



Connecting an ICT/Cybersecurity Pre-Apprenticeship Program to a Registered Apprenticeship Program

January 2022

Pursuant to the National Apprenticeship Act, the Department of Labor works to expand opportunities related to apprenticeship programs. This project has been funded, either wholly or in part, with Federal funds from the Department of Labor, Employment & Training Administration under the contract number/work order DOL-OPS-16-A-0012/1605DC-18-F-00060. The contents of this publication do not necessarily reflect the views or policies of the Department of Labor, nor does mention of trade names, commercial products, or organizations imply endorsement of same by the U.S. Government.



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In recent years, there has been increased interest and success with expanding registered apprenticeship programs (RAPs) to nontraditional career pathways such as those related to information and communications technology (ICT) and cybersecurity.¹ High-quality pre-apprenticeship (PA) programs are being developed and integrated into the larger apprenticeship ecosystem, especially for these nontraditional industries. PA programs are completed prior to RAPs and provide structured, contextualized training opportunities that augment technical and essential work-readiness skills sought out by employers. They also provide RAPs with pre-screened, job-ready, and qualified apprentice pools that are positioned to succeed in specific occupations and careers, including those that are more technical and specialized in nature. PA programs typically have an arranged partnership with at least one RAP and help provide equitable and accessible pathways that prepare individuals—especially those from underrepresented groups—for RAPs and sustainable employment in a variety of sectors, industries, and fields. By helping to develop and enhance problem-solving and other employability skills, PA programs ensure prospective apprentices meet the entry requirements for both RAPs and entry-level employment. Thus, high-quality PA programs can help resolve the competency gaps for those interested in pursuing apprenticeships, especially in more technical industries such as ICT and cybersecurity. Figure 1 summarizes the key components of a PA program.

A Pre-Apprenticeship Program:²

- Prepares individuals to meet basic qualifications for entry into and success in an apprenticeship program.
- Includes a formal partnership with at least one program sponsor.
- Promotes a skilled and diverse workforce by offering training informed by industry standards, educational and pre-vocational services, hands-on-learning, and assistance with applying to apprenticeship programs.

Figure 1. Components of a Pre-Apprenticeship Program

Component	PA Programs ²	High-Quality PA Programs ³
 Curriculum and employability skills training based on industry standards and approved by local employers and RAPs	✓	✓
 Strategies to increase apprenticeship opportunities for disadvantaged, low-skilled, and underrepresented groups	✓	✓
 Access to wraparound support services (e.g., childcare, housing, etc.) so participants can successfully complete the PA program	✓	✓
 Promotion of RAPs as a preferred means for employers to obtain and retain a skilled and diverse workforce	✓	✓
 Hands-on and work-based learning that simulate an industry-specific work environment with proper supervision and safety protocols	✓	✓
 Formal agreements with RAPs that allow direct entry or advanced placement based on skills and mastered competencies ⁴	✓	✓

¹ Tieszen, N., Garcia, R., Banerjee, A., & Johnson, C. (2020, April 9). Principles for a high-quality pre-apprenticeship: A model to advance equity. Retrieved from https://www.clasp.org/sites/default/files/publications/2020/04/2020_principleshighqualitypreapprenticeships.pdf

² Employment and Training Administration, U.S. Department of Labor. (2012, November 30). Training and Employment Notice No. 13-12: Defining a Quality Pre-Apprenticeship Program and Related Tools and Resources. Retrieved from https://wdr.dolleta.gov/directives/attach/TEN/TEN_13-12_Acc.pdf

³ Allen, L., Cahill, C., Kobes, D., Seleznow, E. M., & Sullivan, M. M. (2019, July 22). JFF's Framework for a High-Quality Pre-Apprenticeship Program. Retrieved from <https://www.jff.org/resources/jffs-framework-high-quality-pre-apprenticeship-program/>

⁴ Language is taken from the following sources:

Employment and Training Administration, U.S. Department of Labor. (2012, November 30). Training and Employment Notice No. 13-12: Defining a Quality Pre-Apprenticeship Program and Related Tools and Resources. Retrieved from https://wdr.dolleta.gov/directives/attach/TEN/TEN_13-12_Acc.pdf



