

Manufacturing Jobs Part II: Education and Workforce Development Strategies to Close the Skills Gap

Briefly

Manufacturers in Washington state face ongoing workforce challenges. The strong economy and growing retirements from the Baby Boom generation have created substantial new job opportunities. Yet, too often, employers have difficulty finding workers with the necessary skills.

The industry has been transformed by technology. Production workers increasingly require education and training beyond high school. Professional and trade certifications, apprenticeships, mentoring, and college coursework are among the strategies being pursued to close the “skills gap” confronting employers and job seekers.

As a state with a vibrant manufacturing sector, including leaders in aerospace, agriculture, maritime, and other technology-driven production, Washington has made significant investment in addressing the demand for skilled workers. Industry executives are working with state and local officials and educators to design programs to increase the postsecondary education attainment rate. An ambitious, but reasonable goal has been set to increase the number of Washington students attaining a postsecondary credential by age 26 from the current 31 percent of Washington students to 70 percent by 2030.

Much of the emphasis in this paper addresses strategies to meet near-term demand for production workers, positions which often do not require a four-year degree. There are many paths to career employment in manufacturing: Apprenticeships, certification in skilled trades, two-year and four-year degrees all play a critical role in preparing workers for the opportunities a vibrant economy offers. As individuals' careers evolve, employees will often experience demands for additional training and education, from onsite workplace programs to post-graduate degrees. And some with four-year degrees may choose to supplement their education through apprenticeship or trade programs. The key is making sure that no path is prematurely foreclosed, no opportunity for advancement precluded because the necessary training and education is not available.

Opportunities in manufacturing abound. In 2016, 286,272 workers were employed in manufacturing in Washington, an industry with above average wages. Average annual wages for all industries statewide are \$59,090; manufacturing jobs pay an average of \$74,632 (26.3 percent higher).

Obtaining the skills required for manufacturing careers involve an inclusive, all-of-the-above approach. It begins with opening up the pathways to postsecondary training and education, including boosting the state's high school graduation rate. Washington is making encouraging progress, through the Career Connect Washington Task Force, Workforce Training and Education Coordinating Board, career-focused programs at the community and technical colleges, apprenticeships, and more. Closing the skills gap requires maintaining both a sense of urgency and a close partnership with industry to guarantee that training and education programs align with demand.

This is the second in a series of reports on manufacturing in Washington. The first, **“Rebalancing Priorities: The Case for Manufacturing Jobs Part I”** was published September 18, 2017.

An extraordinary number of employment opportunities will come open in Washington in the next few years. A recent report from the Washington Roundtable (WRT) and Boston Consulting Group (BCG) estimates there will be 740,000 job openings between 2016 and 2021 (WRT and BCG 2017). In the years ahead, manufacturing jobs are projected to increase in the state. This expansion of jobs, coupled with the accelerating pace of Baby Boomer retirements, means that there will be a substantial demand for workers.

Unfortunately, employers report that they currently experience difficulty finding workers with the requisite training and education. The WRT-BCG report emphasizes that “The majority of job opportunities—particularly those that will support upward mobility and good quality of life—will be filled with workers who have postsecondary education or training” (WRT and BCG 2017).

Manufacturing jobs in Washington’s tech-driven economy require workers with higher levels of education and training than they previously needed. Rather than recruiting these workers from out of state, employers want to hire Washingtonians for Washington jobs. And they are working with state education and economic development leaders to help shape a training and education system that maximizes opportunities for Washington students. Community and technical colleges, training partnerships between the colleges and businesses, and registered apprenticeships are some of the routes being explored and expanded—along with continued focus on career education in middle and high schools.

Although the skills gap is a national phenomenon, Brian Bonlender, head of the state Commerce Department, believes there are factors that are particularly acute in Washington. He says the state’s diverse and technology-driven economy may be causing Washington to experience the skills gap before other states.

“Workforce is universally the number

one issue for anyone coming into an area,” he says. And “having workforce ready and able to adjust and obtain additional training has become more important.”

Manufacturing’s Role in Washington’s Economy

Although nearly all industries report a skills gap, the shortfall in manufacturing is acute and, given the industry’s prominence in the Washington economy, of statewide concern. As we reported in Part I of this series,

Manufacturing is a particularly beneficial economic activity. Wages are generally substantial. . . . National experts of varying ideological persuasions agree that restoring American manufacturing should be a priority.

In 2015, economists brought together by the Brookings Institution and the American Enterprise Institute (AEI) agreed that the creation of manufacturing jobs is key to securing a middle-class life for workers without advanced degrees and should be among our highest priorities. . . .

The whole community benefits in many ways from manufacturing activity. Each manufacturing position creates from two to eight additional jobs, and sometimes as many as 13. (WRC 2017)

Washington’s manufacturing future builds off a strong base. In 2016, 286,272 workers were employed in manufacturing in Washington. King County is home to the largest percentage of state manufacturing employment (36.4 percent), but just 7.9 percent of employment in the county is in manufacturing. Manufacturing is more important as a share of total county employment for 15 other counties, located all over the state (as shown in Table 1 on page 3). Snohomish County has 22.0 percent of state manufacturing employment, and 22.3 percent of employment in the county is in manufacturing (the highest percentage in the state). Manufacturing accounts for 18.4

percent of Klickitat County employment and 16.5 percent of Cowlitz County employment. (ESD n.d.)

As part of the state's Feb. 2018 economic and revenue forecast, the Economic and Revenue Forecast Council (ERFC) projects that manufacturing employment in the state will increase by 4.4 percent from

2017 to 2023 (total employment is projected to increase by 9.5 percent) (ERFC 2018).

