Career Pathways in Advanced Manufacturing
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>3</td>
</tr>
<tr>
<td>Introduction</td>
<td>4</td>
</tr>
<tr>
<td>Manufacturing Is a Multi-trillion Dollar Industry</td>
<td>5</td>
</tr>
<tr>
<td>How Guided Pathways Align with Career Pathways</td>
<td>7</td>
</tr>
<tr>
<td>What Are Career Pathways?</td>
<td>8</td>
</tr>
<tr>
<td>The Key Components of Career Pathways and Action Steps to Strengthen Them</td>
<td>10</td>
</tr>
<tr>
<td>I. Student Support</td>
<td>10</td>
</tr>
<tr>
<td>A. Career Awareness</td>
<td>10</td>
</tr>
<tr>
<td>1. Build awareness of advanced manufacturing career pathways in middle and high school</td>
<td>10</td>
</tr>
<tr>
<td>2. Conduct outreach to unemployed and career-transitioning adults</td>
<td>11</td>
</tr>
<tr>
<td>3. Host an advanced manufacturing open house and/or career day on campus</td>
<td>12</td>
</tr>
<tr>
<td>B. Career Navigation</td>
<td>12</td>
</tr>
<tr>
<td>1. Utilize career navigation tool</td>
<td>12</td>
</tr>
<tr>
<td>2. Partner with manufacturing employers to offer students job-shadowing opportunities</td>
<td>13</td>
</tr>
<tr>
<td>3. Launch or expand work-based learning opportunities</td>
<td>13</td>
</tr>
<tr>
<td>4. Launch or expand mentoring programs with local advanced manufacturing employers</td>
<td>14</td>
</tr>
<tr>
<td>C. Integrated Services</td>
<td>14</td>
</tr>
<tr>
<td>1. Partner with community-based organizations to provide wrap-around services</td>
<td>14</td>
</tr>
<tr>
<td>2. Integrate support services</td>
<td>14</td>
</tr>
<tr>
<td>II. Established Competencies and Stackable Credentials</td>
<td>15</td>
</tr>
<tr>
<td>1. Ensure curriculum and credentials are aligned with and driven by local employers’ needs</td>
<td>15</td>
</tr>
<tr>
<td>2. Clearly communicate the progression of stackable credentials within career pathways</td>
<td>16</td>
</tr>
<tr>
<td>3. Build awareness around pathways as a route to advancement</td>
<td>17</td>
</tr>
<tr>
<td>4. Seek dual-credit and articulation agreements for advanced manufacturing certifications</td>
<td>17</td>
</tr>
<tr>
<td>5. Provide input into K-12 curriculum to ensure students are college and career ready</td>
<td>18</td>
</tr>
<tr>
<td>6. Find ways to contextualize employability skills</td>
<td>18</td>
</tr>
<tr>
<td>7. Identify opportunities for upskilling</td>
<td>19</td>
</tr>
<tr>
<td>III. Strategic Partnerships</td>
<td>20</td>
</tr>
<tr>
<td>1. Seek the participation of key stakeholders to build successful career pathways</td>
<td>20</td>
</tr>
<tr>
<td>Conclusion</td>
<td>21</td>
</tr>
<tr>
<td>Notes</td>
<td>22</td>
</tr>
<tr>
<td>Resources</td>
<td>24</td>
</tr>
</tbody>
</table>
Preface

Achieving the Dream is proud to support and recognize the work of three of our network colleges, Muskegon Community College, Cuyahoga Community College, and Westmoreland County Community College. As participants in the Advanced Manufacturing Initiative, funded by Arconic Foundation, these colleges identified and carried out strategies to improve their connections to advanced manufacturing employers in their communities. Through these employer partnerships, the colleges are tackling the need to strengthen the skilled workforce.

Advanced manufacturing is an important industry sector in many local economies. Careers in advanced manufacturing provide family-sustaining wages, benefits, and the opportunity for advancement. Manufacturers are deeply rooted in their communities and are looking to grow their own talent. By working together, community colleges, employers, and other stakeholders can utilize career pathways as a means to build the advanced manufacturing workforce.

As colleges continue to move forward with guided pathways, it is critical to be intentional about the blending of career and guided pathways. Career pathways can provide the context for individuals to understand the job opportunities while guided pathways can lead them along the progression to the degree they choose.

This publication is intended to assist community colleges in strengthening their advanced manufacturing programs to build a sustainable workforce pipeline. It provides an overview of the key components of any high-quality programming and drills down on how to implement them specifically for advanced manufacturing. Each component has a series of action steps for community colleges. In order to create a balance between research and practice, it is our hope that providing readers with some of the leading thinking from organizations like The Center for Law and Social Policy (CLASP), the Center on Occupational Research and Development (CORD), and the National Association of State Directors of Career and Technical Education Consortium (NASDCTEC), colleges can further develop their understanding of how career pathways enhance their advanced manufacturing programs.

