NOVEMBER 2018

CENTER FOR APPRENTICESHIP & WORK-BASED LEARNING

APPRENTICESHIPS: THE NEXT STACKABLE CREDENTIAL?

Deborah Kobes
Director, **JFF**

Acknowledgements

The author would like to thank Greg Wilson of the U.S. Department of Labor for sharing Registered Apprenticeship data as well as Myriam Sullivan and Eric Seleznow of JFF for their insights and improvements to multiple version of the report. Special thanks to Rachel Crofut of JFF for guiding the publication through each stage of production. This report was funded by the generous support of Salesforce.org as part of JFF's Apprenticeship Awareness and Expansion Initiative. The national initiative expands apprenticeship and other high-quality, structured work-based learning programs through one-the-ground technical assistance and a resource and communications campaign.

About JFF

JFF is a national nonprofit that works to accelerate the alignment and transformation of the American workforce and education systems to ensure access to economic advancement for all.

Apprenticeship and work-based learning are proven methods connecting people to good careers while providing employers with skilled workers. The JFF Center for Apprenticeship & Work-Based Learning consolidates JFF's broad skills and expertise on these approaches into a unique offering. We partner with employers, government, educators, industry associations, and others to build and scale effective, high-quality programs. Visit https://center4apprenticeship.jff.org.

A NEW APPROACH FOR REGISTERED APPRENTICESHIP

The other four-year degree. It's a popular way to describe Registered Apprenticeship, and in many cases, it accurately describes the depth of education and training provided through these programs. Indeed, the median length of a RA program is four years.[1] RA is also the most in-depth, highest-quality form of work-based learning in the United States, with a federal or state agency ensuring that each program is well designed and meets established criteria. A Registered Apprentice begins early in his or her career, and by the end of the program is a journey-level worker who has taken on increasingly large responsibilities paired with progressive wage gains. The RA, in short, has served as a self-contained career pathway.

But this model of RA is not the only one. RA programs can be as short as one year—long enough to provide in-depth training as a strong introduction to an industry or as a way to move one rung up a career ladder, but not long enough to serve as the whole ladder.

This brief explores how changes over the last few years in RA have led to a shift toward shorter programs, and how establishing relationships between RA programs could build some of the benefits of long-term apprenticeships into a more modularized system. It draws on lessons from the stackable credential movement and makes the case for stackable RAs. The Industrial Manufacturing Technician (IMT) program provides a current example of how advanced standing can allow apprenticeships to stack. Other design solutions could leverage RA features in use in competency-based apprenticeships that do not have seat-time requirements and direct-entry agreements from pre-apprenticeship to apprenticeship. The brief concludes with recommendations to support the expansion of stackable apprenticeships.

What is Registered Apprenticeship?

Apprenticeship is a workforce training model that combines paid on-the-job learning and formal classroom instruction to help a worker master the knowledge and skills needed for career success. These programs generally vary in duration, quality, and program requirements, and require no approval by state or federal apprenticeship agencies.

An RA is an apprenticeship that is approved by either the US Department of Labor's Office of Apprenticeship or by a State Apprenticeship Agency. These programs last from 1 to 6 years and are sponsored by employers, labor management organizations, or other intermediary organizations. In addition to the program elements common across all apprenticeships, these programs meet several quality requirements, including providing approximately 2,000 hours of on-the-job learning and 144 hours of related instruction. Registered Apprentices receive on-the-job supervision and mentorship, and earn progressively increasing wages and an industry-recognized credential.

THE LATEST TRENDS IN RA

In recent years, the US Department of Labor has invested over $500 million to expand RA programs through a combination of contracts with national industry intermediaries, grants to state agencies, and grants to a range of local, state, and national organizations developing and launching new RA programs. The Office of Apprenticeship has also provided guidance on competency-based and hybrid programs that remove an emphasis on seat time as a priority for RA completion. Alongside an expansion of over 202,000 apprentices since 2013, shorter and more flexible RA programs have become more common (see Table 1). For programs registered in 2017-2018, the median program length has dropped to 3 years. The average program length has also dropped by almost a year as compared to programs registered before 2000. This trend is accompanied by a rise in RA programs that last 1.5 years or less. Before 2000, these programs were rare, accounting for only 3.4 percent of all programs. By 2005-2009, just over 1 in 10 programs were this length. Since 2017, this number has risen to over 1 in 4.[2]