Manufacturing jobs pay well—in most counties, better than total average wages (as shown in Table 2). Average annual wages for all industries statewide are \$59,090; manufacturing jobs pay an av-

Table 1: County Manufacturing Employment, 2016

	As a Percent of County Total Employment	As a Percent of State Manufacturing Employment
Snohomish	22.3%	22.0%
Klickitat	18.4%	0.5%
Cowlitz	16.5%	2.2%
Walla Walla	13.5%	1.3%
Adams	13.4%	0.4%
Skamania	13.2%	0.1%
Grant	12.5%	1.7%
Pacific	12.4%	0.3%
Lewis	12.4%	1.1%
Stevens	11.8%	0.4%
Skagit	11.5%	2.0%
Franklin	11.2%	1.3%
Whatcom	11.1%	3.4%
Grays Harbor	10.8%	0.8%
Clark	8.9%	4.6%
King	7.9%	36.4%
Mason	7.6%	0.4%
Yakima	7.5%	2.9%
Asotin	7.2%	0.2%
Jefferson	7.2%	0.2%
Spokane	7.1%	5.3%
Pend Oreille	6.9%	0.1%
Wahkiakum	6.6%	0.0%
Pierce	5.7%	5.9%
Clallam	5.2%	0.4%
Island	5.0%	0.3%
Benton	4.7%	1.4%
Chelan	4.6%	0.7%
Douglas	4.0%	0.2%
Kittitas	3.9%	0.2%
San Juan	3.1%	0.1%
Thurston	3.0%	1.2%
Okanogan	3.0%	0.2%
Kitsap	2.8%	0.8%
Lincoln	1.7%	1.7%
Garfield	0.0%	0.0%

Note: Columbia, Ferry, and Whitman counties are excluded.

Table 2: Average Annual Wages, 2016

	Manufacturing	All Industries	Manufacturing Wages as a Percent of All Wages
State	\$74,632	\$59,090	126.3%
Klickitat	\$80,243	\$46,327	173.2%
Pend Oreille	\$75,694	\$46,436	163.0%
Snohomish	\$92,377	\$57,443	160.8%
Jefferson	\$55,597	\$36,831	151.0%
Cowlitz	\$66,616	\$45,759	145.6%
Skagit	\$63,993	\$44,191	144.8%
Island	\$52,940	\$37,297	141.9%
Whatcom	\$60,084	\$43,233	139.0%
Adams	\$50,966	\$37,308	136.6%
Grays Harbor	\$51,623	\$38,053	135.7%
Grant	\$52,026	\$38,573	134.9%
Lewis	\$51,819	\$39,018	132.8%
Pierce	\$61,661	\$47,847	128.9%
Stevens	\$46,920	\$36,444	128.7%
Douglas	\$44,197	\$35,188	125.6%
Clallam	\$46,403	\$37,510	123.7%
Skamania	\$43,889	\$35,677	123.0%
Walla Walla	\$50,577	\$41,255	122.6%
Yakima	\$44,761	\$36,665	122.1%
Chelan	\$44,189	\$37,480	117.9%
Mason	\$44,963	\$38,272	117.5%
San Juan	\$39,658	\$33,871	117.1%
Spokane	\$52,286	\$44,782	116.8%
Clark	\$56,387	\$48,852	115.4%
Okanogan	\$35,375	\$30,839	114.7%
Asotin	\$40,398	\$35,710	113.1%
King	\$86,298	\$76,828	112.3%
Thurston	\$52,530	\$47,809	109.9%
Franklin	\$40,893	\$38,168	107.1%
Pacific	\$35,958	\$33,906	106.1%
Benton	\$55,683	\$52,587	105.9%
Kitsap	\$46,591	\$48,439	96.2%
Kittitas	\$37,198	\$38,968	95.5%
Wahkiakum	\$28,384	\$34,200	83.0%
Lincoln	\$19,416	\$35,077	55.4%

Note: Does not include Columbia, Ferry, Garfield, or Whitman counties.

erage of \$74,632 (26.3 percent higher). (ESD n.d.)

The ERFC estimates that Washington personal income associated with manufacturing (adjusted for inflation) will increase by 12.0 percent from 2017 to 2023. (Total personal income in the state is expected to increase by 20.1 percent over that period.) (ERFC 2018)

Doug Bayne, vice president–advancement at Walla Walla Community College, points out that sophisticated, technology-driven manufacturing is not limited to the metropolitan Puget Sound region. Close communication between community and technical colleges and local industry, he adds, is key to the success of both.

“We have several manufacturers in Walla Walla that are really high tech . . . heavy into robotics and we have industry that is really heavy into energy systems,” he says. The school “listened to the industry five, seven, ten years ago and we developed a wind turbine program [that] turned out highly skilled, highly trained technicians to work on wind turbines. [But] we were on the cusp of oversaturating the market. We ended up altering the program based on industry needs.” The result was a program focused on plant management related to energy systems that satisfied industry requirements and opened up successful career opportunities for graduates.

That responsiveness continues to be an important priority for community and technical colleges that prepare and retrain Washingtonians for a rapidly evolving industry.

Changing Workforce Needs of Manufacturers

Although the expected expansion of jobs in Washington over the next several years

will create valuable new opportunities for Washington’s jobseekers, changes in the manufacturing industry require new skills and flexibility from those prospective employees. Below we examine the changing technology and its workforce implications.

Technology. Calling manufacturing work “increasingly technical,” a paper from The Manufacturing Institute and Deloitte notes that “skilled production occupations account for over 50 percent of the total manufacturing workforce” (Deloitte 2015). Similarly, a BCG report notes that manufacturing needs a workforce “that is equipped to install, operate, and maintain a new generation of digitally enabled manufacturing technologies, including advanced robots, additive manufacturing, and digital simulation of entire factories” (Sirkin et al. 2017). Over the next decade, such jobs “will account for nearly half of the new direct manufacturing positions created” (Sirkin et al. 2017).

