

TECH JOBS FOR ALL?

Exploring the
Promise & Pitfalls of
Technology Training
in the United States



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Executive Summary

In the past few years, training programs promising on-ramps to high-paying tech jobs have sprung up across the country, drawing attention from the media, government leaders, and the general public. The rapid growth of these new models for tech training—often designed to fill the projected growth in information and communication technology (ICT) jobs—raises questions about how best to classify and understand these programs and their role and value in workforce development more generally.

Programs promising lucrative careers in technology after just a few months of training seem to have exploded in recent years, and the interest in such programs is growing just as quickly. With technology and programming jobs being heralded as the hot new careers, training providers and governments have jumped at the opportunity to help job seekers rapidly launch new careers. This report examines the reasons for the tech training hype and proposes a taxonomy of training programs, cataloguing best practices from each program type. The report also identifies challenges that organizations, employers, and the government will need to address to ensure these expanding programs accurately meet market demand and look to the future of tech training more generally.

Interest in new tech training is often driven by government estimates of as many as 500,000 currently open ICT jobs and more than a million similar new jobs being created in the next decade.¹ While these are only estimates, technology jobs are often touted as being plentiful, high-paying, and available to anyone with the skills to do them, regardless of a formal degree. Spurred on by the promise of these new career pathways, organizations have created training programs that offer to teach anyone the ICT skills they need to get a job in only a few months.

CHALLENGES

Tech training programs face many of the same challenges as traditional workforce development programs, as well as some additional unique or exacerbated obstacles. Generally, these challenges involve ensuring trainees have the skills required to succeed, broadening programs to reach diverse populations, connecting with employers and keeping up with changes in the market, and creating a system for evaluating success.



CLASSIFYING TECH TRAINING

Organizations have developed a number of training models to help different populations learn the skills they need for ICT jobs. These training programs are categorized into five different types in the report, with more information given about their advantages and obstacles:

- **Traditional Education:**
Programs that are connected to traditional education that go beyond or are otherwise complementary to K-12, often through classroom instruction.
Example Programs: Lake Area Technical Institute—Computer Information Programs; Pathways in Technology Early College High School
- **Bootcamps:**
Intensive programs that are usually less than one year in length and aim to teach a discrete skill or skillset. These programs may result in a certificate or nanodegree, but often not a postsecondary degree.
Example Programs: Detroit Grand Circus—Java Bootcamp and Front-End Bootcamp; Flatiron School—Web Development Immersive
- **MOOCs:**
Massive open online courses are often free or low-cost and may or may not have an instructor at the helm of the training.
Example Programs: edX; Udacity; Code Louisville
- **Internships and Apprenticeships:**
Programs that connect participants directly to a career pathway by enabling them to work with potential employers.
Example Programs: Code to Work; CODE2040 Fellowship; LaunchCode
- **Integrated Technical and Experiential Programs:**
Programs that aim to provide multiple methods of training, often through a combination of accelerated learning, an internship or apprenticeship, and mentorship.
Example Programs: NPower—Technology Service Corps; Per Scholas; Year Up; Vermont HITEC

In addition to these training programs, employers and intermediary organizations play an important role in the tech training landscape. Both help to signal demand for skills, building connections with training programs and offering continued training opportunities for employed workers.

MAKING TECH TRAINING WORK

Although many parts of tech training are new and evolving, this report examines a number of best practices that can be used to improve the field more generally:

- **New Pathways:**
Developing new opportunities for more participants to enter tech training jobs by introducing more people to technology as a career or providing people with the skills they need to enter training programs.
- **Skills Matching:**
Working directly with employers to ensure that trainees' skills correlate directly to employer needs.
- **System of New Credentials:**
Creating a way for programs and participants to clearly signal to employers that they have desired skills, either through certifications, portfolios, or standardized curricula.
- **Intentional Efforts to Support Diversity:**
Making an effort to create or support programs with the goal of including students from disadvantaged or underrepresented communities.
- **Institutionalized Data Collection:**
Ensuring that programs collect similar data to better evaluate the success of individual programs as well as the field as a whole.
- **Creating a Hub:**
Forming a system for effective communication toward collaboration, ensuring that programs meet actual need, and expand, replicate, and share best practices.