Dr. Karen A. Stout
President, Achieving the Dream
Achieving the Dream’s (ATD) Community College Advanced Manufacturing Career Pathways Initiative, funded by Arconic Foundation, brings together ATD network colleges Muskegon Community College (MI), Cuyahoga Community College (OH), and Westmoreland County Community College (PA), in partnership with employers, local workforce boards, and other key stakeholders to improve industry-college collaboration and strengthen the advanced manufacturing workforce pipeline. The initiative began in November 2016 with three regional convenings during which partners discussed the current state of education and training for advanced manufacturing—including strengths to build on and challenges to overcome—and identified priorities for their regions. Each college developed a work plan with specific action steps to be implemented by the end of 2017.

As part of the Advanced Manufacturing Initiative, ATD researched best practices and documented findings around employer engagement, career pathways, and leveraging federal funds. ATD is sharing resources and promising practices in these areas through three publications: Building Sustainable and Strategic Partnerships with Business and Industry: A Step-by-Step Guide for Community Colleges; Career Pathways in Advanced Manufacturing; and Funding Career Pathways in Advanced Manufacturing. The Building Sustainable and Strategic Partnerships guide provides action steps to support community colleges seeking to move beyond employer engagement to forming active partnerships with business and industry and securing deeper and more sustained commitment from employers. This publication, Career Pathways in Advanced Manufacturing, is intended to assist community colleges by defining key characteristics and components of career pathways, outlining specific action steps to strengthen them,
and providing practical examples from the three colleges participating in the Advanced Manufacturing Career Pathways Initiative. Finally, the Funding Guide for Advanced Manufacturing Career Pathways details funding available to community college students who have selected this career pathway.

**Manufacturing—A Multi-trillion Dollar Industry**

There are several compelling reasons for the focus on advanced manufacturing career pathways. First, the sheer size of the manufacturing sector and its impact on the U.S. economy demands higher education’s attention. In 2016, manufacturers contributed $2.18 trillion to the U.S. economy or 11.7 percent of our GDP. For every $1.00 spent in manufacturing, another $1.81 is added to the economy. That is the highest multiplier effect of any economic sector. In addition, for every one worker in manufacturing, another four employees work in related industries.1

Besides the national impact, many community colleges are located in areas where advanced manufacturing is a key player in their regional economies. For example, labor market analytics company Burning Glass projects that manufacturing and production jobs will grow 10 percent in the Muskegon Community College area of western Michigan over the next 10 years. Manufacturing and production job demand is 128 percent more concentrated in Muskegon than in the nation overall. In the Pittsburgh regional area around Westmoreland County Community College, manufacturing jobs are expected to grow by 2 percent. Around Cleveland, the region Cuyahoga Community College serves, manufacturing and production job demand is outpacing the national average; over the past two years, there were 31,337 manufacturing and production job openings and demand for these workers was 22 percent more concentrated in the Tri-C area than in the nation overall.

The need for talent in advanced manufacturing is significant. According to the 2015 Skills Gap in U.S. Manufacturing report, over the next decade, nearly 3.5 million manufacturing jobs likely will open up, fueled by baby boomer retirements. Two million are expected to go unfilled due to a skills gap in the pool of STEM-capable workers. Eighty percent of manufacturers report a moderate or serious shortage of qualified applicants for skilled and highly-skilled production positions. Manufacturing executives state the most serious skill deficiencies are technical and computer skills, followed by a lack of problem-solving skills, basic technical training, and math skills.2

There is an opportunity for community colleges to supply a qualified, entry-level workforce and also to provide training to “upskill” incumbent employees in the advanced manufacturing workforce to help address the skills gap. There is an opportunity for community colleges to supply a qualified, entry-level workforce and also to provide training to “upskill” incumbent employees in the advanced manufacturing workforce to help address the skills gap. This year, the National Academies of Sciences, Engineering, and Medicine released a
report that explores the skills gap challenge for technician positions in several industries, including advanced manufacturing. “Public-private partnerships,” it says, “including practical training partnerships between employers and educational institutions, are one way to develop necessary competencies—particularly as practice models and technologies evolve.”

Community colleges have an important opportunity to prepare students for manufacturing jobs through certificate programs or Associate of Applied Science degrees.

The colleges participating in ATD’s Advanced Manufacturing Career Pathways Initiative already are. For example, Muskegon Community College has four AAS degrees and 11 certificate programs in advanced manufacturing. Westmoreland County Community College has six AAS degrees and five certificate programs. Cuyahoga Community College has a large program with five AAS degrees, 20 certificate programs, and three certifications. Certificate programs are associated with a set of learning objectives and can be assessed in a variety of ways. Certifications validate competencies and require a psychometric-validated, high-stakes exam or performance-based assessment.

