MISSING MAKERS:
HOW TO REBUILD AMERICA’S MANUFACTURING WORKFORCE
ACKNOWLEDGMENTS

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FOREWORD FROM
ALCOA FOUNDATION
Technological innovation has transformed American manufacturing over the past several decades, and the pace of change shows no signs of slowing. Manufacturing jobs of the future will require all workers to continually upgrade and diversify their skills to match the evolving needs of production systems. U.S. manufacturing employers and educators alike are continually adjusting their traditional outreach, education, and training mechanisms to keep pace with the growing demand for skilled workers.

To prepare the communities in which Alcoa operates to be globally competitive, Alcoa Foundation is focused on finding new ways to transform education and training opportunities in manufacturing. We must move beyond fragmented training solutions and take a broader, more holistic view of what individuals need to achieve self-sufficiency in an increasingly complex working world.

Missing Makers: How to Rebuild America’s Manufacturing Workforce is designed to provide this view, offering a clear framing of the challenges that American youth, educators, manufacturing employers, and others face in today’s manufacturing education and training environment. More importantly, it lays down the blueprint for a comprehensive set of solutions that would mitigate these challenges, empowering youth with the skills and information they need to find skilled, sustainable careers. These solutions are broadly applicable across the nation, yet flexible enough for manufacturing employers to tailor and implement locally, taking into account the unique needs of their plants and their communities.

In short, this report is a guide and a call to action for manufacturers of all sizes to collaborate with other stakeholders in their communities and to initiate widespread changes to the ways they engage youth. We are committed, along with Hope Street Group, to furthering economic opportunity for all Americans, and believe this report is an important step in ensuring career access to one of our country’s cornerstone sectors.

Alcoa and Alcoa Foundation are dedicated to fostering manufacturer-led, collaborative solutions to the skills gap in communities across the nation. We encourage all readers of this report to join the movement, and to find ways to spark change in their own communities.

Esra Ozer, President, Alcoa Foundation
EXECUTIVE SUMMARY
The U.S. manufacturing workforce is aging rapidly, with half of the existing workforce only 10-15 years away from retirement. Yet, American manufacturing employers are struggling to build a pipeline of new workers. Some 600,000 positions are currently unfilled, and more than three million additional positions are due to open by 2020.

Meanwhile, the youth unemployment rate remains above 16%, with nearly four million 16-24 year olds looking for but unable to find work. Why does this gap continue to exist across many regions, and what challenges are preventing the U.S. education and workforce training systems from addressing these issues? How can manufacturing employers and workforce development practitioners most effectively invest in youth in their regions, so that more young people are aware of, interested in, and on the path to careers in manufacturing?

Hope Street Group and Alcoa Foundation set out to address these questions. In this report, we frame the systemic challenges that currently discourage able young people from entering manufacturing career tracks. To do so, we interviewed a select group of American manufacturing employers, high school and college-aged youth, education professionals, and nonprofit organizers. Below, we share their stories and synthesize them into common themes, supported by secondary research.

We also propose potential solutions to these challenges, with examples of promising practices already being implemented, which reformers can choose to flesh out and implement in their regions.

We focus on two key stages in a young person’s career journey: 1) Career Exploration, the process of exploring and understanding the range of potential career options available, and 2) “Skilling Up,” the process of earning the skills and experiences necessary to be ready for entry-level jobs. Our findings are as follows:

CAREER EXPLORATION

In this section, we discuss why young people receive the majority of their career information through day-to-day interactions with adults, primarily their parents, family members, or media role models. Through this process, we learned that manufacturing has very low visibility among youth, and what information they do hear tends to be outdated, or framed in language that is not designed to appeal to their interests and passions.

Although career and technical education programs used to be important vehicles for introducing youth to technical careers,
such programs are on the decline across the nation. In fact, the majority of schools place little emphasis on career education at all. As a result, relatively few youth seriously consider manufacturing during their career exploration process.

Educators also face a number of challenges. Teachers do not have incentives to cover career education in the classroom, and must prioritize a host of other district and state requirements. Many regions rely on career and education counselors to provide career education, but these counselors have very limited capacity to provide attention to all students, and often focus on academic requirements and post-secondary education rather than careers. Finally, many educators remain hesitant to recommend non-four year degree options, as the value proposition of alternative credentials are less clear to them than a “traditional” bachelor’s degree.

SKILLING UP
In this section, we examine why many regions do not offer enough training opportunities to meet employer demand for skilled manufacturing workers. We identify three primary barriers. First, educators and employers face significant financial barriers to building and maintaining training and education programs. Second, numerous communication barriers prevent regional alignment on needed skills and appropriate curricula. Finally, we note a lack of easily understandable, up-to-date, and region-specific information on manufacturing career pathways.

RECOMMENDATIONS
Throughout the report, we present proposals that address each of these challenges. Our main recommendations include:

- Early outreach to youth that focuses on the excitement of manufacturing, including site visits, demo fairs, and course modules
- Outreach to educators about the current state of advanced manufacturing, as well as the provision of tools and information that they can easily integrate into their students’ daily coursework
- Best practices for creating and fostering partnerships between employers and educators within a region. By pooling resources and coordinating efforts, these partnerships help overcome financial and communication barriers that impede the “skilling up” process
- Principles for designing and developing an online information resource and career connector tool for youth, educators, and employers

Each region within the United States has its own unique characteristics and associated economic challenges. Although we aim to shed light on the most common challenges, we do not claim to address all the education and workforce training issues that local regions may face.

Similarly, the pathways that we propose are all high-level options, and would need to be selectively tailored, refined, and expanded upon by regional reformers to truly match the specific needs of an individual district. However, we aim to provide principles that reformers can apply and expand upon to drive change in their regions and help youth across the United States find sustainable futures.
INTRODUCTION
The existing manufacturing workforce is aging, and there are few signs of relief on the horizon. Driven by a combination of rising demand and worker retirements, an additional 3.5 million manufacturing jobs are expected to open up by 2020, primarily in durable goods and high-tech manufacturing.

Why aren’t America’s education and workforce training systems producing more qualified young people to fill growing demand for skilled manufacturing workers? Part of the answer is that most educational and training institutions have struggled to keep up with the technological changes that have swept through manufacturing and transformed the skills needed for a successful career.

Employers, educators and policymakers all have strong incentives to address the growing skills mismatch in manufacturing. Yet many struggle to understand the fundamental issues and challenges involved. In this report, Hope Street Group and Alcoa Foundation present possible solutions to some of the systemic issues that prevent young people from hearing about, getting interested in, and preparing for skilled, meaningful manufacturing job opportunities in their regions.

**THE CHANGING WORKPLACE**

In a recent study of technology and the modern labor market, MIT professors Erik Brynjolfsson and Andrew McAfee discuss the concept of skill-biased technological change: “Technologies like payroll processing software... have been deployed for routine work, substituting for workers. [...] By contrast, technologies like big data analytics, high-speed communications, and rapid prototyping have augmented the contributions made by more abstract and data driven reasoning, and have in turn increased the value of people with the right engineering, creative, or design skills.”

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53 percent of skilled trade workers in the U.S. were 45 years and older in 2012

*Source: EMSI*
In other words, navigating the workforce without some kind of valued skill or postsecondary credential is a difficult proposition, and will only become harder in the future. More than 47 million jobs are expected to open between 2008 and 2018, according to a recent study from the Harvard Graduate School of Education and the Georgetown Center on Education and the Workforce. More than 63% of these openings will require some college education or better, and approximately half of these will be for so-called “middle-skill” jobs that require an associate’s degree or an occupational certificate.

**CHANGING SKILL NEEDS**
Manufacturing has followed this trend of up-skilling, substituting machine labor for routine tasks and placing increasing importance on technical, cognitive, and interpersonal (“soft”) skills. As the authors of the Harvard study note: “The technology itself takes on more of the rote, manual processing tasks, allowing employees to spend more time interacting, exploiting the new flexible technologies and delivering cutting-edge value (quality, variety, customization, convenience, speed, and innovation).”

This evidence points to a potential skills mismatch for middle-skill professions in the United States, which will worsen over time without conscious intervention from manufacturing employers, education and training providers, and other reformers. In fact, the U.S. Department of Education predicts that 60% of new jobs in the 21st century will require skills possessed by only 20% of the current workforce. This misalignment is already measurable in the manufacturing sector. Burning Glass, a market and workforce analytics firm, recently tracked online requisitions for middle-skill manufacturing positions, which they defined as skilled

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*Source: Harvard Graduate School of Education, Georgetown Center on Education and the Workforce*
production roles for which employers are likely to request postsecondary training, such as production supervisors and Computer Numerically Controlled (CNC) machine programmers.

On average, these jobs paid more than $52,000 a year, well over the U.S. average income and higher than the U.S. median household income. Yet the Burning Glass researchers found that for each skilled production opening, employers were recruiting from a labor pool that was, on average, one third the size of the labor pool for general production roles. Moreover, skilled job openings took 10% longer to fill than general production openings.

If left unaddressed, this misalignment between workforce skills and employer needs can cost workers billions of dollars in lost earnings. For example, the Center for American Progress recently estimated that the one million Americans who experienced long-term unemployment during the Recession would lose more than $20 billion in earnings over the next 10 years. These figures do not include the billions in lost revenue and recruiting expenses incurred by employers struggling to fill skilled positions. In a recent study of 300 manufacturing executives by Accenture, the companies surveyed reported, on average, a 12% increase in overtime cost, a 10% increase in downtime, and an 8% increase in cycle time due to skilled roles going unfilled.

**DEBATING THE SKILLS GAP**

The severity of the current skills gap in manufacturing has been up for debate in recent months. According to a CNBC report, U.S. manufacturers have added half a million jobs since 2010. Yet they have also shed millions of jobs over the past several years due to mechanization and the recession. In a recent New York Times column, the economist Paul Krugman invoked stagnant manufacturing wages as evidence that the skills gap was a myth, arguing that “if employers are really crying out for certain skills, they should be willing to offer higher wages to attract workers with those skills.” Krugman also cited a 2012 Boston Consulting Group (BCG) study finding that skill shortages were highly localized, with some regions having a sufficient supply of talent. Therefore, they argue, the present severity of the crisis has been “overblown.”

Recent studies offer differing views on how the skills gap is affecting manufacturers. In a 2011 survey of manufacturers by the National Association of Manufacturers (NAM) and Deloitte, 45% of employers predicted a worsening labor shortage in the skilled trades, and 74% of employers said that a shortage of qualified machinists and other skilled production personnel had significantly hurt their ability to expand operations or boost productivity. On the other hand, only 16% of employers in a recent Economic Policy Institute survey reported lack of access to skilled workers as an impediment to growth. Only a few high-growth markets, such as Charlotte, North Carolina, had rising wage rates that indicated a severe talent shortage.

However, our focus is not on the short and medium-term, but rather on the long-term impact that lack of engagement with youth has upon the manufacturing industry. In the medium term, rather than raising wages significantly, employers appear to be using mitigating strategies to address local skills shortages, such as poaching experienced workers from other plants or retaining their existing skilled workforce past retirement age. These tactics by nature are unsustainable, and cannot be relied upon forever: The Manufacturing Institute reports that the
The median age of U.S. manufacturing workers rose from 40.5 in 2000 to 44.7 in 2012, double the aging rate of the general working population.

Source: The Manufacturing Institute

Thus, although the magnitude of the current gap is unclear, U.S. manufacturing industry still needs to cultivate a new talent pipeline to prevent longer-term hiring challenges, particularly for skilled trades that require years of apprenticeship and on-the-job learning. The authors of the BCG study themselves note that without sufficient upfront investment, “the shortage of highly skilled manufacturing workers could worsen to approximately 875,000 machinists, welders, industrial-machinery mechanics, and industrial engineers by 2020.”

THE JOB SEEKER’S JOURNEY
In this report, we map a “typical” young person’s journey to finding their first job, from the initial career exploration process, to “skilling up,” to finally finding a job. We also examine the steps involved in this journey, as well as the challenges, from the perspectives of students, their mentors and educators, and manufacturing employers. Next, we present key challenges that prevent regional market alignment on needed manufacturing skills.

Each section ends with a set of recommended next steps for educators, local nonprofits, and manufacturers of all sizes. We present strategies that regional, manufacturer-led coalitions can build upon to address these challenges within their own communities. In addition, we present a series of case studies that illustrate successful strategies deployed by organizations in the private and public sectors.

Our aim is to shine light on the education to employment process for manufacturing, highlighting key issues, and identifying basic principles that manufacturers and educators can apply to help resolve labor market inefficiencies in their regions. We believe that a concerted effort by community-minded employers, working together with local educators and community advocates, can make a real difference in the number of young people aware of, interested in, and on the path to skilled careers in manufacturing.
BACKGROUND & METHODOLOGY
DEFINITIONS:
For the purposes of this work, we define “middle-skill jobs” as occupations that require education beyond high school but short of a four-year college degree. Examples include passing a certificate or apprenticeship program, receiving on-the-job training, earning an associate’s degree, or some combination of the three. Experts estimate that there are currently about 69 million Americans, comprising 48% of the workforce, who are working middle-skill jobs across many fields, including computer technology, nursing and manufacturing. Examples of common “middle-skill” manufacturing professions include skilled artisans, such as electricians or mechanics, as well as welders and CNC machine programmers. Such positions typically require some postsecondary credential in addition to a high school degree, although exact requirements tend to vary by region and employer.

Our analysis focuses on “young job seekers,” defined as Americans between the ages of 16–24. The BLS currently estimates that there are approximately 40 million civilian, non-institutionalized Americans in this age range. Our findings are broadly applicable to all young people in this age demographic, since we believe that all young people should be aware of the range of career paths open to them. However, the “middle-skill” opportunities may be most immediately relevant to the 26 million young Americans defined by the Bureau of Labor Statistics, who currently have a high school diploma or some level of college education, but not a full four-year diploma.


