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Working Toward Change

A Closer Look at Tech Apprenticeship in the 21st Century

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About DPI

The Discovery Partners Institute empowers people to jumpstart their tech careers or companies in Chicago. Led by the University of Illinois System in partnership with top research universities, it does three things: Train people for high-demand tech jobs; conduct applied R&D; and support business building. With state investment and a new innovation district in development, DPI has the resources to attract, develop, and leverage the most ambitious people and companies the region has to offer — and keep them here.

On the cover: Chicago Booth Clinical Associate Professor Raghu Betina teaches HTML and CSS to the first group of tech apprentices at DPI.

Executive Summary

Apprenticeship is a symbiotic relationship, enabling tech companies to produce much-needed workers and participants to develop valuable skills at little to no cost — that's what we believe at Discovery Partners Institute, and that's what we'll prove in this short report from the Workforce Education team at the Pritzker Tech Talent Labs.

Apprenticeship can help the Chicago tech space grow into one that is forward-thinking and inclusive. Furthermore, it is built to scale and to provide a long-term return on investment, creating a robust tech ecosystem now and into the future. Bottom line: apprenticeship is good for workers and good for industry.

In this report, we will paint a picture of apprenticeship as the workforce development solution the tech field needs. First, we will examine the literature on and statistics about tech apprenticeship. Then, we will summarize interviews we conducted with seven software development- and cybersecurity-focused apprenticeships from across the United States, chronicling their stories and successes. You will learn how tech apprenticeships can increase company diversity, produce well-prepared tech workers, and secure a return on investment. Join us in transforming tech!

Introduction

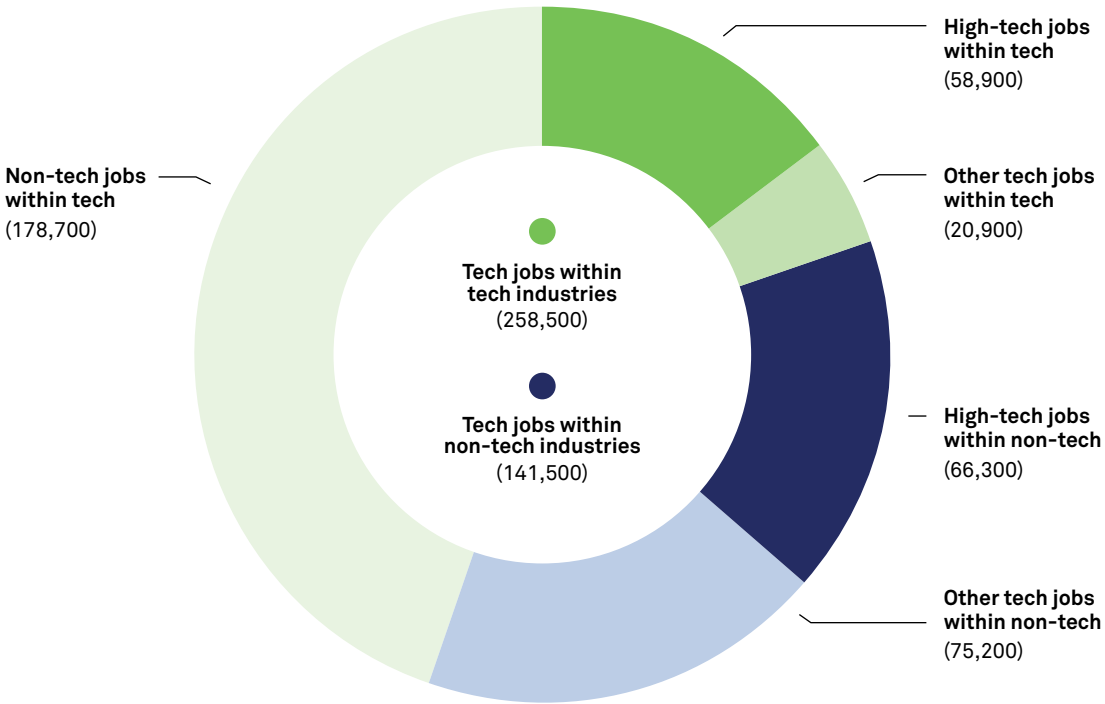
Chicago is a diverse city quickly becoming a global tech hub, where the tech ecosystem is composed of both tech and non-tech industries and occupations. Chicagoland's tech ecosystem is made up of approximately 400,000 jobs. These were determined by calculating occupations from three different categories: (1) Tech Occupations in Tech Industries, (2) Non-Tech Occupations in Tech Industries, and (3) Tech Occupations in Non-Tech Industries.

Of the 400,000 Tech Ecosystem jobs, more than 125,000 are considered "high-tech." As seen in the chart, there are more high-tech jobs in non-tech industries than there are in tech industries.