Community colleges have many strengths to bring to helping meet the talent needs of employers in their regions, as demonstrated by the three colleges in the Advanced Manufacturing Initiative. The regional convenings identified several starting points, including:

- Using existing program advisory committees composed of advanced manufacturing employees to provide ongoing advice on curriculum and skill development needs.
- Reaching out to the K-12 career and technical education system to ensure continuity for students interested in pursuing advanced manufacturing credentials in college.
- Using regional partnership opportunities to build strong ongoing relationships with employers.
- Leveraging the willingness of colleges, employers, and other stakeholders to work together to strengthen the workforce pipeline through advanced manufacturing career pathways.

“Public-private partnerships, including practical training partnerships between employers and educational institutions, are one way to develop necessary competencies—particularly as practice models and technologies evolve.”
The Community College Research Center has studied guided pathways and followed how colleges—and universities—are adopting the approach to improve student outcomes. According to the CCRC, the institutions are “redesigning academic programs and support services to create more clearly structured and educationally coherent program pathways to student end goals, with built-in progress monitoring, feedback, and support at each step along the way. These institutions are starting with the end in mind, working with education providers at the next level and with employers to ensure that program learning outcomes are clearly aligned with the requirements for success in further education and careers.”

The California Community College System has further organized guided pathways into pillars and elements:

The four pillars of guided pathways are:
1. Create clear curricular pathways to employment and further education.
2. Help students choose and enter their pathways.
3. Help students stay on their path.
4. Ensure that learning is happening with intentional outcomes.

The key elements of guided pathways include:

- Structured onboarding processes
- Academic maps
- Proactive academic and career advising
- Early alert systems
- Instructional support and co-curricular activities

The combination of robust pathways systems such as guided pathways and career pathways helps community colleges create opportunities to better serve students while simultaneously strengthening local economies. The alignment of these pathways systems requires systemic changes in the culture, organization, and delivery of education, workforce development, and social support programs. In addition, it requires key leaders to establish critical policy infrastructure to remove barriers and encourage pathways development.
What Are Career Pathways?

Career pathways are a powerful approach to addressing the talent gap in the advanced manufacturing industry. In 2009, Thriving in Challenging Times: Connecting Education to Economic Development Through Career Pathways, a joint report from the Institute for a Competitive Workforce and the National Career Pathways Network, noted the potential impact of career pathways as “an educational model that creates relevant, challenging learning environments, and, if widely implemented, has the potential to significantly increase American employers’ access to high quality, home-grown employees.” The report defined a career pathway as:

... a coherent sequence of rigorous academic and career courses that begins in high school and leads to an associate degree, a bachelor’s degree and beyond, and/or an industry-recognized certificate or license. Career pathways are developed, implemented, and maintained by partnerships involving educators, community leaders, and employers. Over the years, career pathways have emerged as part of regional efforts to create aligned programming across different educational systems that serve adults, such as adult education, non-credit training, and community colleges. Communities and industries around the country have come to use the term broadly to refer to programs that are responsive to regional labor market demand, engage employers in program design and delivery, and offer different entry and exit points along the way from adult education through a postsecondary degree. When the federal Workforce Innovation and Opportunity Act (WIOA) was passed in 2014, it contained a more detailed definition of a combination of rigorous and high-quality education, training, and other services (including counseling) that:
Aligns with the skill needs of industries in the economy of the state or regional economy involved;

Prepares an individual to be successful in any of a full range of secondary or postsecondary education options, including registered apprenticeships;

Includes counseling to support an individual in achieving the individual’s education and career goals;

Includes, as appropriate, education offered concurrently with and in the same context as workforce preparation activities and training for a specific occupation or occupational cluster;

Organizes education, training, and other services to meet the particular needs of an individual in a manner that accelerates the educational and career advancement of the individual to the extent practicable;

Enables an individual to attain a secondary school diploma or its recognized equivalent, and at least one recognized postsecondary credential; and

Helps an individual enter or advance within a specific occupation or occupational cluster.

In this definition, career pathways align with regional industry demand, encompass secondary and postsecondary credentials, and accelerate an individual’s advancement in education and career.

Career pathways have emerged as part of regional efforts to create aligned programming across different educational systems that serve adults, such as adult education, non-credit training, and community colleges.

Other organizations also have offered definitions of career pathways and their components. The Center for Law and Social Policy (CLASP) and its 10-state Alliance for Quality Career Pathways project, the Center on Occupational Research and Development (CORD), and the National Association of State Directors of Career and Technical Education Consortium (NASDCTEC) all have suggested definitions that have informed this report.
The Key Components of Career Pathways

Career pathways programs have three key components:

- student support
- established competencies and stackable credentials
- strategic partnerships

Combined, these components provide a holistic approach to career pathways where all stakeholders work together to ensure students are successful. In addition, they address the varied needs of students, whether they are traditional or nontraditional.

This section provides a brief overview of the components along with action steps associated with each one that can strengthen pathways. Examples from the three colleges participating in the Advanced Manufacturing Initiative are included here, as well.