Source: Harvard Business Review
METHODODOLOGY
We focused on gathering in-depth, firsthand accounts from a select number of current high school and community college students, manufacturing employers and educators, along with workforce development practitioners and other experts. Our aim was to understand the challenges encountered by members of these groups, and the role that each plays in the skills management ecosystem. The participants in these interviews, by their request, will remain anonymous when referenced in this document. We have supplemented our conclusions from these interviews with references to broader-based research from a number of organizations active in this field, such as the Georgetown Center on Education and the Workforce, the McKinsey Global Institute, and the Manufacturing Institute, to whose work we are indebted.

YOUNG LEARNERS
Over the course of several months, we conducted interviews with more than 30 high school and college-aged students, the latter group primarily from community colleges around the country. The first phase of work was a weeklong diary study of approximately 20 students enrolled in high school or community college. We asked each student to catalogue all the tasks they performed related to finding a job, advancing their education, or building on their professional skills. After the weeklong diary study, we conducted half-hour interviews with each of the students to understand their choices in more depth.

The second phase consisted of in-depth interviews with several high school students, aged 16 – 24, with a strong focus on representing low-income students, or students with other characteristics that made them academically “at-risk” of failing to graduate from college, as defined by the National Center for Education Statistics.27

MANUFACTURING EMPLOYERS
Five manufacturers, including Alcoa, granted in-depth interviews for this study, although we engaged in conversations with several more during the course of the work. Most of our primary interviews were with multinational companies that had multiple plants across the United States. These companies are engaged in advanced manufacturing across various sub-sectors, including consumer products, aerospace, automotive, materials and mining, products for industrial applications, and others. In order to gain a more diverse set of perspectives, we also interviewed a small-to-medium-sized manufacturer. Over several months, we conducted interviews with employees at multiple levels, including senior leadership, current and former plant managers and other leaders, HR and talent development, and line employees. On average, we interviewed three to four employees at each firm.

EDUCATORS
We collected perspectives from several career and academic counselors at high schools and community colleges. Also, we spoke to several middle and high school teachers, including STEM and Career Technical Education (CTE) teachers. In addition, we reached out to several school administrators, including community college deans and other college staff who worked on regional employer partnerships. Finally, we met with staff at several regional nonprofits dedicated to workforce training and education support. In total, we interviewed approximately 40 education and nonprofit professionals across the country.
We used these diverse perspectives to construct a narrative centered on the journey of a young learner from high school to postsecondary education and training to employment, while highlighting common challenges cited by our interviewees. Due to the small sample size, we cannot guarantee that this group is fully representative of the challenges faced by American youth, businesses, and educators. However, we believe that by presenting a diverse set of perspectives, we can shed light on common problems that members of these three groups currently face.28
YOUTH, EDUCATOR, & EMPLOYER PERSPECTIVES
Our interview subjects offered a variety of frequently differing perspectives on the career journeys of American youth. Yet, nearly all our subjects agreed that waiting until the actual job search process to begin thinking about career paths and skills alignment was far too late. Several of them echoed the feelings of one community college student interviewed: “(I wish I knew that) everything you do as a child and a teenager and a young adult reflects on what’s going to happen to you in your adult career.”

A survey of recent four- and two-year college graduates led by McKinsey & Company and Chegg confirms this feeling: Over half of all graduates surveyed expressed regrets about their education choices, saying they would pick a different major or school if they had an opportunity to start over.

Therefore, we argue that it is not enough to attempt to reach learners while they are looking for jobs post-graduation. Instead, efforts to impact career pathways decision-making in youth must start from the very beginning of a young person’s journey to employment, as represented by the following stages:

1. A student’s initial exploration of career opportunities, including opportunities in their region, via speaking with mentors, viewing educational content and gaining exposure to various careers via the classroom, independent research, and in other ways. For this part of a young person’s journey, we aim to answer the following question: Why don’t more young people choose to pursue careers in advanced manufacturing?

2. The “skilling up” process every young person goes through in order to receive the necessary skills. This process could involve postsecondary training through local colleges, work-study opportunities (e.g., apprenticeships), online training, and other means. For this part of the process, we aim to answer this question: Why aren’t regional education and training programs providing enough skilled workers, in alignment with regional demand?

We explicitly do not address the job-finding aspect of the career journey in this report; to wait until the final stages of a job-seeker’s journey to intervene may be too late! Instead, we argue that focusing on the early stages of this journey is most critical to engaging youth.
THE CAREER EXPLORATION PROCESS: WHY DON’T MORE YOUNG PEOPLE CHOOSE TO PURSUE A CAREER IN ADVANCED MANUFACTURING?
THE JOURNEY OF A YOUNG JOB SEEKER

1 EXPLORING CAREERS

2 SKILLING UP

3 FINDING AND SUCCEEDING AT A JOB
“I’m exploring medicine because my mom would like me to be a doctor”
A high school senior

If the manufacturing sector is growing again, why aren’t more young Americans pursuing careers in the skilled trades? In several of the plants that we visited over the course of this research, it was rare to find engineers and technicians under 40; one 20-something engineer interviewed noted that the next-youngest employee in his division was more than 20 years his senior. Indeed, several of the manufacturers interviewed cited the lack of youth interest in skilled manufacturing as a key obstacle to finding the next generation of skilled workers.

To address this issue, we asked young learners, as well as their teachers and mentors, to walk us through the process of exploring career options.

**YOUTH PERSPECTIVES**
We found that young people commonly experience the following challenges early on in their education-to-employment process, which can significantly affect their ability to explore their local career landscape:

**UNKNOWN TERRITORY**
“Students can only be interested in the jobs that they hear about,” one guidance counselor told us. “If all they observe are doctor, teacher, lawyer, and lifeguard, they’re not ever going to hear about [manufacturing] and the different possibilities.”

Accordingly, we interviewed youth to understand how they learned about careers, as well as what experiences and information typically piqued their interest. We found that typically, young people learn about possible career paths from relatives, peers, or entertainment media. They rarely encounter the manufacturing sector during their day-to-day lives, and what little information they do receive may be inaccurate or not optimized to spark their interest.

Despite an increasingly high-pressure job market and the wealth of career information available online, few of the young people we interviewed had conducted a conscious career exploration process, unless it was mandated by their schools. In the absence of external pressure (e.g., needing a job in the near term), most saw little point in thinking actively about life after college. As one community college student explained, “To be honest, I haven’t [thought about careers] just because I’m still undecided. I’m still far away from actually needing to declare anything.”

Therefore, for the majority of students interviewed, the bulk of their knowledge about careers came via personal interaction—day-to-day encounters with adult influencers. Many students learn about potential career paths from immediate family. In a recent survey of 2,213 Rhode Island high school students, more than half of the respondents cited their mother or father as a significant influence on their course selections and career choices. Similarly, a Ferris State University study found that 78% of high school students cited parents as their top source of career information.

Non-family mentors were less common, but still influential, particularly for students with absent parents or difficult family lives. One high school junior cited a guidance counselor at the school where she had transferred after years of struggling
“I want to be honest, I haven’t thought about careers because I’m still undecided. I’m still far away from actually needing to declare anything”

A community college student

academically at another school. “She’s my role model because she was my support and my motivation when I had no motivation,” she told us. “I want to become a counselor and be like her so that I can be supportive of other people that don’t have support.”

“Day-in-the-life” presentations by working professionals can have a lasting impact on the career decisions of some students. One student attended a small business owner’s presentation in high school, which inspired him to major in business when he entered college. Finally, several students cited well-known performing artists as their role models and inspiration to pursue careers in music.

With the exception of media influences, most of these interactions happened in person. Few of them required students to go out of their way, or even to begin a conscious career exploration process. Finally, every one of these interactions allowed students to see a trusted adult modeling the daily realities of their jobs.

Even highly motivated students who had embarked on an online career exploration process told us that their interest in a particular career had been sparked by a similar in-person exposure. One high school sophomore, Anna, hopes to be a crime scene investigator when she gets out of school. Anna did independent career research via Google. She also used her school’s career exploration software, Naviance. Ultimately, Anna decided that she wanted to attend a college with a strong degree program in forensic science. Yet, when we asked Anna why she chose her field of study, she replied: “I was watching NCIS and there’s a character named Abby who is a forensic scientist. I thought she was awesome, and that her job was awesome. So I Googled what she does and I found it interesting.”

Takeaways:

1. Early, personal exposure to the day-to-day realities of a job is crucial to sparking interest in and engagement with a field.

2. Young people tend to think about the job market in terms of the jobs they encounter on a day-to-day basis. Manufacturing, by its nature, is less ubiquitous in daily life compared to other common occupations, such as medicine, nursing or teaching. Unless a member of a young person’s family or broader network happens to work in manufacturing, or unless manufacturers proactively engage with them, young people are less likely to encounter the field early on without active intervention from regional manufacturers.
MANUFACTURING MISCONCEPTIONS

Given this lack of exposure in daily life, it was not surprising to find that most young people interviewed had little exposure to modern manufacturing. Many harbored misconceptions about what manufacturing jobs actually involve. They tended to reference the repetitive factory work commonly pictured in films, or other examples of menial labor that they might encounter in their daily lives. One production supervisor we interviewed gave a talk about manufacturing careers at a local high school. The students started out believing that plant maintenance was “janitorial work,” only to become more engaged when he explained that the job actually involved significant technical expertise, working within teams, and solving challenging problems.

When we asked students about their interest in manufacturing, reactions ranged from ambivalent to dismissive: One community college student said, “If [manufacturing] was a last resort I’d probably have to go in, but that’s definitely not what I want to be doing.” Another student told us: “My parents don’t really want me to be working in those kinds of jobs. This is why I’m going to college. I really respect all those people because it’s really hard work, but minimum wage doesn’t satisfy what you need to live.”

These stories highlight just how significant parental and community outreach is to changing young people’s perceptions of manufacturing as a career path. Although generally well meaning, parents often work on assumptions based on outdated or inaccurate knowledge of the manufacturing sector. If they have not worked in manufacturing personally, they are often unfamiliar with contemporary manufacturing wage scales or the rapidly changing nature of manufacturing jobs.

“My parents don’t really want me to be working in those kinds of jobs. This why I’m going to college. I really respect all those people because it’s really hard work, but minimum wage doesn’t satisfy what you need to live”

A community college student
For example, despite parental concerns about earning minimum wage in factory jobs, manufacturing employers paid $32 per hour on average wages and benefits in 2009, according to the Manufacturing Institute. Employers in the overall economy paid about $29.39 per hour.\textsuperscript{32} In addition, manufacturing technology continues to advance, requiring increasing sophistication from employees. Today, manufacturing firms account for more than 45% of all R&D-performing companies in the United States.\textsuperscript{33}

Some companies have started actively working to change popular perceptions of manufacturing in their regions. In South Carolina, for example, BMW recently partnered with USC Upstate to develop a two-week manufacturing skills camp for rising high school seniors in Greenville and Spartanburg Counties (see page 28 for details).\textsuperscript{34} Other firms, like Caterpillar, have started collaborating with local high schools to offer work-study programs in which students take on paid internships while earning high school graduation credit.\textsuperscript{35}

Overall, however, few companies make concerted efforts to correct negative perceptions of manufacturing at the K–12 level. One manufacturer we interviewed offered a robust internal training program that only required a high school diploma to enter. However, the company did not publicize this program at local high schools, preferring to recruit from its existing workforce. We spoke to other manufacturers who had phased out high school outreach and apprenticeship programs in an effort to reduce costs. We also found that many outreach programs may be too small to have significant impact on their regions; several firms interviewed mentioned outreach programs they had recently implemented, such as site visits to local students, but these visits were often limited to fewer than 15 students per year.

\textbf{52\% of American teens have little or no interest in a manufacturing career}

\textit{Source: The Foundation of the Fabricators & Manufacturers Association, Intl}

\textbf{Takeaways:}

1. Young people often develop misconceptions about manufacturing early on because they have little direct exposure to manufacturing in their daily lives. Few manufacturers work actively to correct these perceptions.

2. Therefore, it is extremely important for manufacturing firms to reach out early and proactively to youth to counter these stereotypes.

3. Manufacturers should explore methods of scaling outreach cost-effectively, reaching larger numbers of high school students. We will explore potential solutions, including online outreach, later on.
CASE STUDY:

MATH AND SCIENCE FOR THE REAL WORLD

Who: BMW and University of South Carolina Upstate
What: USC Upstate/BMW Manufacturing Academic Outreach Camp

Description:

Each year, BMW and USC Upstate provide rising high school seniors from South Carolina with the opportunity to build leadership skills and apply their knowledge of math and science to the real world, through a weeklong summer camp. The campers are given hands-on experience with Lean and Six Sigma tools, which they apply to computerized challenges, physical simulations, case studies, and teaching games. They also meet with manufacturing professionals, and are given tours of BMW and USC Upstate facilities.

The ultimate goal is for students to learn professional skills related to lean manufacturing and management. The camp places emphasis on how math and science can be applied to automotive manufacturing processes, thus enabling students to make the connection between academic learning and their professional careers.
“Kids don’t see how information in the classroom translates into a career path”
A community college career counselor

MANUFACTURING PASSION
Companies need to sell manufacturing careers in terms that will engage youth at an emotional level. Largely, young Americans speak the language of self-actualization and fulfillment. While older generations may have been primarily interested in finding a secure livelihood, today’s youth have grown up believing that it is far more important to follow your passion. Steve Jobs summed up this ethos in a 2005 commencement address that urged Stanford graduates to not “settle.” He said: “The only way to do great work is to love what you do. If you haven’t found it yet, keep looking.”

We interviewed young people from a range of backgrounds who all described their ideal careers in highly emotive, aspirational terms. While most expressed a desire for financial security, they placed more value on personal fulfillment, intellectual stimulation, and self-actualization. “I’ve thought about plenty of other jobs,” one student explained. “[But] I want to be somewhere where I could be happy and enjoy what I’m doing with my life.” Other students expressed the desire to be “passionate” about their careers and to “help people.” Other common aspirations were “not doing the same thing over and over” and “not sitting in a desk all day.”