The explosion of new tech training models is an exciting moment for the tech world and workforce development, but the tech training buzz that “anyone can have a tech job” also deserves a healthy bit of caution. This field is still relatively new, and it remains to be seen what the future of these programs is and whether the growth of tech jobs will continue as promised. As new models mature, however, their success will ultimately depend on their ability to ground claims of success in data, to adjust to changes in the marketplace, and to meet employer demand.



These tech jobs are touted as plentiful, high-paying, and available to anyone with the drive and desire to learn the skills, often by the training programs trying to attract prospective students. Media coverage has painted a similarly rosy picture, with headlines like “12 Weeks to Six-Figure Job”³ and “Coding ‘Boot Camp’ Opens High-Tech Doors.”⁴

On a larger scale, tech training models, especially bootcamps, are thought of by some to be at the forefront of workforce development more generally. Tech training is touted even by workforce development as being at the leading edge of trends such as skills-based hiring, non-traditional learning, and rapid education models.⁵

Yet the field is new, and the lack of comprehensive and concrete data on outcomes and transparency makes much of the tech training hype difficult to verify. Additionally, policymakers and employers may be overwhelmed by the abundance of new training programs. Questions still linger about whether these programs are successfully creating a skilled tech workforce that meets employers’ needs, much less if these programs are fulfilling the promise of economic mobility for participants and creating a workforce that is diverse in gender and race.

This report seeks to rise above the buzz that often surrounds tech training and instead begin to make order out of this rapidly developing field. It identifies the common challenges faced across the information and communication technology (ICT) training landscape, the solutions that experts and practitioners have found to overcome such challenges, and the questions that need to be addressed to create a healthy and successful tech training field in the future.⁶ The report draws on extensive background research and interviews with over 30 experts in tech training, including practitioners, government officials, employers, and participants, to form a landscape of technology training for adults in the United States.

The Tech Training Explosion

Programs promising lucrative careers in technology after just a few months of training seem to have exploded in recent years, and the interest in such programs is growing just as quickly. With technology and programming jobs being heralded as the hot new careers, training markets and governments have jumped at the opportunity. In just the past few years, coding bootcamps have sprung up across the country to help people rapidly launch a new career and, at the same time, the White House and the city of New York have launched initiatives to invest in technology training efforts.²

THE POSSIBLE TECH TRAINING OPPORTUNITY

A Growing Demand for Tech Talent

IT workers are increasingly becoming a key component of the U.S. economy. Technology companies are not the only ones who need employees with these skills. Nearly every modern business needs people with technology skills, be it for straightforward tasks like setting up an email server or building a website, or for complicated activities like developing a mobile banking app or creating software to manage international logistics.

Contractors and banks are each hiring hundreds of programmers at a time, and every employer from large retailers to small business—anyone who wants to do business on the Internet—needs employees to develop and manage its software. Entire sectors are increasingly integrating technology into their operations, including fields such as healthcare, manufacturing, and the government, all of which will require a dedicated workforce to build, maintain, and update this technology. As technology needs continue to expand, employers are searching for new sources of technologically skilled workers to keep up with the technological developments.

OFF-SHORING

Amid the enthusiasm for the boom in tech jobs, there is an undercurrent of concern that American workers may not benefit and these jobs will instead be filled by foreign workers. In 2015, ConAgra announced plans to outsource many of its technology jobs⁷ and Disney only scrapped plans for outsourcing of tech workers after a public backlash.⁸ At the same time, the H1-B visa program has come under scrutiny as some skeptically

view it as a chance for companies to train foreign workers on technology jobs that could be filled by Americans.⁹ Yet, recent surveys of corporate officers have shown a decline in tech outsourcing.¹⁰ Tech leaders also say that between dealing with time zones and cultural issues, it is often better to have coders in house who can do the work.¹¹

As technology increasingly becomes integral to new industries, experts are predicting a boom of new jobs. As of March 2015, the White House estimated that there were 500,000 open ICT jobs in the U.S.¹² The Bureau of Labor Statistics estimates that by 2022 in the U.S., more than 1.2 million computer programmers and 800,000 computer support specialists will be needed.¹³ The growth rate for both of these job types is projected to be more than 20 percent over 10 years, nearly double the national average for all occupations.