Exhibit 1

Distribution of 400,000 Jobs in Chicagoland's Tech Ecosystem

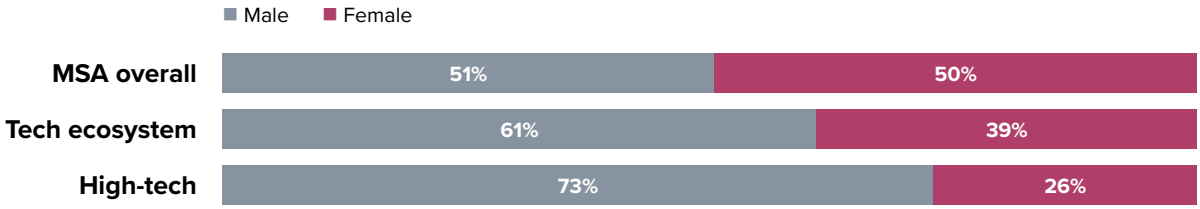
By Industry and Job Type



Note: Tech occupations are divided into "high-tech" and "other tech," where occupations such as software developers were considered high tech and occupations such as computer user support specialists were considered other tech. The data visualized in this graphic comes from Lightcast, formerly known as Emsi-Burning Glass.

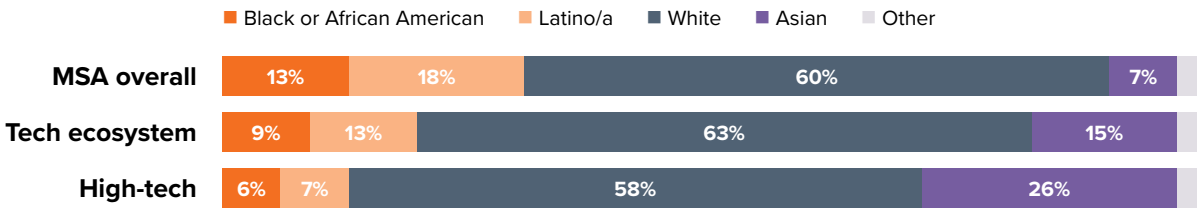
Although there are nearly 400,000 jobs in the area's tech ecosystem, the people holding these jobs are not necessarily representative of Chicagoland's workforce. There are approximately 9.5 million workers in the region. Of these workers, they are almost split evenly between male and female. However, within the tech ecosystem, men have a greater share of those jobs, which becomes more pronounced when examining high-tech jobs.

Exhibit 2 Chicagoland Workforce Gender Distribution



Similarly, when examining the jobs by race, Black and Latino/a workers are not well represented within the tech ecosystem, especially in high-tech jobs.

Exhibit 3 Chicagoland Workforce Race Distribution



Discovery Partners Institute seeks to propel Chicago into a pre-eminent and inclusive tech center over the next decade. Our goal is three-fold: tech talent development, applied research and development, and business building. As part of our commitment to tech talent development, we aim to prepare promising and diverse Illinoisans to step into lucrative and resilient tech jobs.[1] We believe one of the best ways to achieve this is through the establishment of tech apprenticeships in the community. This year, we launched two apprenticeship-related programs: a pre-apprenticeship and full stack development apprenticeship that partners with the City Colleges of Chicago and Cognizant, a Fortune 200 IT services provider; and DPI's software development apprenticeship program.[2]

[1] See DPI's website, https://dpi.uillinois.edu/, for more.
[2] To learn more about both programs, visit the TechReady Illinois website: https://techready.uillinois.edu/

> **Apprenticeships have stood the test of time, proven their malleability, deflected partisan politics, and enhanced economies.**
>
> — Excerpt from the Urban Institute's report *Skilling Up: The Scope of Modern Apprenticeship*,

What is Apprenticeship?

Apprenticeship is an "earn-and-learn" model that includes classroom and on-the-job training. Modern-day apprenticeships span a number of industries and provide thousands of jobs to workers across the United States.[3] As explained in the Urban Institute's report *Skilling Up: The Scope of Modern Apprenticeship*, "From beekeepers whose scientific techniques protect our food supply, to mental health practitioners serving remote indigenous communities in need of essential services, to veterans finding meaningful employment in agricultural science and environmental preservation, to diverse young people working in the oil and gas industry, all are modern apprenticeships destined to shatter myths and beg replication. Apprenticeships have stood the test of time, proven their malleability, deflected partisan politics, and enhanced economies."[4] Yet despite growing numbers and support from politicians across the political spectrum, many executives have not heard of apprenticeships, let alone considered having their company participate in one.[5]

In this report, we focus on apprenticeships related to tech occupations across all sectors. Not every tech apprenticeship is in a tech company, as even "non-tech jobs … have been transformed by technology," especially in light of the COVID-19 pandemic.[6] Our aim with this report is to showcase the knowledge we have gathered throughout the creation of our tech-focused apprenticeship programs: first, through a brief survey of the existing literature on tech apprenticeships, and next, through a summary of our findings from interviews with companies and apprenticeship intermediaries across the United States. We hope that this report will provide the information necessary for others to advocate for tech apprenticeship programs within their organizations.