Component	PA Programs ²	High-Quality PA Programs ³
Clear requirements for entry and successful transition to a quality RAP, expectations for participation, and strategies to address gaps		✓
Accumulation of nationally- and industry-recognized, portable, and stackable credentials that support entry into the workforce		✓
Career development services that identify relevant pathways and explore postsecondary education and job opportunities		✓

PA Programs in ICT and Cybersecurity

PA programs in ICT and cybersecurity equip individuals for RAPs by helping them build and improve industry-specific technical and job-readiness skills, while simultaneously strengthening the pipeline of eligible apprentices and skilled workers ready to fill labor shortages. PA programs are a vehicle to help people gain the type of skills ultimately deemed important by employers in these fields.

Technical skills—sometimes called hard skills—demonstrate a basic understanding of essential cybersecurity and ICT-related topics, as well as terminology related to cyber-attacks and hacking, web development, security management, and network infrastructure. They also include development of industry-wide technical competencies such as hardware and software installation, user support, and data analytics. PA programs focus on enhancing individuals' proficiency in literacy and mathematics to the level required for entry to RAPs or employment. Industry leaders and employers also believe employability skills must be balanced with technical abilities as they work in tandem to help individuals



Digital Citizenship:

the ability to use the internet, digital devices, or other forms of technology responsibly, effectively, and safely.

effectively protect organizations, respond to threats, and foresee future needs. Employability skills—often called soft or work-readiness skills—in ICT/cybersecurity PA programs include meticulousness, critical thinking, communication, teamwork, digital citizenship, complex and creative problem solving, and other interpersonal skills. As technology evolves, the demands of industries and employers also change so both “adaptability” and “flexibility” become two important employability skills taught and practiced in a PA program. Industry leaders and employers

underscore the need for a set of diverse employability and cognitive skills over and above the technical and computer-based skills required in ICT/cybersecurity industries.

There is consensus that employability skills can be more easily taught in the classroom.⁵ A

CyberWyoming PA program in development in Casper, Wyoming plans to offer employability skills internship opportunities to its students to fortify their non-technical skill set. The summer internships will draw on the Cyber Readiness Institute’s four focus areas and require students to write policies and develop a training program for the company they are serving. This will help the interns to become more security aware as well as improve their cyber readiness.⁶ Other important employability skills are listed in Figure 2.

Allen, L., Cahill, C., Kobes, D., Seleznov, E. M., & Sullivan, M. M. (2019, July 22). JFF's Framework for a High-Quality Pre-Apprenticeship Program. Retrieved from <https://www.jff.org/resources/jffs-framework-high-quality-pre-apprenticeship-program/>

⁵ Castellanos, S. (2018, May 24). Cybersecurity requires 'insatiable' problem-solving skills; technical skills can be taught. Retrieved from <https://www.wsj.com/articles/cybersecurity-requires-insatiable-problem-solving-skills-technical-skills-can-be-taught-1527180960?tesla=y>

⁶ About Cyber Readiness Institute - Cybersecurity Awareness Training. Cyber Readiness Institute. (2020, November 24). Retrieved from <https://cyberreadinessinstitute.org/about/>



Figure 2. Employability Skills Desired by RAPs and Employers

	<p><i>"They need to be trainable and open to constructive criticism. When you have people that feel they have a very strong talent in ICT or cybersecurity...they also have to realize they're working with an entire team." – CTE Cyber Academy Pathway Instructor</i></p>
	<p><i>"Another important soft skill is emotional intelligence: how to read a room, how to do the body language, what language to use on the different generations." – Executive Director of a Statewide Cybersecurity Initiative and Alliance</i></p>
	<p><i>"Employers want to know if they are going to be a good fit for the team, if they will get along and work well with everybody else because most of these teams are not large." – IT Pre-Apprenticeship Program Executive Director</i></p>

