BUILDING PATHS TO THE MIDDLE CLASS

Innovations in Career and Technical Education

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Table of Contents

Foreword

There is currently more focus than ever on the importance of earning a college degree. At the same time, many students and parents are dubious that America's expensive, one-size-fits-all higher education system can adequately educate students for an ever more diverse and sophisticated world of work.

But there are other educational options that are worth more sustained and serious attention. Technical programs provide many students with marketable job skills, often for far less time and money than four-year bachelor's degrees. Even still, many policymakers are hesitant to endorse tracking students into occupational training programs, and parents tend to have higher aspirations for their children than technical training. In turn, it is unclear that students and parents are learning about these options at an early stage, or that consumers are generally aware of these programs' likely return on investment.

AEI's Center on Higher Education Reform thus sought to highlight a diverse array of technical training options available to students today. How do students learn about these programs? What makes them work well and what challenges do they face? And how successful are their graduates? To answer these questions, we commissioned four case studies on high-quality occupational training programs that strive to prepare students for the workforce.

In the first case study, Daniel K. Lautzenheiser profiles Chicago's Austin Polytechnical Academy (APA), a high school providing a manufacturing and engineering curriculum to a traditionally low-performing, urban student population. APA offers a telling example of the successes and struggles that come with creating new pathways to college and careers at the secondary level.

In the second case study, KC Deane explains how some US automotive manufacturers have collaborated with community colleges to design and implement factory-specific training programs. She highlights three partnerships that place students on a clear pathway to employment at the partner company's factory while also giving students credentials that will serve them well throughout their career.

In the third case study, Kevin J. James and Deane examine two well-regarded cooperative education programs at the University of Cincinnati and Drexel University in which students receive a bachelor's degree. By offering students extended, paid, and professional experience in their field between traditional academic semesters, these programs potentially provide a more sustainable and valuable on-ramp to the workforce than the conventional summer internship or standalone undergraduate degree.

In the final case study, Rooney Columbus, KC Deane, and I touch on the newly emerging phenomenon of stackable credentials: smaller, more discrete certificates that have standalone labor market value but also build on each other for students who want to pursue a full degree. We showcase two programs at Brazosport College in Texas that have the potential to provide students with more efficient and flexible long-term educational pathways that students can take advantage of throughout their careers.

These case studies are examples of interesting attempts to align education with the demands of today's labor market. But while they appear to have positive effects on those who take advantage of them, options like these are few and far between. Students often don't know they exist, and even fewer students actually participate. Given these challenges, we hope these case studies not only aid researchers and policymakers but also help inform practitioners who might consider offering similar programs in the future.

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Austin Polytechnical Academy: Linking Public Education with Advanced Manufacturing

Daniel K. Lautzenheiser

Three years ago, Austin Polytechnical Academy (APA), founded in 2007, was all the rage. Situated in a low-income neighborhood in Chicago's West Side where 99 percent of students received free or reduced-price lunch and 97 percent were black, the school attracted national attention for its manufacturing- and engineering-heavy curriculum.[1] National Public Radio described APA as "an advanced-manufacturing magnet school that teaches everything from engineering and English composition to modern factory skills."[2] The school was featured in *Wall Street Journal*, *Chicago Sun-Times*, and *Chicago Tribune* articles on the future of manufacturing. A 2011 profile of the first graduating class adorned the pages of the *New York Times*, which covered APA in five separate stories between 2010 and 2011.[3] For those concerned about decreasing American manufacturing jobs or the role of high schools in promoting economic mobility, APA was the example du jour.[4]

But, as is often the case with something exciting and new, the press soon moved on to other more timely issues. A list of press hits on APA's website counts more than 50 stories from 2006 to 2012, but only a handful over the past two years.[5] The silence is unfortunate, as the first graduating class will graduate from college in 2015, meaning that a big piece of the story—how APA's graduates have fared after graduation—has gone untold.

Since its founding, APA has also grappled with a number of challenges inherent in its location and mission, including teaching advanced manufacturing in a school that has long suffered from low levels of student achievement in a predominantly low-income community that is skeptical of manufacturing as a viable career path. As such, APA provides a number of key lessons for industry leaders and policymakers looking to link public education with advanced manufacturing.

The Genesis of APA

Before there was Austin Polytechnical Academy, there was Austin High School and its reputation as a "mammoth, violence-prone high school on the city's struggling West Side." In 2006, Austin High School was shut down by then–CEO of Chicago Public Schools Arne Duncan—now the US secretary of education—and replaced by three new, smaller schools: APA, Austin Business and Entrepreneurship Academy, and VOISE Academy High School (a part-classroom, part-online school). This effort was a byproduct of the small-schools movement, a trendy solution to chronically underperforming schools that was supported by a number of private backers, including the Bill & Melinda Gates Foundation. As the *Wall Street Journal* noted at the time, "Inner-city school systems throughout the country are moving fast to open legions of small, experimental schools, in many cases replacing bigger institutions that were becoming unmanageable."[6]

APA was the brainchild of Dan Swinney, a former machinist who in 1982 started Manufacturing Renaissance, a nonprofit organization focused on revitalizing Chicago's manufacturing industry.

In 2001, Manufacturing Renaissance received a grant from the US Department of Labor to look at manufacturing pathways in the Chicago area. The Department of Labor had noticed that the manufacturing sector was facing two trends: On the one hand, while there were fewer jobs in the sector, they paid higher wages. On the other hand, Chicago's manufacturing companies were having trouble finding enough qualified candidates for those higher-paying jobs, which often required more-advanced skills than in the past. A Department of Labor–funded report estimated that 10,500 new or replacement manufacturing jobs were being created each year in the Chicago area, but more than half of those were going unfilled.[7]

These trends are not unique to Chicago, nor have they abated in the past decade. While the US manufacturing sector remains relatively strong in terms of overall output, technological advances have resulted in greater efficiency and fewer jobs. One economist calculated that annual US manufacturing production has exceeded $2 trillion since 2004—twice the output in the 1970s—while the sector has lost 7 million total jobs over that time span.[8]

And the manufacturing jobs that remain often require a greater level of training than those that came before. One report from the Georgetown University Center on Education and the Workforce estimated that by 2018, almost half (42 percent) of manufacturing jobs—and almost two-thirds of *all* jobs—would require some sort of college credential or degree.[9] In a follow-up report, the authors wrote, "For the past three decades, manufacturing shed jobs as worker productivity increased and jobs moved offshore. Today, however, we see jobs returning in this sector, particularly in durables and high-tech manufacturing."[10]

The result has been a clarion call from policymakers to both increase the number of manufacturing jobs and better prepare students for this new class of jobs. While much attention has been directed to postsecondary education, high schools are often seen as the first line of attack in preparing students for vibrant careers in this new, "advanced" manufacturing.

Surveying manufacturing education at both the high school and community college levels in the Chicago area, Erica Swinney—Dan's daughter, who today is the Manufacturing Renaissance program director responsible for coordinating activities at APA—found what she has described as a "nonsystem."[11] Most manufacturing programs were antiquated, and students were not learning skills applicable for the modern manufacturing economy. As Dan Swinney recounted, "Our goal [at APA] was to build a prototype: to link public education—no matter how good or bad it is—to the manufacturing sector and prove that can be a successful approach."

The timing was propitious: as Dan Swinney was making the case for a high school focused explicitly on manufacturing training, the powers-that-be in Chicago were experimenting with new, smaller schools. In 2007, APA opened its doors with 140 ninth-grade students. It added a grade each year and graduated its first class in 2011. The school enrolled 196 students in the 2013–14 school year.

Teaching Manufacturing: Curriculum and On-the-Job Training

The first important aspect of APA is its unique relationship with Chicago Public Schools (CPS). APA is a public school, but unlike many of the small schools that opened in the mid-2000s, it is

not a charter or contract school, meaning Manufacturing Renaissance was never responsible for operations or outcomes—rather, APA has always been wholly operated by CPS. CPS hires faculty, designs the curriculum, and oversees all programmatic and instructional aspects of the school. This structure has caused some friction, with the ambitious aims of the nonprofit rubbing up against the practical needs of a new school in a challenging neighborhood.

The first question facing CPS and Manufacturing Renaissance was this: what does a modern high school with a meaningful link to the 21st-century economy look like? Erica Swinney highlighted two key factors. The first is that the school needed to focus on both college and career preparation. She was adamant that APA would include not just manufacturing training but also an engineering curriculum. Although CPS urged APA to pick one or the other, in Swinney's mind, modern manufacturing is a far more dynamic sector than in the past, and a high school diploma is often insufficient for modern manufacturing jobs.[12] Since its founding, Manufacturing Renaissance has made a clear push to marry the engineering and manufacturing tracks, "and this is exactly what an 'advanced manufacturing' curriculum looks like. . . . You need both," said Swinney. In addition, a strong engineering curriculum is critical for APA graduates who matriculate to college and do not enter the labor force.

APA's curriculum is that of a traditional high school, but with an advanced manufacturing add-on. Students take the typical high school classes in English, math, history, and science, supplemented by a science, technology, engineering, and math (STEM) curriculum designed by Project Lead the Way and taught by a teacher hired by the district.[13] APA's goal is for each student to take, at minimum, three years of advanced manufacturing and engineering courses. More recently, recognizing that many APA students were entering school at least a grade level or more behind in math, CPS started offering a voluntary summer camp for all incoming 9th- and 10th-grade students to catch up on core math concepts.