[3] "FY 2020 Data and Statistics," 2020.
[4] Dimeny et al., 2019, p. 1.
[5] Dimeny et al., 2019; Elliot et al., 2022; "FY 2020 Data and Statistics," 2020; Kuehn, 2017; Lerman and Rauner, 2012; Lohr, 2020
[6] Consumer Technology Association, 2019; Consumer Technology Association, 2020; Lohr, 2020.

Summarizing the Literature on Tech Apprenticeship

Tech apprenticeship is a small niche within the realm of apprenticeship in the United States. According to an article by Open Campus, "Apprenticeships in tech roles remain rare — just 4,100 active apprentices worked in tech last fall, according to federal data, roughly 1 percent of the total 366K apprentices in the U.S. at that time."[7] Even tech hubs like New York City and San Francisco report only a handful of tech apprenticeship programs.[8] Yet recently, apprenticeship has grown.[9] According to the U.S. Department of Labor, from 2011 to 2020 the number of new apprentices grew 70%.[10] Additionally, the Urban Institute states, "In recent years, registered apprenticeships in computer and mathematical occupations — as varied as IT generalists, software developers, and mainframe technicians — have expanded from 369 total in the United States in 2015 to 2,684 by 2021."[11] Open Campus reports "a 41% increase last year in registered apprenticeship programs in tech fields."[12] Since not all apprenticeships are registered with federal or state governments, these numbers are likely even higher than reported.

DPI apprentices train for an upcoming apprenticeship.

The global COVID-19 pandemic has slowed, but not stopped, apprenticeships.[13] In 2020 alone, the state of Illinois had almost 17,000 apprentices and almost 500 active registered apprenticeship programs.[14] The growth of apprenticeship has developed alongside the growth of the tech field in Illinois. In 2019, Illinois ranked third in the United States in graduating computer science students, and 10% of all computer science degrees in the U.S. come from this state.[15] Illinois also contains outposts for many major tech organizations, including Microsoft, IBM, Abbvie, Thoughtworks, and Motorola Solutions.[16] Data from the Lightcast database show that between January 2021 and February 2022, there were 238,456 unique posts for tech, data, and engineering-related positions in Illinois. Nearly 20,000 of these were postings for entry-level jobs with zero to one year of experience required.[17] However, the tech industry has had a difficult time filling diverse positions, in part due to "a growing skills gap."[18] Apprenticeships can help to fill these gaps by training entry-level talent for high demand positions.[19]

[7] Fain, 2022.
[8] Bruggeman and Baltodano, 2020; Messina and Dvorkin, 2019; Prebil, 2020.
[9] Fain, 2022.
[10] "FY 2020 Data and Statistics," n.d.
[11] Elliot et al., 2022, p. 1.
[12] Fain, 2022.
[13] "FY 2020 Data and Statistics," n.d.
[14] "FY 2020 Data and Statistics," n.d.
[15] ISTC, 2021, p. 8.
[16] ISTC, 2021; Urwin, 2022.
[17] 51 occupations were included in this search, including "Computer and Information Systems Managers," "Special Effects Artists and Animators," "Statisticians," "Computer Hardware Engineers," and more.
[18] Consumer Technology Association, 2019, p. 5.
[19] Consumer Technology Association, 2019.

With the number of apprenticeships growing each year and the continuous expansion of apprenticeship to new fields, there are a number of ways in which the growth of tech apprenticeships would benefit the industry. One major reason is that apprenticeships are a great way to expand diversity in tech.[20] The underrepresentation of historically minoritized populations — particularly women of color — in the STEM workforce have been a source of concern for several decades.[21] Apprenticeships can help reverse this trend. For example, some apprenticeship programs specifically invite groups historically underrepresented in STEM to apply for their programs.[22]

However, "Even if people from underrepresented groups acquire the right skills and apply for tech jobs, many companies still won't consider them for an interview if they don't have a Computer Science degree," wrote Ryan Carson, CEO of the tech company Treehouse.[23] This is a challenge, as a disproportionate number of individuals in minoritized groups may have a "limited access to quality education," especially when it comes to STEM.[24] Apprenticeships can help reverse this imbalance by providing learning opportunities, on-the-job training, and pathways to permanent jobs for those who don't have traditional education credentials.[25] Apprenticeships also pay apprentices for their time, helping students avoid many of the risks associated with costly degree or bootcamp programs that may have low completion rates. For example, DPI's Software Development Apprenticeship includes both a paid pre-apprenticeship, which introduces participants to basic coding knowledge, and a three-month, full-time classroom training period, which prepares students to be as successful as possible once they start their on-the-job training period. This means that we can take students with little to no prior knowledge of programming and prepare them for software development careers in less than 18 months.