Apprenticeships and entry-level occupations in ICT and cybersecurity often require the completion of a secondary credential, basic technical knowledge, relevant prerequisite coursework, as well as nationally- and industry-recognized, stackable, and portable credentials.⁷ All of these create higher barriers to advancement relative to other sectors, such as the skilled trades. ICT/cybersecurity PA programs ensure that participants meet these requirements prior to applying to apprenticeships or entry-level positions. Such preparation and instruction are predominantly offered by PA programs through contextualized learning. Contextualized learning helps prospective apprentices in specific fields apply the concepts they learned during classroom instruction to "real world" occupational practices. It

involves the teaching of immersion curriculum through the simulation of workplace activities in an in-class lab setting. This helps PA program participants prepare to work in these technical industries. For example, McLane Technology Partners in Texas offers a cybersecurity PA program that enhances in-demand technical and employability skills through lectures, breakout discussion groups, and hands-on-experiences in a lab environment where participants work with live computer viruses such as worms and Trojans.⁸ Another example is a Casper-area PA program under development in Wyoming that will leverage Casper Community College's cyber lab and allow PA program participants to carry out projects related to digital forensics, tracking, and hacking inside the dark web. Contextualized learning can also be achieved through participation in "capture the flag" information security and cyber hacking competitions, or by having participants complete field-specific case studies during the PA program. Accumulated experience that focuses on applied problem-solving in these contexts is important. This is especially true when it comes to security intelligence and vulnerability management because such experience drives operational efficiency and helps protect confidential information and data.

ICT/cybersecurity is interdisciplinary, and the skills learned can be applied to any industry or sector where employers are interested in protecting or securing information, data, and intellectual property, and are not limited to employment by Managed Security Service Providers (MSSPs). Given this, PA programs in ICT/cybersecurity facilitate career navigation activities, familiarizing participants with a multitude of professional pathways they can pursue given their emerging skill sets and interests. In the ICT/cybersecurity field, those professional pathways have unusual depth and breadth in a range of

⁷ Bennett, V., Kobes, D., Gregg, A., & Lamback, S. (2020). JFF's Framework for a High-Quality IT Pre-Apprenticeship Program (Rep.). JFF. Retrieved from https://jfforg-prod-new.s3.amazonaws.com/media/documents/Framework_for_a_High_Quality_IT_PreApprenticeship_-_July_2020.pdf

⁸ McLane Technology Partners. (n.d.). Cybersecurity Pre-Apprenticeship Program Overview. Retrieved from <http://www.mclanetech.com/pre-apprenticeship-program/cybersecurity/>



sectors and industries including healthcare, energy, financial services, municipal government, defense, and manufacturing, to name a few. To promote career navigation activities, Computing for All's PA

Through a pre-apprenticeship program, these students are being prepared for "new-collar jobs. They are not blue-collar, and they are not white-collar. You have to have the blue-collar skills that are taught traditionally with certifications and at community colleges, but you also have to have the white-collar skills that are taught in four-year business programs in order to be successful. This is because today's IT [pre-apprentices and] apprentices are tomorrow's IT managers and they need to know how to budget, manage people, and communicate." – Executive Director of a Statewide Cybersecurity Initiative and Alliance

program in Seattle, Washington invites industry experts to speak on panels to help participants learn about different types of technology and IT-related job roles. This PA program also coordinates site visits to local technology companies to help participants gain insight into the work culture, norms, and setting of such job roles.⁹ With this valuable career information, PA program participants become judiciously prepared for a range of relevant occupations while gaining insight into expected wages and job responsibilities. CyberUp's PA program in St. Louis, Missouri helps pre-apprentices prepare for careers by assisting them with resume development, hosting mock interviews, and inviting representatives from local companies to attend Q&A sessions (termed "speed dating").¹⁰ Some ICT/cybersecurity PA programs will also task participants to research career opportunities in these fields (using sources such as cybergeek.org and websites in the CareerOneStop network such as myskillsmyfuture.org and mynextmove.org) and then

present their findings to their PA program cohort. The guided career exploration offered through ICT/cybersecurity PA programs helps participants identify career preferences and specializations within certain occupations, sectors, and industries. These PA programs also tend to provide information related to the unique occupational landscape of these types of jobs, which are available at ICT- and cybersecurity-specific companies as well as other companies that have these technical needs or are interested in protecting their data and having secured internet access. For example, a Casper-area PA program under development in Wyoming plans to host afternoon open houses where participants can speak with a broad variety of IT professionals (e.g., network administrators, compliance directors, HR directors, etc.) that represent local employers from an array of industries (e.g., critical infrastructure, healthcare, municipal government, etc.). Such career direction and insights are not typically provided by employers in these fields, so PA programs fill this knowledge gap.¹¹