I. Student Support

The first component of a career pathway program is student support, which has three elements: career awareness; career navigation; and integrated services.

A. Career Awareness

The first question that might come up in a career pathways context is, what are the careers that might be of interest to students? Career awareness typically refers to a specific industry (for example, advanced manufacturing) and includes: the knowledge and skill sets required for each career in that industry; educational requirements (such as degrees or required experience); where the demand is for those careers; the types of organizations that employ individuals in the careers; and the steps for advancement for each career. Career awareness is focused on helping students learn their career options and find out which ones might be good matches for them.

Action Step 1: Build awareness of advanced manufacturing career pathways in middle and high school.

According to Career Exploration in Middle School: Setting Students on the Path to Success, middle school is a time when students can benefit the most from career exploration, a process of building self-awareness, learning about potential careers, and developing a plan for reaching future goals. Students in middle school are at higher risk for disengaging from learning due to challenges in forming identity, coping with puberty, and navigating new environments. Yet, they are also developing the ability to think abstractly, and forming their preferences for teamwork and active learning through exposure to relevant real-life scenarios. These preferences make middle school a natural time for students to learn about careers and develop skills such as problem solving, critical thinking, and teamwork through career exploration activities. Community colleges can collaborate with middle schools to organize field trips to campus for hands-on demonstrations in their advanced manufacturing labs, or plan mini-summer camps or other activities. College representatives can visit the middle schools to build awareness around advanced manufacturing careers and the programs the college offers.
In many states, students often begin crafting personalized education and career plans in middle school to help guide decisions about future course-taking and career exploration.

Once students are in high school, they typically start making more concrete decisions on career pathways, given that they may need specific classes in preparation for the college-level coursework that leads to a credential. Among high schoolers, a large majority (64 percent) report that the greatest influence on their future careers is their own experiences and interests. This is followed by their father and mother (22 percent and 19 percent, respectively) and their teachers (11 percent). This is where career and technical education (CTE) offerings in high school can make a difference by exposing students to a variety of career pathways.

CTE programs prepare students to be college- and career-ready by providing core academic skills, employability skills, technical skills, and job-specific skills. Some CTE programs have advanced manufacturing career academies where students can start coursework and even earn industry-recognized certifications. When considering what field to pursue as a career, 43 percent of all CTE students indicate they plan to pursue a career in their CTE field of study. However, for students that participate in Career and Technical Student Organizations (CTSO), 55 percent plan to pursue a career in their field of study. And this rises to 63 percent for participation in SkillsUSA, a national membership organization serving middle-school, high-school, and college/postsecondary students who are preparing for careers in trade, technical, and skilled service occupations. In comparison, only 37 percent of CTE students not participating in CTSO activities will pursue a career in their field of study.

Community colleges can partner with their local high schools in many ways, such as by supplying instructors, providing hands-on experiences on campus for the students, distributing materials on the college’s advanced manufacturing offerings, and making their career advisors available to students. They can also get involved in organizations like SkillsUSA that help prepare students for technical careers in advanced manufacturing, such as additive manufacturing, engineering and technology, mechatronics, mobile robotics technology, and welding.

**Action Step 2: Conduct outreach to unemployed and career-transitioning adults.**

Advanced manufacturing offers stable careers and opportunities for advancement, which are attractive to adults who are unemployed or may be working in low-wage/low-skill jobs. Community colleges can connect with unemployed adults and those transitioning into new careers through America’s Job Centers (also called One-Stop Career Centers) or through non-profit and community-based organizations that focus on increasing the skill levels of adults and on employment training. Community colleges also can reach out to
adult students taking classes on the non-credit side of their colleges (possibly as part of changing jobs/careers) and inform them of the high-quality career pathways available in advanced manufacturing.

**Action Step 3: Host an advanced manufacturing open house and/or career day on campus.**

Colleges can host career days to build awareness around advanced manufacturing careers and the educational opportunities available through their colleges. These can be held around the time of Manufacturing Day on the first Friday in October or any time of the year. For example, Muskegon Community College is hosting an open house for junior high and senior high students at the new MCC Downtown Center in conjunction with Manufacturing Week activities. Colleges can access materials and national support through programs such as The Manufacturing Institute’s Dream It. Do It. network. Dream It. Do It. is a national campaign focused on changing public perception of the industry and inspiring next-generation workers to pursue manufacturing careers. More information can be found on The Manufacturing Institute’s web site, listed in the Resources section.

**B. Career Navigation**

Just as important as career awareness, career navigation answers students’ questions about “How do I get there?” and identifies where students may acquire assistance, in the form of navigation tools, career counseling, and mentoring. According to The Career Pathways Effect: Linking Education and Economic Prosperity, there are a number of players who can counsel students about selecting and navigating through their careers. These people include counselors who act as team leaders and facilitators; teachers who assist with integrating career information into the curriculum framework; administrators who are part of the school improvement process; employers who ensure programs are on target and support work-based learning; parents who model attributes and knowledge that affect students’ career choices; and the community that provides mentors and work-based learning experiences. By working together, all players can contribute to helping students find their passions, match their interests to pathways and programs of study, be college and career ready, and select their careers.