One manufacturing employee told us that he only discovered his true passion when an entry-level welding position happened to open up when he needed a job. “I want to be really good at this, I want to know everything about this I can,” he remembered thinking. “And maybe I want to be a weld engineer.” He used that passion to take additional welding classes at a local community college, but wished that similar opportunities had been available to him much earlier, when he was in high school.

This is not intended to downplay the importance of fair wages and benefits to young workers, particularly as they start families and take on pressing financial responsibilities. In order to attract youth very early on in their careers, however, employers should appeal first to higher order needs. Young people tend to think of manufacturing in terms of routine, manual labor, involving assembly lines and “dirty” work. It is important to counteract that image by speaking directly to young people’s need for excitement and emotional satisfaction. It is very possible to speak of manufacturing and technical work in such terms. For example, an article by Matthew Crawford, a University of Chicago PhD who chose to become a motorcycle mechanic, describes building and fixing motorcycles as an emotional rush:

“I once accidentally dropped a feeler gauge down into the crankcase of a Kawasaki Ninja that was practically brand new, while performing its first scheduled valve adjustment. I escaped a complete teardown of the motor only through an operation that involved the use of a stethoscope, another pair of trusted hands and the sort of concentration we associate with a bomb squad. When finally I laid my fingers on that feeler gauge, I felt as if I had cheated death. I don’t remember ever feeling so alive as in the hours that followed.”

Young people need exposure to technical trades at an early age, so that they have the opportunity realize that these career paths may be something that they are interested in and passionate about pursuing. In presenting manufacturing career options to youth, employers should stress the satisfaction of building something with one’s hands, not working in an office, and doing new things every day. This sort of outreach will generally be more fruitful than emphasizing salary and benefits alone.
Takeaways:

1. It is important to appeal to higher order needs, e.g., self-fulfillment, when describing careers to young people, in addition to monetary and practical benefits.

2. Providing young people with the opportunity to try manufacturing-related activities may give them the opportunity to realize that manufacturing could be a career that they are passionate about.

SCHOOLS NEED TO DO MORE

Although the classroom provides a potential opportunity for career exposure, few U.S. schools provide significant exposure to real-life career opportunities in general, let alone in manufacturing.

Although we found significant variance between individual schools and districts, the majority of schools offer few resources and guidance to help students understand how taking basic coursework, such as high school mathematics, can impact their career options. As the Department of Education put it in a recent study: “Many high school graduates lack exposure to learning that links their work in school to college and careers—especially in the critically important fields of science, technology, engineering, and mathematics.” This disconnect can have a negative impact upon young people’s career exploration process. “Kids don’t see how information in the classroom translates into a career path,” as one community college career counselor told us.

For the majority of middle and high school students interviewed, the occasional career fair, field trip, or counselor presentation formed the bulk of their in-school career exposure. While some educators cited general state or district guidelines, which included broad language on providing students career exposure, few educators received specific, tactical help on how to integrate career lessons into the classroom. “I do not get any support,” one K-12 teacher told us. “Our schools do have different CTE [Career & Technical Education] options; however, teachers don’t really have guidance in terms of incorporating career exploration into our curriculum.” Another middle school science teacher took the initiative to contact a local laboratory and set up a field trip for her students, as her school had no system in place to enable such partnerships.

Some states and districts have more detailed requirements for schools to provide career-planning programs, but the effectiveness of these programs appears variable. Delaware, for example, requires all students to choose a Career Pathway in high school. However, one Delaware teacher reported that students were not aware of what the career pathways actually meant, and what their chances for employment would be after education and training in their chosen field. “Most students don’t fully understand the career pathways,” she said. “For example, a student will not pick the biotech pathway because they don’t know what ‘biotechnology’ is. Students often gravitate towards what is familiar. We have a ridiculous number of students enrolled in our vet tech program. I suspect the furry animals have something to do with it.”

Similarly, Colorado recently passed a law requiring all students to complete an Individual Career and Academic Plan (ICAP) in order to graduate high school. In practice, the ICAP program
mainly encourages students to pursue a four-year college track rather than thinking further ahead about career opportunities. As one Colorado teacher put it, “By the time [students] get to senior year, [ICAP] becomes more focused on getting into colleges.”

Takeaways:

1. Educators currently have little guidance on how to provide career learning to students. As a result, many young people receive little exposure to potential career opportunities in the classroom before they graduate from high school or college.

2. Manufacturing firms have an opportunity to strengthen their formal connections with regional schools, by removing financial and organizational roadblocks that prevent educators from including career education in curricula.

“What happened to shop class?”

Career and technical education (CTE) courses, along with shop classes, were once a key way for students to get basic technical training and exposure to technical careers outside of their traditional classes. As one manager at a manufacturing firm recalled, “I didn’t realize that most of the school boards, at least in Michigan, had cut out technical training and shop class. When

“Students often gravitate towards what is familiar. We have a ridiculous number of students enrolled in our vet tech program. I suspect the furry animals have something to do with it”

A Delaware high school teacher

I was in high school, we all understood welding and some of the basic trades.” This particular manager went into manufacturing, in part, because of his early exposure to technical trades. In a harsh budgetary environment, however, many schools are cutting out these programs.

These cuts are occurring in several states, and their effects are being felt nationwide. Forbes magazine recently reported that shop classes are disappearing in California due to the University of California and California State’s “a-g” admissions requirements. Under this program, students are expected to demonstrate proficiency in seven academic subjects before beginning college, including social sciences, math, and English. “Shop class is not included in the requirements, thereby not valued and schools consider the class a burden to support, the article stated. “Los Angeles Unified School District (LAUSD), with 660,000 students in K–12, has already eliminated 90% of shop classes.”

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In 2009, 36% of U.S. high school students had at least two CTE credits, down from 41% in 1990, according to The National Center for Education Statistics and BusinessWeek. The number of students with higher-level CTE skills (more than three credits) fell to 19%, down from 24% in 1980. In the European Union, by contrast, about 45% of all “upper secondary” students are enrolled full-time in vocational education.41 Worse yet, a lack of investment in CTE can cause existing programs to rapidly lose relevance. As one North Carolina teacher explained, “My limited exposure to CTE classes in my district has left me, for the most part, quite disillusioned. When I compare what I see to the archaic “shop/vocational tech” courses I took in high school many years ago [...] I find little in the way of real differences that one would expect after decades of technological advancement.”

Part of the decline is due to CTE’s troubled history in U.S. schools. CTE still suffers from the perception of being used as a “dumping ground for disadvantaged students and students with disabilities,” as the public policy and strategy firm Civic Enterprises put it.42 Yet as these programs die, they close off what was once a clear pathway to viable long-term careers for technically minded students.

**Takeaway:**

1. **Young people are getting fewer opportunities to experience technical trades directly.** Educators and manufacturers should consider alternative ways to deliver these exposures to youth through the classroom, through field trips, online, or by other means.

**DIGITAL CAREER RESOURCES**

American youth are becoming increasingly reliant upon online and mobile content; according to a 2010 report by the Kaiser Family Foundation, youth are now spending a considerable portion of each day—1.5 hours—on the computer. Moreover, cell phone ownership among 8–18 year olds rose from 39% in 2006 to 66% in 2010, further driving up consumption.43

Entrepreneurs and educators have responded to this trend, using online technology as a way to quickly scale and personalize educational content to learners, using simulations and online classes to facilitate learner engagement. Over the past few years, education providers who offer online course content, such as Khan Academy, and massive open online course providers (MOOCS), such as Coursera, are still in their early stages, but could potentially transform pedagogy in dramatic ways.

Albeit controversial, the “flipped” classroom model, in which students rely on a combination of at-home online lectures (provided by Khan Academy and others) and in-class workshops, has continued to gain traction among teachers. More than 15,000 teachers had joined the Flipped Learning network as of October 2013, the New York Times reported.44 While many employers remain reluctant to substitute MOOC credentials entirely for “traditional” education credentials, there is still movement toward integrating online content into learners’ educational experiences. Udacity, one of the largest MOOC providers, has recently partnered with tech firms like Google and AT&T to provide vocational certifications in programming, “big data” management, and related skills.45 Similarly, millions of young people are using digital learning tools to supplement their academic curricula. In 2013, Khan Academy alone reported about six million unique visitors per month.46
This trend could benefit the manufacturing industry. High-quality online simulations and tutorials could be used to share knowledge about manufacturing with both teachers and students. However, few digital education services currently emphasize or even reference manufacturing as a viable career option. For example, Coursera currently has about 600 courses in its library. Other than introductory math classes, very few of these courses are pertinent for a manufacturing career. The only exceptions are MBA-level classes such as “Intro to Operations Management.”

As more and more students spend their time online, and as schools adjust their coursework to take advantage of readily available online content, this omission suggests that there is a vacuum of content knowledge for manufacturing employers to address. Alcoa and Discovery Education recently created free online lesson plans and virtual plant tours designed to inform students about career pathways in manufacturing (see left panel for details), but they are still one of the first entrants into this space; additional momentum from all sectors of manufacturing is still needed.

Takeaways:

1. As traditional CTE programs continue to decline, online educational resources offer an alternative, cost-effective way for students to learn about manufacturing.

2. Online educational tools designed especially for the classroom can provide high-quality information
to many students at low cost. At the same time, the classroom environment ensures that this content doesn’t have to compete for “mind space” with entertainment media and other online distractions.

However, manufacturers should not neglect personalized outreach to students. As one high school counselor said, helping students find their path “takes a lot of hand holding, like everything else.”

**SOLUTION: ENGAGE STUDENTS EARLY**

If our goal is to interest more young Americans in pursuing manufacturing careers, we need to provide early outreach about manufacturing at the point when students are just starting to think about possible jobs. These outreach programs should be scalable enough to reach a large population, while still providing a human, personalized touch.

It is important to reach youth early on in their academic careers, in a format that does not require them to go out of their way to find helpful information. One good way to do this is to integrate career information with regular classroom teaching. Regional employers and educators need to establish direct relationships, so that there are fewer roadblocks to youth receiving career education in the classroom.

Any outreach should be designed to appeal to a contemporary audience. It should include enough interactivity and opportunities for creative thinking to engage the interests and passions of young people.

PROPOSALS

Below, we have laid out suggestions for manufacturing firms looking to launch outreach programs in partnership with schools and colleges. These options are designed to bridge the gap between education and employment in ways that engage students and are minimally disruptive to educators.

1. **Expose young people to manufacturing work environments by providing opportunities for student/employee interaction via career fairs, site visits, mentoring programs, and classroom presentations.** Career fairs and similar engagement programs are not a new idea, but they can nonetheless be very effective at a regional level. As we previously discussed, one Colorado teacher brought in a local businessman to tell students how he ran his store, as part of a regular series of career talks at her school. At least one student was sufficiently inspired by this career presentation to pursue a college major in business. Therefore, while these talks required minimal financial investment by the school, they had tangible impact upon students.

Similarly, local manufacturers can use site visits, in-person presentations, and even guest teaching appearances by employees to dispel manufacturing myths and convey the day-to-day realities of working for a modern manufacturing company. Dividing these activities among a consortium of participating employers can reduce the overall investment of time and resources by a single employer, making participation by small and medium-size firms more feasible.

A more labor-intensive but potentially very rewarding option is to take a page from Silicon Valley and develop regional “Maker Fairs” dedicated to advanced manufacturing. At these events, students would complete small projects that teach them the
basics of assembling machines and using tools. These fairs could emphasize hands-on interaction and include projects that have broad appeal to teenagers, such as programming a robot or building a mini car.

As an example, the 2013 San Francisco Maker Faire featured complex projects such as “Build and Program a Humanoid Robot that Walks and Talks,” and “DIY Driverless Super RC Car,” as well as simpler topics like “The Science of Making Tasty Waffles.” These topics appealed to a variety of ages and personalities, while still focusing on manufacturing ideas with broad appeal to youth.48

Finally, manufacturing companies can band together as consortia to provide career advisory services for students, given that school systems frequently have little time or resources to provide such tools. Options for manufacturers include providing career consultations with employee volunteers, or even funding full-time career pathways advisors at schools (see page 37 for a real-life example of extensive employer involvement in schools).

Manufacturing firms can also deploy inexpensive digital resources such as a Q&A page supported by employee volunteers, with whom students can interact virtually. Alternatively, they can build an online presence with the help of existing connector organizations like CareerVillage (see page 38 for details). These resources could be deployed in conjunction with live presentations and other outreach programs to maintain an ongoing connection with potential entry-level recruits.

2 Help students learn about manufacturing by developing online learning modules and case studies that can be easily integrated into coursework.

Students need to learn how their skills and passions might lead to a career. They also need exposure to the day-to-day realities of a job. In-person outreach is critical to meeting both these needs, but it can be expensive and difficult to scale. While online learning resources have upfront development costs, scaling is generally inexpensive. We recommend a blended approach that uses in-person outreach to supplement online case studies and simulations that teachers can integrate into the classroom experience.

We suggest focusing on digital learning tools that share the following basic characteristics:

- They should be free to students and easily available online
- They should offer personalized content that allows students to match their skills and interests to specific pathways within manufacturing. Students should be able to choose between a variety of case studies, based on their interests, which should then help students understand how their particular skills might lead to a promising career. For example, a strong interest in programming and a talent for working with other people may flag a student as a good future CNC machinist.
- The tools should integrate basic technical concepts needed in entry-level manufacturing jobs (e.g., measuring surfaces, cutting metal) with academic subjects such as geometry and reading, presented in accordance with relevant state and local standards. The goal is for the modules to fit easily into a typical middle or high school course of study.

Some educational content providers are already creating such products. For example, Learning Blade, an education software
Who: IBM, City University of New York-City Tech, New York City Department of Education
What: Pathways in Technology Early College High School (P-TECH)

Description:

P-TECH is a New York City public high school that offers an integrated high school and college curriculum focused on STEM education, with an emphasis on college and career readiness. In addition to a high school diploma, graduates of P-TECH receive an associate's degree in applied science in Computer Information Systems or Electromechanical Engineering Technology.

