'T REMAKE THE WHEEL

Organizations such as the SME Education Foundation are valuable partners as schools consider the best ways to strengthen programs that provide pathways to rewarding careers in manufacturing.

These groups can share experience from interactions with networks of programs across the country and ensure schools avoid remaking the wheel.

For instance, SME Education Foundation's Partnership Response In Manufacturing Education (PRIME®) provides opportunities for students to develop industry-relevant knowledge and advanced manufacturing skills before they graduate from high school. This tailored approach bolsters career pathways by providing interaction with industry as well as scholarships. Teachers also receive access to professional development and training on new equipment and procedures.

By working together with manufacturers and schools, PRIME helps build a tailored pipeline of qualified workers in a community, providing companies with access to a highly skilled and educated local workforce.

A recent PRIME partnership brings together Anna High School and Honda of America Mfg., both located in Anna, Ohio. To strengthen its future workforce Honda's Anna Engine Plant defined the competencies required for production roles and created a training program using Tooling U-SME online classes. Collaborating

with the Anna School District education team, PRIME is now bringing this same training, starting with two courses, to Anna High School so that students will have a solid foundation for potential future employment. The PRIME collaboration with Honda is also helping provide new technologies and equipment to the school.

"This program shows the power of continuity for students from high school to career, and can be a model for schools of any size, location and demographic," said Josh Cramer, senior educational programs officer, SME Education Foundation. "And, the collaboration all started with an employer who wanted to be involved and an education team that was enthusiastic about change."



CASE STUDY: ADVICE FROM A PROFITABLE STUDENT-RUN MANUFACTURING BUSINESS

Cardinal Manufacturing, a student-run manufacturing business within Wisconsin's Eleva-Strum School District, receives calls from teachers and administrators across the country eager to replicate its success.

The school's shop handles machining, welding and fabrication projects for local businesses and residents, allowing students to gain authentic business experience.

Started in 2007 by Instructor Craig Cegielski, Cardinal Manufacturing has cracked the code on building a well-trained pipeline of manufacturing employees, bringing benefits to students, industry and the local economy.

"We started the program because there was no funding to buy equipment or materials," said Cegielski. "Over the years, we have worked with hundreds of customers and now we are completely self-sufficient."

Students apply for the popular year-long, two-credit class by submitting a resume, project portfolio and letter of recommendation. Once accepted, students participate in all facets of the business, such as quoting jobs, ordering materials, manufacturing parts, quality control/inspections, invoicing, accounting, marketing and more.

"Students need real-life experience; they don't need to learn how to build a birdhouse," said Cegielski. "Through Cardinal Manufacturing, they deal with real deadlines, learn that they use math for a reason, and do everything from writing magazine articles to public speaking."

Most importantly, students learn the soft skills that employers say are especially important.

"We get comments all the time that our students are well-spoken and look you in the eye," said Cegielski. "They get jobs."

An extra perk for students is that they receive a profit-sharing check at the end of the school year based on the number of hours worked and other measurement tools. The rest of the earnings are invested back into the business.

Cegielski, who is working on introducing the program on a national level, believes Eleva-Strum's success can be replicated in any school. He offers this advice:

1 Start slow and grow. Get school board approval by presenting a two-, three- and five-year plan. "We started with nothing, like most start-ups, doing \$20 or \$50 jobs," said Cegielski. "When we had enough funds, we bought a new welder, and continued to improve and grow each year." A decade later, Cardinal Manufacturing has a \$50,000 Haas machine purchased with this funding. Continuous improvement is still a top priority.

2 Build industry partnerships. Cegielski shares his top-secret formula for building strong relationships: Leave the building. He advises schools to share their story with those in the community who want to grow their workforce and can benefit from a partnership with the school. "No one has ever said no."

3 Ask: How can we help you? When approaching businesses, don't go in and ask for a donation. Instead ask, "How can we help you?" or "Do you have jobs we can do for you?" Often the school will take on jobs a company wouldn't do itself, say for an internal improvement that has been put off. Customers appreciate the lower pricing. A partnership also provides manufacturers with a pipeline of future employees with real-life business experience. Just by reaching out, said Cegielski, "Good things can happen."



Photos courtesy Creative Technology Corp.

CTE PROGRAMS ESSENTIAL FOR SOLVING SKILLS GAP

From simulated workplaces to industry partnerships, progressive high school Career and Technical Education (CTE) programs centered on manufacturing are implementing creative ideas to sustain and grow. As the skills shortage continues to increase, these measures are critical for developing the next generation of manufacturing workers.

By adopting a business approach, aligning externally with industry and internally with others within the school network, many Manufacturing CTE programs are successfully addressing development and funding challenges.

Moving toward a more business-oriented approach is a winning strategy for all:

- ◆ CTE programs become sustainable while launching their students into successful careers.
- ◆ Students obtain real-life work experience, resulting in good jobs and salaries.
- ◆ Manufacturers gain access to a solid pipeline of skilled workers that will help their businesses grow well into the future.
- ◆ The economy strengthens from the resulting business growth.

The bottom line is that Manufacturing CTE is essential for solving the skills gap.

Contact

For more information, please call Tooling U-SME at 866.706.8665 or email info@toolingu.com.

About Tooling U-SME

Tooling U-SME, a division of SME, delivers versatile, competency-based learning and development solutions to the manufacturing community, working with more than half of all Fortune 500® manufacturing companies, as well as 500 educational institutions across the country. With hundreds of high schools, community colleges and universities, Tooling U-SME is able to help develop a skilled workforce by providing industry-driven curriculum. In addition, Tooling U-SME works closely with the SME Education Foundation to inspire, prepare and support the next generation of manufacturing engineers and technologists. Since its creation by SME in 1979, the SME Education Foundation has provided scholarships and awards through its partnerships with corporations, organizations, foundations and individual donors. Additionally, the Foundation's PRIME® initiative was created to provide high school students with a tailored advanced manufacturing/STEM education. Tooling U-SME can be found at toolingu.com or on Facebook ([facebook.com/toolingu](https://www.facebook.com/toolingu)) and Twitter (twitter.com/toolingu). Visit the SME Education Foundation at smeef.org. Follow @mfgeducation on Twitter or [facebook.com/SME.Education.Foundation](https://www.facebook.com/SME.Education.Foundation).