The apprenticeship model also has a proven return on investment for companies that invest in them. Carson suggested that tech companies could save millions by creating their own apprenticeship programs.[26] International studies estimate that for every dollar an employer spends on apprentices, they gain nearly $1.50, according to The Consumer Technology Association.[27] Furthermore, recruiting employees with specific skills can be time consuming and costly versus training apprentices in those skills.[28] Apprentices typically command lower salaries and have very high workplace retention rates, reducing costs associated with employee turnover.[29] Companies with apprenticeship programs can also plan for when apprentices will be ready to start, taking away the uncertainty and potential cost that comes from simply posting a job advertisement and waiting for it to be filled.

[19] Consumer Technology Association, 2019.
[20] Elliot et al., 2022, p. 10-11.
[21] Funk & Parker, 2018, p. 14.
[22] Carson, 2018.
[23] Carson, 2018.
[24] Funk & Parker, 2018, p. 21.
[25] Carson, 2018.; Elliot et al., 2022, p. 10.
[26] Carson, 2018.
[27] Consumer Technology Association, 2019, p. 19.
[28] Carson, 2018; Consumer Technology Association, 2019; Elliot et al., 2022.
[29] Consumer Technology Association, 2020, p. 10-11; Elliot et al., 2022, p. 4.; The Chicago Apprentice Network, n.d., p. 7.

Apprentices start with three months of training and finish on a diverse, agile team in the workplace.

Why Offer Apprenticeships?

In December 2021 and January 2022, staff at DPI's Pritzker Tech Talent Labs interviewed representatives of seven companies or intermediaries currently involved in running tech apprenticeship programs. Our goal was to learn more about best practices and lessons learned from organizations that have already implemented tech apprenticeships. The apprenticeships detailed range widely, from government-registered apprenticeship programs to youth apprenticeships to on-the-job-learning programs run by private companies.

We asked representatives about their apprentices as well as apprenticeship structure, program outcomes and evolution, wraparound services, and more in hopes of getting a fuller picture of the unique planning and execution of each apprenticeship. Some companies and intermediaries agreed to be named, while others are anonymized (Companies A and B).

Build Labs

1 Build Labs, a software company located in Minnesota, describes itself as "an immersive coding experience for developers and designers." [30] Build Labs employs a three-level apprenticeship model: DevApprentices (entry-level), Journeymen (mid-level), and DevMentors (mid- to senior-level).[31] DevApprentices work under the supervision of Journeymen who are under the direction of DevMentors for a few months to a year. As individuals master skills, they have the opportunity to level up into Journeymen and potentially later to DevMentors.

According to founder/CEO James Dietrich, the idea for Build Labs came out of his own experience hiring interns and apprentices at other companies. He saw firsthand the improvement of workers who were partnered with dedicated mentors. He also noticed that the best mentors had "three legs of the stool" — time, empathy and emotional intelligence, and a desire to help others. At the same time, Dietrich was aware of coding bootcamps and a lack of opportunities for graduates of these programs. All this led him to the creation of what he calls "a focused, apprentice-based software development shop."

"It surprised me greatly that when I was launching this, I really couldn't find any examples" like Build Labs, Dietrich said.

At Build Labs, apprentices focus mostly on on-the-job learning. Although some training is available, apprentice candidates should already know basic coding. As a result, Build Labs now partners with bootcamps, and gets many of its apprenticeship recruits through these relationships.

Build Labs instructs apprentices in everything from commenting on code to learning when to ask for help. In return, Dietrich has seen how much apprentices can grow: "For instance, one of our individuals who joined us — right before bootcamp, he was delivering pizzas. And now, he is one of our strongest embedded firmware software developers, and … is helping … several of our clients on his own [to] tackle really complex technical projects … In just about three years or so, he has gone from … a minimum wage with tips job to a very lucrative career in software."

The COVID-19 pandemic has affected the Build Labs' apprenticeship program, leading the company to establish remote positions for both apprentices and mentors, thus expanding their reach. Yet despite the pandemic, Build Labs' apprenticeship program is still going strong.

See the website at https://buildlabs.io/

[30] Build Labs, n.d.
[31] Build Labs, n.d.