**Action Step 1: Utilize career navigation tools.**

Navigation tools can vary from online career inventories used by various state departments of education to O*NET (the U.S. Department of Labor Education & Training Administration’s database) or actual organized career systems like the National Career Clusters® Framework. The framework provides a vital structure for organizing and delivering career pathways programs. In total, there are 16 career clusters in the National Career Clusters® Framework, representing more than 79 career pathways.
to help students navigate their way to greater success in college and career. The National Career Clusters® Framework is useful for career pathways in advanced manufacturing since the industry has its own career cluster within the framework. As an organizing tool for curriculum design and instruction, career clusters provide the essential knowledge and skills for the 16 career clusters and their career pathways. It also functions as a useful guide in developing programs of study bridging secondary and postsecondary curriculum and for creating individual student plans of study for a complete range of career options.

Action Step 2: Partner with advanced manufacturing employers to offer students job-shadowing opportunities.

As defined by Monster.com, job shadowing involves following, or shadowing, a professional throughout a workday or work week to get a close look at what a particular job involves. In cooperation with employer-partners, students can “try out” different careers that are of interest to them and determine which is a good fit. Job shadowing typically is different than internships in that students shadow several different employees and for shorter periods of time.

Action Step 3: Launch or expand work-based learning opportunities.

Work-based learning, such as internships and co-ops, offer advantages for both students and employers. These opportunities are included under the umbrella of career navigation in that they give students who are aware of advanced manufacturing careers a way to confirm interest and fit. The 2015 Deloitte and Manufacturing Institute’s 2015 Public Perception of Manufacturing Report identified internships and work-study programs as the best way to increase interest in manufacturing.

The benefits to students include:
- Learning new skills;
- Building their resumes;
- Trying out a potential employer;
- Completing interesting and challenging tasks;
- Earning money while in school;
- Fulfiling degree requirements; and
- Earning college credit.

For employers, advantages include:
- Identifying future hires;
- Creating a pipeline for additional candidates;
- Recruiting with low risk (by first “trying out” the students);
- Gaining short-term talent; and
- Providing new ideas to the company.

Westmoreland County Community College is increasing the availability of student internships at advanced manufacturing companies and is establishing a metric to document the number of students it has placed. Through the initiative, it has addressed employer and intern confidentiality by developing statements that require student, faculty, and employer signatures. The college is integrating a capstone course into its curriculum that prepares students for internships, covering topics such as interview skills, how to dress for the workplace, writing resumes, and developing soft skills.

Cuyahoga Community College promotes internships and co-op opportunities with regional employers using a professionally designed brochure on how they can get involved. It also distributes a workforce readiness and professionalism piece to interns.
Action Step 4: Launch or expand mentoring programs with local advanced manufacturing employers.

Mentoring can be helpful to students navigating a career pathway. According to the National Mentoring Partnership, by preparing young people for college and careers, mentoring helps develop the future workplace talent pipeline. Mentors can also prepare their mentees for professional careers and assist with their workplace skills. Partnering with employers on career pathways can sometimes mean that employers play a mentoring role all along the workforce pipeline from the time students select careers all the way through post-hiring.

The importance of students having employer-mentors while in the educational setting cannot be overstated. Mentors can help the students see the link between their current interests and skills and a potential future career in the mentors’ selected career pathway. They can offer guidance and direction as to what skills the student should be mastering and how to navigate any potential pitfalls. Corporate culture is something that needs to be observed and learned, and mentors can help speed up the process for mentees. The employer mentor-mentee relationship in both the educational and work setting can help individuals make the transition from education to work, especially when the mentoring relationship begins in college and lasts through the mentee’s securing a job.

C. Integrated Services

Today’s community college students are juggling work, family responsibilities, and school. According to the American Association of Community Colleges’ 2017 Fact Sheet, 62 percent of community college students are working and going to school, 36 percent are first-generation college students, 16 percent are single parents, and 72 percent apply for financial aid. One of the key components included in CLASP’s Alliance for Career Pathways Framework is students’ access to services, including child care, transportation assistance, housing assistance, mental health and counseling, personal success skill development, workplace skills, digital literacy skills, and citizen development for some pathway programs for youth and immigrants. Connecting to community-based organizations (CBOs) can provide wrap-around support for students in a variety of areas that may not be available through their education providers. This can help students embarking on career pathways to focus more on school and completion.

Action Step 1: Partner with community-based organizations to provide wrap-around services and build awareness among students on their availability.