This need for higher skilled manufacturing workers is a current reality in Washington. For example, the Eastern Washington Partnership’s plan* for its workforce development area (WDA) notes, “With manufacturing processes becoming more automated and technology dependent, workers will need to upgrade skills to keep up with the computerized aspects of many jobs” (EWP 2016). And, according to the South Central Workforce Council, manufacturers say that as technological advances boost productivity, “many of the new jobs require a more skilled workforce” (SCWC 2016).

Aging Workforce. Meanwhile, the manufacturing workforce is getting older and retiring. This is happening across industries as the Baby Boomers reach retirement age. The WRT and BCG estimate that of the 738,497 job openings Wash-

* There are 12 Workforce Development Councils in Washington, each of which oversees a Workforce Development Area (WDA). The councils each “must create a four-year workforce plan that offers a vision for their local workforce development system” (WTB n.d.c).

ington will have by 2021, 427,736 will be due to retirements and individuals leaving the workforce or the state (WRT and BCG 2017).

Manufacturing has a workforce that is older than the all-sector average in Washington. Workers aged 55 to 64 make up 16.9 percent of Washington's workforce across all sectors. But those workers make up 21.9 percent of the manufacturing workforce here. The manufacturing workforce is especially older than the all-sector workforce in the Seattle-King and Snohomish WDAs, as shown in Table 3. (Census n.d.)

"Baby Boomers are retiring in record numbers from the manufacturing sector and the resulting loss of knowledge and skill they possess does not exist in the younger generations of the workforce," reports the South Central Workforce Council (SCWC 2016).

The Skills Gap. Nationally, The Manufacturing Institute and Deloitte estimate, "Over the next decade, nearly three and a half million manufacturing jobs likely need to be filled and the skills gap is expected to result in 2 million of those jobs going unfilled" (Deloitte 2015). This is

despite the fact that manufacturing pays higher wages than other industries. Indeed, 80 percent of respondents to The Manufacturing Institute and Deloitte's survey of manufacturing executives said, "they are willing to pay more than the market rates in workforce areas reeling under talent crisis" (Deloitte 2015).

The U.S. Chamber of Commerce Foundation agrees: "the skills gap is not just a wage issue. It can't be solved simply by offering more money and waiting for the job applicants to show up. That won't happen if the skills aren't there in sufficient quantity in the first place" (USCCF 2017).

Again, the national trend is even more pronounced in Washington. A report from the Washington Student Achievement Council, State Board for Community and Technical Colleges, and Workforce Training and Education Coordinating Board notes, "despite overall progress during the last decade in increasing numbers of students completing degree programs, the supply of skilled workers is lagging behind rising employer demand in a range of key fields. Gaps are present at all education levels: middle skills, baccalaureate, and graduate" (WSAC et al. 2017). The report finds that the mid-level gap in production and trades is 1,263 (14.8 percent of the total) (WSAC et al. 2017).

According to the National Skills Coalition, in 2015, "Middle-skill jobs account for 51 percent of Washington's labor market, but only 44 percent of the state's workers are trained to the middle-skill level" (NSC 2017). (Middle-skill jobs are defined as those requiring more education than high school, but not a four-year degree.)

There are many examples of skills gaps across Washington, and across industries:

- Of respondents to a survey of area employers done by Our Valley, Our Future (a Wenatchee Valley partnership) as part of a workforce needs as-

Table 3: Percent of the Workforce Aged 55–64 (2016 Q1, by WDA)

	<u>Manufacturing</u>	<u>All Sectors</u>
State	21.9%	16.9%
Northwest	18.0%	17.8%
Snohomish	24.9%	18.2%
Seattle-King	22.9%	15.5%
Tacoma-Pierce	21.1%	17.2%
Olympic	17.4%	19.3%
Pacific Mountain	18.7%	19.3%
Southwest	21.7%	16.9%
South Central	17.8%	17.2%
North Central	16.9%	17.9%
Benton-Franklin	18.5%	16.8%
Eastern	17.3%	19.0%
Spokane	21.8%	17.5%

essment, 59 percent reported some difficulty and 30 percent indicated significant difficulty hiring qualified applicants in the previous 12 months (OVOF n.d.).

- According to a SkillUp Washington survey of manufacturing employers, 74 percent “had difficulty hiring for certain positions” (SW 2016).
- In King County, “Total demand among manufacturing occupations is expected to be 1,815 jobs annually between 2018 and 2023, while total supply among manufacturing occupations is expected to be 519 jobs annually” (WDCSKC 2016).
- In the South Central WDA, “Skill gaps continue to exist in the food processing and manufacturing industries as these sectors invest in new technology and restructure their workforce in order to remain competitive” (SCWC 2016).

The skills gap is important for the broader economy. As the Northwest Workforce Council writes, “Until more workers gain the skill and knowledge competencies employers need, the growing skill gap will likely slow economic recovery” (NWC 2016).

Strategies to Close the Skills Gap

Closing the skills gap—preparing today’s students for the explosive expansion of job opportunities in the coming years—begins with opening up the pathways to postsecondary training and education. According to the WRT and BCG, of job openings in Washington from 2016 to 2021, 73 percent of workers in career jobs, 34 percent of workers in pathway jobs, and 20 percent of workers in entry-level jobs will have a credential (WRT and BCG 2017). But only 31 percent of Washington’s high school class of 2006 earned a postsecondary credential by the age of 26. The WRT and Partnership for Learning estimate that 40 percent of the high school class of 2015 will earn a credential, and the WRT’s goal is that 70 percent will do so by 2030 (WRT and PFL 2018). As it

is, “The state’s education pipeline does not supply a workforce with education and training levels sufficient to meet employer demand” (WRT and BCG 2018). That will need to change if the skills gap is to be closed.