To aid CPS's efforts, Manufacturing Renaissance hired a full-time instructor—Pablo Varela, who spent more than 20 years in advanced manufacturing before joining APA and also taught part time at the community college level—to teach an additional set of courses for sophomores through seniors that are verified by the National Institute for Metalworking Skills (NIMS), enabling students to earn anywhere from one to four metalworking credentials in courses that would be immediately applicable to a future machinist career. Under Varela's instruction, sophomores complete the basic NIMS credential in measurement, materials, and safety. Juniors work on an operation credential that would allow them to run a metalworking machine, while seniors study for a programming credential that would enable them to program the machines they are using.

The second critical factor that Swinney highlights is having partners on the ground who can hire student interns, facilitate site visits, and provide guest speakers to the classes. Partners include local manufacturing companies such as Mazak and DMG Mori (Japanese companies that make a wide array of machine tools), Johnson Controls Inc. (a US-based Fortune 500 company specializing in car products), and Kay Manufacturing (a smaller, Chicago-based company that makes car transmissions). When APA opened in 2007, it had 25 partners; by 2014, that number had grown to 55.

Manufacturing Renaissance has a full-time industry coordinator to help find these partners, set up internships and job shadows, and recruit guest speakers. In addition, Manufacturing Renaissance has three other employees—for a total of five full-time staff—at APA to coordinate the career program, on top of the regular teachers and staff hired by CPS to run the traditional high school curriculum. "You can't do it with less," Swinney contends.

In its first few years, APA placed a heavy emphasis on field trips, running about 15 to 20 each year. But Swinney observed that the trips weren't sticking with the students; a field trip was just a day out of school. The solution was to scale back to about six trips per year and attempt to ground them in what the students were doing in class. For instance, an 11th-grade math teacher was having difficulty teaching algorithms to his students, so the school visited DMG Mori to see those concepts in action. The school also sets aside one day a year when students can shadow employees at local factories for more exposure to manufacturing jobs, and Manufacturing Renaissance works to place juniors and seniors in short, week-long internships over spring break and to find rising seniors paid summer jobs in local manufacturing firms. Just under half (47 percent) of APA graduates leave with experience in at least one paid job: in total, 126 students have had 192 paid internships or summer jobs over the past four years.

Where the Rubber Meets the Road

APA's field trips, internships, jobs, summer camps, and STEM curriculum are good news, and APA has attracted deserved attention. At the same time, the school has wrestled with a number of deep-seated challenges since opening in 2007, and the lessons on what happens when theory gets put into practice are instructive for other similarly minded high schools.

A Struggling School. First and foremost, APA struggles mightily with respect to academics. In the 2012–13 school year, for example, no APA student met the college-readiness threshold on the ACT, while a mere 13 percent of APA juniors hit the benchmark on the state math assessment.[14] APA's four-year graduation rate is 45 percent, and less than 50 percent of students from the classes of 2011 and 2012 have gone on to college. The school is classified under CPS's progress reports as Level 3 (the lowest) and has been on probation for the past four years.[15] APA's principal, Ali Muhammad, said the school's performance is reflective of the community—a low-income area with a high crime rate. This is supported by Varela, who cites the prevalence of gang violence in the Austin, Chicago, area and the lack of parental support as major difficulties.

What's more, an especially high dropout rate—"transient students," in Muhammad's words—means that although APA started the 2013–14 school year with 220 students, that number dropped to 165 by midyear. Given that CPS funding is tied to the number of students a school enrolls, this state of affairs has financial implications in addition to educational ones.

As such, one common complaint the school faces is that it is unwise to put students who are several grade levels behind in math in more challenging manufacturing courses. Swinney is quick to emphasize that such classes allow students to contextualize what they are learning in math classes; as opposed to the sometimes dry memorization of facts and abstract concepts, engineering is math in action, with real-world implications. While that makes intuitive sense,

when student achievement is below the 10th percentile for all grade levels compared to Chicago schools at large, it is likely to seriously limit success in tackling more advanced concepts.

Massive leadership instability, both in the CPS system and at APA, has also not helped. Since APA's opening in 2007, the district has seen five different superintendents, and the school itself has had four different principals. "There is no institutional memory," Swinney lamented, and this adds yet another obstacle for a school trying to create a positive culture around manufacturing.

Limited Field Experience. A related difficulty concerns the practical, hands-on side of Manufacturing Renaissance's vision. While the fact that 47 percent of APA graduates have paid job experience is encouraging, just a handful of APA graduates continue on to a career in manufacturing or engineering. In 2013, Swinney estimates that this was about 20 percent of the graduating class, or 9 or 10 students. This rate has held steady: since 2011, according to Manufacturing Renaissance's internal figures, the program has made 36 full-time manufacturing job placements. Given the small size of the school, there is a natural limit to how many students will continue on to manufacturing careers. And yet, at first blush, this number seems low for a school dedicated to manufacturing and engineering.

Again, part of the problem stems from APA's general academic difficulties: time for field trips or job placements is, quite simply, a luxury when the school is on probation and must hit set student achievement targets. This is compounded by Manufacturing Renaissance's unique role within the school, and the sometimes conflicting aims of Manufacturing Renaissance and CPS. For example, it is a district-wide policy to allow just a single day for job shadows. While this might be a sensible precaution against abuse at other Chicago high schools, it is a burden for a school like APA.

Also, CPS—not Manufacturing Renaissance—is responsible for hiring all teachers. In its first few years especially, CPS hired teachers first and foremost to fill empty slots, regardless of whether teachers supported (or were even aware of) the school's manufacturing mission. "The program was at the mercy of whatever misconceptions about manufacturing teachers and administrators who were hired brought with them," Swinney recollected. "For years there was a major disconnect between APA staff and the work we thought we were there to do." While Swinney alluded to the healthy relationship Manufacturing Renaissance currently enjoys with the district and APA faculty—"I'm confident the vast majority of staff now support the program," she said—such barriers are likely to limit the scope of the project.

Community Engagement. And it's not just teachers who were skeptical. APA has had difficulties convincing the Austin community that the school's model is a good one. In Swinney's words, manufacturing has become a "foreign concept [with] a negative legacy" in Austin. The local African American community, rightly or wrongly, often associates manufacturing with racist labor unions and high school students being tracked into manufacturing jobs rather than being pushed toward higher education. Swinney says she has had to work to convince the area that manufacturing is a worthwhile career and that modern manufacturing entails far more training and technical skills than the assembly-line jobs of the past.

To do so, Manufacturing Renaissance invested heavily in modern manufacturing tools for APA, including building a state-of-the-art machine shop in 2009 and bringing in families to see the new, revamped facilities. The shop was built to teach a type of machining called computer numerical control (CNC), which programs computers to automate the process by which metal and other materials are cut. Swinney referred to CNC as the "basic unit of technical skills needed by operators and programmers" entering the machinist profession, citing the growth in CNC jobs as the reason behind Manufacturing Renaissance's decision to invest so heavily in the shop.

CNC is a good example of what Swinney means by "advanced manufacturing," or the fact that today's manufacturing jobs require more than a high school diploma. As recently as the 1950s, machinists manually operated metal cutting machines using levers. But the advent of numerical control in the late 1940s allowed this to be done via punched ticker tape, and the widespread availability of computers over the past couple of decades further expedited this process.[16] In other words, over the course of two generations, a fairly basic manufacturing job of cutting materials went from wholly manual to heavily computerized, and the level of skills needed to get a job in the field has risen as a consequence.

With its APA machine shop, and with an eye to using it for wider community development in addition to high school classes, Manufacturing Renaissance started hosting night classes in 2011 for adults. The classes meet for four hours two nights a week for 10 months, after which the adults receive between three and five NIMS credentials and help from Manufacturing Renaissance with job placements. Initially, Manufacturing Renaissance struggled to fill available seats, but participation has grown recently and, to date, about 45 adults have completed the program.

Questions of Scalability: Fundraising, Staffing, and Costs. Finally, this entire effort is labor intensive and financially burdensome. Manufacturing Renaissance has five full-time staff at APA to run just the manufacturing program—this in a school that enrolls less than 200 students. Manufacturing Renaissance also raises about $500,000 per year to pay salaries and build infrastructure for the school, and when it decided to build the new machine shop, the school had to rely on an influx of one-time private support of more than $150,000. Such an investment in both man hours and money might be possible for a single school and with the dedicated support of a partner like Manufacturing Renaissance, but it seems like a much more difficult ask to scale beyond that.

When questioned about these costs, both Dan and Erica Swinney counter that the cost of inaction far outweighs the short-term costs of opening the school. That is, by educating students in advanced manufacturing, APA is laying the groundwork for a revitalized middle class, lower unemployment, a larger tax base, and future job creation. That may well be the case, but the fact remains that startup costs are not insignificant, and it takes strong leadership and political will in the face of competing reforms (such as expanded prekindergarten, better health care, and affordable housing) to invest limited funds in an experimental manufacturing high school.

In April 2014, Chicago Mayor Rahm Emanuel announced that APA had received a 4.5-year, $2.7 million grant from the US Department of Labor to increase its number of internships and job shadows, provide more teacher professional development, and offer more NIMS-certified

courses.[17] Swinney called this a "capacity-building grant" whose explicit purpose is to "find promising models that are effective at connecting secondary students to STEM career paths for both work and college." Manufacturing Renaissance has robust plans for the funding, including a substantial rebranding, hiring new staff, and expanding course offerings (which is further detailed in the next section). Much of this is generally helpful and shows a real willingness on Manufacturing Renaissance's part to evaluate its model and make changes. At the same time, though, it is highly unlikely that other high schools would have access to such financial support; only 24 organizations received Labor Department grants out of more than 400 applicants, for example.[18] Other high schools looking to start similar manufacturing training programs will need to take a hard look at the requisite finances before proceeding.