The program encompasses grades 9-14, with the last two years leading to an associate's degree. Students follow personalized academic pathways mapped to the requirements for entry-level IT jobs. Each student is matched with an IBM employee as a mentor. Students are also able to intern with IBM and other companies, and take some of their classes at CUNY-City Tech.

P-TECH has roughly 100 students in each grade level, and the student body reflects the multicultural makeup of New York City.
CASE STUDIES

IT TAKES A VILLAGE

Who: CareerVillage.org
What: Career information site

Description:
Guidance counselors and parents are valuable career resources for students, but they may not have all the answers that students need. CareerVillage, an education services provider, addresses this challenge by giving students the opportunity to directly ask questions of industry professionals, who volunteer their time via LinkedIn. Students can ask questions from their phone or computer, at school or at home, and can access these questions along with a question archive. This way, students can get a firsthand account of what a job in their chosen field really looks like. CareerVillage keeps students and professionals engaged and contributing through participation rewards such as badges and points.

STEM GAMES

Who: Thinking Media
What: Learning Blade

Description:
Learning Blade is an education system that introduces students to STEM-based jobs via gamification. Students complete missions that range from rescuing an injured dolphin to tackling the transportation issues of a new city. In the process, they gain exposure to real-world professions while reinforcing their math and language skills. Teachers are able to track student performance as they master applications for skills that are becoming ever more important as the demand for STEM skills continues to grow. Learning Blade's curriculum was developed with help from the Manufacturing Institute and other leaders in the manufacturing sector, as well as educators from Stanford and other universities.
developer, exposes children to STEM careers via modules that mimic real-life career activities such as working with a marine biologist to save a sick dolphin. This content is explicitly mapped against Common Core State Standards (CCSS) to provide an easy guide and integration strategy for teachers (see page 38 for more details).\(^{49}\) Khan Academy’s math curriculum modules also these standards.\(^{50}\) To avoid reinventing the wheel, manufacturers and educators interested in developing educational materials for potential manufacturing recruits should consider partnering with experienced content providers.

3 Encourage the development of innovative outreach ideas and content by incentivizing more creative minds and entrepreneurs to work in this space.
Reformers should not feel limited to working with existing educational content providers, as there is a considerable dearth of engaging content for students out there. As one educator put it, “One of the things that I really struggled with was... the lack of multimedia examples of different careers and the one that existed were just cheesy. For example, I was developing a medical assistant program and we wanted to have career exploration be the first step in the process. So I searched medical assistant and it was like all these stupid, cheesy videos that everybody just laughed at.”

One option for creating innovative new forms of youth outreach would be to crowdsource entrepreneurial expertise. Just as the X Prize Foundation (see pg. 40 for more details) hosts competitions designed to encourage technical innovation for the greater social good,\(^{51}\) manufacturers could host an “M-Prize” that would encourage content creators, tech companies and others to generate ideas for non-traditional forms of outreach, including video games, simulations, podcasts, online career exploration tools, maker fair projects, and more. The prize would include funding and development support for winning ideas.

Sample challenges could include the following: “Create a video game that simulates CNC machine programming while teaching coding fundamentals” (see page 40 for an example of a product that blends video games with learning and assessment), or “create a game that simulates running a factory while teaching critical thinking and time management.”
**CASE STUDIES**

**EYE ON THE PRIZE**

**Who:** The XPrize Foundation  
**What:** XPrize

**Description:**

Since 1996, when Peter Diamandis offered a $10 million prize for the first privately developed craft to reach an altitude of 100 kilometers three times, his XPrize Foundation has been incenting leaders in the technology, education, and business community to work together to address some of the stickiest problems of the day. More recent competitions include the 2009 Northrop Grumman Lunar Lander X Challenge and the Wendy Schmidt Oil Cleanup X Challenge in 2011. With public partners from NASA to the United Nations as well as private partners like Cisco Systems and Google, the XPrize Foundation demonstrates that finding the right incentives and bringing the right stakeholders to the table can solve challenges that stumped earlier generations.

**GET THE KNACK**

**Who:** Knack.it  
**What:** A gaming site that also measures skills

**Description:**

Knack.it is a startup game developer seeking to help individuals discover their potential, and help employers identify talent. Users play online games that ask them to make micro-decisions, which are then analyzed for insight into the individual's talents. While users are playing, the games collect data on their temperament, perceptiveness, adaptability, and many other characteristics. Employers can then use the games to match recruits with appropriate jobs.
EDUCATOR PERSPECTIVES
We also interviewed the people who work with learners throughout the course of their education—middle and high school teachers, and professors, as well as career and academic counselors and administrators—to understand the challenges they faced when preparing youth for the workforce. The following themes emerged from their stories:

TEACHERS FACE CONFLICTING PRIORITIES THAT LIMIT THEIR TIME
Most students rarely get career guidance outside the home, according to a 2002 survey of high school students. Just over half (51%) of high school students surveyed were unable to identify “someone in high school who has been a mentor or especially helpful in advising them on career or job options.”\(^5^2^\) This statistic is damning at first—however, rather than rushing to blame teachers for not adequately helping students, one should first understand the systemic issues that prevent educators from providing the appropriate resources and information that youth need.

The educators we interviewed generally expressed interest in exposing students to regional career opportunities. As one Maine teacher put it, “I am always open to easily accessible and user-friendly resources. I think most teachers are.” However, educators expressed concerns about balancing this exposure with state-mandated curriculum requirements, especially since teachers, administrators and schools are assessed based on compliance with those requirements.

Only 8% of high school counselors see their primary role as “help[ing] students plan and prepare for their work role after high school.”\(^5^1^\) ranked this role as their lowest priority
Source: National Center for Education Statistics

As one high school teacher explained, “If I take all this time out so kids can figure out what the automotive manufacturing industry is like, how much time does that take away from my kids learning math and English so that they can try to perform well on the state mandated assessments?” Another high school administrator cited the importance of balancing career education with states’ emphasis on four-year college preparation: “If you’re asking me to prepare them for college over here and that’s how I’m measured, to keep my school open I have to do that. We can’t really take several days out so kids can explore machining and line manufacturing and mechanics and all that, although I know our kids would love that.”

Several teachers cited career fairs and counselor presentations as primary methods currently employed to provide career education. However, school counselors face significant limitations in their work as well, as discussed below.
Takeaways:

1. Manufacturers and career education reformers attempting to reach students in the classroom should design their method of outreach with teachers’ existing educational metrics and commitments in mind.

2. To address capacity concerns, manufacturers could either A) offer a menu of career exploration options to teachers (e.g., videos, class visits) with varying levels of commitment based on individual teacher capacity, or B) work to integrate career exploration content with Common Core State Standards or other college and career ready standards, in the manner of Khan Academy, Learning Blade, and other innovative content providers previously discussed.

CAREER COUNSELORS ARE OVERWHELMED

In many cases, high school and community college counselors are the only source of career information that students have readily available within their educational institutions.

Yet, in the wake of post-recession academic budget cuts, student to career counselor ratios are extremely high across the country, nearly without exception. At a typical community college, there are hundreds, if not thousands, of students assigned to each career counselor. One can look to the California Community Colleges system as an example; with 72 districts, 112 colleges, and over 2 million enrolled students each year, California Community Colleges makes up the largest education system in the nation, and represents one quarter of all U.S. community college students.53

A 2011 report by the California Community Colleges Student Success Task Force showed that, “even before the 52% budget cut to Matriculation funding, colleges were unable to provide all students with access to counseling services... student to counselor ratios range from 800 to 1 to more than 1,800 to 1 in the community colleges.”54 Although numerous transformation efforts are ongoing, via the Chancellor’s Office, increasing scale is a slow process, and continues to be a critical problem for all community colleges nationwide.

High schools face a similar problem. According to the American School Counselor Association (ASCA), K-12 public school counselors have an average caseload of 471 students each,55 while high school counselors serve 239 students each, and often have to write dozens, if not hundreds, of college recommendation letters each year.
K-12 public school counselors have an average caseload of 471 students each, while high school counselors serve 239 students each.*

Each icon represents 10 students.

Source: American School Counselor Association
Also, high school and college counselors frequently do not prioritize career guidance. For example, a 2001 survey of high school counselors conducted for the National Center for Education Statistics found that 48% of counselors saw their primary role as “helping students with their academic achievements in high school.” Only 8% saw their primary role as to “help students plan and prepare for their work role after high school.” 51% ranked this role as their lowest priority.56

Colleges also struggle to prioritize career guidance. Given the large ratio of students to college counselors, the counselors we interviewed noted that it was extremely difficult to provide career guidance beyond basics, such as helping them select coursework and pointing students to common online resources such as O*Net.

College academic counselors in particular are focused mainly on helping students complete their course credit requirements. “[Counselors] don’t have time to actually sit down with the student, and help them plan out their career,” one college counselor told us. “It doesn’t work. They don’t have the time to do that. They’re trying to assist them in making sure that they have an academic plan to get the classes that they need [to graduate].” Even dedicated career counselors rarely have the time to provide individualized guidance. As one career counselor lamented, “We’re trying the best we can, but there’s such a large population.”

Takeaways:

1. For many schools, career and guidance counselors are the primary source of career information, so manufacturers should include them in outreach efforts.

2. As with teachers, counselors have limited capacity and mind space. Manufacturers should consider outreach methods that require (at least, initially) low time investment on the part of counselors until initial interest and contact are established.

EDUCATING EDUCATORS

Just as manufacturers need to proactively win over students, employers who wish to recruit the best and brightest need to overcome preconceived notions held by educators about the viability of middle-skill careers in manufacturing.

Career counselors and teachers often have little first-hand knowledge of manufacturing careers. Counselors typically have a master’s degree in counseling or a related field, according to the Bureau of Labor Statistics,57 and relatively few are versed in fields that are more technical.

Compared to academic counselors, career counselors are more likely to have professional experience outside of counseling. In fact, the majority of the dozen career counselors interviewed for this report had previously worked in a different field for at least a few years. However, these prior career paths tended to be in fields in business or the social sciences, like human resources and social work. Some educators told us that while they felt comfortable advising students on business-related careers, they had little knowledge of manufacturing pathways, and what information they did have might be outdated. One career counselor was surprised to hear about a large manufacturer’s recruiting efforts in her state, commenting, “I go to [a convening of educators and businesspeople] each year, and the big message that keeps coming out is that manufacturing has left [my state].”
Manufacturers and other employers seeking to recruit technically trained students should educate career counselors about potential manufacturing career paths and the training needed to follow those paths. If counselors are not fully aware of the skills needed to pursue successful manufacturing careers, it is difficult for them to help students make informed choices.

Takeaway:

1. Career counselors frequently feel less comfortable advising on technical careers, and would benefit from receiving clear information about the day-to-day and skills required for manufacturing careers.

DOES EVERY STUDENT NEED A BA?

We found that many high school counselors and teachers are still unsure on the pathway to success for non-four-year-degree options. Many of them tend to conflate technical training paths with high school CTE programs, which have operated for decades under a stigma of being the option for students who “can’t get into college.”

In recent years, given increased focus on STEM education, as well as the rising cost of a four-year college education, public opinion has become somewhat more welcoming of technical career paths. For example, Chicago Public Schools and the City Colleges of Chicago recently partnered with IBM, Microsoft, Cisco, Motorola Solutions, and Verizon to build five six-year public Chicago high schools focused on technical trades. Graduates of these schools would receive both a high school diploma and an associate’s degree, with guaranteed job interviews after graduation.58

However, the teacher and counselors we interviewed seemed divided on the benefits of technical, non-four-year degrees. While some of them encouraged technically minded students to explore alternative pathways, others seemed to feel that a bachelor’s degree was the surest route to professional success for most if not all students.

We interviewed one high school science teacher and department head who expressed positive views about vocational training alternatives to a four-year degree program. “I know a lot of students feel pressure to just follow a path from high school to college,” he said. “But I don’t necessarily think that’s a good thing.” Instead, he encouraged students to think consciously about their choices, including two-year college programs, “gap years” and other non-traditional options.

Other teachers were more cautious. “[Employers] look at the schools that students go to as a prerequisite for setting pay scale,” said one educator. Many teachers seemed especially reluctant to steer high-performing students into technical training programs because they feared that these programs would limit their career options.

One science teacher shared a story about a student who came to her with the idea to attend community college to get a pilot’s license. The teacher pushed back, suggesting that the student get a bachelor’s degree first. In the end, the student chose to pursue the pilot’s license anyway, and is now successfully employed as a commercial pilot. Still, this teacher believes that four-year degree programs offer the safest and surest route to a successful career.
This is a very popular view. In a 2013 poll conducted by Gallup on behalf of the Lumina Foundation, 75% of Americans surveyed on higher education either “agreed” or “strongly agreed” that a bachelor’s degree would lead to a “good job.” Only 50% agreed that an associate’s degree would lead to a good job. An additional 33% were neutral or unsure.59

In short, recruiting talented young people into manufacturing involves more than just persuading students. Even though technical training programs are increasingly gaining acceptance, employers need to carefully consider how to educate regional educators on potential alternative career pathways to success for students.

Takeaways:

1. Outreach to educators should include information on potential career pathways for their students related to manufacturing, to provide educators with confidence that manufacturing options (both degree-requiring and non-degree-requiring) are viable career paths for interested students.

2. Messaging to educators should emphasize that non-four year degree options or technical tracks are not “limiting” to youth’s future career options.

SOLUTION: HOW TO IMPROVE THE CAREER EXPLORATION PROCESS FOR EDUCATORS

Educators play an important role in steering young people into careers. Accordingly, student outreach efforts should actively include educators, demonstrating how their mentorship can have a significant impact on students, and providing information on viable regional career pathways. Such a program should have the following traits:

1. Be tailored to accommodate teachers’ regional educational metrics and requirements (e.g., meeting Common Core State Standards if applicable, state-level exams, etc.)