In addition to various forms of contextualized learning, the most effective PA programs in ICT/cybersecurity also prioritize assisting students with self-branding. Efforts are largely concentrated on strengthening PA program participants' LinkedIn profiles and coaching them about how to appropriately describe their experiences when speaking with employers or RAP interviewers. This process involves helping participants identify *why* they choose to enter this profession, how to overcome self-doubt, and *how* to communicate their skill set by providing examples of when they used those skills and competencies in past experiences. Some PA programs dedicate the tail-end of their program to helping students reflect on their PA experience and pinpoint the skills they have cultivated. Participants explore how those experiences and skills are applicable to different ICT/cybersecurity occupations. Self-branding exercises create an environment where participants can enhance their professional image, which is critical to improving one's career potential and employability.

⁹ Computing for All. (n.d.). Pre-Apprenticeship Programs. Retrieved from <https://www.computingforall.org/pre-apprenticeship/>

¹⁰ Lowry, A. (2019, February 07). Opening Up a Pathway for True Entry Level Talent. Retrieved from <https://wecyberup.org/opening-up-a-pathway-for-true-entry-level-talent/>

¹¹ JFF. (n.d.). IT Pre-Apprenticeship Framework Component 5: Offering of Academic, Career Exploration, and Wraparound Supports. Retrieved from <https://www.jff.org/resources/framework-high-quality-pre-apprenticeship-program-it-it-pre-apprenticeship-framework-component-5/>



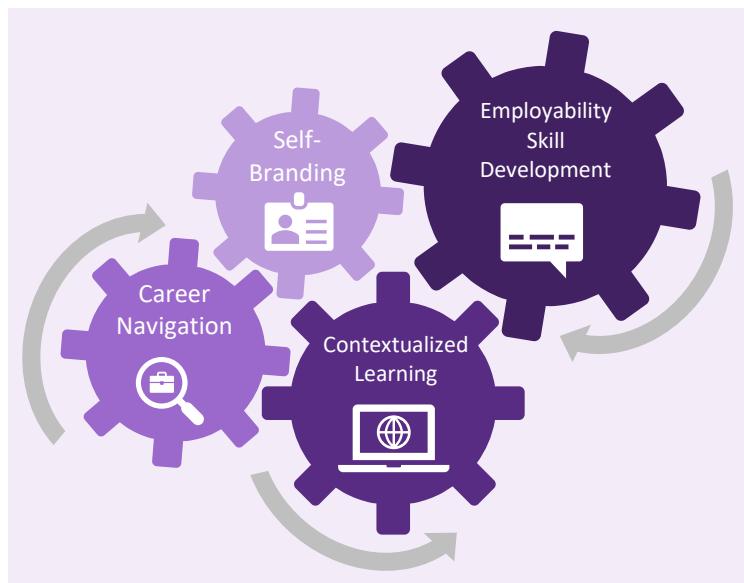
ICT/cybersecurity PA programs also provide a feeder into related RAPs. They assess candidates for their readiness for successful participation in RAPs and further develop required skills and traits where gaps exist. Together, PA programs and RAPs represent a viable talent development solution that can produce a highly skilled and diverse workforce of ICT/cybersecurity professionals who are competent in the knowledge needed to perform well.

Combining and Rebranding Existing Activities to Create a PA Program

Given the varied activities offered in an ICT/cybersecurity PA program, engagement from different stakeholder groups to provide services, instruction, or input is essential. Communities have an opportunity to link existing classroom training and extra-curricular activities such as Cyber Clubs, Cyber Boot Camps, and Cyber Capture-the-Flag competitions with internships and other work-based learning

experiences. With guidance from local strategic partners and in compliance with the state (where applicable), this combination of academic, extra-curricular and work experiences can be rebranded as a PA program. Local strategic partners can help shape a PA program's curriculum and goals so it can more effectively prepare PA program graduates and ensure they are qualified for RAP entry or entry-level employment. Gathering existing resources from and forming relationships in the community can lay the foundation for building a sustainable and successful ICT/cybersecurity PA program.