Going Forward

It is possible that the $2.7 million investment will go a long way in rectifying some of the aforementioned challenges APA faces. But there are also reasons to be cautious. As with many education reform fads, there is a temptation to find a single success story and prop it up as the silver bullet for all reform challenges: Concerned about the dearth of American manufacturing jobs and recognize the growing need for some level of higher education to find a job in a constantly evolving sector? Have no fear: this high school in Chicago is churning out students ready for manufacturing jobs *and* engineering degrees to boot.

The silver bullet narrative oversimplifies the hard work necessary to make a school like APA a reality, and it papers over the cracks beneath the surface. It's also not what APA aspires to be. "In no way did we see ourselves as a silver bullet," Dan Swinney recounted. "That's an impossible task." Rather, the hope was, first, to demonstrate that manufacturing as an industry was a viable route to the middle class and, second, that public education could be a viable link to the manufacturing sector. But APA was just a single testing point.

The truth is, a school like Austin Polytechnical Academy—which is in a major city, educating a low-income student body, and providing practical skills—can be a real positive. But it is important to push back on overhype and focus on a handful of lessons for districts and schools looking to emulate APA.

1. **Be willing to adapt**. As mentioned earlier, the $2.7 million Department of Labor grant was given to Manufacturing Renaissance both as past acknowledgment of the work done at APA and as support to improve and update that model. And there has been a great deal of updating. As Swinney tells it, the grant application forced a hard look at Manufacturing Renaissance's model. Now called Manufacturing Connect, APA's rebranded STEM program is something students actively enroll in as opposed to simply being part of by virtue of attending the school. "The reality," Swinney said, "was only 50–60 percent of the students at APA participated in [Manufacturing Connect] at any one time."

   Manufacturing Connect is now a unique program within the larger school. Interested APA students apply to Manufacturing Connect and, if admitted, enroll in a more coordinated, multiyear program. The hope is that this creates a stronger program targeted

toward those students who are truly interested. Of the 140 students currently at APA, 110 are in Manufacturing Connect.

The Department of Labor grant will also help Manufacturing Renaissance fund two new hires: one to oversee a formal mentoring program, and one postsecondary coach with explicit knowledge of two- and four-year institutions that accept students' NIMS credentials. The grant will also make financial aid available for women and minority STEM students and facilitate local manufacturing career connections.

2. **Foster excellent academics**. It is important to note that Manufacturing Renaissance made an intentional decision to work at APA, an inner-city school with low levels of student achievement, and views its work as part of a larger community revitalization initiative. Some of the academic challenges it faces would likely not be as pronounced in, say, a suburban school. Still, in the educational accountability era, schools are under increasing pressure to hit academic performance targets. In certain cities and states, schools and even teachers are graded and evaluated based in large part on the value-add they contribute to student academic growth. This trend is likely to increase as the Common Core State Standards and corresponding assessments are rolled out in a majority of states over the next couple years.

   A school that wants to emphasize manufacturing careers or engineering skills needs to make sure it has a rigid focus on providing excellent academics across the board. This includes remedial classes to help incoming students catch up on fundamental math and English. It is quite possible that the voluntary, week-long summer camp APA provides is simply too limited to address that deficit (not to mention that it is optional). Something longer and more robust should be considered.

3. **Have willing industry partners**. A vital part of APA's vision is combining classroom instruction with on-the-ground experience. As such, it is crucial for schools to partner with industry leaders for job shadows, internships, and field trips. This need not be limited to students visiting a company; schools could also have industry veterans guest teach classes or otherwise interact with students. In turn, the school's curriculum also has to be closely connected to industry demands. As Swinney argued, any such program "has to reflect the needs of the industry."

4. **Ensure community and district buy-in**. For a school to attract students, build support, and engender goodwill, it is important that the school itself is just one piece of a larger agenda for community workforce development. Swinney sees APA as a catalyst to spur economic development in the area, to support the neighborhood, and to attract companies to west Chicago. Using facilities for night classes for local adults could help. As important as community support is full buy-in from the school district. Some of the problems APA faces stem from having to work around CPS requirements, including how many days can be set aside for job shadows and the fact that CPS hires teachers. A school looking to imitate APA would first need to get its district's blessing.

Conclusion

The story of Austin Polytechnical Academy—from its idealistic founding with aims to revitalize a community, to its early praise from people across the country, to its more recent struggles with student achievement and scalability—is worth telling for its lessons about what it takes in terms of community and industry buy-in, financial muscle, and long-term vision to offer a manufacturing and engineering curriculum at a traditionally low-performing urban high school. If the country is serious about offering multiple pathways to both college and careers, such an effort will need to start at the K–12 level. APA offers one useful reference case for local district and industry leaders, educators, and policymakers.

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Community College Partnerships with Automobile Manufacturers: Employment Drivers?

KC Deane

In recent years, a number of automotive manufacturers with major US plants have collaborated with community colleges to design and implement factory-specific training programs. Older workers in these communities are beginning to retire, and partnerships with community colleges allow the factories to replace retiring workers with well-trained new employees. The manufacturer benefits from a more reliable pipeline of skilled workers, the student obtains a flexible credential and some assurance that his or her efforts are likely to translate into a worthwhile job opportunity, and the surrounding community gains the peripheral benefit of a more highly educated workforce.

For all the good that comes of these programs, their scalability is unquestionably limited. While students work part time during their training, they aren't full time until program completion, which slows the manufacturer's rate of replacement. And, unless the programs are supported by philanthropic donations, the up-front costs of purchasing the necessary equipment and establishing lab space are steep for both the automotive manufacturer and the community college. In these particular programs, student cohorts are small in size, constrained by physical capacity and the labor needs of the partner factory.

This case study discusses three such automotive partnerships.[1] Two of the three partnerships—Mercedes-Benz with Shelton State Community College, and Volkswagen with Chattanooga State Community College—place students on a clear pathway from college to employment at the partner's factory. Both programs are relatively new, but each began in response to the manufacturer's long-time presence in the local community. In contrast, a third program—one between State University of New York (SUNY) Canton and Subaru—approaches the partnership as a mutually beneficial opportunity to leverage shared resources and, in the process, help students gain valuable workplace skills. Subaru helps SUNY Canton outfit on-campus lab space, and the community college agrees to share the lab space with Subaru for new employee training.[2] As an added benefit, students who enter the school's automotive technology program have the opportunity to take Subaru training courses as an extracurricular during their senior year.

Federal, state, and local policymakers, educational institutions, and other industries can learn from the implementation and effectiveness of these boutique training programs. From the careful development of their curricula to their recruitment strategies and their finance and tuition models, these three programs exemplify the benefits and drawbacks of industry- or company-specific educational partnerships.

Program Structure

All three partnerships rely heavily on the existing course offerings of the community college but then supplement those offerings with courses designed specifically around the training needs of the manufacturer. At both Shelton State and Chattanooga State, existing courses account for more than 80 percent of the partnership program's curriculum.

Shelton State's partnership with the Mercedes-Benz factory in Tuscaloosa, Alabama, formalized what had been an informal partnership for almost 20 years. Since January 2012, students who complete the Shelton State–Mercedes-Benz mechatronics program earn 99 credit hours over seven terms and receive an associate in applied science (AAS) degree in industrial electronics.[3] Since the credit requirements exceed what is required of a traditional associate degree (60 credits), graduates also receive a short certificate in industrial maintenance.[4]

Volkswagen's partnership with Chattanooga State grew out of an earlier partnership with Tennessee College of Applied Technology–Chattanooga. After three years operating in partnership with the technical college, Volkswagen made the decision to require coursework in language arts in addition to science, technology, engineering, and math (STEM) coursework, which necessitated the partnership transition to Chattanooga State. "It became apparent to everyone what [Volkswagen] would like is an associate degree program," said Mike Ricketts, dean and department head at Chattanooga State. Graduates of the current iteration of the program receive an AAS degree in systems engineering technology with a concentration in either automation or car mechatronics, as well as an industrial mechatronics certification from Volkswagen Chattanooga.

In contrast to the other two programs, SUNY Canton—which offers an AAS degree in automotive technology—did not tailor its existing program to meet Subaru's needs. Instead, SUNY Canton agreed to house a new training center, SUNY Canton Subaru Training Center. Subaru gets on-campus space to train its new employees, which SUNY Canton faculty and students have access to when not in use by Subaru. Furthermore, when the Subaru training classes are not at capacity, SUNY Canton opens enrollment to senior automotive technology students with at least a B average. If those students go on to work at Subaru, the courses count toward new employee training requirements.

Financing and Tuition

In all three partnerships, significant startup funds were required either from the automotive manufacturer or through a state grant. As displayed in table 1, at Shelton State, Mercedes-Benz provided the program with a $1.6 million injection of capital in early 2013; this money was used to purchase the requisite lab equipment and build out the facilities to support the new program. At Chattanooga State, the work began in 2008 when the Tennessee Community Development Program awarded Volkswagen with a $577 million incentives package, $16 million of which went to the development and expansion of the Volkswagen academy.[5] In 2012, SUNY Canton launched the partnership with Subaru using an initial investment of $500,000 to purchase new equipment required for Subaru's training classes.