2. Offer information and resources that require low upfront commitment of time from educators

3. Educate teachers and counselors about the day-to-day realities of manufacturing careers, as well as career pathways to success that open to youth who enter manufacturing

4. Get educators excited about the future of manufacturing as a major opportunity for their students, rather than seeing technical careers as a less-compelling alternative to four-year college

PROPOSALS

Here are some ideas for educator and community engagement that will complement the outreach efforts proposed for youth and students.

1. Change the messaging of manufacturing programs and partnerships with schools; emphasize to parents and educators that technical training can enhance rather than limit opportunity.
Manufacturers should work to educate teachers and counselors, along with parents, about the many career opportunities open to students who master technical trades. The first step is to change the messaging around technical education and trade school programs. Currently, most such programs stress benefits such as financial stability, high graduation rates, short timeline to graduation, and so forth.

Instead, to combat worries that technical training might limit future career options, a technical education should be framed as another step on a young person’s ladder to economic opportunity. Further education is always possible, and encouraged. In the near term, however, technical training can significantly boost a young person’s earning potential. South Korea’s vocational Meister Schools” in South Korea (see page 48 for more details) serve as a potential model for this idea.

2 Provide opportunities (both in-person and virtual for teachers and counselors to educate themselves on manufacturing career pathways. Manufacturing employers can cost-effectively scale the impact of their investment in student outreach by creating resources for teachers and counselors, giving them the ability to educate thousands of students in turn.

For example, teacher field trips are gaining rapid traction in the STEM advocacy community. Chicago’s Museum of Science and Industry hosts daylong field trips where local elementary and middle school teachers learn engaging methods to teach science and math (see page 49 for more details).60 This outreach is especially critical for K–8 teachers, who normally teach a variety of subjects and may not have backgrounds in science or engineering.

Similarly, manufacturing firms interested in regional outreach could organize plant visits for local teachers and counselors. The goal of the field trips would be to convey basic manufacturing principles and provide educational materials to be shared with students.

Another option is to develop online educational resources for educators and counselors. In addition to Alcoa’s partnership with Discovery Education, discussed previously, existing models include LearnZillion (see page 49 for more details), an education site designed to help teachers learn best practices on teach various subjects from their peers. Manufacturers could work with LearnZillion or similar sites to help proliferate high-quality teaching resources and methods among secondary and post-secondary educators.

3 Ensure that all classroom materials provided by manufacturing firms (e.g., online learning modules) are designed with regional teachers’ requirements in mind. We have already discussed the possibility of developing online learning modules that integrate career education with coursework. Rather than rehashing this solution here, we instead will discuss two potential enhancements to an online module/coursework program that are specifically designed to facilitate teacher education and engagement:

• When serving a particular region, it is important to be cognizant of regional and/or state requirements that teachers may need to address as well. For instance, New York State requires the majority of high school students to take the Regents Examination in a set of “core” subjects in order to graduate and attend a four-year college, and is a top area of focus for secondary teachers.61 Therefore, a manufacturing-
CASE STUDY:

KOREAN TRADECRAFT

Who: South Korea
What: Meister Schools

Description:

In Korean culture, college has traditionally been viewed as an essential step to a successful career. As a result, Korean manufacturers often have difficulty recruiting entry-level workers with the necessary technical skills. Enter Meister Schools. Named after a German word meaning “master of a trade,” these vocational schools feature partnerships with local manufacturers, who donate equipment and expertise. Each Meister school focuses on a single trade, such as shipbuilding or semiconductor manufacturing. Each school is led by a CEO who has a professional background in that field. Meister School partner companies guarantee that students will have jobs waiting for them once they graduate. After completing four years in the workplace, graduates still have the option of earning their bachelor's degrees. By investing in students and collaborating with manufacturers, South Korea is reframing a technical career as a pathway to greater opportunity for youth.
FIELD TRIPS FOR TEACHERS

Who: Chicago Museum of Science & Industry
What: Teacher field trips

Description:

Most teachers struggle with tight budgets and limited resources that impact their ability to teach. One fifth-grade teacher, Joel Spears, admitted that when it came to science, “I went in not knowing how to teach [it], really. I didn't have the materials or the know-how.” Chicago’s Museum of Science and Industry has found a unique way to fill that gap with their Teacher Field Trips. Teachers visit the museum for a day and learn how to bring science to life in the classroom. For example, teachers are taught how to use marbles, incline planes, and Styrofoam cups to convey core mechanical engineering concepts. This program’s results have been proven to cause a marked improvement in educator knowledge and enthusiasm for teaching scientific and technical concepts. A similar concept can be used to improve manufacturing education and technical knowledge among high school and college educators.

POWERING TEACHER COLLABORATION

Who: LearnZillion
What: Collaborative learning site for teachers

Description:

LearnZillion co-founder Eric Westendorf, a former charter school principal in DC, came up with the idea of capturing and sharing best practices for teaching to Common Core State Standards. Working with a group of teachers, he created a website where teachers post examples of successful lesson plans, allowing rapid dissemination of ideas. Although educators are the primary audience, parents and students can access these lessons as well. LearnZillion now features a deep selection of Common Core content from teachers in 42 states, covering math and English topics for grades 2-12.
track program aimed at NY high school students may want to integrate explicitly with the Integrated Algebra or Geometry Regents exams.

- Before rolling out the program in full, offer teachers and counselors the opportunity to provide input and feedback on career exploration programs for students. This feedback can be solicited via online testing, focus groups, etc., as an opportunity to increase teacher engagement and interest upfront. Also, the involvement and buy-in of educators will ultimately ease of implementation and acceptance of any manufacturing curriculum when it is finally unveiled. As the failure of InBloom (see page 51 for more details), a student data startup, demonstrates, tactful messaging and feedback upfront from key stakeholders, including educators, is critical to making even the most promising products succeed.

In short, the Career Exploration process as it currently operates for the majority of U.S. students would benefit from significant intervention, with outreach from employers that is scaleable, performed early on in young people’s academic career, and designed with the needs of teachers, counselors, and other educators in mind.
CASE STUDY: WITHERING ON THE VINE

Who: InBloom
What: Student data management software

Description:

When advocating for change in public education, reformers should remember those on the front lines: parents and teachers.

InBloom, a student data management startup, offered school districts software tools that would allow them to better manage student information; by doing so, educators could offer solutions that were tailored to each student's needs. This service attracted significant attention from education reformers, along with support from the Gates Foundation and the Carnegie Corporation.

However, parent and teacher groups protested, claiming that the service hampered student privacy and allowed outside vendors access to sensitive information. Implementation of the service faltered, and the startup folded after just 15 months in early 2014. Data privacy is a complex and contentious issue, particularly in the wake of the recent NSA surveillance scandal. Therefore, InBloom's failure is at least partially due to several factors outside of its control. Yet, as Slate Magazine noted, InBloom failed to build trust among educators and often used insensitive language; the former CEO once publicly announced, “Education happens to be the world's most data-mineable industries in the world, by far.” Parental and educator fallout may have been inevitable.

InBloom failed to get early buy-in from parents and teachers and ultimately paid the price for it. Thus, this case highlights to reformers the importance of engaging communities early on when implementing change in one's region.
THE “SKILLING UP” PROCESS:
WHY AREN’T EDUCATION INSTITUTIONS & TRAINING PROGRAMS MEETING DEMAND FOR YOUNG, SKILLED WORKERS?
THE JOURNEY OF A YOUNG JOB SEEKER

1 EXPLORING CAREERS

2 SKILLING UP

3 FINDING AND SUCCEEDING AT A JOB
According to manufacturers, demand for skilled workers will only continue to grow in the future. Furthermore, regional demand for graduates of existing manufacturing training programs appears to be robust; as one college dean interviewed put it, “Our biggest problem is that employers hire our students before they even graduate.” Several manufacturers interviewed cited finding qualified hires with both adequate technical skills, as well as the “soft” skills needed to work effectively in a plant, as a top need when hiring entry-level workers, and often struggled to find such candidates in their region.

Yet, the supply of training opportunities, which facilitate the “skilling up” process for young people, seems to be in decline. For example, government-funded technical training programs have faced deep funding cuts in recent years, including a $1 billion cut in 2012.62 Training opportunities in the private sector appear to have dropped as well; as an example, the number of registered apprenticeships in the United States has fallen from 24,966 to 19,430 during 2011 to 2013 alone. The number of active apprentices has fallen approximately 40% since 2003.63 Several employers interviewed mentioned in-house apprenticeship programs that had been shuttered or downsized to cut down on expenses. In response, manufacturers are increasingly poaching skilled employees from their competitors.64 The employers interviewed generally agreed that poaching is an unsustainable recruiting tactic. Over time, it can “lead to a self-defeating cycle in which companies lose their investments in training, cut back on it even further, and grow ever more dependent on poaching,” in the words of Peter Cappelli, a professor at the Wharton School of Management.65 Given this situation, what can manufacturers and educators do to increase the supply of skilled entry-level workers?

Below, we offer strategies that manufacturers and educators can deploy to overcome various barriers that currently inhibit schools and training programs from attracting the right students and graduating students with the right skills. These barriers can be briefly summarized as follows:

1. **Financial barriers** – Both for educators and employers, which prevent program establishment and retention

2. **Communication and alignment barriers** – A lack of emphasis on soft skills, a lack of clear demand signals from employers to educators, and barriers to regional curricular alignment between employers and educators

3. **Information barriers** – A lack of easily accessible, up-to-date information about manufacturing careers that facilitates youth entering and succeeding at manufacturing programs

We will attempt to unpack why these barriers exist, and offer a set of strategies that regional reform coalitions of manufacturers and educators can consider utilizing to overcome these challenges.
As a final note: In this section, we primarily cover employer-provided training, which usually takes the form of a formal apprenticeship program or work-training program. In many regions, this is the most common form of postsecondary training provided to middle-skill manufacturing job holders. Second, we refer to educator-led programs, such as community college training programs, which are frequently, but not always, developed with the sponsorship/contribution of a local employer(s).

It is important to also acknowledge the importance of union-created training programs. In many states, unions are a major training provider for skilled trades, such as electrical work. However, as this guide focuses encouraging the growth of employer-led outreach and training efforts, we will primarily discuss training programs provided by employers and educators.

**FINANCIAL & COMMUNICATION BARRIERS**

Discussions with manufacturing employers and local training providers pointed to the following financial and communications barriers that hamper training program establishment and success:

**FINANCIAL CHALLENGES**

Traditional apprenticeship programs tend to have very high setup costs, including equipment, qualified instructors, and use of space (e.g., shop floors). Additional costs may include idle time for equipment, and the risk of having relatively untrained persons working with specialized machinery. For smaller manufacturers and even many larger ones, in-house apprenticeship programs are a difficult sell without overwhelming need.

“Most manufacturers are not giant firms. They’re 50 person and under shops and they literally are focused on making payroll by Friday”

A small/medium-sized manufacturing employer
One fabricated products plant in the Midwest spent about $1 million to set up a training program for approximately eight apprentices. These costs can grow quickly for training programs that teach specialized skills. For example, one large manufacturer sponsored a training program at a West Coast community college that taught fastener production skills; the program required $1 million worth of equipment alone.

The Manufacturing Institute points out another risk of investment: “Employees who are not already credentialed when hired require more training time on basic manufacturing processes and prerequisites prior to any specialized instruction. That increases costs and time invested. Additionally, non-credentialed employees often do not stay with a company for long periods of time, which escalates retention and recruitment costs.”66

There is also the risk that employees will go elsewhere after learning new skills on the company dime. Many of the employers we interviewed worried about employees leaving the company or being poached after completing their apprenticeships. In a poll conducted by Gallup and the Lumina Foundation, 68% of business leaders believed it was at least somewhat likely that an employee who earned a work credential would leave the company to take a different job.67

These costs impose an especially severe burden on small employers, who account for 98% of American manufacturing firms and employ one out of three Americans working in manufacturing, according to the Small Business Administration.68 As one smaller employer put it: “Most manufacturers are not giant firms. They’re 50 person and under shops and they literally are focused on making payroll by Friday.”

Only 29% of business leaders report any meaningful collaboration with higher education institutions

Source: Gallup and the Lumina Foundation

In order to justify the expense of a training program, manufacturers must be able to anticipate a certain level of demand for workers. However, the manufacturing business is inherently cyclical, especially for small firms, and is strongly impacted by the performance of the overall economy. Also, manufacturers of all sizes are under constant pressure to increase their productivity. As a result, many firms have difficulty forecasting hiring needs even over the medium term. This makes it hard for firms to justify investing in training programs, and can even inhibit employers from adequately communicating their hiring needs to the market.

Due to budget concerns, one company in our study shut down an internal training program for young people with mechanical aptitude. Some years thereafter, the company began having trouble hiring qualified workers. “Economic ups and downs are definitely one of our challenges,” another manufacturer told us. “You could have as many welding classes as you wanted in the last two years and we wouldn’t have hired any graduates. But when we did need them we were screaming for welders.”
Communication Breakdown

Education providers, such as community colleges, that establish manufacturing training programs also face high upfront costs—sufficient space, equipment of varying specialization, and qualified personnel to teach—which often acts as a deterrent to program creation. Also, metrics that determine funding may not necessarily align with market needs. “We have a system that doesn’t reward student success,” said Klamath Community College President Robert Gutierrez in a recent interview with Inside Higher Ed. “It rewards seat time.” For example, a CNC machinist training program may lead to better outcomes for students, but could still lose funding because of low completion rates (e.g., students leaving the program early to take jobs).

Because of high upfront costs and the current incentive systems, it is important that colleges and other training providers receive a clear demand signal from employers. However, systemic inefficiencies can easily inhibit good communication.

Takeaways

1. Many manufacturing firms are reluctant to invest in training programs because of their high upfront and operating costs, which are especially burdensome for smaller firms.

2. Training programs tend to be victims of market cyclicality, especially when hiring needs drop.

3. Finding ways to share costs among manufacturers and educators, or offering varying tiers of financial commitment, may encourage more firms to invest in training programs.