Indeed, a high school diploma is a prerequisite for many jobs and many types of postsecondary education. Yet the state graduation rate for the class of 2016 was just 79.7 percent. That’s below the U.S. figure of 84.1 percent and ranks Washington 42nd in the country. (NCES 2017)

Several groups are involved in training the next generation of workers in our state, including public schools, community and technical colleges, and universities. Concurrently, the Workforce Training and Education Coordinating Board (WTB) oversees the state’s workforce development system. The system “helps Washington residents find jobs, re-enter the workforce, or move ahead in their careers. The programs begin with high school and reach through apprenticeships, certificate programs and college, but stop short of a four-year degree” (WTB n.d.a).

Throughout, the system is meant to incorporate the business community. Business engagement is important because whatever strategies are undertaken by the educational and workforce system, they must be aligned with employer needs if they are to be effective. As the Association of Washington Business (AWB) writes, “Support for, and collaboration with, the state’s higher education system is necessary to produce the demanded workforce needed to grow the manufacturing industry” (AWB 2014).

According to the WTB, “Washington is already known as a leader in business engagement” (WTB 2016). Since 2000, Washington has used industry skill panels (including for manufacturing) “to address common skill gaps and training needs” (WTB 2016). And Washington has ten Centers of Excellence that “serve as statewide resources representing the

needs and interests of a specific industry sector” (SBCTC n.d.a). (These sectors include aerospace and advanced manufacturing and marine manufacturing and technology.)

Still, the WTB reports, “Only 8 percent of Washington businesses utilize the public workforce system” (WTB 2016). To increase its usefulness for business, the WTB says the system should “shift its focus when working with businesses from the promotion and administration of programs and management of services, to a more strategic role of building regional talent pipelines, addressing skill gaps, and creating meaningful education and career pathways for a range of workers in key industries” (WTB 2016).

In 2014, Gov. Inslee set goals for the workforce development system, including “Close skill gaps for employers, with a focus on in-demand industry sectors and occupations” (Inslee 2014). Then, in 2017, Gov. Inslee created the public-private Career Connect Washington Task Force “to conduct an intensive review of how to better align education programs with career opportunities,” with the goal to connect “100,000 Washington youth with career-connected learning opportunities over the next five years” (CCWTF 2018). The task force released recommendations in Feb. 2018; these include ensuring students are on a “pathway to careers” and expanding apprenticeships (CCWTF 2018).

In a statement on the Career Connect Washington Task Force’s website, Brad Smith, president of Microsoft and a member of the task force, identifies the components of a comprehensive strategy: “A career connected learning system that includes apprenticeships, mentorships, job shadows, and hands-on learning will allow businesses to meet their workforce needs and youth in our state to be prepared for great careers” (WTB n.d.b).

To build on the task force recommendations, Gov. Inslee retained Maud Daudon (formerly president and CEO of the Seattle Metropolitan Chamber of Commerce)

earlier this year to “lead the creation of a 10-year vision and strategic plan for building a statewide career-connected learning and apprenticeship system in Washington” (WGO 2018).

As one example of how the multi-pronged strategy can evolve, Bonlender points to the successful Apprenti experience, citing a nonprofit established by the Washington Technology Industry Association Workforce Institute. If successful apprenticeships can be developed in the tech sector with industry partnerships, the possibilities of replication are endless.

In achieving workforce development goals, rural communities often face unique hurdles. Bonlender says,

We have a lot of appealing sites, particularly in rural areas, but sometimes the population is simply too small. [When you’re] looking at hundreds of new jobs in a small town, that can be a challenge. . . . Collaborating with ESD we put together a very concerted, direct plan on how we’re going to put together that workforce, recruiting to the community. . . .

He points out that the high cost of living in the metro areas can make location in rural communities an attractive option for manufacturers, assuming the workforce challenge can be met.

Doug Bayne tells of Walla Walla Community College’s creative approaches to meeting employer requirements in rural communities and provide opportunities for area residents of all ages.

“[We try to] find people who are willing to stay in the rural economy but who will benefit greatly from a degree, certificate or higher education in the job they’re in. It will raise their academic attainment level,” he says. The opportunities for qualified workers are substantial. Bayne says that employers in the region—farm companies and management companies for farms—“will promote and keep on [workers] who have these degrees. It will directly impact their wages.” So it’s im-

portant to increase awareness of both the career and the educational opportunities available in these communities.

The community colleges, he points out, are well positioned to assist students. “We have access to resources, Perkins grants, worker retraining, and oftentimes we can greatly assist the student in attaining the degree or certificate with a minimum amount of student loan,” he says. “We work very hard to lower that barrier.”

The AWB Institute and the State Board of Community and Technical Colleges hosted industry skills gap forums in 2013. Employers told them, “All workforce programs should include a focus on basic employability skills” (AWB Institute 2013). Additionally, “College programs need to focus on developing leadership and management skills as identified by key industries” (AWB Institute 2013).

Other strategies to close the manufacturing skills gap include focusing more on early guidance in middle and high school as well as encouraging and expanding postsecondary education, workforce training, and apprenticeships.

Early Guidance. Washington’s Career and Technical Education Act was enacted in 2008. As part of the bill, legislators found,

[T]eachers, counselors, students, and parents are not well-informed about the opportunities presented by high quality career and technical education. . . . Secondary preapprenticeships and courses aligned to industry standards can lead directly to workforce entry as well as to additional education. Career and technical education is a proven strategy to engage and motivate students, including students at risk of dropping out of school entirely. (RCW 28A.700.005)

Under the law, all career and technical education (CTE) programs must either

- “Lead to a certificate or credential that is state or nationally recognized by trades, industries, or other professional

associations as necessary for employment or advancement in that field” or

- “Allow students to earn dual credit for high school and college through tech prep, advanced placement, or other agreements or programs” (RCW 28A.700.030).