Table 1. Information about Partnerships at Shelton State, Chattanooga State, and SUNY Canton

	Shelton State/ Mercedes-Benz	**Chattanooga State/ Volkswagen**	**SUNY Canton/ Subaru**
City, State	Tuscaloosa, AL	Chattanooga, TN	Canton, NY
Initial Investment Amount (Source)	$1.6 million (Mercedes-Benz)	$16 million (Tennessee Department of Economic and Community Development)	$500,000 (SUNY Canton)
Year Launched	2012	2010	2012
Credential Offered	AAS, industrial electronics	AAS, systems engineering technology	AAS, automotive technology
Additional Credentials	Industrial maintenance certificate	Industrial mechatronics certification (Volkswagen)	Credit toward new employee training at Subaru (if employed there)
Credit Hours Required	99	63	66
Annual Cohort Size	35	12	40
Guaranteed Employment?	Yes, based on academic performance	No	No
Job Placement Rate, Most Recent Cohort	Not available	13 at Volkswagen, 13 in total	3 at Subaru, total not available

Source: Interviews conducted between January and February 2014 with Mike Ricketts, dean and department head at Chattanooga State; Ralph Gwaltney, coordinator of the automotive mechatronics program at Chattanooga State; Tim McGhee, dean at Chattanooga State; Steve Fair, former dean of technical services at Shelton State; Jason Moore, associate dean for business and industry services at Shelton State; and Brandon Baldwin, curriculum coordinator and assistant professor of automotive technology at SUNY Canton.

While the financing structure is similar across all three programs, the tuition model varies. At Shelton State, the amount of a student's tuition paid by Mercedes-Benz varies each semester. In a student's first term, Mercedes-Benz pays 65 percent of tuition. By terms four through seven, a student with a GPA above 3.0 receives 100 percent tuition assistance, while a student with a GPA below 3.0 receives only 50 percent tuition assistance. At Chattanooga State, students are eligible for traditional forms of federal financial aid, and Volkswagen offers a small scholarship

to some students based on academic performance and attendance. The community college receives all tuition and fees, which are used to support partnership responsibilities.

In Subaru's partnership, which is a space- and enrollment-sharing agreement, students who are eligible for enrollment in one of the Subaru classes are not required to pay additional tuition or fees. The classes do not count toward the student's degree, and access is based on merit and the availability of open seats. In that sense, the course offerings might be better described as an extracurricular activity than a traditional course taken as part of a degree program.

Recruitment

For the programs at Shelton State and Chattanooga State, successful recruitment draws on each manufacturer's long history in its respective community and on a clear articulation of demonstrated value. Both Mercedes-Benz and Volkswagen are known as well-respected, high-quality employers, and program staff know to advertise this reputation. "Mercedes is, of course, one of the best paying and best careers here in West Alabama," said Steve Fair, former dean of technical services at Shelton State. But that doesn't make recruitment a cinch.

When attracting students into these longer-length programs, both programs focus recruitment efforts on local high schools (although the programs are by no means limited to this demographic), where they can communicate the value of the program to the greatest number of students at once. "Mercedes-Benz has put a lot of effort [into] trying to get information sessions at different schools, high schools and school systems in the afternoons [and] evenings. Invite the parents in and explain the program and all of the opportunities," said Fair. He further emphasized the importance of catering the message to parents. "They would love to see their children be able to make a living and remain in this area, to know that there's a good quality of life they can attain right here in West Alabama."

Recruiters also emphasize the tangible benefits of the program, from the potential employment opportunity with the partner automotive company to the transferability of the credential and average industry-wide starting salary. At Shelton State, the top 75 percent of students in each cohort are automatically accepted into an additional 18-month training program at the Mercedes-Benz factory.[6] Volkswagen makes no promises about whether students in the Chattanooga State program will be offered employment with the company, but highlights the labor market value of the credential. Workers in the industry had an average hourly wage of $21.23 in 2010, compared to a median hourly wage of $14.38 for all workers in Tennessee.[7] And, even without the employment guarantee, the odds are promising: 24 of the 25 students from the first two cohorts now work for Volkswagen.[8]

Although they recruit intensively, Shelton State and Chattanooga State must also be rigorous in their admissions process: both programs receive about three times as many applications as they can accept. "We will bring in for an interview everybody that meets the qualifications. This gives Volkswagen an opportunity to look at every one of them a little bit closer than just the application process," said Ralph Gwaltney, coordinator of the automotive mechatronics program at Chattanooga State. He continued, "If a student likes taking stuff apart, but doesn't necessarily know how to get it back together, that's the kind of person we're looking for. We can teach you

the getting back together part, but you've got to have that desire to get in there and manipulate things with your hands and use your mind to solve problems."

SUNY Canton's partnership is not built around a specific program offering, nor is there any guarantee of employment with the partnership company, two differences that change the recruitment strategy. Instead, SUNY Canton uses social media and traditional recruitment strategies to demonstrate to prospective students what they will learn and how they can apply those skills to any number of jobs.

This isn't to say that there is no pipeline between SUNY Canton and Subaru. The Subaru distribution center entered the partnership with SUNY Canton in the hopes that doing so would help set a precedent that graduates can work at Subaru. The classes that Subaru holds on the SUNY Canton campus are required for all Subaru employees, which means that SUNY Canton students who complete these courses are completing training that, were they to take a job with Subaru, would be required in the early stages of their employment. On average, between four and five students at SUNY Canton take the training classes each year; of those who took the classes last year, three now work for Subaru. Those who do not work for Subaru have frequently accepted other, more attractive job offers.

Lessons and Limitations

Despite the promise of these programs, there are a number of limitations. First, while students who graduate from them frequently benefit from high starting salaries and promising job guarantees, the programs serve a small portion of students enrolled at community colleges nationally. Each automotive manufacturer has a finite demand for new labor, and each benefits from limiting access while attracting students whose existing skills best fit the needs of the company and the demands of the program. This isn't a criticism; oversaturating the job market with skilled workers—without the accompanying demand—is not a desired outcome. But it does show that such partnerships would have to be replicated many times over, across a wide array of fields, to make a dent in the nation's skills gap.

Furthermore, these programs tend to target students straight out of high school, not adults who had previously opted out of postsecondary education. At Shelton State, the majority of students are straight out of high school. The same is true at Chattanooga State: in the third cohort of 12 students, 9 came straight from high school.

Finally, these programs are expensive to fund, especially given the small number of students they serve. At Chattanooga State, a grant from the state workforce development program supplemented early costs incurred by Volkswagen. At Shelton State and SUNY Canton, the initial capital infusion came directly from the automotive manufacturer. Even with support for startup costs, lab space is at a premium, which further limits the total number of students that the programs can enroll. "We can only train so many people because of lab space, equipment availability, and instructor resources," said Jason Moore, associate dean for business and industry services at Shelton State. The Volkswagen partnership is similarly limited: early cohorts had 20 students, but as Gwaltney explained, the Volkswagen Academy "didn't have enough machines to keep everybody active and busy," so they have since decreased the cohort size to 12.

Despite the limitations, these partnerships set a powerful example: by working together, community colleges and employers can ensure that program offerings are better aligned with workforce needs. Both Mercedes-Benz and Volkswagen have harnessed the existing resources at community colleges to develop a credential with clear labor market value, and the community colleges have bolstered their own programmatic offerings by leveraging the funds provided by the automotive manufacturers. Subaru could have built its training center independent of SUNY Canton, but the decision to partner with the college was a win for the community, as it resulted in more affordable training for Subaru, additional resources for SUNY Canton, and valuable labor market training for students.

College students' desire for credentials with tangible value will likely become more common in the coming years. Training efforts that capitalize on these desires, whether through partnerships or alternative training programs, will have an edge in the recruitment process. Consider recent trends in other high-demand industries, such as programming and technology. Computer programming "boot camps"—typically 12-week intensive programs—highlight program outputs (for example, job placement rates and estimated salary) instead of the more traditional student inputs (such as admission selectivity or average SAT scores). And new rankings—by *Money* magazine, *Washington Monthly*, PayScale, and others—focus on postgraduation earnings and the return on investment that a student receives from the college credential, not the college's reputation or selectivity.[9]

But challenges remain. These partnerships are successful in large part because the automotive manufacturers are a key player in their communities' economic development: they provide well-paying jobs to dozens, sometimes hundreds, of residents. Not all companies have the luxury of developing a highly selective program to train potential future employees, and an influx of boutique programs may not cast a wide enough net to significantly influence large-scale workforce development. Likewise, community colleges in areas that lack the presence of an industry with demand for highly skilled workers may struggle to develop fruitful partnerships that lead to valuable credentials for residents.

It's more likely that the success of the boutique model presented here is context dependent: In regions with a clear skills gap and existing industry presence—as is the case with these automotive manufacturing partnerships—there are opportunities to replicate or even scale partnerships that align credentials with employer needs. But for the majority of the nation's struggling communities, a small-scale model focused on a single industry is just one small part of overcoming the skills gap.