Large manufacturers are more likely to have sufficient resources, a large enough presence, and sufficiently strong demand for talent in a given region to create a strong enough “pull” on their own. One large employer we interviewed described setting up a training program in a new plant location by articulating skilled worker needs to the local government, which then fronted some of the initial training costs. “[We agreed in advance], ‘this is approximately how many employees we anticipate, and the skill set. This is what we would need to focus on in training.’ The government actually set up a site, a very small training area, very close to our plant... They purchased equipment [so that we could] bring in folks and train them for a few months on that equipment.” Larger manufacturers also have more capacity to maintain partnerships with educational institutions. For example, a succession-planning manager at one such firm stated, “At almost every community college that I can think of where we have a pretty large, growing facility, there’s [a firm representative]. Whether it’s a facility manager, an HR person,
or just someone who’s got a good relationship, whether they’re on the board or not, there is constant communication and contact with those organizations to let them know what our needs are.”

Smaller shops are unlikely to be able to maintain such contact, nor do many of the larger regional manufacturing firms choose to maintain such contact. Only 29% of business leaders polled by Gallup and the Lumina Foundation reported any meaningful collaboration with higher education institutions. Also, smaller firms often cannot afford to operate their own training programs. Few of them generate enough demand for talent to incentivize educators to create the necessary programs. In the absence of direct outreach to educators from an employer with a major hiring need, or potentially a group of employers via a regional collaboration, demand signals from individual employers may be obscured, hindering the development of needed regional training programs.

**Takeaways:**

1. **Due to market fragmentation and other factors, manufacturers often have difficulty conveying clear demand signals to educators.**

2. **A single body, acting on behalf of multiple employers (e.g., a workforce board, industry association, or coalition of employers) can help provide the necessary demand signals.**

**The Disconnect Between Manufacturers and Educators**

Rapid technological change has led to equally rapid change in the skills and abilities that manufacturers need to see in recruits. “We expect a lot more of the new hire than we did 30 years ago,” one employer told us. Yet at most educational institutions, the curriculum design process has not kept pace with these changes. As a result, educators frequently struggle to understand signals from an ever-evolving market.

To address this issue, it is critical to strengthen and institutionalize the connections between employers and educators at the regional level. It is also important that educators and employers speak a “common language” of skills, which can be incorporated effectively into curricula.

In recent years, several college systems have opened formal or informal channels of communication with local companies. For example, California Community Colleges recently established a cohort of Deputy Sector Navigators, who interface with regional employers in various economic sectors (see page 59 for more details).

Most of the community colleges we interviewed had some form of ongoing connection with local employers, frequently in the form of an employer council that provides input on curriculum design and market demand. However, educators and employers both expressed frustration with the prevailing quality of communication.
**CASE STUDIES**

**NAVIGATING YOUR CAREER**

**Who:** California Community Colleges  
**What:** Deputy Sector Navigators

**Description:**

The California Community Colleges system has developed a framework, called Doing What Matters for Jobs and the Economy (DWM), to promote student success and innovation and spur economic growth. To this end, college deans take on the role of Deputy Sector Navigators, and work within their regions to foster partnerships between high schools, community colleges, employers, and workforce investment boards. These Navigators allow the individual colleges to consolidate their voices to better align curricula with regional employer needs.

Another component of the Doing What Matters framework is CACareerCafe. This online resource acts as a student-employer link, helping students identify their strengths, talents, and education options, and connecting them to qualified employers.

**IDENTIFYING SKILLS FOR MANUFACTURERS, BY MANUFACTURERS**

**Who:** Federation for Industry Sector Skills & Standards (formerly the Alliance of Sector Skills Councils)  
**What:** Sector Skills Councils

**Description:**

In order for colleges and workers to meet the needs of employers, employers must be clear about exactly what their needs are. Britain’s Sector Skills Councils help 550,000 UK manufacturers to codify job skills and standards across the industry. As a result, employers can create focused apprenticeships and find training providers that teach the necessary skills. Employers are also free from the burden of wondering if their apprentices are truly qualified, as the council takes on the responsibility of verifying the qualifications before issuing an apprenticeship certificate.
Several college administrators and career counselors noted shortcomings in the frequency and granularity of feedback that they received from employers. Employer councils often meet as infrequently as once a year. One educator told us that manufacturing partnerships with higher education had declined in her region: “They used to do a better job of maintaining educator partnerships, but in the last 10 years they have not.” This is not true everywhere. We interviewed several manufacturers that had made truly laudable outreach efforts to local educators. The unfortunate reality, however, is that infrequent communication between employers and educators is still the rule rather than the exception.

Additionally, many educators expressed frustration about the process of translating employer feedback into curriculum change. “The employers really could do a really better job in reaching out to us,” said one employer liaison. “What do they want specifically? What are they willing to do to help us?”

Another administrator, charged with facilitating discussions between his college and local manufacturers, explained that the quality of feedback from employers was highly variable. Employer representatives with engineering/technical backgrounds who actually oversaw new hires tended to provide more valuable feedback than human resources and PR representatives. The latter were less likely to “speak the same language” as the program instructors who were actually responsible for training future recruits.

At the same time, manufacturers often find it difficult to communicate with numerous small colleges that all pursue independent partnership programs with employers. One community college dean recalled a meeting with a manufacturer of computer components and software. At first, the manufacturer refused to consider partnering with the college because it was too small. The manufacturer later reconsidered when the dean consolidated his college’s resources with those of other colleges within his regional system.

Another manufacturer praised Indiana’s community colleges because “they have one common community college [system] across the whole state. It’s just an easier communication path, because you’re really communicating with one group of people.”

In order to ensure productive and ongoing communication between employers and educators, it is critical to ensure that existing communication mechanisms bring the right people to the table at regular intervals. It is also vital to minimize duplicative communication efforts across regions. Successful models include Britain’s Sector Skills Councils (see page 59 for more details), and others.

Takeaways:

1. Although community colleges and employers often maintain relationships, their communication needs to be more frequent and more detailed.

2. Regional educators and employers could benefit from a single point of contact to ensure that communication between parties is clear.
NATIONAL SKILL STANDARDS WOULD HELP, BUT FACE BARRIERS

Another barrier to effective communication between employers and educators is the lack of national standards for core manufacturing skills, which help create a common language of skills for educators and employers to use when setting curriculum. In countries with a longer history of industry associations, such as Germany, standards for the vast majority of large industries are established by industry consortia and widely accepted by industry as a whole. In the United States, medicine and the law are two examples of professions that have established systems of common standards and credentials. By contrast, the manufacturing industry is still in the process of defining common and encouraging adoption of credentials for skilled trades.

Currently, there is no national manufacturing industry body that creates a set of universally accepted standards for all trades within manufacturing. Instead, there are several certifying bodies within each trade, such as the American Welding Society (AWS) and the National Institute for Metalworking Skills (NIMS). Larger employers often consider such credentials when evaluating new hires. However, other companies, especially smaller shops, often prefer to use their own internally developed assessments to hire, rather than relying on an external body. As a result, it can be challenging for educators to review the numerous existing credentialing systems and understand what credentials are most respected by employers in their region.

Several promising reform efforts are underway to clarify these distinctions and develop a unified set of standards. For example, the Manufacturing Skills Standards Council (MSSC) has developed a set of well-known credentials for “core skills” at entry-level positions in production and logistics, such as the Certified Production Technician credential. Meanwhile, the Manufacturing Institute (MI) has been working in partnership with the ACT Foundation, the MSSC, AWS, NIMS, and others to develop a Skills Certification System (see page 62 for more details), a set of uniform, “stackable” credentials for skilled trades such as welding and CNC programming. However, efforts to encourage adoption of standards thus far have encountered some obstacles to scaling and widespread acceptance.

Many companies see value in using credentials to codify needed skills in employees. The employers we interviewed generally agreed that nationally accepted credentials were more portable, enabling workers with credentials to have greater workforce mobility. They also agreed that credentials helped clarify skill needs with educators and provide a baseline set of training expectations. As one hiring manager asked, “Why can’t every technical college graduate kids with a [basic, commonly-recognized] certification? It’s standard. If everybody knew about hydraulic codes before they joined, [they wouldn’t] get themselves hurt.” A study by the Manufacturing Institute of the Skills Certification System appears to support this perspective: a number of “leaders in the manufacturing industry” reported using the credentials, and noticed lower recruiting costs, entry-level training costs, and high employee engagement.

Yet, employers in the same study reported drawbacks, namely, “lack of market acceptance” among manufacturing employers. As the report explained, the progress of credentialing seems to be affected by a Catch-22; employers are reluctant to accept new credentials until graduates with credentials are tested and proven. Yet colleges are hesitant to implement training programs centered around new credentials until those credentials gain market acceptance.
CASE STUDY:

CREDENTIALS THAT WORK

Who: The Manufacturing Institute (National Association of Manufacturers)
What: The Skills Certification System

Description:

The Manufacturing Institute's Skills Certification System develops nationally portable, industry-recognized credentials for manufacturing careers. Workers can earn credentials for skills learned in school and on the job.

The program covers a variety of skill sets across the industry, including welding, automation, die casting, fluid power, and others, along with a core set of "foundational" skills. For each area, the Manufacturing Institute partners with market leaders in skill certification to shape a set of stackable credentials.
Indeed, several site managers told us that they preferred to use their own assessments for new hires. These assessments had often been built up over several years to serve the site’s unique needs. One employer used ACT’s National Career Readiness Certificate (NCRC) to test cognitive skills, but hesitated to accept technical certificates because he felt that technical skills were too site-specific. As he explained: “An AWS-certified welder would still need to work on our machines for at least six months before being ready to work independently.”

Small and medium employers often hold similar views: one mid-sized employer interviewed, who led credentialing efforts in his region, stated, “What’s very common is that an individual employer will demand some skills [in their region] and create some sort of a local certificate that is not scalable or sustainable.”

Other employers cited the need to see a clear justification for investment before accepting new credentials. One talent development manager explained the process of how she would evaluate a credential thusly, “[I’d] go through my old training, go through the new training that’s NIMS certified, and see if it makes a difference after those four weeks. Or, we’d need to go back and find some people who actually did have those certifications and see if their performance improved.” This process tends to be onerous and expensive; moreover, if a pre-existing, site-developed assessment is already in use at a site and performs adequately, it is difficult for local hiring managers to justify the expense and time investment in an extensive credentials testing process without an external push from leadership.

Also, companies with significant government contracting businesses cited regulatory compliance as a potential obstacle to adopting new standards. “As a federal contractor, and as somebody that is analyzed regularly by the OFCCP, we are very conservative on what kind of tests we have,” one contractor told us. “I’d say 80% of our process is being worried about compliance, and 20% is on the right fit.”

**Takeaways:**

1. The manufacturing sector is still working to develop common standards for core technical skills.
2. Standardized credentialing systems can improve communication between employers and educators.

**SOFT SKILLS ARE KEY**

Thanks to the spread of automation, the ability to perform routine manufacturing tasks has become increasingly less valuable. Moreover, core manufacturing skills continue to evolve along with technology. As a result, so-called “soft” skills, such as being able to identify and correct errors, problem-solve with others, and think critically, are becoming increasingly crucial.

Workers with strong soft skills have an easier time adapting to ubiquitous change in the workplace. As one hiring manager at a manufacturing plant explained, “When we get into [skilled jobs like] machining ... again, we’re looking for core competencies in manufacturing, which really aren’t that different than they are for our management workforce. It’s teamwork, responsibility, and accountability.”
Manufacturers interviewed for this guide repeatedly stressed the importance of both soft and technical skills in new hires. The ACT Foundation goes one level deeper, and divides core workplace skills into three basic categories:

1 **Technical skills** – the appropriate knowledge and abilities needed to perform a specific task or set of tasks. For manufacturing, these skills could include understanding how to read blueprints and diagrams, or knowing how to program a CNC machine.

2 **Cognitive skills** – involve the exercise of conscious intellectual effort, such as reasoning, thinking, or remembering. These are often tested via mastery of reading and mathematics.

3 **Non-cognitive skills** – Also known as “soft skills,” these skills relate to motivation, integrity, and interpersonal interaction.

Employers across all industries in the United States are having difficulty recruiting workers with appropriate cognitive and soft skills. ManpowerGroup’s 2013 Talent Shortage survey found that 33% of employers cited “lack of workplace competencies (soft skills)” as a key reason why they were having trouble filling jobs, up from 26% in 2012. Similarly, several of the manufacturing employers interviewed cited the difficulty of finding reliable workers with the appropriate abilities.

Larger employers we interviewed addressed this issue by incorporating cognitive and soft skills into their training programs. “In our orientation, now we say, ‘you have to have interpersonal skills. You have to be a team player,’” one employer told us. “That’s one of our basics, before we even go into the job.” Additionally, a medium-sized employer told us that soft skills were one of their most critical hiring criteria, and that they were willing to provide technical skills training to those already possessing the appropriate cognitive and non-cognitive abilities. “What I can tell you with 100% certainty is that I need a pool of people who are trainable,” he said. “They come in here with the foundational skill sets of math and reading and problem solving. They show up ready to work, they don’t use drugs, they can work in teams, and beyond that they have to possess an eagerness to learn whatever the technology happens to be.”

Smaller companies, with fewer resources to spend on training programs, tend to concentrate on hiring experienced personnel, which may be a contributing factor to the poaching problem. These problems are compounded by the fact that the majority of K–12 school systems do not appear to emphasize soft skills. In a recent study by America’s Promise Alliance, 40% of employers surveyed said that the high school graduates they hired “lack[ed] enough of the ‘soft’ skills they need even for entry-level jobs.”