Table 1. RA Program Length by Year Registered

Year Registered	Average Length (Years)	Median Length (Years)	Quartile Length (Years)	Programs 1.5 Years or Less (Percentile)
Before 2000	3.64	4	3.25	3.4%
2000-2004	3.34	4	2.4	8.7%
2005-2009	3.22	4	2.0	11.2%
2010-2014	3.07	4	2.0	17.7%
2015-2016	3.03	4	2.0	18.1%
2017-2018	2.74	3	1.39	26.7%

The trend to shorter RA programs reflects, in part, that RA has expanded into new industries and occupations (see Table 2). The median length for programs in the finance, insurance, and retail industry is only two years. Retail trade, services, and public administration each have a median program length of 3 years. In the service industry, this includes the almost 20 percent of programs that are 18 months or less. The trend is even more pronounced in subsectors within these industries. In health services, 44.4 percent of all RA programs are only a year, and only half are more than 18 months. In fact, the average program length for the subsector is just below

2 years. In personal services, the majority of RA programs are 12 to 18 months and the average program length is just over 18 months. This is true even for subsectors in which many programs remain longer. For example, the median business services RA is 3 years, but 26.7 percent of them are only 1 year. Similarly, while motor freight transportation has a median program length of 4 years, 1 in 5 are 1 year and another 8 percent are 12 to 18 months.

Table 2. RA Program Length by Industry

Industry	Average Length (Years)	Median Length (Years)	Quartile Length (Years)	Programs 1.5 Years or Less (Percentile)	Average Hourly Wage
Mining	3.71	4	4	1.4%	$28.29
Construction	3.72	4	4	1.1%	$24.13
Manufacturing	3.86	4	4	1.9%	$21.39
Transportation, Communications, Electric, Gas, And Sanitary Services	3.59	4	3	4.2%	$25.00
Wholesale Trade	3.42	4	3	4.6%	$21.73
Retail Trade	3.00	3	2	11.6%	$17.34
Finance, Insurance, And Real Estate	2.70	2	2	15.8%	$19.05
Services	2.89	3	2	19.3%	$20.71
Public Administration	2.83	3	2	15.8%	$15.20

Shorter programs can be an appealing way to get a foothold in new industries: employers can test the RA model without having to commit four years and associated training costs to each employee before having evidence of impact. Moreover, employers feel they will lose less if their freshly trained journey-level workers take their new skills down the road to a competitor. Finally, this model also aligns more closely with the just-in-time expectations of many employers who are more comfortable predicting their talent needs next year than four or five

years down the road. Yet, international research shows that although the specific duration varies by industry, firms recoup their investment in longer apprenticeships. While apprentices are less productive and training costs higher initially, in subsequent years, employers see a greater return on their investment in skills, competencies, and productivity of apprentices.[3]

Further, the international response to shorter apprenticeships has included concern that it would decrease program quality, causing Germany and Austria to maintain length requirements of at least two years. In the United Kingdom, as apprenticeships expanded to include shorter options, a backlash emerged that led to the creation of new quality standards.[4] While the RA requirements help ensure that the education and training provided during the apprenticeship remain high quality, less time does mean there is not as much opportunity to teach more advanced skills along a career pathway. Therefore, shortening RA programs may come at a cost to apprentices.

The patterns among existing RA programs do suggest that this wage trade-off exists. The average wage for a journey-level worker is $21.01 per hour *(see Table 3)*.[5] In comparison, the average journey-level wage for RA programs of no more than 18 months is $17.93 per hour while it is $26.16 for programs that are at least 4 years. These trends roughly map onto wages at the industry level, with those industries employing longer RA programs also culminating in a higher journey-level wage. Personal services and health services, two subsectors with a pronounced use of 12- to 18-month apprenticeships, have average journey-level wages of $16.71 and $17.86 per hour, respectively. More data is needed to see whether these journey-level workers continue to advance in their careers to make progress toward wage gains equivalent to longer-term apprentices, or whether wage gains stall at the end of the apprenticeship because there is often no clear next step for advancement.