Code For America

2 Code for America is a nonpartisan, nonprofit organization that has "partnered with community organizations and governments at all levels to build digital tools, change policies, and improve programs." [32] According to their website, "The Code for America apprenticeship is a full time, salaried, nine-month program targeted to candidates with non-traditional backgrounds, such as recent boot-camp graduates, people switching careers, or those re-entering the workforce." [33]

The apprenticeship program was started to create a more inclusive organization. "We really at Code for America believe that we want the staff to reflect the...country as a whole and the people that we serve and the programs that we work on," said Laura Kogler, Engineering Director at Code for America. "We look for people that [have] lived experience with the programs that we are working on. So that's things like food assistance and ... Medicaid ... "

While potential apprentices need "a baseline" of experience with coding, degrees are not required, and nontraditional learners are preferred. Although interns were once required to live in or move to San Francisco, where Code for America is headquartered, the COVID-19 pandemic changed this requirement. Now, apprentices can be remote workers.

The Code for America apprenticeship program has a unique structure. Rather than having front-loaded training, apprentices complete training throughout their apprenticeship using resources like "online trainings, tutorials, [and] courses." Additionally, apprentices have access to a supportive learning structure within the company: "We have three roles designated to support them ... " Kogler said. "One is a mentor; another is a manager and the third is — we call them an ally. It's kind of like a buddy ... And we did that in order to ... make sure that people had multiple points of contact that they could lean on for support."

Apprentices also join teams where they program with fellow teammates to gain more in-depth knowledge of coding, and their learning is tracked via rubrics. Depending on need and capacity, apprentices have the chance to work in teams focused on software engineering, data science, qualitative research, and search service design.

Code for America has hosted two or three apprentices yearly since 2018, and most end up becoming full-time employees. "Our goal with the apprenticeship program is to hire people in as regular employees at the end," Kogler said. "We try and make that feel as seamless as possible by treating them as much in the same way as we do with our other employees from the beginning."

Code for America "definitely intend[s] to" continue on with their program, Kogler said, adding that the experience of helping with this program has personally turned her into "an apprenticeship evangelist."

See the website at https://codeforamerica.org/

[32] Code for America, n.d.
[33] Code for America, n.d.

Meet an Apprentice

Melissa Chaca, 25

> **It was great to see people of all backgrounds doing this together. People have all these different experiences — pharmacy, law, healthcare — but we are all on the same playing field.**
>
> — Melissa Chaca

A year ago, Melissa Chaca was working as a patient care technician at a hospital, on a path to be a nurse. But she had the nagging feeling that a career in healthcare wasn't for her.

Always interested in problem solving and puzzles, she was intrigued by the idea of a career in tech, but wasn't sure how to pivot. Then, she learned about the Cognizant Full Stack Developer Apprenticeship Program.

"I immediately thought it was too good to be true," she said. "I said, 'I'll try it.' It was the best decision I've made."

While the fast pace and new material was challenging, Chaca appreciated the program's in-person learning format and the opportunity to connect with a diverse cohort.

"It was great to see people of all backgrounds doing this together," she said. "People have all these different experiences — pharmacy, law, healthcare — but we are all on the same playing field."

Growing up, Chaca said she never considered a career in tech.

"I'm first-generation," she said. "My mom wanted me to be a lawyer or a doctor. Now, I want to show my community that there's way more opportunity out there."

Company A

3 Company A is a tech consulting firm with offices across the United States and beyond. Their services include the design and development of software and blockchain-based products, as well as training and coaching. Company A is notable because they began their development-focused apprenticeship more than a decade ago when the company was founded. In that time, they have hosted over 180 apprentices.

"Our company is actually founded by basically a mentor and his apprentice," said Adrian,[34] Director of Key Initiatives at Company A and a former Company A apprentice. "It sort of organically developed as an apprenticeship program."

Over its lifespan, Company A has refined the program's structure. Today, it entails five to eight months of learning a number of defined "skills and competencies" under the tutelage of primary and support mentors. Because Company A uses a cohort model, apprentices can learn from fellow apprentices. Many applicants come from coding schools or bootcamps and "have not been paid professionally to write code" before, Adrian said. No matter their background, all apprentices must pass both a take-home assignment and a pair programming interview to be accepted, as well as two other interviews.

Apprentices begin by supporting their mentor with solo projects, working alongside other apprentices, and learning through avenues like company-sponsored workshops. Next, they join a real client project as a team member. Finally, they prepare for their own client project after their apprenticeship period ends. Using this structure leads to a high rate of apprentice success.

"So for the program itself … our aim is to have everyone complete it. And we do have a really high percentage. It's very uncommon to have anyone not complete it," Adrian said, adding that apprentices usually stay with the company for several years after becoming full-fledged employees. Because apprentices are full-time, entry-level employees of Company A, very few workers leave after their 5-8 months are up, Adrian said. "It's not even a conversation at the end. It's a promotion conversation where we talk about being promoted from apprentice to crafter, just like any other level promotion," he said.

Adrian "personally [is] passionate" about apprenticeship, and so is Company A. The apprenticeship model has worked so well that Company A has helped client companies create new apprenticeship programs.