These problems disproportionately affect low-income youth, explained Gerald Chertavian, founder of the nonprofit training program Year Up, to the New York Times. Chertavian’s
inspiration came from his observation that the low-income youth he mentored had ambition and talent, but “little scope to plug into the mainstream economy.” This was due, he felt, to a lack of exposure to “professional culture,” which put them at risk of being permanently marginalized.\footnote{This was due, he felt, to a lack of exposure to “professional culture,” which put them at risk of being permanently marginalized.}

When promoting manufacturing training programs, it is critical for reformers to keep cognitive and non-cognitive skills firmly in mind. Although these skills are called “soft,” promoting a strong workforce ethic and problem-solving mindset in youth is crucial to building a pipeline of properly trained, work-ready employees.

\textbf{Takeaways:}

1. The lack of emphasis on “soft skills” by training programs has exacerbated the lack of alignment between training/education providers and regional employers.

2. Educators and employers should cooperate to ensure that graduates leave training programs with the hard and soft skills they will need to succeed in the workplace.

\textbf{SOLUTION: HOW TO BUILD SUCCESSFUL PARTNERSHIPS BETWEEN EMPLOYERS AND EDUCATORS}

In markets where broad demand for talent exists, but individual organizations don’t have the financial resources or market pull to create their own training programs, pooling resources can be an effective solution. However, it is not always easy for disparate employers to agree about what skills need to be taught, or to ensure effective communication between educational institutions and the private sector.

\textbf{PROPOSALS}

Based on our interviews and existing research on successful collaborations between educators and employers, we suggest keeping the following principles in mind:

1. **Neutral third-party organizations can help bring employers and educators to the table.** Intermediary organizations, such as local industry associations, can play a key role in bringing manufacturers to the table. Ryan Costella of Click Bond, a midsize fasteners manufacturer, helped establish the collaborative manufacturing training partnership Dream It Do It Nevada (see page 67 for more details). He credits industry associations with having the credibility and connections to convince several smaller employers to join the partnership. As he explains, “Manufacturers are not social animals by nature, but the state manufacturers’ association had the legitimacy to bring companies to the table to create a meaningful partnership.”

Similarly, one dean interviewed, who managed a training program supported by multiple employers, credited the industry association in his region with playing a key role in launching the program. The association, he claimed, was able to use its reputation to “pound the table” and push for consensus among employers; later, they also helped overcome fears among the smaller firms participating that larger manufacturers would benefit disproportionately from the program.

Educators and employers who form training partnerships may wish to have a third-party organization manage the partnership’s day-to-day operations, in order to address any
ongoing concerns about fairness. A local nonprofit with a history of working with both employers and education providers may be the right fit for this role.

2 Training programs should allow multiple tiers of commitment from employers. To encourage participants with limited time or money to invest in training and youth outreach programs, reformers should consider designing programs so that participants can initially participate at varying levels of commitment. This approach encourages more risk-averse participants to get involved and committed early on to the program’s ideals.

For example, a highly motivated employer could invest more upfront in creating a training program in exchange for priority in hiring candidates. A lower-commitment option would involve less upfront investment. A firm that chose this option would not have first choice of candidates, but could still be confident about the training that all candidates had received. Lower-tier participants would have the option of increasing their level of commitment, should initial participation prove successful.

3 Manufacturers need to be clear about their hiring needs. Much like students, educators need a clear value proposition in order to participate in training programs. In successful collaborations such as Dream It Do It Nevada, manufacturers committed upfront to estimating their hiring needs over the next year. The same is true for the manufacturers in our study who had established successful hiring programs.

We have seen that many manufacturers are reluctant to forecast hiring levels because they operate in highly cyclical markets. This is especially true of smaller employers. However, even rough estimates are crucial to creating momentum behind training initiatives. If individual manufacturers are unable to commit to an estimate on their own, a data analytics firm could create a broad estimate of new manufacturing job openings in the region. However, employers should still review and validate the service provider’s estimate before the project moves forward.

4 Casting is key. As we saw above, collaborations between educators and employers tend to work much more smoothly if both sides can communicate at the right level of detail about the skills that youth need to be effective workers.

On the educator side, it is critical to involve faculty who will actually be teaching the courses/training programs in question. Meanwhile, on the employer side, it is crucial to include representatives with responsibility for hiring and managing entry-level workers, who can clearly communicate the skills and behaviors that they are looking for with real-life examples. This is true for cognitive and non-cognitive skills, in addition to technical skills; manufacturing firms need to provide clear examples of how employees are expected to behave and collaborate during the course of their day-to-day life, so that educators can replicate these circumstances in training programs.

5 Employers and educators should meet regularly. While partnerships created to develop training programs are a step in the right direction, it is important to ensure that connections between educators and employers are ongoing and institutionalized, ideally in the form of an advisory council. Training and education programs can only be effective if educators stay abreast of employer skill needs. We encourage any partnerships developed to build training programs to become
Who: The Manufacturing Institute, Nevada manufacturers, and partners
What: Dream It Do It Nevada

Description:

Backed by The Manufacturing Institute (the 501(c)(3) arm of the National Association of Manufacturers), Dream It Do It is a national nonprofit engine that aims to drive industry growth and workforce development in regional economies. Nevada is one of approximately 23 states currently participating in the Dream It Do It effort, which was created to attract workers to fill the approximately 600,000 open manufacturing jobs in the U.S.

Dream It Do It Nevada provides three basic functions in its effort to lower unemployment, fill jobs in critical industries like manufacturing, increase high school graduation and college completion rates, attract new business to the state, diversify the state's economy, and make Nevada a competitor in the global marketplace:

Dream It Do It Nevada first identifies the assets within the community that enable someone to earn the training and credentials that employers value. These may be found in the business community, educational system, nonprofit sector, or workforce development system.

Next, the program identifies the necessary steps along each career pathway in Nevada's fastest-growing industries, especially manufacturing. It aligns those career paths with the Manufacturing Institute's Skills Certification System, a series of stackable, nationally portable credentials. Dream It Do It Nevada programs like Right Skills Now offer career training and internship experiences that work to fill critical worker shortages with immediate, recognized employer needs. The programs provide students with academic credit and a credential that proves to an employer that the individual is ready for work on Day One.

Finally, Dream It Do It Nevada connects job seekers with these assets by sharing messages about job fairs, factory tours, job training or professional development programs and more. It provides information to students, parents, transitioning workers and the broader community through traditional marketing and advertising, social media and community outreach efforts.
institutionalized, remain active, and meet multiple times a year. While trust can be slow to build, it is essential to successful collaboration between employers and educators.

The benefits of this close relationship can be seen in Germany’s vocational training system (see page 69 for more details). Despite fundamental cultural and political differences between Germany and the United States, U.S. manufacturers have much to learn from the German system of preparing young people for careers in manufacturing.

Consider this: All companies registered in Germany, with the exception of handicraft businesses, the liberal professions, and farms, are required by law to join a Chamber of Commerce, and to help set educational requirements for apprenticeship and training programs. The standards are set by engineers, technicians, and others with relevant technical expertise. As a result, the local Chamber of Commerce has a strong voice in setting educational standards in every community. It works closely with educational institutions to create curricula designed to develop the skills that regional employers need.

OTHER SUCCESSFUL EMPLOYER-EDUCATOR COLLABORATIONS
There are many more examples of successful educator-employer sector collaborations, both within and outside the manufacturing sector. Charlotte Works, a workforce board for Charlotte, NC, aims to “drive the development of a globally competitive workforce for Charlotte’s employers.” Charlotte Works has since established several successful skills training programs in partnership with local employers, including Siemens North America (see page 70 for more details).

The Greater Metro Denver Healthcare Industry Partnership (see page 71 for more details) is another example of a successful sector partnership outside of the manufacturing sector. It encompasses three regions—Adams, Arapahoe/Douglas and Denver—and involves collaboration between local healthcare providers, workforce investment boards, and education and training providers.

Finally, Dev Bootcamp is an excellent example of a training partnership developed by the private sector, with a non-traditional education model (see page 72 for more details). This program is a nine-week intensive training course designed to teach students how to become Ruby on Rails programmers.

At the end of the process, graduates meet with 200+ tech companies that have vetted Dev Bootcamp’s curriculum and training process. While this example does not map perfectly to the sector partnership model (Dev Bootcamp is a for-profit organization), it is a great example of a fast, responsive system that works closely with employers to identify and transmit needed skills. With further study, several of its practices could be applied to the manufacturing training space.
CASE STUDY: THE GERMAN WAY

Who: The German government, German corporations, and public vocational schools
What: The German Vocational Training System

Description:

Germany has a unique, dual vocational training system in which the federal government oversees vocational training within corporations, and the government of the German states (called Lander) oversees vocational training in vocational schools. Companies in Germany provide vocational training voluntarily, and cover two thirds of the costs associated with vocational training each year in Germany. This practice allows the workforce training system to remain current with the needs of employers. Over 50 percent of German students who do not attend university apply for vocational training.

In addition, Germany has 350 occupational standards, which have been established by representatives from government, industry, and trade. These comprehensive standards are codified in German law, to provide clear pathways for students and workers as they move along their respective career paths.
CASE STUDY:

KICKSTARTING REGIONAL RECRUITMENT

Who: Central Piedmont Community College (CPCC), Charlotte Works, Siemens Energy
What: A program that trains entry-level recruits for jobs at Siemens Energy

Description:

Charlotte Works, the workforce investment board for the Charlotte, NC area, has collaborated with Central Piedmont Community College (CPCC) and Siemens Energy to place more Americans in skilled manufacturing careers. In order to help Siemens identify qualified candidates in the Charlotte Area, the partnership created an online screening tool designed not only to find qualified workers, but to provide technical training opportunities as well.

The system requires candidates to hold the ACT Career Readiness Certificate (CRC) in order to be considered for employment, and allows applicants to schedule testing. Once candidates pass the assessment and obtain the CRC, they move on to additional, job-specific levels of assessment. Candidates who do not pass are referred to regional services, including programs provided by Charlotte Works and CPCC, for assistance with their job searches.

Siemens has hired 250 hourly workers through this program, which has identified a pool of more than 10,000 candidates that regional partners use to fill open jobs. This model of collaboration can be adapted and applied to match other regions' workforce development needs.
A HEALTHY PARTNERSHIP

Who: Colorado Department of Labor and Employment (CDLE) and the Colorado Workforce Development Council (CWDC)
What: Greater Metro Denver Healthcare Industry Partnership

Description:
The Greater Metro Denver Healthcare Industry Partnership was created in response to growing in-state demand for nurses, laboratory technicians and surgery technicians. The partnership aims to create a robust pipeline of talent for the health services sector by streamlining the process by which job seekers are informed of health care opportunities, increasing the utilization of workforce system services among the health care industry, and creating partnerships with organizations that work with youth and adults.

Members of this partnership include human resources executives, talent development managers, operations managers, and business service representatives, who meet regularly to discuss implementation activities. Their work has led to more support for training and development in the fields flagged as having a critical shortage of workers.
CASE STUDY:

BUILDING JOB-READY PROGRAMMERS

Who: Dev Bootcamp
What: A crash course for aspiring programmers

Description:

Dev Bootcamp is a nine-week immersive training program in computer programming, designed to produce graduates who are immediately employable in the software development industry. Students do not need prior programming experience. At the “boot camp,” they learn professional web development skills, such as JavaScript, HTML5, and Ruby on Rails, in an intense program that requires 70-80 hours of learning per week. Students usually work in pairs and small groups, and build skills through a series of programming challenges. As a final project, students build a new application from scratch.

The course costs $12,200, a significant upfront investment. However, about 95% of graduates find programming jobs afterward, with assistance from Dev Bootcamp. Such models of rapid training, although largely confined to programming today, have major potential to disrupt traditional training and hiring in other industries in the future.
INFORMATION BARRIERS

In addition to overcoming financial and communication barriers, reformers should consider informational barriers that prevent regional supply of talent from matching demand. We found that most regions suffer from a shortage of available information on how young people can acquire the tools and training to find meaningful work in manufacturing. We have already discussed the importance of engaging young people early on in their career exploration process. Without proper information on next steps in a manufacturing career path, even interested and motivated young people may fail to find their way into training programs.

In the course of this work, we identified several informational barriers and gaps that may hamper young people’s ability to make informed decisions about training opportunities; if left unaddressed, these gaps may hurt regional markets’ ability to supply qualified graduates to the manufacturing sector.

SOME HIGH-LEVEL INFORMATION ON MANUFACTURING JOBS AND TRAINING PROGRAMS IS AVAILABLE, BUT DOES NOT APPEAR TO BE REACHING THE TARGET YOUTH

Much of the essential baseline of information that young people would need is already being collected and published in some form. Yet for a variety of reasons, this information is not finding its way to the people who need it most. Basic statistics about professions, such as median wage, economic outlook, and educational requirements, are available on a national level. For instance, O*Net publishes a national and state-level economic outlook on machinist, mechanic, and electrician jobs (see page 77 for more details). The data includes median wages, both nationally and statewide, and an overview of the educational background and knowledge required to perform these jobs.82

The same information is available in simplified format on MyNextMove.org, a site targeted directly at students. However, none of the 30+ students83 whom we interviewed had even heard of O*Net or MyNextMove.org, let along used them for their job searches, although several expressed interest in searching these sites after learning about them. Instead, many used basic job search sites like Indeed.com, which offer far less granular data, and received the rest of their career information from in-person interactions with family members or other adults.

Data analytics firms such as Burning Glass, TrueNrtth, and EMSI collect basic wage and career pathways data, aggregating from O*Net and proprietary sources. However, these services are generally available only to students at universities that purchase this information. Moreover, even students with access may not actually receive this information—the students we interviewed showed limited awareness of the career information resources that their universities provided. Also, as previously mentioned, career counseling programs at most schools are limited by capacity constraints.

We also assessed the availability of “outcomes” data—information on how readily graduates of a training program were able to find a career, as well as basic information about starting salaries and income potential. According to the Lumina Foundation, 95% of Americans agreed that knowing the percentage of graduates from an education or training program who were able to get a good job was either “somewhat” or “very important.”84 Much of this information is becoming more readily available for middle-skill manufacturing training programs. As of 2011, the Department of Education has applied a “gainful-employment rule” to vocational programs at for-profit and community colleges. It includes mandatory disclosures
about debt accumulation and job placement rates. This rule was expanded in early 2014. Yet, it remains unclear whether these important disclosures are actually reaching students. In a Gallup/Lumina Foundation poll conducted in late 2013, 56% of Americans agreed that placement information for postsecondary institutions was either “somewhat” or “very” difficult to find. Once again, while information is out there, much of it does not appear to be in the right format or location to reach its target.