CTE programs must also “Lead to workforce entry, state or nationally approved apprenticeships, or postsecondary education in a related field” (RCW 28A.700.030). Further, the Office of Superintendent of Public Instruction (OSPI) must “develop a list of statewide high-demand programs for secondary career and technical education” (RCW 28A.700.020). School districts may suggest additional programs if there is “evidence of local high demand” (RCW 28A.700.020).

From all revenue sources for school year 2016–17, Washington spent \$450.9 million on CTE programs (\$57.6 million for grades 7–8, \$353.3 million for grades 9–12, and \$40.0 million for skills centers) (OSPI 2018). The Legislature has increased funding for CTE programs as part of its response to the state Supreme Court’s McCleary decision on school funding. In 2017, the Legislature reduced class sizes for CTE from 26.57 to 23 and for skill centers from 22.76 to 20 (EHB 2242). The bill also specified that the enhanced funding allocations may only be used for CTE purposes, including, for example:

- “Work-based learning programs such as internships and preapprenticeship programs, including coordination tied to career and technical education coursework”;
- “New high quality career and technical education and expanded learning program development in high-demand fields”; and
- “Student fees for national and state industry-recognized certifications.”

Despite the focus of the state’s CTE programs on jobs and high-demand fields,

there are opportunities to improve outcomes. In Dec. 2017, the State Auditor's Office (SAO) released a performance audit of the state's CTE system. It found that if Washington adopts leading practices in four areas, it "could create more opportunities for students while closing the gap between students' skills and employers' needs" (SAO 2017). These areas are:

- "Improve career guidance given to students, and provide it in a classroom setting in the 7th or 8th grade."
- "Strengthen employer engagement to better align CTE programs and courses with high-wage industry-needed skills."
- "Update the list of high-demand programs, strengthen the review of local labor demand data and clarify laws to help reduce the skills gap." (The audit found that OSPI has not updated the list of high-demand programs since 2009. OSPI responded that this has simply been an oversight.)
- "Expand the number of CTE dual-credit opportunities to increase the number of pathways from high school to college." (SAO 2017)

Moreover, according to the SAO, there is a lack of coordination among OSPI, the Workforce Training and Education Coordinating Board, and the State Board for Community and Technical Colleges: "This lack of coordination extends to school districts and colleges, making a student's secondary-to-postsecondary transition more difficult" (SAO 2017).

The STEM Education Innovation Alliance, created in 2013, made similar recommendations in a Jan. 2017 report. For example, it notes the state should "work towards developing and implementing a process for scaling or phasing out pathways that don't lead to credentials in high-skill, high-demand programs. State and local employer needs should drive CTE course approvals and district offerings" (SEIA 2017).

And the Career Connect Washington Task Force similarly recommends that dual credits should be offered and credits and credentials should be portable across institutions (CCWTF 2018). The task force also recommends that more career connected learning should take place in middle school.

By increasing the career education that occurs in middle school, students would have more time to learn about opportunities. As it is, the Northwest Workforce Council found, "Employers remain concerned too few young people consider advanced manufacturing or careers in trades, and are unaware of both skills needed and the career's financial rewards" (NWC 2016). The AWB Institute forums similarly noted, "Middle and high school students, as well as the educators who advise them, are often unaware of available career and training programs" (AWB Institute 2013).

Annette Herup, head of Human Resources at SGL Composites LLC in Moses Lake, recognizes the importance of involving young people early. She says,

I'm getting very involved in trying to develop a long-term relationship with the [local public schools]. There's a whole bunch of organizations that are in agreement that educators and businesses need to partner up. . . . There are a lot of very good jobs that people are not recognizing that are good careers, even if you don't want to go to college. We're trying to coordinate workforce development, WorkSource, SkillSource, the Port of Moses Lake, the high school . . . trying to develop an avenue for these other students, a second avenue for them to focus on that gives them credits in high school for the technical side of the courses that they're taking. . . . I'm really hoping it decreases the high school drop-out numbers because they'll see that there are other opportunities if they finish.

There are organized programs that introduce students to manufacturing. For ex-

Given the increasingly high-tech nature of manufacturing, having a high school degree and some CTE coursework may not be enough to prepare students for these jobs.

ample, the Manufacturing Industrial Council worked with OSPI to create a two-year program for high school students called Core Plus. The first year includes instruction in transferable manufacturing skills and the second teaches trade-specific skills. Boeing created an aircraft manufacturing curriculum in 2014. (Core Plus n.d.)

Another example is the Instructional Worksite Learning Program for Advanced Manufacturing Careers. It was created in 2012 by the Southwest Washington STEM Network, industry, and schools in the Camas, Evergreen, and Vancouver school districts. As part of the program, “Students demonstrate their competency through work-based projects during their internship. Mentors identify real business problems for students to work on” (WA STEM 2017). Additionally, “Academic standards are identified that align with the work-based projects, and students get high school and Clark College credit” (WA STEM 2017).

Postsecondary Education and Training. Given the increasingly high-tech nature of manufacturing, having a high school degree and some CTE coursework will often not be enough to prepare students for these jobs. Thus, some sort of post-secondary education is important. This could mean a bachelor’s degree, an associate degree from a community college, or some other type of credential.

As the SAO notes, “High school graduates who do not complete CTE programs, apprenticeships, college degrees or college certificates contribute to the state’s skills gap” (SAO 2017). For example, in the South Central WDA, “a lack of short-term certificates and the opportunity for advanced manufacturing training is a barrier for considering careers in this industry sector” (SCWC 2016).