Stakeholders in the RA program—sponsors, industry associations, intermediaries, and other practitioners—should explore program designs that can respond to employer preferences for 12- to 18-month apprenticeships while also continuing to provide similar value to workers as RAs have traditionally provided.

Table 3. Journey-Level Wages by RA Program Length

Program Length	Average Hourly Wage	Median Hourly Wage
1 Year	$17.84	$17.93
1–1.5 Years	$18.26	$17.00
1.5–2 Years	$18.12	$18.00
2–3 Years	$20.67	$20.00
3–4 Years	$23.14	$22.00
4+ Years	$26.16	$25.00
Total	$21.01	$20.00

STACKING UP TO A SOLUTION

RA providers should look to a recent trend in postsecondary education for inspiration: stackable credentials. Stackable credentials have emerged as a popular design strategy over the past 15 years as a way to combine shorter-term credentials into a coherent pathway that culminates in one or more recognized, in-depth credentials associated with expert-level skills. Generally, stackable credentials are discussed in the context of higher education, with short-term credentials ultimately stacking to a degree.[6] The evidence is mixed about the value of stackable credentials, but researchers and practitioners continue to argue that, if implemented well, this kind of system could benefit both learners and employers. The demand-driven emphasis of RA provides an opportunity to build on the strengths of stackable credentials while mitigating some of the current weaknesses in their design.

Most of the arguments for stackable credentials are learner-focused, emphasizing in particular the value to low-skilled, low-income earners. Proponents of stackable credentials argue that stacking makes it easier for students to switch between school and work while continuing to progress to an in-depth credential such as a degree.[7] In theory, learners can enroll in a short-term credential that brings immediate value, and stop and start credential attainment to accommodate their careers. Most importantly, rather than spending time earning parallel credentials that do not necessarily lead to greater wage returns, a stackable pathway is designed to include wage bumps with each credential that can add up to a larger wage gain for the learner.

The major benefit of stackable credentials to employers should be that workers can more quickly enter the labor market with evidence of in-demand skills. Once in the workforce, they can more quickly attain new skills to fill high-skill needs in their industry. Stackable credentials are only effective—for both employers and learners—if the credentials that are being stacked are valued in the labor market.[8] For this reason, proponents of stackable credentials recommend that employers be engaged early and serve as leaders throughout credential, curriculum, and program design.[9] Continued involvement in these programs benefits employers by positioning educational institutions to provide a steady stream of new talent and upskill workers to meet the latest employer needs.

Unfortunately, the research does not indicate that stackable credentialing has lived up to its potential. Short-term credentials are broadly defined—sometimes for-credit, sometimes vocational, and of all different lengths with differing levels of employer buy-in. Many included in stackable pathways do not actually lead to wage increases, particularly in some industries.[10] Even when individual credentials have labor market value, more work needs to be done to ensure that their value is additive when earned sequentially.[11] Another major challenge with stackable credentials has been that most learners, particularly people of color, do not persist through to completion of the culminating credential. [12]

The stackable credentials movement points to the potential power of stacking, while the research demonstrates that employers must be central to the credential design in order for benefits to accrue to both employers and learners. RAs bring an employer focus to the credentialing system, with employers playing a central role in both apprenticeship design and delivery. With wage progression written into their standards, apprenticeships also ensure that each credential brings wage gains for apprentices, and that stacked apprenticeships have additive value. In short, stackable apprenticeships can offer the proposed benefits of stackable credentials—for workers, a way to advance the highest-skill training and careers; to employers, a quicker path to completion for their current labor needs—while addressing many of the limitations in some existing stackable credential efforts.

DESIGNING A STACKABLE APPRENTICESHIP

Many RAs already integrate industry-recognized credentials into their program design. But RAs themselves are a credential. The apprenticeship system would offer clearer pathways to advancement if the RAs themselves were designed to build on each other, and fully credit the knowledge gained in related programs.