Notes

1. Unless otherwise noted, all quotes derive from interviews conducted between January and February 2014.
2. As this brief was being published, SUNY Canton was in conversations with Subaru to revamp the partnership model. No further details were known or publicly available.
3. Mercedes-Benz US International Inc., "Mercedes-Benz Industrial Mechatronics Training & Curriculum," www.mbusi.com/employment/mechatronics-training/mech-trainingandcurriculum-main.
4. Shelton State Community College, "Mercedes-Benz and Shelton State Partner to Provide

Students with Technical Training and Job Opportunities" news release, October 1, 2011, www.sheltonstate.edu/Uploads/Files/News/Mercedes-Benz%20Plant%20Launches%20Industrial%20Training%20Program%20with%20Shelton%20State.pdf.
5. William F. Fox, Matthew N. Murray, and Ann Boyd Watts, *Economic and Sales Tax Revenue Effects of Volkswagen's Location of its Automobile Assembly Plant in Chattanooga, Tennessee* (University of Tennessee Center for Business and Economic Research, August 2008), www.newschannel9.com/news/features/files/VW_Economic_Impact_Study_0830.pdf.
6. The first cohort of this program graduated in May 2014.
7. For recruiting information, see Chattanooga State Community College, "Engineering Technology," www.chattanoogastate.edu/sites/default/files/imported/engineering-technology/packet/amp-pkt.pdf. For information on Tennessee workers' wages, see Bureau of Labor Statistics, "Occupational Employment Statistics: State Occupational and Wage Estimates Tennessee," May 2010, www.bls.gov/oes/2010/may/oes_tn.htm#00-0000.
8. The 25th student is pursuing additional education.
9. See "The Best Colleges for Your Money," *Money*, http://time.com/money/collection/moneys-best-colleges/; "2014 Best Bang for the Buck Rankings—National Universities," *Washington Monthly*, www.washingtonmonthly.com/college_guide/rankings-2014/best-bang-for-buck-national-universities-rank.php; and "2014-2015 Payscale: College Salary Report," PayScale, www.payscale.com/college-salary-report.

Enroll in School to Go to Work: Cooperative Education Programs

Kevin J. James and KC Deane

In 1906, the University of Cincinnati's dean of engineering, Herman Schneider, noticed two related problems: First, students tended to work part-time jobs while in school, but these jobs rarely related to their career plans. Second, some curriculum elements, especially in a technical program like engineering, seemed best taught by experience.[1] To address this challenge, Schneider founded the nation's first cooperative education (co-op) program, an alternative degree pathway where students blend college coursework with hands-on work experience related to their area of study.

Since then, co-ops have become more widespread in American higher education, although how widespread is difficult to assess. Part of the reason is that co-op programs are similar in nature to other forms of experiential learning. As Scott Maynard, director of the Career Center at Mississippi State University, pointed out, "All forms of applied learning are coming into major focus now more so than ever, and co-op programs are just one example. Others forms of experiential education include internships, service learning, externships, and parallel co-op programs where students attend school and work to obtain experience prior to graduation."[2] Peter Franks, vice provost for career education at Drexel University, makes a similar point, saying that "While almost every institution offers some form of experiential learning, in most cases that consists of internships or programs on extended winter breaks." He estimates that a few hundred institutions in the United States offer formal co-op programs, although most do so only for a limited number of majors.

Maynard's comments illustrate that even the term "co-op" can refer to multiple types of experiential learning. Specifically, in "parallel" co-op programs, students frequently switch between the classroom and the workplace, typically multiple times a week. This model is similar to a traditional internship—each week, students take courses over three or four days and spend a number of hours at a firm working in an entry-level position. In contrast, an "alternating" co-op model requires that students switch, typically term to term, between full-time employment (often paid) and full-time school on a longer timeframe. In theory, this model gives students an opportunity to dig deeper into real projects, build a relationship with their employer, and take on more responsibility, each of which should lead to a higher-quality co-op experience for both the student and the employer.

The distinction between these two models is critical. As we discuss in this case study, co-op programs that provide students with an extended period of paid employment in their field potentially provide a more valuable and accessible on-ramp to the workforce than traditional internships or parallel co-op programs. For that reason, we do not focus on internships or parallel co-ops but, instead, examine two longstanding and well-regarded alternating co-op programs. The first is the program at the University of Cincinnati—where the idea was born—and the other is Drexel University's co-op program.

Like any model, it is helpful for policymakers and practitioners to understand more fully its benefits and limitations. We look at the mission, structure, and costs of both alternating co-op

programs to help illuminate why they have proven successful at their respective institutions, and the conditions under which similar programs may be helpful additions to other institutions' efforts to prepare students for the world of work.

University of Cincinnati

Cincinnati's co-op program began in 1906 when Schneider submitted a proposal for a one-year trial program to the university's board of trustees.[3] Despite general skepticism at the time, the plan narrowly passed. There were only 27 male students in the first co-op program: 12 mechanical, 12 electrical, and 3 chemical engineers. The program divided students into pairs in which one attended classes for a week while the other worked at a local company; they would then switch off the next week.

Positive program reviews encouraged the board of trustees to continue what would later be called the Cincinnati Plan. As the program expanded, the employer community came to support it, viewing it as "a dominant feature of Cincinnati, well-known even to those employers who do not use [it]."[4] Today, the program has grown to encompass new academic disciplines and has expanded internationally to offer co-op placements in countries such as Germany, Japan, Chile, and Mexico.[5]

Participation. The University of Cincinnati's co-op program had 5,529 participants out of an overall undergraduate student body of 25,583 in the 2010–11 school year.[6] While the co-op program is not available across all academic disciplines, two of Cincinnati's colleges—the College of Engineering and Applied Science and the College of Design, Architecture, Art, and Planning—have a mandatory co-op requirement for all their students; students specifically within the Information Technology Department in the College of Education, Criminal Justice, and Human Services must also participate in the program to graduate. The co-op is an option for business students as well.[7]

Schedule. In most academic programs at the University of Cincinnati, students can choose between a co-op schedule that would allow them to finish a bachelor's degree in four years and one that includes more co-op placements but takes five years to complete. Some programs group students into different sections that allow employers to hire two students that will alternate terms, ensuring that the employer always has a student to fill the co-op position in any given term. Tables 1 and 2 show example schedules from different disciplines at Cincinnati.

Table 1. Co-op Schedules for the School of Design, Architecture, Art, and Planning

Five-year schedule

	Fall	**Spring**	**Summer**
Year 1	School	School	Vacation
Year 2	School	Co-op	School
Year 3	Co-op	School	Co-op
Year 4	School	Co-op	School
Year 5	Co-op	School	Graduation

Four-year schedule

	Fall	**Spring**	**Summer**
Year 1	School	School	Vacation
Year 2	School	Co-op	School
Year 3	Co-op	School	Co-op
Year 4	School	School	Graduation

Source: University of Cincinnati, "Co-op under Semesters," www.uc.edu/propractice/uccoop/employers/currrent_employers/semester_conversion/co-op_under_semesters.html.

Table 2. Co-op Schedules for the Carl H. Lindner College of Business (example of alternating between two sections of students)

	Year 1			Year 2			Year 3		
	Fall	**Spring**	**Summer**	**Fall**	**Spring**	**Summer**	**Fall**	**Spring**	**Summer**
Section 1	School	School	School	Co-op	School	Co-op	School	Co-op	School
Section 2	School	School	Vacation	School	Co-op	School	Co-op	School	Co-op

	Year 4			Year 5		
	Fall	**Spring**	**Summer**	**Fall**	**Spring**	**Summer**
Section 1	Co-op	School	Co-op	School	Graduation	
Section 2	School	Co-op	School	Co-op	School	Graduation

Source: University of Cincinnati, "Co-op under Semesters," www.uc.edu/propractice/uccoop/employers/currrent_employers/semester_conversion/co-op_under_semesters.html.

Student Support. The University of Cincinnati offers an introductory course for co-op participants that is designed to prepare students for the workplace and maximize their experience in the co-op program.[8] The program also assists students in finding a position. As a result, almost all student participants are placed with employers. In 2011, for example, the program successfully placed 95.6 percent of students in co-op employment.[9] Furthermore, the program requires that all participating students receive a performance review by their co-op employer at least once during each co-op term, a tool that helps student advisers at Cincinnati guide students' professional development.[10]

Geographic Placement. The university has students working with more than 1,500 organizations located in more than 30 states and a dozen countries. The majority of students work their co-ops in the Midwest region, with more than 40 percent of students working in the greater Cincinnati area. The remaining 60 percent, who work outside of the Cincinnati area, have to move away from home and school for their placement.[11] Because the university only charges students while they are enrolled in traditional academic semesters, students use their earnings to pay living expenses. During co-op semesters, students pay a fee of $465 per term to help cover the costs of the program.[12]

Co-op Salary. At Cincinnati, the average co-op salary is between $1,700 and $2,500 per month (roughly equivalent to $20,000–$30,000 per year).[13] According to the program's annual report, "UC co-op students earned a collective $43 million, averaging close to $7,800 per co-op term worked. That's up from a collective $38.6 million earned by UC co-op students in fiscal year 2010."[14] Only a small fraction of co-op positions are unpaid (roughly 1.9 percent in 2011).[15]

Drexel University

Drexel University's co-op program began in 1919, making it slightly younger than Cincinnati's but still one of the oldest such programs in the world. Founder A. J. Drexel believed that the university should be an institution that prepared students for the professional world by balancing book learning with on-the-job practical experience. Drexel's four-year co-op program began by serving three majors in the College of Engineering, but by 1925 it had added a five-year program that would serve as the basis for the more than 75 majors that participate in the program today.[16]

Participation. Drexel students in a wide variety of majors are eligible to participate in the co-op program. The option is open to majors in the College of Arts and Sciences; College of Business; College of Engineering; College of Nursing and Health Professions; School of Biomedical Engineering, Science, and Health Systems; College of Computing and Informatics; College of Professional Studies; and the College of Media Arts and Design. Unlike some majors at Cincinnati, Drexel's co-op program is not mandatory. Despite that fact, however, participation rates among eligible students are very high: for the 2014–15 school year, 91 percent of eligible undergraduates at Drexel were participating in a co-op program.[17]

Table 3. Drexel's Four-Year, One Co-op Option

	Fall	Winter	Spring	Summer
Year 1	School	School	School	Vacation
Year 2	School	School	School	School
Year 3	Co-op	Co-op	School	School
Year 4	School	School	School	Graduation

Source: Drexel University, "Undergraduate Programs: Sample Co-op Schedule," www.lebow.drexel.edu/academics/programs/undergraduate/co-op/co-op-schedule.