Figure 3. Important Elements of PA Programs in ICT and Cybersecurity



Qualifications for Entry into a RAP or Employment to Inform PA Program Development

An effective strategy to design and then launch an ICT/cybersecurity PA program consists of thorough backwards planning. Specifically, those developing the PA program need to connect and collaborate with local industry, employers, government, and education partners to identify the prerequisites for entry level employment and RAPs. Understanding the qualifications desired at each level of the workforce development pipeline for ICT/cybersecurity fields will define the required coursework, covered competencies, and offered experiences in a PA program. These qualifications will vary depending on the preferences of local employers and RAPs as well as the regional economic outlook and landscape for these industries. There is a consensus that more preparation is needed for entry into the workforce, and that training should begin earlier to prepare individuals for placement in either RAPs or employment. Thus, PA programs in ICT/cybersecurity predominantly target middle or high school students to introduce them to these industries and give them opportunities to participate in contextualized learning experiences. Such applied learning will make students more attractive to RAPs and employers beyond other traditional criteria, such as academic course completion and receiving nationally- or industry-recognized certifications.

Prerequisites for a RAP or employment in ICT/cybersecurity can include having a blend of desired employability and technical skills, participating in relevant extracurricular activities, completing certain pathway courses, and obtaining nationally- and industry-recognized, portable, and stackable certifications. Some employers and RAPs will hire or admit individuals without professional experience if they show curiosity, aptitude, mechanical ability, and a genuine desire to develop competencies in the field. Students can demonstrate these attributes by dismantling and re-building their own computer or by articulating what steps they carried out as well as how all the parts work together. However, some employers and RAPs have more stringent requirements. These can include consistent participation in cyber camps or competitions, completion of community college coursework or community service hours, presentations at community cyber safety or cyber hygiene outreach events, or certifications relevant to the field. Regardless of prerequisites, as a first step to PA program development, the required qualifications of local employers and RAPs must be identified. This ensures the activities, instruction, and other programmatic components included in the ICT/cybersecurity PA program align with stakeholder expectations and satisfy employer needs.

Identifying and Connecting the Dots between Different Stakeholders

To develop and effectively operate a PA program, initial buy-in and a high level of involvement are required from several different stakeholders. Examples of these stakeholders—preferably local—are

listed in Figure 4. While not all are required to build a successful PA program, the cumulative knowledge, resources, and networks can improve skills development and employment outcomes for employers and ICT/cybersecurity PA program participants. CyberWyoming convened a local community college and one of the largest high schools in the state (e.g., education partners), a state medical center (e.g., employer), the Wyoming Association of Career and Technical Education (based in Casper), and active economic development agencies (e.g., government partners) to form a local cybersecurity workforce collaborative partnership. As a result, the PA program developers ensured their competency-based cybersecurity program aligned curriculum at the high school- and college-level with local industry standards. The partner high school has a Cisco Networking Academy onsite which will provide participants with contextualized learning experiences and already-

Figure 4. Examples of PA Program Stakeholders



established coursework related to internet technology skills and Cisco networking techniques. As another example, Moreno Valley College is developing an IT/cybersecurity PA program for the LAUNCH Apprenticeship Network¹² (which partners with community colleges in the Riverside City College District

¹² LAUNCH http://launchapp.wpengine.com/?page_id=47



in California) by using workforce placement coordinators from Moreno Valley College.¹³ The college staff will leverage their industry and sector connections to help PA program completers secure employment in IT/cybersecurity.