Stackable RA programs do not have to be designed from scratch. Practitioners interested in developing a stackable apprenticeship can take advantage of the fact that the RA system is designed to recognize the acquisition of skills valued across an industry, and to promote portability of that recognition. Three characteristics of the RA system in particular can support strategies for stacking: the ability to award advanced standing in a program based on prior knowledge, competency-based delivery models that focus on skill gains rather than seat time, and the ability to establish direct-entry agreements into a program. One RA, the IMT, illustrates how the first of these options works, and an exploration of the other two design elements offers insights into new strategies to stack programs.

Advanced Standing

RA programs have the option to allow apprentices to begin as far as just under halfway through the program rather than from the beginning, based on prior training. By mapping skills and competencies across two RA programs, the sponsor of the more advanced program can allow an apprentice that enrolls in them consecutively to skip the redundant content. If the two programs are not only mapped to each other, but actually designed as a single continuum, this allows the apprentice to prepare for, and then accelerate through, the more advanced program. The IMT program, developed by WRTP, the Working for America Institute of the AFL-CIO, and JFF, is an RA program that is already designed to stack into more advanced manufacturing programs. Its stackable design can serve as a model for other RAs.

The IMT apprenticeship program trains frontline advanced manufacturing production workers. It differs from many other RAs in manufacturing because it is less specialized and relatively short—the hybrid program is approximately 18 months long. The related instruction focuses on the competencies covered by the Manufacturing Skill Standards Council's Certified Production Technician certification, widely recognized across the manufacturing industry, supplemented by communications and math. On-the-job learning spans a range of broad-based manufacturing skills including production equipment operation, quality production, inspection and measurement, technical information interpretation, routine equipment maintenance, and safety.

This design of the IMT apprenticeship is intended to both build the skills and competencies of workers in manufacturing production positions, and to prepare them to participate in and complete apprenticeships for more advanced and high-skill manufacturing and management occupations. The curriculum overlaps with up to the first 3,000 hours of many long-term 8,000- to 10,000-hour RAs. This means that journey-level workers are highly skilled and well qualified to advance into a range of apprenticeable occupations including maintenance mechanic and industrial electrician. For example, a tooling design manufacturer in Michigan uses the IMT to prepare workers for the more advanced pattern-maker apprenticeship program. Sponsors of long-term RA programs in these occupations have the discretion to decide how much advanced

standing to provide to IMT completers who enroll in their RA. Leaders of the IMT have begun to establish advanced standing agreements with sponsors of these RAs. Already, IMT journey workers receive 3,000 hours of advanced standing in one sponsor's 10,000-hour pattern maker RA, and five other employers have provided terms for advanced standing.

The advanced standing model employed by the IMT can be applied to RAs in other industries. The shorter apprenticeships emerging in nontraditional industries often prepare skilled, journey-level workers who are still early enough in their career pathway to select among several different, more specialized occupations. For example, in the health care industry, a medical assistant RA program could prepare a worker to pursue becoming a health information technician, a medical laboratory technician, or a Licensed Nurse Practitioner, all apprenticeable occupations. As these initial programs prove the value of the RA model to employers, they can design multiyear RA programs to meet their more specialized high-skill needs. Employers would not need to commit to guiding workers through both RA programs. Rather, this would widen their talent pool, allowing sponsors to select from entry-level workers starting at the beginning of the apprenticeship, or more skilled workers who have already completed a more general 12- to 18-month RA.

Advanced standing agreements enable a system in which 12- to 18-month RAs serve as new avenues to prepare for a multiyear RA, and a sponsor can accelerate apprentices through the higher-skill program.

Competency-Based Delivery

Competency-based RAs advance apprentices through the program as they demonstrate mastery of set skills and competencies, rather than relying on the more traditional requirement to spend a certain number of hours in the classroom and on the job. This design allows apprentices to progress through the RA at different rates, based both on their prior knowledge and how quickly they learn within the program. This design can allow apprentices who have already completed a 12- to 18-month RA program to skip portions of a longer-term, competency-based RA program by demonstrating that they have already gained many of the skills in the more advanced RA. This creates a similar stackable design as advanced standing agreements, although through a different mechanism.