Takeaways:

1. Much of the basic information about manufacturing career pathways that young people need already exists, but not in formats that many young people know about.

2. Rather than focusing on creating new content, reformers may wish to focus on making what is already out there more accessible to youth.

Job seekers need specific, local data

The other missing piece in the information puzzle is finding region-specific and personalized information for students looking to get on a manufacturing career track. Although there is generalized statewide and national data available about manufacturing careers, it is difficult to find easy-to-understand sources of data that lay out the specific steps that an interested young person should take to get trained and ready for the various manufacturing career paths in his or her region. For example, a young job seeker wouldn’t just want to know what educational background manufacturers generally require. Instead, he or she would want to know 1) what certificate or training is required by the manufacturers in the region and 2) what educational programs are available in the region that provide this training, and at what cost.

It is especially critical to offer this information to young people in a clear format, as the path to a skilled job in manufacturing tends to vary significantly by region, by employer, and by regional labor laws. Every manufacturer we spoke to applied slightly different processes for training and recruitment, depending on state regulations, regional characteristics, and company culture. Some relied on union training programs, others operated apprenticeship programs, and still others partnered with local workforce boards or community colleges to develop training programs. However, these pathways to skilled work are often not clearly communicated to local job seekers.

There are some available online resources about regional career opportunities in manufacturing. O*Net, for example, maintains a database of training programs and registered apprenticeships, searchable by region and zip code. However, there is no way for students to assess the likelihood that these programs will lead to an actual job (i.e., how valued the program credentials are by local employers). Nor is it easy for students to understand the long-term career opportunities that a particular entry-level job might lead to.

For instance, an entry-level welder might start out earning $35,000 per year or less. However, after completing 3-5 years of work experience and passing a qualifying exam, a skilled welder can become a Certified Welding Inspector. According to the American Welding Society’s most recent survey of its
members, inspectors earned $67,222 annually on average. Entry into management or supervisory roles is also an option in some cases. Yet, this potential for advancement is not clear to a casual browser. A few companies, such as Burning Glass, are piloting “career ladder” tools. So far, this information has mainly been available to users at educational or workforce-related institutions that have opted to pay for these services.

Takeaways:

1. There is a shortage of granular, region-specific information for youth to use as a guide to possible career paths in manufacturing.

2. Students need specific, personalized information to help them identify career paths and acquire the necessary skills to succeed in their regions.

SOLUTION: PRINCIPLES FOR CREATING REGIONAL CAREER PORTALS

After their initial exposure to manufacturing careers, students still need follow-through and a sense of direction to successfully find training opportunities in manufacturing. Yet, although some of these resources currently exist, they are frequently scattered, have region-specific gaps, and have low awareness among youth. Therefore, local manufacturers should consider aggregating resources and training materials into regional career portals, or “one stop shops” that list all manufacturing jobs in a given region, along with pertinent local training, education, and full-time job and internship opportunities.

Below, we will discuss some key principles to keep in mind when scoping and planning an information tool, as well as some basic features that reformers should consider providing. Finally, to ground our suggestions in reality and to provide inspiration, we will share examples of organizations in both the private and public sectors who have developed similar information resources.

Reformers interested in developing such a tool for their region should consider the following principles:

1. Be timely. Students should be directed to online career portals soon after they receive their first exposure to manufacturing career opportunities via classroom learning or a dedicated presentation. Manufacturers should clearly state the value of the portal to students upfront, e.g.: “This portal will help you get a manufacturing job in your area.” As one nonprofit director who regularly works with low-income youth put it, “Young people are still developing their long-term thinking, so when you’re talking about careers you have to connect it to something tangible that affects them now.”

2. Avoid unnecessary complexity. Any online career portal should perform a few simple functions, and have an interface that students can easily navigate and understand. It is easy to be seduced by a sophisticated product or analytics tool, but remember that the students targeted will have varying levels of technological sophistication, and may be turned off by features that they don’t immediately understand. Simple, clear language is important for similar reasons.

3. Don’t reinvent the wheel. Numerous analytics firms, government websites, and other resources already offer much
of the manufacturing career data that students need, although it may not be readily accessible. Manufacturing consortia that are interested in developing new online resources for students should make full use of these existing tools via partnerships or licensing agreements before building out entirely new data repositories.

4 Communicate, communicate, communicate. Even the most well designed portal is ineffective if it doesn’t find its target audience. Therefore, an outreach and communications plan is a critical part of the overall portal strategy. We recommend some form of in-person outreach via some combination of the strategies suggested earlier (e.g., site visit, classroom activities), following up with a suggestion for students to view the portal.

PROPOSALS FOR BUILDING A PORTAL
Based on interviews with students, their teachers and counselors, and nonprofit leads, as well as conversations with manufacturing employers, we believe that any online career portal should provide, at a minimum, the following data:

1 Basic, region-specific information about manufacturing jobs. This information would include items such as the number and type of current manufacturing jobs in the region (if available) or state, as well as long-term employment growth projections. It would also include basic job descriptions and average salaries for the region.

O*Net is a solid starting place to collect much of this data. It includes state-specific wage information and job projections, and offers a publicly available API that enables easy integration with other web pages and applications.

Several other firms have built analytical engines designed to slice and dice basic jobs data. For example, Burning Glass, a Boston-based analytics firm, has developed “Labor/Insight” and “Career/Focus” tools that provide access to job databases, including regional availability, market forecast, and average salary. EMSI, an analytics firm owned by CareerBuilder, similarly provides “Analyst” and “Career Coach” tools that access jobs databases pulled from governmental datasets and their own proprietary job listings.

Currently, none of these tools is publicly available. Instead, the firms contract out to institutional users such as community colleges, and several of the tools are currently designed for more sophisticated users, such as researchers and data analysts. However, given that several providers have already developed analytical tools, it likely makes sense to partner with an existing vendor to provide a simplified, manufacturing-focused search tool rather than attempt to start from scratch.

2 Digital resources that bring the job to life. Although many online resources offer basic information about manufacturing careers, few of them ground the information in the reality of the
CASE STUDIES:

ON THE ROAD TO THE RIGHT CAREER

Who: Roadtrip Nation
What: A resource for career exploration

Description:
In 2008, three 20-something friends traveled across the United States in a green RV, meeting professionals in various fields. Their goal was to gather insights that would help them choose meaningful and interesting careers. They went on to launch a nonprofit called RoadtripNation.org, dedicated to helping young people explore career pathways. Currently, Roadtrip Nation offers a curriculum that empowers them to explore and discover what career is right for them. These lessons, aligned with Common Core State Standards, are accompanied with videos, hands-on activities, and for teachers, online educator resources and video training.

ONE STOP JOB SHOPPING

Who: US Department of Labor/Employment and Training Administration (USDOL/ETA)
What: O*Net (onetonline.org)

Description:
The U.S. Department of Labor's Occupational Information Network (O*Net) is a portal where job seekers can find basic career information free of charge. O*Net simplifies the task of comparing different occupations by using standard, measurable descriptors to identify the key components of each job, such as the day-to-day activities conducted and the qualifications of the average employee. O*Net currently provides information about some 974 occupations. The Labor Department surveys workers and occupation experts regularly to ensure that O*Net stays current. O*Net is currently one of the most comprehensive sources of labor information that is freely available on the Internet, and is a common resource for service providers and workforce reformers.
job, showing users what they would be required to do in a visual, understandable way.

Several private vendors have begun developing multimedia content to teach young people about career options that they might not otherwise encounter. Roadtrip Nation (see page 77 for more details) develops educational videos and interviews with people in a variety of careers, although they have not yet focused on advanced manufacturing careers.

Viridis Learning, a technology startup, trains middle-skill level job seekers using online tutorials that are designed to be interactive and exciting. Users receive an estimated completion time when they start a tutorial. Upon completion, they receive a certification from an industry organization. Currently, the bulk of Viridis’ content is focused outside of manufacturing, in fields such as retail. However, they have had success partnering with professional societies and offering certified coursework in related fields, such as construction.

As another example, CareerME, sponsored by the Society of Manufacturing Engineers, offers a number of videos, assessments, and “day in the life” write-ups for manufacturing jobs, as well as the option to search for job shadow programs by region (see page 79 for more details). These companies, however, are just a slice of the field of potential partners, both national and local.

Another option would be to encourage the development of innovative new digital resources via an “M-Prize” or similar strategy.

Region-specific career pathways information, with links to regional training programs. As discussed, there is a dearth of publicly available information that clearly lays out, on a region-specific basis, the right training and work experience necessary to receive the right manufacturing skills. Therefore, an online resource should offer a set of career pathways information that is highly region-specific, showing potential growth opportunities for each entry-level job, in addition to links to training programs. This step will provide youth with very tangible, easy-to-follow next steps on how to get trained, making it more likely for youth to actually follow through with entering the manufacturing sector.
CASE STUDY:
MANUFACTURING GOES SOCIAL

Who: National Center for Manufacturing Education, in partnership with the SME Education Foundation
What: CareerME.org

Description:

CareerME is an online resource for individuals interested in advanced manufacturing, with a particular focus on students in high school and college. Users can learn about different career pathways, as well as educational opportunities available in their respective regions and states.

Students can connect with other students, teachers, and employers by creating a profile on the site, and can access resources specific to their interests. The site offers descriptions of various employers and training programs, along with "day in the life" profiles of individual workers. Students can also reach mentors and find job shadowing opportunities.
While this information is difficult to find in publicly available resources, a few private firms offer approximate versions that could be adapted for this purpose. For instance, Burning Glass’s Career/Focus tool allows job seekers to identify potential career trajectories, evaluate their resumes, assess skill gaps, and find training programs to improve their skillset. Similarly, TrueNrt, a competency management platform, is developing a tool in partnership with the nonprofit Innovate + Educate that is designed to direct job seekers to manufacturing training programs in Albuquerque. Alternatively, regional consortia of manufacturing firms could simply identify their “most trusted” local training or work-study programs for each field within advanced manufacturing.

4 A job search tool to find open, entry-level manufacturing jobs in the region. When offering a website with a collection of resources, it’s important to present a value proposition to young people that will benefit them in the near term as well as the long-term; namely, links to entry-level jobs they are currently or nearly eligible for.

A number of companies are already offering job listing databases, including several manufacturing industry associations and professional societies. Some private firms have created specialized, searchable databases that are also worth considering. In addition to the database firms already mentioned, Workhands offers an online database explicitly designed for folks already in the skilled trades. Bright, an online job search platform recently acquired by LinkedIn, has a large database of available jobs by region, and gives applicants a “Bright Score” assessing their job-readiness based on their uploaded resume.

This list is intended as a starting place; regional needs of public-private manufacturing coalitions may vary. However, based on evidence from interviewees, we believe that readily available information with the characteristics described above would be an important first step in getting more young people into training programs, and ultimately into manufacturing.
CONCLUDING
THOUGHTS
As Wayne Gretzky advised, “A good hockey player plays where the puck is. A great hockey player plays where the puck is going to be.” The American manufacturing sector and workforce are undergoing changes at an unprecedented rate, while our current education and training systems struggle and ultimately fail to adapt apace. In order to have a skilled, trained, and adaptable workforce that is prepared for the manufacturing world ten, twenty, or thirty years from now, new models of close collaboration between employers, educators, nonprofits, and other reformers need to be created today.

This guide is intended to help manufacturing employers and educators in the early stages of their regional reform efforts, by attempting to clarify and simplify these workforce, education, and training issues. These strategies are not intended to be comprehensive, nor are they right for every manufacturing region. However, the questions and issues addressed in this document are an important first step for reformers to consider, and serve as a call to action for all to expand and refine upon the ideas proposed here.

As a final thought: the columnist Tom Friedman recently described the American market as a “401(k) world,” one with near-limitless opportunities for the motivated, but without the “walls, ceilings, and floors” that protected the American workforce in the past. Therefore, we owe it to today’s youth to prepare them with the skills they will need to get meaningful, sustainable work in the medium term, along with the non-cognitive skills and adaptability they will need to update their skills and evolve along with the market in the long term. Taking action, engaging in regional collaboration, and reaching out to youth now is crucial to ensuring the continuity and success of the American skilled manufacturing workforce.


10 Ibid., 24.


14 Sarah, Ayres. “The High Cost of Youth Unemployment.”


This method is commonly used among tech firms for user testing: The Nielsen Norman Group, a computer user interface and user experience consulting firm, argues that one only needs to test a website with about five users, since a sample size of n= 5 will uncover the majority of the site’s problems. “As you add more and more users,” argues Jakob Nielsen, a Principal at Nielsen Norman Group and a Ph.D in human-computer interaction, “you learn less and less because you will keep seeing the same things again and again. Source: Jakob, Nielsen. “Why You Only Need to Test with 5 Users.” Nielsen Norman Group. Last modified March 19, 2000. Accessed March 20, 2014. http://www.nngroup.com/articles/why-you-only-need-to-test-with-5-users/.


Ibid.


45 https://www.edsurge.com/n/2013-11-14-udacity-s-u-turn


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84 Lumina Foundation/Gallup, pg. 12


CASE STUDY ENDNOTES

ASSEMBLING A BETTER FUTURE
Van de Raadt, Suzanne. Interview by author.

STEM GAMES

KOREAN TRADECRAFT

EYE ON THE PRIZE
MANUFACTURING A NEW REALITY

HIGH SCHOOL FOR TECHIES

IT TAKES A VILLAGE

GET THE KNACK

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How to Rebuild America's Manufacturing Workforce
Hope Street Group is a national nonpartisan, nonprofit organization dedicated to expanding economic opportunity and prosperity for all Americans.

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