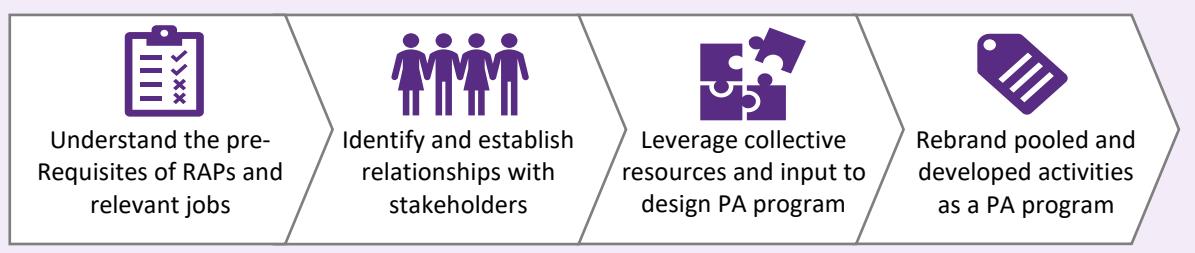
The LAUNCH Apprenticeship Network was originally formed in 2018 by the Inland Empire Desert Region College Consortium and leverages the workforce and education systems of the region's community colleges, K-12 districts, and two Workforce Development Boards.

In Southern California, Inland Empire is one of the fastest-growing population centers in the U.S., located 40 miles east of Los Angeles. Leaders there and from Moreno Valley College began to develop the IT/cybersecurity LAUNCH PA program by approaching potential partners with benefits that would make their involvement in the PA program worthwhile. To secure business partnerships, they offered small businesses a free cybersecurity safety workshop for their employees that would be taught by IT/cybersecurity LAUNCH PA program participants. This

provided a direct service to the local business community at no cost. Concurrently, it equipped PA program participants with experience teaching cyber hygiene and digital citizenship to employees of those businesses, as well as created internship or job opportunities for them with participating employers upon PA program completion. Establishing these relationships with stakeholders and supporting mutual benefits can encourage potential sponsor-employers to fully invest in the PA program design, offering their resources, human capital, finances, or network connections. With these significant contributions, stakeholders will have an influence over the PA program, ensuring that it will be grounded in business needs and industry-recognized credibility.

There is consensus that PA programs are an effective means to bolster the ICT/cybersecurity workforce by addressing some workforce challenges at the local level, including a skills gap in the community, an unstable pipeline of workers, or a high cost of training and retaining workers. Communities often have all the components available to launch “learn-and-earn” employment programs, but they lack the coordination of efforts among stakeholders. ICT/cybersecurity PA programs require strong collaborative partnerships among educators and trainers, community-based organizations, workforce system partners, and a business community concerned about protecting their data and intellectual property. Developers of a Casper-area ICT/cybersecurity PA program in Wyoming convened all the pertinent stakeholders and community leaders—identified through existing relationships—to discuss what was required to develop a local ICT/cybersecurity PA program. Once these goals were identified and relationships were strengthened over time, they collectively brainstormed *how* to provide students opportunities to gain experience and knowledge in the ICT/cybersecurity field. This collaborative group also benefited from stakeholders’ willingness to invest energy, attention, and resources.

Figure 5. Essential Steps in ICT/Cybersecurity PA Program Development



¹³ LAUNCH. (n.d.). About LAUNCH. LAUNCH Apprenticeship Network. <https://launchapprenticeship.org/>



Formal Agreements & Articulation between PA Programs and RAPs

An effective and high-quality PA program directly links PA program graduates to an existing RAP through a formal agreement. Though PA programs are not vetted, registered, or regulated by the federal government (unlike RAPs), having PA programs establish a partnership with a RAP is crucial to prepare individuals for entry-level RAP admittance and situate them on a career pathway.¹⁴ These formalized partnerships either facilitate entry—allowing those who successfully complete the PA program to directly enter into a RAP—or include articulation agreements that allow PA program completers to earn credit or advanced placement in a RAP for the skills and training they have already acquired. While the former is uncommon, the latter allows participants to potentially finish a RAP in less time. Preferential consideration for program graduates is another benefit that can be articulated in

Key Terms

Formal agreement:¹⁴ documentation between the RAP sponsor and PA program that clearly defines the obligations and expectations of each party in the agreement

Articulation agreement:¹⁴ agreements with RAP sponsors that enable PA program completers to earn advanced credit or placement for skills and knowledge gained

Facilitated entry:¹⁵ agreements with RAP sponsors that allow PA program completers to enter directly into a RAP

these formal agreements. This could include guaranteeing PA program completers an interview with an RAP, putting them at the top of the list for new RAP openings, or offering them other advantages during the RAP application process. For example, the IT/cybersecurity LAUNCH PA program in California has a formal agreement established with its affiliated IT/cybersecurity LAUNCH RAP. It specifies that the IT/cybersecurity LAUNCH RAP and affiliated employer partners agree to interview and look at these PA program completers first as a preference for RAP entry and hiring.^{15,16}