While specific community-based organizations vary in each community, locating resources to support students, such as housing, transportation assistance, child care, and other services is important. Once these relationships are established, building students’ awareness of them and connecting students to them is key. According to the research brief, “The Role of Community-based Organizations in the College Access and Success Movement”, community-based organizations meet student needs for support with persisting to degree completion in a way that postsecondary institutions do not always have the capacity to address. The knowledge CBO staff have of the issues students and their families face in their daily lives enables them to help students overcome barriers to their college goals that otherwise might seem insurmountable.

Action Step 2: Integrate support services.

On the other hand, community colleges may have their own efforts underway to enhance
and integrate student support services. For example, the ATD’s Working Students Success Network (WSSN) initiative involved 19 community colleges in four states working in partnership with local non-profits and public agencies to help low-income students complete certificates and degrees and prepare for jobs that pay family-sustaining wages. As part of the initiative, students accessed wrap-around services as well as training, information, and tools about budgeting and financial products. One of the proven strategies of the WSSN was to coordinate and bundle support services to stabilize students’ financial lives and strengthen their capacity to earn an income, build or repair credit, and increase their savings and security. The initial set of colleges that adapted this approach demonstrated gains, such as increasing term-to-term retention rates by 15 to 20 percent. Details on the WSSN, including how the participating college used an integrated services delivery approach, can be found at the link listed in the Resources section.

II. Established Competencies and Stackable Credentials

The second component of career pathways is established competencies and stackable credentials. Competencies encompass the knowledge and skill sets required for specific career pathways. Those competencies are “established” and represented in the curriculum based on what employers say is required for careers in their industry. In other words, curriculum builds competencies that provide significant value to students, ensuring that their investment in time and money is going to lead to employment.

According to the CLASP Alliance for Career Pathways Framework, stackable credentials are those that are part of a sequence of credentials that can be accumulated over time to build up a person’s qualifications and help the person to move along a career pathway or up a career ladder to different and potentially higher-paying jobs. The credentials are carefully aligned to skill sets needed in a given industry or occupational sector and have relevance, credence, and currency with employers.

Action Step 1: Ensure curriculum and credentials are aligned with and driven by local employers’ needs.

Advanced manufacturing curriculum and associated credentials will vary by community college, but they should be aligned to the regional and local needs of employers. Many times, community colleges have employers serve on
curriculum advisory groups, which is important, but the ideal with career pathways is that employers are engaged partners and provide input into the credentials that can be earned as well as the curriculum.

Advanced manufacturing credentials include degrees, certificates, and certifications. Currently, degrees and certificates in advanced manufacturing and related sciences are more common, though there is an increase in the number of community colleges offering certifications. A third-party organization issues these certifications using an exam and/or performance-based assessment to validate an individual’s competence to perform a specific set of skills. Examples include stamping or metalworking certifications awarded by the National Institute of Metalworking Skills or welding certifications issued by the American Welding Society. According to the National Survey on the Value of a Credentialed Workforce report, over 90 percent of companies that use industry-recognized certifications believe they make a difference in validating the skills of their employees. Community colleges are the partners that companies most frequently use to hire certified students as well as to certify their incumbent workers.

The Manufacturing Institute has what it calls the “M-List” of high schools, community colleges, technical schools, and universities that offer students the opportunity to earn skill certifications endorsed by the National Association of Manufacturers as a standard part of its manufacturing education programs. These certifications start with foundational skills and cover crosscutting technical skills, machining and metal working, welding, automation, construction, die casting, fabrication, fluid power, lean, mechatronics, quality, transportation-distribution-logistics, and technology and engineering. Detailed descriptions of these certifications can be found on the Manufacturing Institute’s web site listed in the Resources section.

Besides linking curriculum and credentials to the needs of employers, another aspect of meeting employer needs is verifying that the college is using equipment equivalent to what its manufacturing partners are using. For example, Westmoreland County Community College has made it a goal of the Advanced Manufacturing Initiative to upgrade its equipment. Another practice—and goal for the college—is enlisting retired employees from local/regional employers to come work as instructors.

**Action Step 2:** Clearly communicate the progression of stackable credentials within career pathways.

Ensure students know their options in advanced manufacturing at the college by communicating which credentials are available in each career pathway and how they build on one another. Visuals are an effective tool for present-
ing career pathways. For example, Cuyahoga Community College uses an arrow diagram (see graphic below), with each step in the pathway presented as a building block beginning with pre-college training through a bachelor’s degree.

Other options could include a pyramid figure, with each stackable credential moving up the pyramid, or “steps” showing the progression of stackable credentials up the stairway.