A BCG report notes that the newer, higher tech manufacturing jobs “will demand workers with adaptive skills” (Sirkin et al. 2017). These are skills that “allow employees to learn more quickly, solve real-world problems, and understand, moni-

tor, and improve systems” (Sirkin et al. 2017). The report points out that these skills are being taught in universities, not technical schools. BCG estimates that to qualify for the new manufacturing jobs, “around two-thirds of employees will need at least a BA and nearly one-quarter will need a master’s or a doctorate” (Sirkin et al. 2017).

Still, for some students, the state’s community and technical colleges offer a less expensive, more direct path to jobs than four-year institutions. Their CTE programs must be approved by the State Board for Community and Technical Colleges, and that approval process must be informed by labor market analysis, “including wage data and employment opportunities” (SAO 2017).

The community and technical colleges also work with employers in the state to train new and current employees. The Job Skills Program “funds training in regions with high unemployment rates and high levels of poverty. It also supports areas with new and growing industries; locations where the local population does not have the skills needed to stay employed; and regions impacted by large-scale job loss” (SBCTC n.d.b). The program was established by the Legislature in 1983 (RCW 28C.04.420), and since 2007–09, the state has appropriated \$5.45 million for the program each biennium. At least half of the cost of training is paid by employers, either with cash or in-kind payments (unless the business has gross business income of less than \$500,000) (SBCTC 2017). (In-kind payments may include the wages of employees being trained.) In the 2015–2017 period, 96 companies participated in the program, and 6,134 people were trained. Of those, 80 companies and 5,012 trainees were in the manufacturing sector. A total of \$5.4 million of grants were awarded for the training programs, of which \$4.6 million went to manufacturing trainings. (SBCTC 2017)

Herup at SGL Composites says the Job Skills Program (JSP) has played a signifi-

cant role in the firm's training. SGL is a carbon fiber manufacturer. She describes the highly technical process, converting the plastic to carbon fiber for use, initially, in BMW automobiles. "It's stronger than steel and much lighter," she says. To assure quality, SGL must be able to demonstrate that their employees have been trained to meet rigorous standards. SGL will be expanding product lines to other industries, including aerospace.

All this, she says, "requires that we can prove that people can do their jobs successfully . . . we're audited annually to the [International Organization for Standardization (ISO)] standards by a third party. The training is part of the verification for the quality side."

"We have to train from the ground up," she says. "We were able to get a JSP grant for developing [training materials]. It's a very successful program. We went from taking about a year to be certain that someone was capable and able to do their job down to 90 days. It's very well documented."

Documentation and verification is essential for meeting ISO standards. "Our customers expect it," she says.

Saying that the program has helped the firm deal with turnover, she adds, "Hundreds of entry-level employees have been trained in the last five years, mostly high school graduates." SGL also has used the program to develop leadership training for salaried employees, including supervisors who were promoted from within.

There are other training programs receiving state support. The Legislature created the Customized Training Program in 2006 (RCW 28B.67.020). It offers training assistance to employers in the state; it is interest-free and employers pay back the fund over 18 months. The program also provides a business and occupation (B&O) tax credit (RCW 82.04.449) for participating employers repaying their loans. The training is given at local community or technical colleges, and the program is

administered by the State Board for Community and Technical Colleges. In 2017, the Legislature made the program permanent (though the B&O credit still expires July 1, 2021). To date, 89 training contracts have been awarded through this program.

Apprenticeships. Another way to reduce the skills gap is apprenticeships. Common in European countries, apprenticeship programs are getting a second look from American policymakers and industrial leaders.

Matt Poischbeg, vice president and general manager of SEA-LECT Plastics Corporation, may be one of the state's leading advocates for apprenticeship programs. But he's far from alone in recognizing their value. As the Career Connect Washington Task Force notes, "apprenticeships are proven to provide a high return on investment for both jobseekers and employers" (CCWTF 2018). There are currently 168 apprenticeship programs registered with the state (L&I n.d.a). In 2017, there were 17,160 active apprentices in the state—up from 15,534 in 2016 (WSATC 2018).

Poischbeg credits his apprenticeships while an at-risk teenager in Germany with giving him the skills and discipline to succeed later in life. Now, he sees apprenticeships as important vehicles to satisfying, well-compensated careers for individuals, as well as essential to developing the workforce skills manufacturers require.

The SEA-LECT apprenticeship program began in 2013-2014 when the firm, which does plastic injection molding, had to replace its principal mold maker, who was retiring. Custom injection molding requires molds, which are "pretty intricate pieces of craftsmanship usually made out of steel or aluminum." The mold makers are typically craftsmen who learn the skills in apprenticeships lasting three or four years, Poischbeg says. There'd been an exodus of U.S. companies to Asia for their plastics manufacturing and mold making. SEA-LECT

Apprenticeships do not foreclose options, they expand them.

acquired a local mold making firm and the owner came to work for SEA-LECT, handling most of the molds in Everett, with six journeymen mold makers working in the shop. But in 2003, he retired. And it was very difficult to find a mold maker who “knew the old school and the new technology.”

When he left, “we started outsourcing molds to China,” Poischbeg says. That worked until the next principal mold maker announced his retirement in 2013. “When I started to find a replacement for him, I just couldn’t find anybody.” He searched locally then nationally, “through any portal you could think of.”

With my back against the wall, because even though we didn’t build the molds here anymore . . . , we still needed a mold maker to do the maintenance and repair. When new molds come in they have to get checked in, they have to get ready for production. The mold making department is essential for our business.

The frustrating and unsuccessful search for qualified mold makers led him to consider apprenticeships. “I remembered that when I grew up in Germany I went through an apprenticeship program. I guess if worse comes to worse we have to start up one of our own.”