However, whether formal agreements between PA programs and RAPs are required varies by state. In 2018, California's state legislature passed Assembly Bill No. 235 which requires all PA programs in the state to be formally registered, meet certain state requirements, and to be formally linked to state-approved RAPs.¹⁷ Given that the IT/cybersecurity LAUNCH PA program is in California, its associated IT/cybersecurity LAUNCH RAP went through the state approval and registration process with the IT/cybersecurity LAUNCH PA program nested under it. The formal articulation process between this PA program and RAP was carried out through Moreno Valley College which hosts the IT/cybersecurity LAUNCH RAP. Once the formal agreement is approved by the state of California, the IT/cybersecurity LAUNCH PA program will begin placing students in its associated IT/cybersecurity LAUNCH RAP. Until the articulation is approved by the state, the IT/cybersecurity LAUNCH PA program can only place program graduates in non-RAP avenues, such as directly into a job or into available internship opportunities.

¹⁴ Employment and Training Administration, U.S. Department of Labor. (2017, January 12). Training and Employment Guidance Letter WIOA No. 13-16: Guidance on Registered Apprenticeship Provisions and Opportunities in the Workforce Innovation and Opportunity Act (WIOA). Retrieved from https://wdr.dol.gov/directives/attach/TEGL/TEGL_13-16_acc.pdf

¹⁵ Employment and Training Administration, U.S. Department of Labor. (2012, November 30). Training and Employment Notice No. 13-12: Defining a Quality Pre-Apprenticeship Program and Related Tools and Resources. Retrieved from https://wdr.dol.gov/directives/attach/TEN/TEN_13-12_Acc.pdf. This is called a "linkage agreement" in the state of California.

¹⁶ Office of Apprenticeship. (n.d.). Explore Pre-Apprenticeship. Apprenticeship.gov. <https://www.apprenticeship.gov/employers/explore-pre-apprenticeship>

¹⁷ California Legislative Information. Bill Text - AB-235 Apprenticeship and preapprenticeship. (2018, September 24). https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB235





Figure 6. Example States that Require Formal Agreements with RAPs and PA Program Registration

	PA Program Registration PA Program and RAP Formal Agreement
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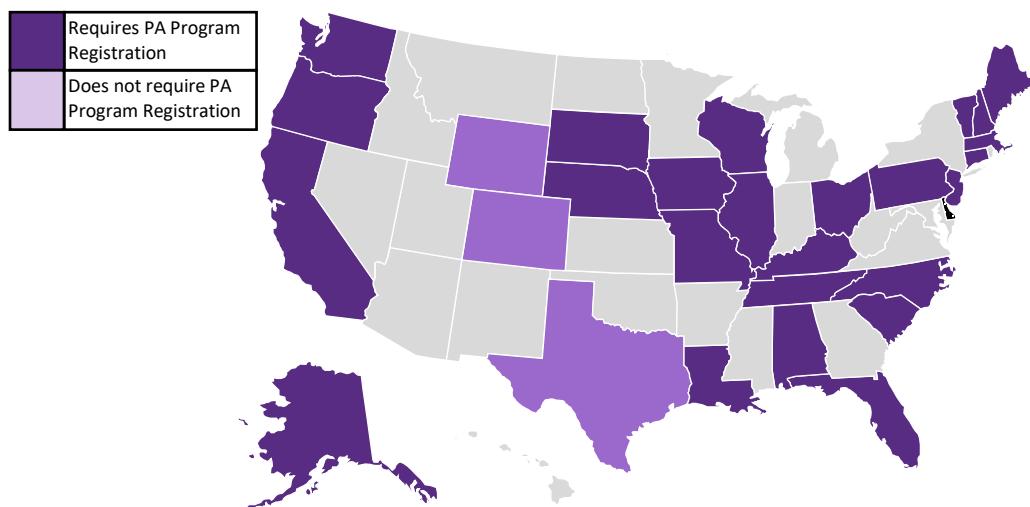
Alternatively, as documented in Figure 6, Wyoming (for example) does not currently require formal agreements between PA programs and RAPs. Developers of a Casper-area ICT/cybersecurity PA program in Wyoming indicated that while such articulation is not mandated, they systematically linked their PA program with two of CyberWyoming's ICT/cybersecurity RAPs. Specifically, they started with the technical competencies underscored in these existing RAPs and then worked backwards to design their PA program. Formal agreements between PA programs and RAPs are also not required in Missouri. CyberUp's PA program in St. Louis, Missouri first created a RAP and then developed its PA program to improve the skills of apprenticeship candidates. Its PA program is thereby designed to directly feed into its own RAP. Even though it is not required, an articulation was developed within the host organization to strengthen the talent of its own RAP pipeline.