**Advanced Manufacturing Career Pathway – Stackable Certificates**

**Secondary Pathway: Industrial Welding**

<table>
<thead>
<tr>
<th>Pre-College Training</th>
<th>Introductory Welding (Credit Welding)</th>
<th>Industrial Welding (Credit Welding Tech)</th>
<th>ISET: Integrated Systems Engineering Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>8th Grade Reading/Math/Algebra</td>
<td>16 Weeks Training</td>
<td>1 Year Training</td>
<td>28 weeks Training</td>
</tr>
<tr>
<td></td>
<td>Credits: 18</td>
<td>Credits: 35</td>
<td>Credits: 27</td>
</tr>
<tr>
<td></td>
<td>Median Salary: $10-$14/hr</td>
<td>Median Salary: $10-$18/hr</td>
<td>Median Salary: $45,000-$70,000</td>
</tr>
<tr>
<td></td>
<td>Tuition: $4,295</td>
<td>Tuition: $8,690+fees</td>
<td>Tuition: $2,850+fees</td>
</tr>
</tbody>
</table>

**Postsecondary Program: Technology Management Degree**

<table>
<thead>
<tr>
<th>Bachelor's Degree Technology Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated Systems Engineering Technology</td>
</tr>
<tr>
<td>Technology Management</td>
</tr>
<tr>
<td>4-year</td>
</tr>
</tbody>
</table>

**Action Step 3: Build awareness around pathways as a route to advancement.**

Be sure students know that the college’s clearly defined career pathways not only lead to entry-level employment, but also to career advancement once they are employed in advanced manufacturing. Burning Glass analyzed the resumes of manufacturing and production workers to identify the most common pathways to advancement in advanced manufacturing. It pinpointed the opportunities workers have to earn stackable credentials in a career pathway and developed them into a career ladder leading to professional advancement. The career pathways focus on machining, installation, maintenance and repair, and quality assurance and testing. Examples of these pathways can be found on the ATD website.

**Action Step 4: Seek dual-credit and articulation agreements for advanced manufacturing certifications.**

The added value for community colleges to embed advanced manufacturing certifications in pathways is the academic credit students earn as well. This credit the community college can grant for its current students as well as for high school students through dual-credit and articulation agreements. The Manufacturing Institute’s *Awarding Credit for Industry Certifications and Developing Innovative Articulation Agreements: A Brief on Best Practices* includes ideas and examples of how to institute practices that maximize the opportunity to embed certifications. These include:

- Creating dual-credit arrangements with local and regional high school systems to allow students to begin certification in high school and complete in college, many times leading to AAS degrees;
Awarding college credit to individuals who earned advanced manufacturing certifications in the past;

Embedding certifications into college coursework, awarding credit for those certifications;

Articulating accelerated models on the non-credit side to for-credit associate degrees;

Cross walking certifications to college courses.23

In addition, there is also the option to implement articulation agreements for advanced manufacturing certifications offered through other training providers, which can attract new populations of students, particularly adults, to the community college and help accelerate their completion of credentials. For example, as part of the Workforce Innovation and Opportunity Act (WIOA), certain localities where advanced manufacturing is a high-growth industry have training programs in place through non-profit and community-based organizations. The WIOA requirement of offering industry-recognized credentials would include advanced manufacturing certifications. These programs service adult unemployed and dislocated workers, who as part of their career plans, could enroll in community colleges to complete a certificate or degree.

Action Step 5: Provide input into K-12 curriculum to ensure students are college and career ready.

According to the National Academies of Sciences, Engineering, and Medicine, advances in science and technology have transformed production processes such that many skilled technical manufacturing jobs now require higher levels of science and math skills, placing manufacturing squarely in the class of STEM occupations.24 To ensure that students are prepared for post-secondary coursework and have the technical, problem solving, and STEM skills required for advanced manufacturing careers, it is important that all stakeholders in workforce development, industry, and education encourage a focus on STEM skills in the K-12 curriculum.

The need for STEM skills crosses a variety of industries, producing many opportunities to collaborate and approach K-12 with a unified voice to support STEM education efforts. For example, on the policy-side, there is the STEM Education Coalition, which works to raise awareness in Congress, the Administration, and organizations about the critical role that STEM education plays in enabling the United States to remain the economic and technological leader of the 21st century global marketplace. There is also STEMconnector®, which is both a resource and a service, designed to link “all things STEM” through a comprehensive website and portfolio of products that connect national, state, and local STEM entities. The STEMconnector® website contains profiles of STEM-related entities and details who is doing what in STEM education throughout the world. Web site links to the STEM Education Coalition and STEMconnector® are included in the Resources section.

Action Step 6: Find ways to contextualize employability skills.

A common theme at the initiative’s regional convenings was the need for students to be versed in “soft skills” in addition to required technical skills. These skills are also commonly referred to as 21st century skills, workplace skills, or employability skills. They include teamwork, communication, problem-solving skills, and productivity.

The integration of these skills into community college coursework can be done through contextualized learning. Educators already apply many approaches to building soft skills through
group projects and presentations. The National Network of Business and Industry Associations has several tools that provide practical ideas for integrating these skills into everyday instruction. They are built on its Common Employability Skills Framework. A link to the document is included in the Resources section.

In addition, employers can bring what students are learning in school to life by recommending real-world applications of academic topics. They can provide educators with input on how to contextualize subjects like math and reading as well as project-based learning ideas. Company employees can even serve as advisors to students who are completing a manufacturing-related project.