A conversation with staff at the Department of Labor and Industries took Poischbeg to the Aerospace Joint Apprenticeship Committee (AJAC), “And yes, they had a program that was not just designed for aerospace, because they catered to companies in the aerospace industry as well as all other advanced manufacturing. They had everything I needed.”

Fortunately, within weeks after that contact, Poischbeg was contacted by a young worker, recently laid off, who saw the advantages of participating in the apprenticeship program.

With the help of the program and the additional schooling apprentices receive in the program, “he was able after three

years to start building his first mold. That laid the foundation to start building molds in Everett again,” Poischbeg says. And then they hired a second and a third apprentice. He attributes the success of the SEA-LECT program to the help of AJAC.

As part of apprenticeship programs, apprentices get on-the-job training while taking at least 144 hours of instruction a year at community or technical college (L&I n.d.b). Apprentices earn wages that increase as they gain experience, and they get 50 percent tuition waivers (L&I n.d.c). Ultimately, apprentices earn “a nationally recognized certificate of completion and official journeyworker status” (L&I n.d.b).

AJAC, which successfully handled Poischbeg’s need for apprenticeship training, was started in 2008 (AJAC n.d.). AJAC also has a youth program for juniors and seniors in high school, which “combines traditional classroom learning with 2,000 hours of paid, on-the-job apprenticeship training at an AJAC-employer” (WGO 2017).

According to the governor’s office, “[AJAC executive director Lynn] Strickland said the average age of a community or technical college student is 29, and the average age of an AJAC apprentice is 33. Enrolling students in a registered youth apprenticeship program while they’re still in high school helps build a direct pipeline of skilled workers into good-paying jobs” (WGO 2017).

“We are basically and completely at the bottom of the barrel of a skilled labor force. There’s just nobody out there we can hire,” Poischbeg says, “We have to tap into the only source of skilled workers, which is our schools. We have to get the kids early.”

He notes that “soft skills”—showing up to work on time, following directions, acting responsibly—are best acquired at the workplace. At sixteen and seventeen young people haven’t developed bad habits. “They want to excel.”

The current shortfall in qualified workers inhibits economic growth.

Moreover, apprenticeships do not foreclose options, they expand them. While they can and usually do lead to satisfying, well-compensated careers, at some point—as Bayne reports from Walla Walla—midcareer workers may want to return to school for a four-year degree.

That turned out to be Poischbeg’s experience.

“The apprenticeship really turned me around. Then, I reached a ceiling at 29 . . . I needed more education,” Poischbeg says. “Then, because of the knowledge I had . . . and my changed mindset, I flew through college, and was very successful with great grades. [This] accelerated me in my career more than if I had gone right after high school, if I even would have gotten there.”

As the AWB Institute forum found, “Employees must embrace lifelong learning and participate in continued professional development if they are to remain competitive in today’s employment market” (AWB Institute 2013).

Policy Recommendations

A common theme underlies all these efforts to close the skills gap, create opportunities for Washingtonians, and support the continued growth of Washington manufacturers: There’s no single answer. Multiple paths must be opened and expanded.

Current efforts to improve and expand learning opportunities that prepare Washingtonians for expanding career and job opportunities represent significant progress in recent years. It’s also a recognition of the consequences of failing to match training and education with careers. The shortfall in qualified workers inhibits economic growth. Prospective employees lacking the necessary training and education find themselves left behind in a challenging economy.

Maintaining a sense of urgency will be critical, as will be the recognition of the importance of diverse pathways to career readiness. The WRT-BCG report recom-

mends that the state take a “cradle-to-career” approach to increasing the postsecondary attainment levels. The earlier students become aware of the opportunities awaiting them, the more likely they will be to focus their efforts toward career readiness. Implicit in much of the current research and discussion of career-readiness is the endlessly evolving nature of work in an innovation- and technology-driven economy. The paths to career readiness will often intersect. An apprenticeship may lead to career that requires a post-graduate degree. The key is making sure that no path is prematurely foreclosed, no opportunity for advancement precluded because the necessary training and education is not available.

To encourage more of Washington’s students to earn postsecondary credentials and qualify for manufacturing jobs, the state should:

- Start career education in middle school. By showing students that there are many paths to good jobs, they will be better equipped to make decisions about their futures that will lead to rewarding work. Also, knowing the skills that work will require as early as possible gives students more time to develop them.
- Improve the high school graduation rate while maintaining standards that ensure that all students graduate career- and college-ready. To achieve its goal of increasing postsecondary education attainment, the state must continue to focus on boosting the high school graduation rate. Students who graduate high school and meet academic standards are more likely to succeed as they pursue postsecondary credentials or college degrees.
- Allow for more dual-credits in career and technical education. When students can take courses that result in both high school and college credits, it saves time and money because they don’t have to retake courses as they are earning a postsecondary creden-

- tial. And when more schools accept these credits in their CTE programs, students have more postsecondary options.
- Expand apprenticeships and youth apprenticeships. Learning by doing is not only a good way to train for a job, it's also a good way to elicit interest in manufacturing careers.
 - Continually work to align career education with career opportunities. No one knows with certainty what the jobs of the future will look like. But schools and training programs that are always adjusting curricula based on the needs of employers (who are best placed to understand future needs) will be most helpful to their students.