"We had everybody in place. We had a community college and CyberWyoming has a great relationship with them. The community college was able to bring in the high school with the most active computer science program. We had a relationship with the Association for Career and Technical Education which is also located in Casper. We also had an association with an employer which was the Wyoming Medical Center, the largest hospital in the state. The community college and the Wyoming Medical Center were also members of the town's economic development agencies and there is a Department of Workforce Services in Casper. So really everything we needed was self-contained in Casper and given that, a committee for a pre-apprenticeship program was started." – Executive Director of a Statewide Cybersecurity Initiative and Alliance

While all states might not currently require formal agreements between RAPs and PA programs, 26 states do officially recognize PA programs at the state-level through a registration and approval process. These states are highlighted in Figure 7 and this information can be used to inform and accelerate the development of ICT/cybersecurity PA programs in different states. Also shown earlier in Figure 6, California requires PA programs to be state-registered and have a formal agreement with an existing RAP which aligns with the elements of a high-quality PA program. Alternatively, Missouri requires PA program state registration but *not* a formal agreement and Wyoming requires neither.



Figure 7. PA Program Registration Requirements by State



Spotlight on California

California passed Assembly Bill No. 235 in 2018 which describes the state's approval process for PA programs. To be approved and receive state registration, PA programs must submit a request for approval to the state's Division of Apprenticeship Standards. This request for approval includes documentation that substantiates the PA program's training activities are conducted in partnership with one or more RAPs already approved by the state's Division of Apprenticeship Standards. This valid documentation includes a formal agreement (termed a "linkage agreement") between a PA program and RAP. A linkage agreement is required to help ensure that PA programs in California lead to an increase in apprentices across trades and domains. To create a linkage agreement, PA programs and RAPs work together to define and negotiate the terms. A template of a linkage agreement provided by the Division of Apprenticeship Standards includes the following terms that a PA program and RAP should consider when establishing their working partnership:

- Successful completion of a PA program prioritizes but does not guarantee PA program completers acceptance into their RAP.
- The RAP makes a commitment that a set portion or number of PA program completers per cohort are accepted as apprentices into their RAP.
- PA program curriculum and training will be based on industry standards and approved by the RAP.
- Both parties will employ strategies that increase apprenticeship opportunities for underrepresented, disadvantaged, or low-skilled individuals so they are prepared to succeed in an RAP. These could include those related to recruitment and outreach efforts, hands-on training, offering support services, assistance in identifying and applying to local RAPs, and giving advance credit in the RAP for skills and competencies already obtained.

These exact same partnership terms and PA program elements are also enumerated in Assembly Bill No. 235.

Recommendations

PA programs represent a viable entry point to valuable careers, especially for individuals who lack the nationally- and industry-recognized credentials, technical and employability skills, relevant experience, or professional network connections to be successful in a RAP or entry-level employment. PA programs in ICT and cybersecurity provide industry-specific training, career navigation assistance, and instruction to help individuals obtain the skills, awareness, and knowledge needed to enter and succeed in RAPs—



and ultimately careers—in these technical fields. The following recommendations (Figure 8) can be leveraged to develop ICT/cybersecurity PA programs or bolster existing programs. They can serve as guideposts to inform how PA programs in ICT/cybersecurity should be configured and used to expedite the growth and improve the quality of those already in operation.

Figure 8. Recommendations for ICT/Cybersecurity PA Program Development and Enhancement