The ability to accelerate apprentices is a key appeal to employers who are looking to quickly upskill workers to their highest-need occupations. For example, Tooling U-SME has created an acceleration guide for employers interested in apprenticeship.[13] This approach seems to work for apprentices as well. Australia has been utilizing a competency-based apprenticeship model for longer than the United States, with over half of adult apprentices accelerating their programs to less than two years. Those who shorten their program through recognition for prior learning have earned the same wages as those who do not accelerate.[14]

Unlike with advanced standing, a sponsor of a competency-based apprenticeship program does not need a formal agreement to stack with a shorter RA program. Rather, the two programs just need to intentionally align the skills and competencies that are taught so that an individual who has completed the first RA program is prepared to demonstrate mastery of many skills and competencies upon entering the second RA program. As with the IMT, the two programs could share a sponsor or provide a pathway across sponsors. The benefit to employers is the same: they gain the option of training a journey-level worker in less time when they have specialized needs. In addition, they can do this without making the same up-front commitment to apprentices about their standing. Rather, they only need to accelerate apprentices to the extent that those apprentices can show they learned the intended skills of the shorter-term apprenticeship program.

Competency-based apprenticeships enable a system in which apprentices can accelerate through a longer-term, specialized RA program based on skills and competencies already gained in an aligned 12- to 18-month RA program.

Direct Entry

RAs are required to establish protocols to accept apprentices into programs. One of the ways that sponsors can prioritize candidates is through a direct-entry agreement, in which graduates of a designated program are accepted into the RA program when spots are available. Currently, direct-entry agreements do not exist between two RA programs, but rather between pre-apprenticeship and RA programs. This creates a pathway into apprenticeships, with the explicit recognition that the two programs are not only aligned, but also that skills and competencies taught in the pre-apprenticeship fully prepare individuals to enter and succeed in the RA program. This kind of direct-entry agreement could be used more broadly and applied between two RA programs, rather than only as a pre-apprenticeship-to-apprenticeship pathway.

Pre-apprenticeship-to-RA agreements illustrate how direct entry serves to directly stack programs, establishing a smooth continuum from one program or credential to the next. For example, New York has created a recognized set of pre-apprenticeship programs that attract different populations to the building trades: Nontraditional Employment for Women; Helmets to Hardhats, focused on veterans; Building Works, sponsored by the New York City Housing Authority; and the Edward J. Malloy Initiative for Construction Skills, which is available to public school youth. The direct-entry pathway is viewed as a successful tool for diversifying the city's trade unions. Four out of five program graduates, 90 percent of whom are people of color, continue into a union apprenticeship, with a high return on investment for participants.[15] Pre-apprenticeship programs such as this provide a steady stream of talent, with some relevant skills in hand, to apprenticeship programs.

There is no reason that this kind of direct-entry agreement has to be between a pre-apprenticeship program and an RA program, rather than two RA programs. This design would bring the same recruitment benefits to employers as direct entry from pre-apprenticeship: graduates of the broad-based 12- to 18-month RA program provide a talent pool for a more advanced RA program, with an even higher skill level than they would bring from a pre-apprenticeship program. As with the IMT, the sponsor of the entry-level RA could be the same employer or a different one than the more advanced RA.

Direct-entry agreements would also allow sponsors to reconsider how they create high-skill apprenticeship programs. Those employers who are not willing to commit to a single multiyear program, whether concerned about the upfront investment or a greater need for flexibility, could design a set of stacked 12- to 18-month apprenticeship programs that target occupations at different levels of their company. The most basic programs would have broad-based skills relevant across the company, while more advanced programs would be more specialized. The most advanced apprenticeships could be designed as parallel programs to target multiple high-demand occupations. The sponsor of the more advanced RA does not have to commit to a long-term program, but rather could rely on apprentices entering with enough skills to target their priority skills and competencies in a similarly short program. Employers would have a pool of workers with standardized skills ready to receive targeted training where the most immediate needs exist. This design would match the current trend in nontraditional apprenticeship industries toward shorter apprenticeships, while supporting employers' needs for their highest-skill positions. While the benefit to employers is deploying a quick-turnaround RA only when they have talent gaps, the benefit to workers is a way to achieve predictable but incremental progress within a company. Employees could enroll in each apprenticeship as increasingly high-skill positions become available.