"I still think it's an inefficiency in the software market that everyone seems to be wanting to hire, trying to hire, desperate to hire, but unwilling to train to hire," Adrian said. "As long as we've had this program … we've seemed to have an advantage over other companies who, for whatever reason, weren't willing to have a program." Because of this, Company A is continuing their apprenticeship program into 2022 and beyond.

[34] Name has been changed.

Company B

4 Company B is a non-profit apprenticeship intermediary in the United States focused on youth apprenticeship for high school students. This intermediary has employers' perspectives built into its foundations because its founder, a successful entrepreneur and businessman, identified a disconnect between education, training, and ultimately, employment.

"Businesses in Colorado and across the country are constantly looking for talent, and struggling to find the right talent that they need. And the Company B model recognizes that the burden has been put on schools alone for too long, that employers have a meaningful role in the development of our future workforce," said Benjamin,[35] Company B's Senior Director of National Partnerships.

Company B benefits from close collaboration with government entities such as the state's Department of Labor and Department of Education, which supports marketing campaigns, funds grants, and helps shepherd apprenticeship-focused legislation.

Company B's online platform serves as a "marketplace" where students can set up a user profile and apply for approved apprenticeships posted by companies. Employers then choose to interview and hire students based on their applications. While some apprenticeships are tech-focused, additional fields, particularly those based in knowledge economy fields not traditionally associated with apprenticeship – for example, education, hospitality, and financial services — are also represented.

As students are still in high school at the time of their application, many of these apprenticeships run for much longer than typical adult-focused apprenticeships — two to three years instead of just one. At first, participants are only part-time apprentices. In the last year of the apprenticeship, apprentices will have graduated from high school and are able to take on full-time work. Because of this, the training portion of the apprenticeship looks much different than others. "We don't have a rigid mandated course sequence for the occupations," Benjamin said. "The employer and the student, with the support of our team, select the courses in the sequence … that make the most sense for where the student is at in their current skill set." Learning is evaluated through regular surveys for both students and supervisors.

Company B provides a number of services to employers supporting or looking to support apprenticeship programs, including recruiting, the creation of training plans, and more. Beyond this, Company B also offers the services of a Customer Success Manager to employers. "They support all the students that employer hires on, as well as the supervisors and trainers of those apprentices," Benjamin said. For example, managers can help apprentices work out transportation challenges or connect them with resources for suitable workplace attire.

Company B has seen a number of successes despite the fact that "it's a two- to three-year model, and [they've] only been around for five years." After five years, Company B has facilitated more than 1,000 student hires. Furthermore, Company B now has five affiliates across the United States who are expanding and scaling the reach of their apprenticeship model, with more to come.

[35] Name has been changed.

Additionally, Benjamin said that many apprentices stay on with their companies after their apprenticeship, whether in a full-time role or part-time as they pursue higher education. Some of these participants even have their degrees partially or fully funded by the company they apprenticed for.

"There's a lot of growing interest in apprenticeship in this country," Benjaim said. "I think it's all kind of coming to a head, which really creates the perfect storm for apprenticeship, if we can all get on the same page and speak the same language and move forward."

Creating Coding Careers

5 Creating Coding Careers (CCC) is a Southern California-based nonprofit that helps students across the country enter the tech industry through pre-apprenticeship and apprenticeship programs.[36] CCC CEO Mike Roberts Jr. created the company after building his own career in the tech field.[37] "It's a very difficult thing to learn how to code. So having to work [a] … usually miserable job during the day and then have to study really hard in the evening for [a] prolonged period of time … is just unattainable for most of the humans that I've met," Roberts said. "We wanted to challenge the status quo and see if we can solve some of those problems. And when we looked at the apprenticeship model, it seemed to solve some of the most significant challenges for the people involved."

Roberts calls CCC "a turnkey apprenticeship opportunity." CCC hires and helps to train apprentices, then companies hire them at the end of their apprenticeship.[38]

CCC has two programs: a pre-apprenticeship and an apprenticeship. The three-month, recommended pre-apprenticeship is run with the San Diego Workforce Partnership.[39] Successful completion of the pre-apprenticeship can lead to the opportunity to join CCC's apprenticeship program. "Apprentices spend a year learning alongside experienced software engineers working on real world projects for real clients," explains the CCC website.[40] The apprenticeship begins with three months of bootcamp-like training, followed by elective training that is "usually specialized for the particular client that [the apprentice is] going to go embed at."