Table 4. Drexel's Five-Year, Three Co-op Option

	Fall	Winter	Spring	Summer
Year 1	School	School	School	Vacation
Year 2	Co-op	Co-op	School	School
Year 3	Co-op	Co-op	School	School
Year 4	Co-op	Co-op	School	School
Year 5	School	School	School	Graduation

Source: Drexel University, "Undergraduate Programs: Sample Co-op Schedule," www.lebow.drexel.edu/academics/programs/undergraduate/co-op/co-op-schedule.

Scheduling and Support. As is the case at the University of Cincinnati, students attending Drexel have the option of pursuing a four- or five-year program. Tables 3 and 4 provide sample schedules within Drexel's co-op program. The university automatically registers all participating students in an introductory co-op course that is designed to help them secure a co-op placement. The program also pairs students with a designated co-op coordinator who assists and guides them through the entire experience.[18] As with the program at Cincinnati, the placement rate is very high: in 2014, Drexel successfully placed 98.2 percent of co-op participants in a position.[19]

Geographic Placement and Co-op Salary. Co-op students at Drexel are placed in states across the US as well as internationally. According to numbers from 2014, Drexel maintains 1,717 employer partners in 33 states, with an additional 48 locations worldwide. More than 80 percent of students still choose to do their co-ops at companies in North America, however, with the three most popular states for placement being Pennsylvania, New York, and California.[20] As with the University of Cincinnati, Drexel students do not pay tuition while not enrolled academically,

although co-op students pay a $790 fee per co-op term. According to the data Drexel has made available, students participating in the co-op program earned an average of $16,880 per six-month co-op term for the 2013–14 academic year (equivalent to about $34,000 annually). All of Drexel's co-op positions are paid.[21]

Discussion

What are the strengths and limitations of these co-op models? In the following paragraphs, we examine this question from the perspectives of the three different stakeholders: students, employers, and universities.

Students. Students are the primary beneficiaries of co-op programs. Those that choose to participate have the opportunity to gain valuable experience in a workplace setting while earning money that can help offset college costs or be put toward other expenses. This is in contrast to more common internship programs that pay little or nothing and are frequently unrelated to a student's future career plans. In a *Forbes* interview, M. B. Reilly, the University of Cincinnati's public relations director, argued that "with real money on the table, employers are extremely unlikely to provide students 'busy' work. Since the money is real, the responsibility is real."[22]

In addition to building valuable work experience, students have the opportunity to learn whether their chosen course of study is really what they'd like to do for a career. This can be one of the biggest benefits of a co-op, said Franks: "We have found that after the first co-op term, 10 percent of students change their major. Or they might come back and say they like business, but I don't think accounting is for me. It really does help a student focus on where they're heading career-wise." He added:

> We strongly encourage students having the opportunity for multiple work terms to try different types of experiences usually with different employers. This provides the student the ability to see different experiences and types of organizations. This is a time in your life when you should experiment with different career options. . . . And because they're working full-time and not in classes, we're able to locate them anywhere in the U.S. or around the world.

The main cost to students participating in a co-op program is their time. By participating, a student may delay his or her graduation and thus give up a semester or a year's worth of postgraduate earnings. And while students receive compensation during their co-op experience, those wages are likely less than what they might earn as a starting salary once they have graduated. Therefore, to be considered a worthwhile investment (from a pecuniary perspective), the student's co-op experience must pay off through improved labor market prospects, a higher salary, or both. According to a Purdue University study, students respond to this trade-off: a $10,000 increase in the real average starting wage for a particular field causes a 5.4 percent drop in participation in co-op programs.[23]

More broadly, a number of studies have shown that co-op students are more successful at finding a job and earning a higher salary after graduation.[24] One study, however, examined a longer time horizon and found that while co-op students had higher starting salaries, that gap disappeared

over time.[25] Looking at nonpecuniary benefits to co-ops, a focus group study in 2000 found that co-op program graduates had a thorough skill set, strong background knowledge, and confidence to jump in and tackle most problems.[26]

One limitation of most of these studies is that they are not able to fully control for selection effects that might bias their results. For example, if the students who are the most motivated or most interested in finding a high-paying job are the most likely to participate in co-op programs, the positive effect might actually be largely due to differences across students. Some studies have attempted to address this by controlling for student grade point average. For example, a 2010 study reported that co-op students have a high probability of being employed after graduation even after controlling for academic background.[27] Likewise, a 1999 study found that graduating students who had completed two or more work terms had significantly higher starting salaries ($1,600 per work term) relative to their peers.[28]

Finally, whereas internships are often unpaid—which makes it difficult for students from lower-income backgrounds to take advantage of them—a co-op that is paid can be an economically feasible avenue for students of all backgrounds to gain valuable work experience. In addition, although students are not paying full tuition while enrolled in their co-op terms, they can still take advantage of federal financial aid to help cover living expenses during those terms.[29] This may be particularly important for older students who might otherwise find it difficult to support themselves and their family on a co-op salary.

Employers. Co-op programs can't exist if employers don't see them as a good investment in time and money. Employers who choose to participate do appear to benefit in three ways. First, they have the opportunity to evaluate students over time and on a trial basis, allowing them to assess student characteristics—such as problem-solving ability or capacity to work in teams—that are difficult to discern from an interview or a resume. Some employers refer to this as "growing their own" employees.[30]

As Franks from Drexel University said:

> The employer is getting real productivity [out of the co-op hires], but the main reason they're hiring them is they want to try them out for six months to see if they want to hire them when they graduate. And what they really want to see is not the hard skills—in many ways they assume those—but do they have the soft skills, work well in teams, how are they with presentations, will they offer to lead on projects, and are they a good fit culturally with the organization.

Second, the co-op program helps connect qualified students with employer openings: the university's co-op coordinator sifts through student resumes to find which candidates fit an employer's specifications, sending a steady stream of applicants who are a good fit for employer openings. Thus, if an employer hires a co-op student full time after degree completion, the co-op program has minimized both recruitment and training costs. Finally, co-ops are a tangible way for companies or industries to communicate their needs to the universities that educate future employees. As Cincinnati's Reilly says, "By working annually with 1,500 global employers, UC

continually collects about 200,000 data points annually from these employers to refine curricula in order to adapt to evolving needs. Co-op impacts teaching, and teaching impacts co-op."[31]

Despite these benefits, funding for co-op program hires can sometimes be one of the first things employers cut when they are facing difficult times. As Maynard pointed out, "In the most recent [recession], co-op programs as well as many entry-level positions were cut because of the knee-jerk reactions of many companies." The pattern doesn't always hold, however: Maynard said that "When a recession comes on slower, we have seen co-op demand increase as companies use them in place of new hires. In those cases where the government makes cuts, co-op students usually do not count in the 'official head count' of the agency. So they will expand the co-op programs until hiring freezes are lifted."

Colleges and Universities. Institutions are the entities that bring the entire process together. Colleges and universities are under increasing pressure to monitor and improve student outcomes, particularly the labor market success of graduates (and their ability to pay off their loans). To the degree that co-op programs help students complete college and find a job, they can help institutions perform well on outcomes-based accountability measures they might face. Said Maynard, "Dollars are being tied to a greater degree to how your particular university is doing from a graduate standpoint—tracking graduates to see what percentage are employed or attending graduate or professional programs, for example. That's all coming back full circle from a financial aid standpoint." Drexel University's Franks pointed out that "Parents are saying 'I'm going to spend all this money to have my son or daughter educated, so I want to know they can be employed when they graduate.'"

Another factor institutions must consider is the degree to which certain academic programs are more conducive to co-op experiences than others. Although, as Maynard pointed out, most programs could develop a co-op option, but the type of employment experience a student may be able to obtain in a co-op could differ. An architecture student, for example, may get to do design work with the caveat that a certified architect review his or her work. In addition, he says, "A freshman or sophomore in psychology is not going to have the opportunity to counsel, evaluate, or make recommendations to individuals because the student doesn't have the proper certifications. But what they can do is work at a camp in the summer—a camp for troubled youth, for example, to see what types of things they might deal with in the future." In general, most students will need a job after graduation, so even a co-op experience not directly related to their field of study can be helpful.

Finally, institutions must consider the costs of co-op programs. Franks said, "It's expensive to run a co-op program when you do it on the size and scope that we do. It means that oftentimes—particularly in a structured curriculum like engineering—you have to repeat courses because half your students are out working at any given point. So there is an expense involved in establishing a co-op program." In an era of tight budgets, where institutions have cut course sections to help reduce costs, colleges must consider whether the benefits of co-op programs outweigh the cost of additional course offerings.