Direct-entry agreements enable a seamless system in which several 12- to 18-month RA programs combine into a 3- to 5-year apprenticeship pathway.

LOOKING FORWARD

As the growth of shorter RA programs demonstrates, not all employers are interested in committing to a multiyear training program. RA programs must continue to evolve to meet the needs of employers in an evolving economy that requires rapidly changing skills, absorbs technology with shifting implications for productivity, and competes in a globalized landscape. Even those employers with gaps in their highest-skill occupations may need solutions to attract workers across their labor continuum, and upskill them through a range of options that look different than a traditional four-year RA.

RA programs must also evolve to continue to connect workers to family-supporting wages in an evolving economy that is becoming increasingly stratified, requires ever-higher skills for high wages, and is redefining the relationship between workers and employers.

Stackable RAs can offer the flexibility and clear skill pathways to benefit both employers and workers. Moreover, advanced standing, competency-based delivery, and direct entry already offer the conditions needed to design a stackable system.

Stakeholders across the RA system can support the establishment of a stackable apprenticeship system. Recommendations include:

The US Office of Apprenticeship (OA) and State Apprenticeship Agencies (SAAs) should incentivize stackable apprenticeship pathways. While recognizing the need to respond to employer preferences for shorter programs, the OA and SAAs should design policies and programs to encourage the best outcomes for apprentices. For example:

- States with tax credits could give larger credits to employers who enroll apprentices in a second apprenticeship or programs at least three years long.
- State Workforce Innovation and Opportunity Act policies could prioritize funding for apprenticeship programs that are stacked or at least three years long.
- Federal and state grants could specifically target the creation of stackable RA programs, just as they have targeted new industries and new types of stakeholders such as community colleges and intermediaries.
- Federal and state grants could require program evaluation that includes measures of the impact of stackable designs or total apprenticeship length on wage potential for journey-level workers.
- OA and SAA representatives could provide guidance on higher-skill apprenticeships suitable for pathways when supporting a sponsor in registering a 12- to 18-month RA program.

Program sponsors and intermediaries developing programs should promote stacking within a larger continuum of stackable credentials. The same approaches to stack RAs with each other can also be used to stack RAs within a broader system of credentials. Just as pre-apprenticeships are designed to stack into apprenticeships, apprenticeships are also increasingly aligned with shorter-term, industry-recognized credentials that can be included independently or as a group within the program's related instruction. The proposed industry-recognized apprenticeships may be particularly well positioned for this alignment if the same bodies oversee an industry's apprenticeships and related credentials. Moreover, adopting industry-recognized credentials within industry-recognized apprenticeships can ensure that apprentices receive a portable credential. This kind of alignment adds further coherence to the credentialing landscape by connecting otherwise competing and confusing systems in order to recognize skills gains.

Employer sponsors of 12- to 18-month RAs should consider how they can lead into longer-term apprenticeships (using advanced standing or competency-based alignment) or create a series of short but increasingly high-skill apprenticeships (using direct entry) to create a 3- to 6-year apprenticeship pathway for their workers. Many employers that are new to the RA system have begun with a short-term program. As they build the evidence that RA works for their organization, they can consider how to build out the model for additional occupations within their company. Using the strategies described above, employers can design flexible RA systems that meet their full range of training needs without relying on a single RA to support talent across all levels of their organization.

In the long run, an apprenticeship system that can skill up workers through long-term pathways, perhaps once again averaging four years as in college, will also go further to providing the highly skilled workforce that employers will increasingly require in the 21st Century.

ENDNOTES

[1] Author analysis of US Department of Labor, Office of Apprenticeship, RAPIDS data from May 2018. This represents programs in all states with RA administered through the federal government, as well as several State Apprenticeship Agency states. RAPIDS analysis throughout this brief examines program-level data (not apprentice-level data) and assumes one year of program length per 2,000 hours for the on-the-job training "Term Length Minimum."

[2] Author analysis of RAPIDS data.