CCC has a firm commitment to diversity, and recruits potential students from bootcamps aimed at diverse groups.[41] When interviewing potential apprentices, CCC focuses less on "numerical, reasoning, verbal skills" and more on "the soft skills that employers are looking for," such as communication, problem solving, and emotional intelligence. Finally, CCC heavily emphasizes resilience and grit in potential apprentices: "Grit is that collection of traits that we know to be the difference in people who crush it and people who flounder." [42]

See the website at https://cccareers.org/

[36] Creating Coding Careers, n.d.
[37] Creating Coding Careers, n.d.
[38] Creating Coding Careers, n.d.
[39] Creating Coding Careers, n.d.
[40] Creating Coding Careers, n.d.
[41] Creating Coding Careers, n.d.
[42] Creating Coding Careers, n.d.

Meet an Apprentice

Jorge Morin, 23

> **I use software everyday. But to finally understand how it's working in the background is really cool.**
>
> — Jorge Morin

Jorge Morin never imagined a career in tech.

"I never considered a career in tech because I was never exposed to tech," the Chicago native said. "I didn't learn how to use a computer until 5th grade. We used encyclopedias at school because they didn't have computers."

Instead, Morin studied engineering and architecture in college, ultimately specializing in fire protection and plumbing design. But he was curious about coding, and started learning it on the side. Then he learned about the Cognizant Full Stack Developer Apprenticeship Program.

"I love engineering, but I also love learning and trying new things," he said.

Since starting the program, Morin feels like he's learned another language and unlocked the secrets to the universe.

"I use software everyday," he said. "But to finally understand how it's working in the background is really cool. I was plateauing in engineering, but I feel like a kid again learning all this."

Cybersecurity Youth Apprenticeship Initiative

6 The Cybersecurity Youth Apprenticeship Initiative (CYAI) is a workforce intermediary for apprenticeship.[43] Funded by the U.S. Department of Labor's Employment and Training Administration Office of Apprenticeship, "CYAI promotes sustainable development of cybersecurity apprenticeship programs for youth aged 16-21 and is administered by [the global consulting firm] ICF. The goal of the initiative is to create at least 900 new cybersecurity apprenticeships for youth by 2024." [44] "Part of our role is to help build those pipelines," said Mike Lawrence, a part of the Workforce Innovations and Poverty Solutions learning group at ICF.

ICF and CYAI assist with cybersecurity apprenticeships across the country, from Philadelphia to San Antonio to the U.S. Virgin Islands. Most apprenticeships CYAI works with are competency-based and entail 2,000 hours of training. Apprentices engage in classroom training. "We collectively give [employers] a quality entry level employee [and] they can customize their training, and that actually reduces their costs," Lawrence said.

CYAI also helps apprenticeship creators access things such as subsidies for apprentices as well as other assistance. "It's obviously not all about the money because our subsidy, by the nature of this contract, is $400 per registered apprenticeship. That's not a tipping point amount of money that's going to make anything happen," Lawrence said. "What they are going to get is [that] we can do some extensive support. So, it's like labor market information, sponsorships, raise awareness, capture the flag challenge type of opportunities." In exchange for help from CYAI in setting up their apprenticeship, program coordinators must report back about their success. As Mike says, "Our main outcome that we look for is … did this person get enrolled into a registered apprenticeship."

While the COVID-19 pandemic affected the work of CYAI and their partners, it did not completely stop them — something Lawrence suggests may be due to the already virtual nature of cybersecurity work. The demand for tech apprenticeship may have also contributed to this. "Certainly, the driving forces that are going to make apprenticeship such an attractive opportunity aren't going to go away," Lawrence said.

See the website at https://cyai2024.org/

CyberUp

7 CyberUp is an apprenticeship intermediary that helps employers train new cybersecurity analysts. It was the first cybersecurity apprenticeship intermediary in the United States, and the third cybersecurity apprenticeship program. CyberUp describes itself as "a national nonprofit organization … committed to cultivating the cybersecurity talent pipeline for today and tomorrow." [45] CyberUp encourages interest in cybersecurity in two ways: competitive PowerUp Cyber Games, and the LevelUp Apprenticeship program.[46]

[43] CYAI, n.d.
[44] CYAI, n.d.
[45] CyberUp, n.d.
[46] CyberUp, n.d.

“What we’ve experienced over the last four years is that companies used to run from us when we would say apprenticeship, because they didn’t understand what it meant. We’ve spent the last four or so years making it easier for them,” said Amber Lowry, Chief of Staff for CyberUp.

As a result, “it’s not so scary anymore,” she said. CyberUp has expanded from working in just two states to four.[47]

The LevelUp apprenticeship has two components: a pre-apprenticeship and an apprenticeship. The pre-apprenticeship is part-time, while the apprenticeship is full-time and paid.[48] There are two forms of pre-apprenticeship — some students go through employer-sponsored in-person classes, but most enter a virtual, flexible pre-apprenticeship that is open to all.