Conclusion

Co-ops present an opportunity for students to gain valuable experience that can both build practical skills and help them figure out what they want to do with their lives. Co-ops can also help them build valuable noncognitive skills that are key to workplace success later in life. As Reilly said in her interview, "At its best, co-op embodies a very personal kind of trust when the young and inexperienced are first handed jobs that mean quite a lot to those around them. It's the challenge of young people taking on jobs involving real trust and real responsibility from employers." Given how rare it is for American students to be exposed to possible careers before choosing a major—and the increasingly costly consequences of making a bad choice—co-ops represent one valuable alternative to the traditional four-year academic degree.

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Stacking for Success: "Stackable Credentials" at Brazosport College

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The traditional approach to higher education often asks prospective students to make a high-stakes decision with imperfect information. Prospective students can choose to make a large investment (typically two or more years' worth of time and tuition) in a program they may not complete and that might fail to provide a positive return. Or they can forego college altogether and lose out on potential career opportunities.

This traditional model seems particularly ill-suited for a rapidly changing economy. Aspiring workers are expected to make a decision about what to study—and, in turn, what career to pursue—after they leave high school, and that human capital is supposed to carry them through their working life. Although adults can always enroll in further schooling, the costs of dropping everything to pursue another credential, coupled with the constraints of family and work responsibilities, preclude many from doing so. Traditionally, the US higher education system has not been particularly dynamic or flexible when it comes to this sort of lifelong learning.

Certificates in occupational fields have become a popular answer to some of these issues. They take less than two years to complete (often less than one) and are therefore less expensive than longer degree programs. Certificates are also designed to prepare people for a particular job and (in theory) reflect skills and knowledge that are currently in demand. Evidence suggests that these types of credentials do pay off, but that the returns vary dramatically across majors and by gender.[1]

Critics have pointed out that such vocational programs may pose their own trade-offs. Tracking students into shorter-term vocational offerings can leave them better off in the short-run, but those students may also have a lower long-term ceiling on economic success and mobility.[2] In other words, even if vocational programs are an on-ramp to a decent job, the path may dead end there. Indeed, even colleges and universities have warned against short-term economic thinking, arguing that while the early returns to liberal arts four-year degrees may lag behind those of technical degrees and certificates, they often outpace them over a longer time horizon.[3]

But this apparent trade-off is, in some ways, a product of the high-stakes, inflexible system. In response, community colleges across the country have worked to create a system of "stackable credentials." The stackable concept is quite simple: colleges break up a long-term degree pathway into discrete units, and those units become stackable building blocks to a higher degree. Students can earn the first credential in the stack—often a vocational training certificate—and reap the economic return in short order. If, later on, they decide it's time to return for more school, they don't have to start from scratch; their original investment stays relevant, and the next set of competencies builds on the first.[4]

While the prevalence of stackable credentialing across the nation is difficult to pin down precisely, clear examples are beginning to emerge in a number of states across the country. For instance, in 2004 the Kentucky Community & Technical College System approved 17 career pathways (certificate-to-degree) projects in various disciplines.[5] Oregon and Wisconsin have also

worked to carve existing associate degree programs into more discrete, stepping-stone credentials.[6] Finally, a recent $474.5 million educational grant by the US Department of Labor that supported the creation and improvement of stackable credentialing programs in 16 states has accelerated the development of this model across the country.[7]

Texas has garnered considerable attention for its statewide push toward stackable credentials, especially in energy-related fields.[8] To examine how stackable credentials actually work on the ground, this case study looks at two programs at Brazosport College, a two-year public college in the heart of Texas's Gulf Coast region that has embraced the stackable credentialing model in several technical fields.[9]

Stackable Credentials at Brazosport College

Brazosport College serves 6,400 students in Texas's Gulf Coast region. Nearly three-quarters of its students are part time, and about half of the credentials the college confers overall are in technical domains.[10] Compared to other community colleges, Brazosport's student outcomes are far above average: it boasts a more than 80 percent retention rate and a similarly high graduation plus transfer rate. Brazosport graduates also do quite well in the labor market, earning $47,320 after their first year, 43 percent more than other new hires in the region.[11] Those with technical associate degrees do even better, with median earnings of $63,371 right out of the gate.[12]

Two programs at Brazosport stand out as examples of how stackable credentials can work in practice for two different groups of students. The first is the process technology program (PTAC), which trains skilled workers for various levels of employment in petrochemical plants. The second is Jumpstart, which is designed to provide low-income workers with basic construction skills and credentials that can then serve as the foundation for a technical associate degree.

PTAC. The PTAC program prepares students for employment in a petrochemical plant. A student can earn a basic certificate, an advanced certificate, and a two-year associate in applied sciences (AAS) degree, with each clearly building on the previous one. Table 1 lists the courses that combine to constitute each level of credentialing. Brazosport also offers a bachelor's degree in PTAC, which accepts the same core courses as the associate degree.[13]

Table 1. Brazosport College's PTAC Course Offerings

Course Code	Course Name	Basic Certificate	Advanced Certificate	AAS
PTAC 1302	Introduction to Process Technology	X	X	X
PTAC 2420	Process Technology II	X	X	X
PTAC 2438	Process Technology III	X	X	X
PTAC 2446	Process Troubleshooting	X	X	X
PTAC 1432	Process Instrumentation I		X	X
PTAC 1408	Safety, Health & Environment I		X	X
PTAC 1410	Process Tech. I–Equipment		X	X
INTC 1441	Principles of Automatic Control		X	
CHEM 1305	Introductory Chemistry/Lab		X	X
CTEC 1441	Applied Instrumental Analysis I		X	X
PTAC 2314	Principles of Quality			X
CTEC 1401	Applied Petrochemical Technology			X
CTEC 1380	Cooperative Education I			X
PTAC 1454	Industrial Processes			X
CTEC 1391	Equipment Troubleshooting			X
BCIS 1405	Business Computer Applications			X
N/A	General Education Electives			X

Source*:* Brazosport College, "2014–15 Course Catalog," 2014, www.brazosport.edu/Catalog-Schedule/Catalogs/2014-2015_Catalog.pdf.
Note*:* If the course catalog offered a choice of two courses that could fulfill one requirement for a certificate or degree, only one course was selected and displayed.

Importantly, completers of each credential level fare quite well in the marketplace. While some large companies in the region require new hires to have associate degrees, others are more than willing to hire certificate-holding Brazosport graduates, according to Brazosport Vice President Anne Bartlett.[14] The program has a 97 percent job placement rate for its graduates across all credential levels.[15] And while the college doesn't have specific data about how much graduates with certificates typically earn, the median AAS graduate's first-year earnings approach $90,000.[16]

Many of those graduates go off to work in the growing petrochemical industry, which has driven an exceptional amount of economic growth and job creation in the Gulf Coast region.[17] The expansion of petrochemical manufacturing is expected to result in $10 billion dollars' worth of chemical plant expansion in the area over the next three years. Such growth not only increases employment within petrochemical plants but also helps spur expansion in other fields, such as construction-related trades.[18] As is the case in most industries, the expansion of the petrochemical industry depends on the availability of skilled workers. As a result, employers in

the region have searched for new ways to find and train workers quickly and efficiently, a search that has led many of them to Brazosport College.

About 15 years ago, the development of shorter-term PTAC certificate programs emerged from a collaboration between Brazosport and two companies, Dow Chemical and BASF, to create training options aligned with the companies' needs. At the time, petrochemical manufacturers found that they did not have enough workers with associate degrees in process technology. According to Bruce Raiff, Texas learning leader at Dow Chemical Company, the company "opted to find people with associate or bachelor's degrees in STEM fields already, and see how long it would take to skill them up. That's how we created our program at Brazosport. And we took the relevant courses from their PTAC degree, and built them into the accelerated program." The result is a partnership where Dow and BASF-Freeport send new hires—many of whom already have associate degrees in a science, technology, engineering, and mathematics field—through short-term (6–14-week) PTAC training programs at Brazosport. The companies pay for the programs, with the college actually training the students.

Students greatly benefitted from the short-term, company-sponsored training programs. Over time, however, administrators at Brazosport noticed that these students had some trouble signaling their skills learned in Brazosport training programs to new employers if they chose to change jobs. To address this, the college created the basic PTAC certificate to offer students "a marker with value to reflect their short-term training," said Bartlett.[19]

Furthermore, in more recent years, after recognizing that their basic certificate overlapped with several core courses required for the longer PTAC associate degree program, Brazosport's administrators decided to create a series of stackable certificates—each representing a discrete set of marketable, industry-relevant skills—open to all students. While most of the students currently receiving these short-term credentials are still new hires at local companies, Bartlett estimates that one-fifth are students pursuing short-term certificates or a degree from the onset.[20]

Brazosport's collaboration with Dow and BASF is ongoing. These companies regularly work with the community college to ensure that course content aligns with the skill sets needed in the field. As Bartlett explained, "Dow has a full-time person who we meet with weekly, if not more, to examine what's missing . . . [to hear] what the plant managers at specific sites are saying, and [to] see what we can add to our programs." Tommy Plummer, training coordinator at BASF-Freeport, reveals that he too "meets regularly with the college to discuss matters such as instruction and curriculum, how to get people from high school into the training program, what courses to offer and not offer, etcetera."