References

- Aerospace Joint Apprenticeship Committee (AJAC). No date. "[About Us.](#)" Accessed May 1, 2018.
- Association of Washington Business (AWB). 2014. "[Washington Manufacturing.](#)"
- AWB Institute. 2013. "[Washington State Centers of Excellence: Addressing Skills Gaps, Creating Careers.](#)"
- Bayne, Doug. 2018. Interview with WRC. May 4.
- Bonlender, Brian. 2018. Interview with WRC. May 10.
- Career Connect Washington Task Force (CCWTF). 2018. "[Task Force Recommendations.](#)" Feb.
- Core Plus. No date. "[About Core Plus.](#)" Accessed May 1, 2018.
- Deloitte and the Manufacturing Institute (Deloitte). 2015. "[The skills gap in U.S. Manufacturing: 2015 and Beyond.](#)"
- Department of Labor & Industries (L&I). No date a. "[Apprenticeship Programs in Washington.](#)" Accessed June 12, 2018.
- . No date b. "[Apprenticeship Primer.](#)" Accessed May 10, 2018.
- . No date c. "[Frequently Asked Questions—Apprenticeship for Employers.](#)" Accessed May 10, 2018.
- Eastern Washington Partnership (EWP). 2016. "[Regional/Local Workforce Plan: Program Years 2016–2020.](#)" May 31.
- Economic and Revenue Forecast Council (ERFC). 2018. "[Washington State Economic and Revenue Forecast.](#)" Volume XLI, No. 1. Feb.
- Employment Security Department (ESD). No date. "[Covered Employment \(QCEW\).](#)" Annual averages. Accessed Feb. 15, 2018.
- Herup, Annette. 2018. Interview with WRC. May 3.
- Inslee, Jay. 2014. "[Letter to Workforce Training and Education Coordinating Board.](#)" Oct. 27.
- National Center for Education Statistics (NCES). 2017. "[EDFacts Data Groups 695 and 696, School year 2015–16.](#)" Oct. 25.
- National Skills Coalition (NSC). 2017. "[Forgotten Middle-Skill Jobs: State by State Snapshots.](#)" Feb. 6.
- Northwest Workforce Council (NWC). 2016. "[Regional Workforce Plan: 2016–2020.](#)"
- Office of Superintendent of Public Instruction (OSPI). 2018. "[Apportionment Final: 2016-2017 School Year.](#)" Jan. 30.
- Our Valley, Our Future (OVOF). No date. "[Workforce Needs Assessment Report.](#)" Accessed April 23, 2018.
- Poischbeg, Matt. 2018. Interview with WRC. May 7.
- Sirkin, Hal, Justin Rose, and Rahul Chorraria. 2017. "[Building an Adaptive US Manufacturing Workforce.](#)" BCG. Sept. 21.
- SkillUp Washington (SW). 2016. "[Manufacturing Employer Survey.](#)" Manufacturing Advancement Pathways Project. March.

- South Central Workforce Council (SCWC). 2016. "[Strategic Plan 2016–2020](#)." June 13.
- State Board for Community and Technical Colleges (SBCTC). No date a. "[Centers of Excellence](#)." Accessed May 1, 2018.
- . No date b. "[Job Skills Program](#)." Accessed May 10, 2018.
- . 2017. "2015–17 Job Skills Program: Report to the Legislature." Dec.
- STEM Education Innovation Alliance (SEIA). 2017. "[Vision 2021: Investing in a Future Ready Washington](#)." Jan. 3.
- U.S. Census Bureau (Census). No date. "[Quarterly Workforce Indicators, 2016 Q1](#)." QWI Explorer application. Accessed April 25, 2018.
- U.S. Chamber of Commerce Foundation (USCCF). 2017. "[The Skills Gap: How to Train the 21st Century Workforce](#)." America Working Forward. Fall.
- WA Governor's Office (WGO). 2017. "[School credit, job training and a paycheck?](#)" April 7.
- . 2018. "[Inslee selects Maud Daudon to launch planning effort for career-connected learning and apprenticeship system](#)." Feb. 15.
- Washington Research Council (WRC). 2017. "[Rebalancing Priorities: The Case for Manufacturing Jobs Part I](#)." SR 17–06. Sept. 18.
- Washington Roundtable and Boston Consulting Group (WRT and BCG). 2017. "[Washington Kids 4 Washington Jobs: Pathways to Great Jobs in Washington State](#)."
- . 2018. "[Unlocking Washington's Full Potential: A Framework for Diversified & Inclusive Economic Growth](#)."
- Washington Roundtable and Partnership for Learning (WRT and PFL). 2018. "[Washington Kids 4 Washington Jobs: The Path to 70% Credential Attainment for Washington Students](#)." June 12.
- Washington State Apprenticeship & Training Council (WSATC). 2018. "[Fourth Quarter 2017 Report: October – December](#)." Jan. 18.
- Washington State Auditor's Office (SAO). 2017. "[Leading Practices for the State's Secondary Career and Technical Education Programs](#)." Performance Audit. Report Number 1020510. Dec. 19.
- Washington STEM (WA STEM). 2017. "[Lessons in Career Connected Learning for Youth and Young Adults: A Project of the Washington State National Governors Association Policy Academy on Work Based Learning](#)." Prepared by Verrenti Consulting.
- Washington Student Achievement Council, State Board for Community and Technical Colleges, and Workforce Training and Education Coordinating Board (WSAC et al.). 2017. "[A Skilled and Educated Workforce: 2017 Update](#)."
- Workforce Development Council of Seattle-King County (WDCSKC). 2016. "[2016–2020 Seattle-King County Workforce Development Plan](#)." June.
- Workforce Training and Education Coordinating Board (WTB). 2016. "[Talent and Prosperity for All: The Strategic Plan for Unlocking Washington's Workforce Potential 2016](#)."
- . No date a. "[Washington's Workforce Development System](#)." Accessed May 2, 2018.
- . No date b. "[Career Connected Washington Task Force](#)." Accessed May 16, 2018.
- . No date c. "[Local Workforce Plans and Resources](#)." Accessed May 18, 2018.