For example, Cuyahoga Community College is developing a manufacturing-specific, soft-skill module based on employer input that addresses safety, team-building, and communication skills. Muskegon Community College is including soft skills and work preparation competencies for interns through a new intern-orientation process. Westmoreland County Community College is utilizing the expertise of its local workforce board to help its students with soft skills training.

Action Step 7: Identify opportunities for upskilling.

Upskilling refers to the skills development and training of employees for the purpose of:

- Enhancing employees’ skill sets to provide better performance in their current positions;
- Equipping employees with the skills and opportunities required to advance to higher paying positions;
- Meeting the increasing need for higher level skills to support higher, value-added activities in the economy;
- Providing opportunities to “backfill” vacant slots with other employees positioned to move up the organization.

According to the National Skills Coalition, companies that are interested in helping their employees upskill and advance in the workplace have a range of interventions available to them, such as industry sector partnerships that bring together multiple firms in the same industry along with an education and training partner. Community colleges are ideal partners for this model. In the way colleges themselves are organized, they can provide on- and off-ramps for incumbent workers to earn industry-recognized certifications as well as short-term certificates.
III. Strategic Partnerships

The third key component for career pathways is strategic partnerships.

**Action Step 1:** Seek the participation of key stakeholders to build successful career pathways.

Ensure that stakeholders from the following entities are partnering with the college.

**K-12 education system.** The K-12 education system will be providing the foundation of knowledge and skill sets for the youth who will eventually be in the workforce pipeline. Many of them offer career academies as well as dual-credit options and have a role in building awareness among students of available careers and career navigation.

**Community and technical colleges.** They can provide the curriculum and instruction for the career pathways as well as articulated credit with the K-12 system. They also can help students navigate career pathways and provide services for them to transition to employment.

**Employers.** Employers can provide demand information, advise on curriculum development and appropriate credentials, as well as provide work-based learning, mentoring, and employment opportunities.

**Community-based organizations.** These organizations can provide referrals and a wealth of supportive services to students, such as food, housing, counseling, and more.

**Workforce entities.** These entities can provide workforce data, employment services, and educational opportunities on employment topics such as resume writing and interviewing skills. They also can be a source for reaching adult workers, who might be interested in advanced manufacturing career pathways.

The key to success is that the partnerships are strategic. Implementing career pathways can’t happen overnight and requires commitment from all parties to help advanced manufacturers find the talent they need and to provide students with a variety of high-quality career opportunities. By taking a strategic, regional approach, all players can bring their areas of expertise to the table and work towards a common goal.

One statement about career pathways has great meaning and impact. Career pathways are only successful with strong partnerships.

After its experience with the Advanced Manufacturing Initiative, Cuyahoga Community College affirmed, “We intend to build upon existing partnerships as well as develop new partnerships. We often hear of new workforce initiatives launching in our region. By collaborating and convening with these organizations we become proactive, begin to work more efficiently, and potentially avoid the fatigue for employers and civic stakeholders of stopping and restarting multiple initiatives with no concrete action plan in place.”

While all strategic partnerships are important, one of the most essential to the success of career pathways is between educators and employers. As stated in *Thriving in Challenging*
Conclusion

Career pathways in advanced manufacturing provide community colleges and their partners the opportunity to strengthen the workforce pipeline to meet the talent needs of local manufacturing employers. By understanding the key components of career pathways and taking the recommended concrete action steps, colleges with advanced manufacturing programs can enhance their career pathways. The combined efforts of industry, education, and workforce entities can address the skills gap and help community college students to embark on a variety of career pathways in advanced manufacturing to support themselves and their families with sustainable employment into the future.
Notes


13. https://careertech.org/career-clusters


Resources

Dream It. Do It. Campaign

ATD’s Working Students Success Network (WSSN)
http://achievingthedream.org/resources/initiatives/working-students-success-network

NAM-Endorsed Skill Certifications

STEM Education Coalition
http://www.stemedcoalition.org/

STEMconnector®
https://www.stemconnector.com/

National Network’s Common Employability Skills Framework
http://nationalnetwork.org/blog/wanted-tools-to-equip-students-with-common-employability-skills/
ABOUT ACHIEVING THE DREAM

Achieving the Dream (ATD) leads a growing network of more than 220 community colleges committed to helping their students, particularly low-income students and students of color, achieve their goals for academic success, personal growth, and economic opportunity. ATD is making progress closing achievement gaps and accelerating student success through a unique change process that builds each college’s institutional capacities in seven essential areas. ATD and more than 100 experienced coaches and advisors work closely with Network colleges in 39 states and the District of Columbia to reach more than 4 million community college students.

FOR MORE INFORMATION ABOUT ACHIEVING THE DREAM:
Visit www.AchievingtheDream.org
or contact us at info@AchievingtheDream.org
or call 240-450-0075
Follow us on Twitter @AchieveTheDream