Brazosport relies significantly on industry input to provide its students with the best and most relevant PTAC education. The companies offer more than just input on curriculum and instruction, too. Dow and BASF open their wallets to support the school, often giving large grants to the college for capital projects such as PTAC training facilities.[21]

While the stackable credential is designed to entice some students to pursue further education, most graduates of the initial PTAC certificate program have not returned to Brazosport to pick up additional credentials in the stack. Bartlett recalled only "one or two in recent memory that

have come back for a bachelor's in applied technology." That is because most new hires already have a two- or four-year degree, and entry-level positions in the petrochemical industry are quite lucrative, leaving employees little incentive to go back for more schooling. As Bartlett puts it, since "they already have a two- or four-year degree in a STEM field . . . there is really no benefit to them going back and completing their degree." That is not to say that additional training isn't necessary, but only that much of that training is done outside of the traditional credentialing programs. For instance, Raiff described how Dow offers many noncredit, short-term training modules designed to fill skills gaps among employees.

The question now is how Brazosport and industry partners can encourage more high school students to enroll in the PTAC certificate and associate programs from the start, potentially saving them from wasting time and money on other programs that churn through credits with less value. Both Dow and BASF are working to reach down into local high schools to stir up interest in the credit-bearing PTAC certificate and degree programs. "I see lots of talent coming out of high school," Raiff noted, "and I would like to provide an opportunity for these talented people to obtain paid work experience and a two-year degree."

The Jumpstart Program. Whereas the majority of PTAC students at Brazosport already have a degree of some kind, the Jumpstart program is designed to serve those with no postsecondary education. Jumpstart is a free, nine-week, foundational training program that offers a set of courses either in industrial and commercial electricity or in industrial and commercial pipefitting. Jumpstart is an apt nickname: the program offers introductory courses that are designed to serve as the springboard to both employment and, hopefully, a series of stackable credentials that result in a degree. According to Bartlett, Jumpstart aims to "give the most vulnerable populations portable, stackable credentials, offering a hand-up rather than a handout." That hand-up—a Marketable Skills Award—is equal to nine college credits, or roughly half of a basic certificate (table 2).

Table 2. Brazosport College's Jumpstart Program Course Offerings

Industrial and Commercial Pipefitting			
Course Code	**Course Name**	**Marketable Skills Award**	**Basic Certificate**
PFPB 1305	Basic Blueprint Reading for Pipefitter	X	X
PFPB 1308	Basic Pipefitting Skills	X	X
CNBT 1301	Introduction to Construction Industry	X	X
PFPB 1380	Cooperative Education I		X
PFPB 1381	Cooperative Education II		X
Industrial and Commercial Electricity			
Course Code	**Course Name**	**Marketable Skills Award**	**Basic Certificate***
ELPT 1319	Fundamentals of Electricity I	X	X
ELPT 1329	Residential Wiring	X	X
CNBT 1301	Introduction to Construction Industry	X	X
ELPT 1345	Commercial Wiring		X
ELPT 1357	Industrial Wiring		X

Source*:* Brazosport College, "2014–15 Course Catalog," 2014, www.brazosport.edu/Catalog-Schedule/Catalogs/2014-2015_Catalog.pdf.
Note*:* The basic certificate in industrial and commercial electricity displayed is for those who are not employed in a job that qualifies for cooperative education credit.

Jumpstart graduates also receive a National Career Readiness Certificate and a National Center for Construction Education and Research core card—both useful industry-specific credentials—in addition to an Employment 101 certificate from a local nonprofit.[22] Although the program is in its infancy—the inaugural cohort began in Summer 2014—it can so far boast a 93 percent completion rate and first-year earnings of between $16 and $28 per hour.[23]

Despite its different target population, the Jumpstart program's origins were similar to those of the PTAC program: the boom in the oil, gas, and petrochemical industries increased demand in the construction industry, but there were not enough skilled workers in the Gulf Coast region to meet that demand. As Bartlett pointed out, the regional trend is that "with the building of a new [petrochemical] plant comes construction jobs to build up the plant and the surrounding area." The construction industry thus sought out a relationship with Brazosport to establish a training program. Fluor, a global engineering construction firm in the area, approached Brazosport with an outline of the company's needs. According to Bartlett, Fluor was "instrumental in sitting down with us and sharing their baseline credentials and curriculum and telling us what they wanted their folks to know." Fluor helped design the Jumpstart offerings and, of the 13 students in the first cohort, the company hired 10 graduates.[24]

Jumpstart is designed not only to serve industry needs, but also to help low-income, low-skilled workers secure a good job. The program serves students making less than $32,000 a year who have at least one child at home under the age of 18. Their average age is 30.5.[25] These students,

Bartlett describes, "are already working, coming to the college at night or on the weekends to finish their training so they can get a bump up." They are also likely to be mobile workers, "willing to move to Louisiana or South Texas or North Dakota, or wherever the job is." These are precisely the type of workers who stand to benefit from stackable, portable credentials. The Marketable Skills Award signals a core set of construction competencies, and Jumpstart students can then work toward a basic or advanced certificate.

While the program is free to students—paid for through a combination of funding sources, including the Workforce Investment Act, Pell Grants, and the Texas Workforce Commission—overlapping and conflicting eligibility requirements have constrained Brazosport's ability to expand available grant funds because, according to Bartlett, "The eligibility requirements tied to each grant are really, really tight." The question now is how Brazosport can put the program on sustainable financial footing that would allow it to provide the program for free and to expand it to more needy students.

Key Lessons for Practitioners and Policymakers

Collaborate with Local Industry. Industry demand and industry input were the central driving forces behind the development of the PTAC and Jumpstart programs described earlier. Not surprisingly, industry input helps clarify the skills and knowledge necessary to do certain jobs and helps ensure that those skills are kept up to date. As Raiff said, "Although many of the PTAC instructors at Brazosport are Dow retirees with close knowledge of the field . . . we still have to update [them] on new processes constantly, since much of what they knew has since become out of date." Brazosport has set itself up as a training hub of sorts, creating direct pipelines of skilled workers for area companies. In return, Brazosport receives resources such as input on instruction and curriculum, and donations for capital projects, which allow the school to flourish. As Bartlett explained, "[I] could not imagine the college doing this [the PTAC program] in the absence of our industry partners' input."

In addition to shaping the content, employers are also key to identifying the pieces of that curriculum that can serve as effective standalone credentials. Raiff explained that Dow "focuses less on the range of courses a student has taken, or the degree that they have, and more on whether its workers know exactly what they need to know to succeed on the job." Because employers have an interest in providing hires with the precise amount of training they need, industry input can help colleges decide how to segment degree programs into shorter credentials with labor market value. Dow, BASF, and Flour have not only informed Brazosport's curriculum but have also helped identify the discrete pieces of that curriculum that make up credentials in the stackable system.

Of course, not all community colleges will have the well-developed relationships with industry that Brazosport has. And, specifically, some will lack relationships with large employers that can invest hefty sums in new training programs. The key challenge for institutions that wish to adopt a stackable model, therefore, is how to foster this sort of reciprocal relationship with industry.

Collaborate with Peer Institutions. Additionally, while much of this case study has focused on credentialing at one institution, portability of stackable credentials across institutions is also key.

In some industries, like construction and natural-resource extraction, workers often must move to where the jobs are. Credentials that are only good at the first college they enroll in will not be "stackable" if they find themselves across the state in following years. Lack of portability might further depress any incentive to enroll in additional education. Texas "has an agreement for offering standard courses," Bartlett explains, "so we offer the same classes here at Brazosport that someone at Midland [another local community college] might offer." However, in states where statewide articulation agreements do not exist, portability will depend on institutional cooperation.

Employers may play a facilitating role here, too, by setting standards and developing industry-recognized certifications of their own. For instance, Raiff described how Brazosport uses a common PTAC curriculum developed by the North American Process Technology Alliance (NAPTA), a membership organization including industry representatives and education providers. NAPTA works to develop a shared set of standards for PTEC programs, meeting regularly to evaluate the relevance of its programmatic criteria. In addition to Brazosport, 20 other institutions across five states are NAPTA endorsed.[26]

Engage Students Early in Their Educational Careers. A final lesson that emerges is the importance of connecting with younger students, particularly at local high schools. Reaching students just as they are beginning postsecondary education can help them avoid wasting time and money in programs that do not provide relevant skills. Plummer mentioned that BASF-Freeport actively recruits at area high schools, giving presentations in science classes that tout the Brazosport PTAC program and inviting students to spend a day at its plants. Furthermore, Raiff described Dow's recently founded US Apprenticeship Program geared toward high school students, which offers a two-year associate degree in concert with on-the-job training at a Dow plant. Efforts to publicize these programs further could encourage younger students to enroll in these high-demand, stackable programs from the start, helping them avoid wasted time, money, and effort.

Conclusion

Brazosport College offers two clear examples of how stackable credentials can emerge and thrive within an institution. Its PTAC program offers new hires from local companies an accelerated means to learn the skills needed to become job ready. The program also provides opportunities for traditional students to begin their educational journey by earning short-term certificates with clear labor market value. Targeting a slightly different population, the Jumpstart program helps low-income students learn the foundational skills they need to get started as electricians and pipefitters. In all of these cases, students have clear pathways to pursue further credentials in their fields, options that build directly on their prior educational investments. As a result, both students and local employers appear to be benefitting greatly from this innovative new model at Brazosport.

Notes

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