Apprentices must gain certification in cybersecurity before the apprenticeship start, which can take around six months. “Employers didn’t want to hire on potential, they wanted to hire on a core baseline of knowledge so they can hit the ground running,” Lowry said.

Students who attain this baseline, whether inside or outside of CyberUp’s pre-apprenticeship program, can apply for the LevelUp apprenticeship. As this apprenticeship is a registered apprenticeship, it is structured similarly to others — “upfront training and then on the job training and related technical training” are all built into the LevelUp program. In addition, apprentices gain access to monthly talks from cybersecurity professionals, a Slack community for studying and networking, newsletters, and check-ins with CyberUp staff.

Potential apprentices are required to have or be working on a CompTIA Security+ certification, as well as pass an assessment, personality test, and an interview. Additionally, CyberUp is especially interested in recruiting diverse groups like people of color, veterans, and/or women. Amber suggests that throughout the application process, CyberUp especially looks for one important characteristic: grit. “And so far, everyone who’s had that grit and determination — regardless of their background, income, education level, where they started the program — those are the successful people…Those are the ones who just become rock stars,” she states.

CyberUp’s success can be partially attributed to its strength in creating great local relationships. “We know how to get into each community and each nonprofit organization [that] serves that community,” Lowry explained. This helps CyberUp attract diverse candidates, as well as win grants and keep up-to-date with local labor officials.

“Some of its now come full circle,” Lowry said. “For me, I always ask the apprentice how’d you hear about CyberUp because we don’t really advertise about ourselves. And [one] said, ‘You came to my school and talked about cybersecurity.’ ”

See the website at https://wecyberup.org/

[47] CyberUp, n.d.
[48] CyberUp, n.d.

Summary

By virtue of their status as apprenticeships, the programs highlighted here share some commonalities, whether they were registered programs or not. Most require potential apprentices to have a baseline of knowledge, and pass an interview and/or test. When the program begins, most, if not all, incorporate some form of mentoring or coaching for apprentices and have an emphasis on learning, whether solely on the job or through the addition of some form of structured teaching. However, DPI also gleaned a number of unique insights from our interviews:

- **Many programs want potential apprentices to demonstrate grit and perseverance:** "Grit" was emphasized as an important characteristic for apprentices by multiple interviewees. DPI has learned that learning to code and/or advancing one's coding skills in around one year is a very difficult task, even within a full-time and paid apprenticeship program. Apprenticeship coordinators want participants who are up to the challenge. However, the definition of grit is notoriously variable; organizations must be wary of becoming too subjective in the apprenticeship interviewing process by relying heavily on perceptions of grit in candidates.

- **Many apprenticeships have a commitment to advancing diversity, equity, and inclusion in the tech field:** While not all organizations we interviewed had a specific focus on diversity, many called out the ways in which they worked to explicitly attract diverse candidates to their programs. For some organizations like Code for America and Creating Coding Careers, advancing equity in tech is the guiding light of the apprenticeship program.

- **Higher tech apprenticeships and bootcamps are very intertwined:** Many programs acknowledged that they receive a number of applications from coding bootcamp graduates. Some have embraced this and build relationships with bootcamps, while others were not as happy about the fact that many of their applicants are former bootcamp students. This is because a few interviewees acknowledged that many bootcamp graduates feel they are not totally prepared for the tech field by bootcamps, which is why they try to enter apprenticeship programs. However, some organizations preferred to hire from bootcamps because apprentices already have a certain level of training, knowledge, and skills.

- **The COVID-19 pandemic affected all apprenticeship programs:** Some programs opened up their programs to apprentices from around the country during the COVID-19 pandemic. Others leaned on virtual training. Almost every organization we spoke to acknowledged that the pandemic had some sort of effect on their programs. However, we did not hear of any programs that had to stop completely due to the pandemic.

- **All organizations and companies interviewed seem optimistic about the future of apprenticeship and plan to continue their apprenticeship programs:** None of our interviewees expressed regret about starting an apprenticeship or told us of plans to halt their programs. Instead, they seemed excited about the future of apprenticeships in this country and believed they were making a difference in the tech industry. Many people we interviewed expressed a passion for advocating for tech apprenticeship, and some were amazed more organizations did not participate in them.

Conclusion

Tech apprenticeship is a burgeoning solution to many of the issues facing the tech industry. In conducting a literature review and interviewing seven companies employing tech apprenticeship, we gained insight into the benefits of running an apprenticeship program. These organizations have shown the numerous possibilities for how apprenticeships can change the tech field, all while providing a return on investment for companies.[49] As apprenticeships continue to grow across the United States and the tech industry expands, intermediaries like DPI will need more and more employer partners to commit to apprenticeship. Thus, we end with a call to action: if you would like to be at the forefront of workforce development in the tech space, commit to taking a chance on apprenticeship.

[49] Consumer Technology Association, 2019, p. 19.

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