[3] Samuel Muehlemann and Stefan Wolter, "Return on investment of apprenticeship systems for enterprises: Evidence from cost-benefit analyses," *IZA Journal of Labor Policy* 3, no. 25 (2014): 313-328,

[4] *The Apprenticeships Programme: Twenty-eighth Report of Session 2016-17* (London: House of Commons, 2016), https://publications.parliament.uk/pa/cm201617/cmselect/cmpubacc/709/709.pdf; Sarah Ayres Steinberg and Ethan Gurwitz, "Apprenticeship Expansion in England: Lessons for the United States, *Center for American Progress* (blog), June 6, 2014, https://www.americanprogress.org/issues/economy/reports/2014/06/06/91011/apprenticeship-expansion-in-england/; Angela Hanks, "The Administration and Congress Should Not Undermine Registered Apprenticeships," *Center for American Progress* (blog), January 11, 2018, https://www.americanprogress.org/issues/education-postsecondary/reports/2018/01/11/444829/administration-congress-not-undermine-registered-apprenticeships/.

[5] Author analysis of RAPIDS. Only programs registered since 2015 are included in the wage analysis to minimize the impact of inflation. Some entries appeared to reflect weekly, monthly, and annual wages, so this analysis excluded all wage entries greater than 150. Blank entries or wages equal to 0 were also excluded.

[6] Bryan Wilson, *Stackable Credential Policy Toolkit* (Washington, DC: National Skills Coalition, 2016), https://www.nationalskillscoalition.org/resources/publications/file/Stackable-Credential-Policy-Toolkit-1.pdf

[7] Wilson, *Stackable Credential Policy Toolkit*.

[8] Evelyn Ganzglass, *Scaling "Stackable Credentials": Implications for Implementation and Policy* (Washington, DC: CLASP, 2014), http://connectingcredentials.org/wp-content/uploads/2015/02/CLASP-Stackable-Credentials-Paper.pdf.

[9] Wilson, *Stackable Credential Policy Toolkit*; *Stackable Credentials Tool Kit* (Washington, DC: US Department of Education, Office of Career, Technical, and Adult Education, 2018), http://www.cord.org/stackable_credentials_toolkit_apr2018.pdf.

[10] Christina Carey, *Certificate Structure Study: Do Stackable Certificates Really "Add" up to a Degree? Research Report 17-2* (Olympia: Washington State Board for Community and Technical Colleges, 2017), https://eric.ed.gov/?id=ED573032; Thomas Bailey and Clive Belfield, *Stackable Credentials: Awards for the Future?* (New York: Community College Research Center, 2017), https://ccrc.tc.columbia.edu/publications/stackable-credentials-awards-for-future.html; Matt Giani and Heather Fox, *Stacking Up? Do Stackable Credentials Contribute to Upward Mobility?* (Champaign, Illinois: Office of community College Research and Leadership, 2016).

[11] Thomas Bailey and Clive Belfield, *Stackable Credentials: Do They Have Labor Market Value?* (New York: Community College Research Center, 2017), https://ccrc.tc.columbia.edu/media/k2/attachments/stackable-credentials-do-they-have-labor-market-value.pdf.

[12] Carey, *Certificate Structure Study: Do Stackable Certificates Really "Add" up to a Degree? Research Report 17-2*; Bailey and Belfield, *Stackable Credentials: Awards for the Future?*; Giani and Fox, *Stacking Up? Do Stackable Credentials Contribute to Upward Mobility?*

[13] "Apprenticeship Acceleration Framework," Tooling U-SME, 2018, https://www.toolingu.com/training/apprenticeship.

[14] Jo Hargreaves and Davinia Blomberg, *Adult trade apprentices: exploring the significance of recognition of prior learning and skill sets for earlier completion* (Adelaide: Commonwealth of Australia, 2015), https://files.eric.ed.gov/fulltext/ED560578.pdf.

[15] Ester Fuchs, Dorian Warren, and Kimberly Bayer, *Expanding Opportunity For Middle Class Jobs in New York City: Minority Youth Employment in the Building and Construction Trades* (New York: Columbia University School of International and Public Affairs, 2014), https://sipa.columbia.edu/sites/default/files/Columbia_SIPA_Construction_Skills_Report_Final_March_2014_0.pdf.