Many of these jobs are expected to be high-paying, with support specialists having a median income of more than \$60,000.¹⁴ A survey of coding bootcamp graduates found that after four months, 89 percent were employed at an average starting wage of \$64,000. These salaries continue to grow at more than 5 percent each year.¹⁵



As the need for trained IT workers grows, employers say that they are struggling to find job seekers with the IT skills to fill the positions they have open. Last year, the Manpower Group, a human resource consulting firm, reported that 39 percent of employers had trouble filling all open jobs due to lack of available talent.¹⁶ The problem is perceived to persist. According to a 2012 survey of business executives by CompTIA, 42 percent believed that the IT skills gap had increased over the past two years.¹⁷

Additionally, as the technology workforce grows, it continues to face problems with diversity. A recent comparison of seven of the biggest tech companies in the U.S. found that, on average, only 29 percent of their employees were women, and blacks and Hispanics made up only 7 and 8 percent of the workforce, respectively.¹⁸ A *USA Today* study in 2014 found that tech companies were hiring black and Hispanic employees at half the rate that they were graduating.¹⁹ In order to achieve a workforce that is representative of the country and the communities it serves, many argue that more needs to be done to support diversity in ICT.

Responding to this current and future need from employers, new tech training programs have sprung up around the country, promising to train the workers who can fill the increasing number of job openings. Coding bootcamps alone have grown rapidly, with 67 now operating in the U.S. and Canada, compared to 43 in 2014.²⁰

As employers begin to view IT work as a discrete set of skills that can be learned anywhere, much like a trade, and the variety of technical jobs increases, barriers to entry to the field continue to decrease. A degree in computer science was once the minimum requirement for programming jobs, but employers are increasingly determining that much work can be done by any with the proper training, whether or not they hold a degree.²¹



SKILLS-BASED HIRING

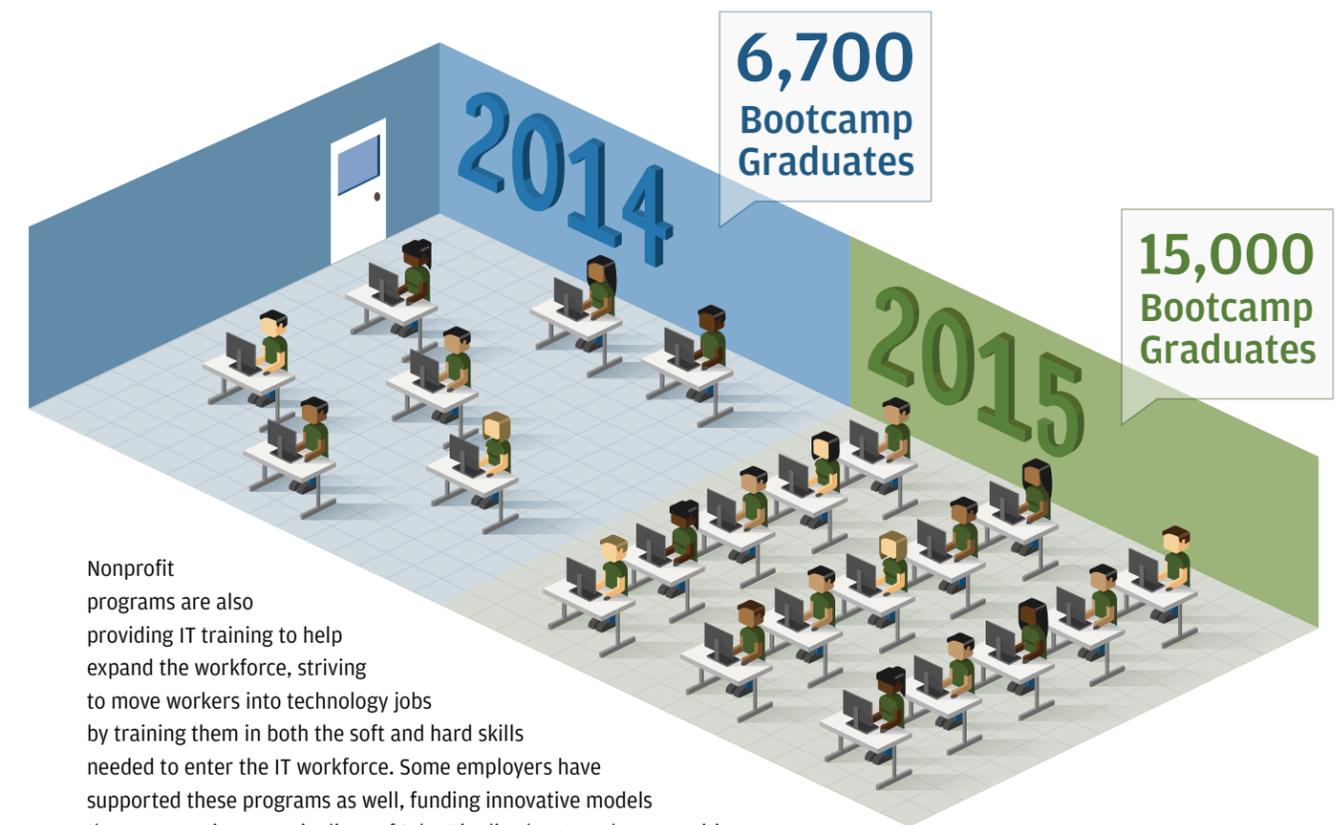
As IT careers are seen more as a trade with a discrete set of skills, companies are looking to find new ways to evaluate applicants based on these skills when traditional proxies, such as college degrees, are no longer applicable. This is part of a larger trend, as data shows that common measures, such as college prestige and GPA, often do not correlate with employee success. A senior vice president at Google, citing an internal study that examined how hiring indicators matched up to job performance, has gone so far as to call GPAs “worthless” when it comes to hiring.²² While skills-based hiring practices do not yet have an abundance of data to support them, a number of recent examples stand out:

- The city of Albuquerque launched Talent Albuquerque in 2013 to use skills assessments to identify qualified job candidates. The program now has 120 participating employers and has received grants from the White House’s TechHire to be implemented in other cities across the country.²⁴
- Companies are increasingly using data to predict which applicants will be successful and to help eliminate bias. Software from Infor Talent Science, for example, allows companies to compare applicants to top performers and has helped to increase diversity in clients’ hiring.²⁶
- Gild and HireArt, recruiting startups based in San Francisco and New York, respectively, are developing assessments to help prospective employers measure job seekers’ coding skills.²⁵

Organizations across the country have created programs to quickly teach individuals the skills they need to do these jobs, in some cases in as few as 10 weeks. Those with the money and time can join a coding bootcamp and learn programming skills in only a few months. Other programs are training help desk workers and cybersecurity professionals. People from many backgrounds, including some without bachelor’s degrees, are using these programs to find steady, middle-skills jobs.

The response to fill a growing demand for tech skills in workers comes from a variety of sectors. Nonprofits, government, and employers are converging on the market with the goal of creating educational opportunities to fill the increased demand for these skills.

Coding bootcamps, both nonprofit and for-profit, are springing up across the country and students are flocking to them. According to recent survey from Course Report, a directory of these programs, there were more than 16,000 bootcamp graduates in 2015, compared to 6,700 in 2014.²⁷



Nonprofit programs are also providing IT training to help expand the workforce, striving to move workers into technology jobs by training them in both the soft and hard skills needed to enter the IT workforce. Some employers have supported these programs as well, funding innovative models that are creating new pipelines of talent in disadvantaged communities. Some are also developing their own training to teach new hires the specific programming languages or skills the employers need.

Governments have stepped in as well with public-private partnerships, such as the White House’s TechHire initiative, which is offering \$100 million to fund programs to train Americans and get them into ICT jobs.²⁸

For some experts, the promise of these programs goes beyond tech jobs to workforce development generally. As more employers begin hiring by looking at specific skills, rather than degrees or experience, some people theorize that these new training models could apply to workforce development and job training more broadly, changing the way people prepare for careers. However there is a lack of evidence that such skills-based hiring is even happening within the tech workforce at the rates promised by tech training programs, showing the gap between the promise and the reality of a new hiring model.

CHALLENGES IN ICT TRAINING

Tech training programs often share the same set of challenges, as well face the same opportunities, as workforce development programs as a whole. The country's models for teaching and hiring are entrenched and will not change overnight by design, no matter how pressing the need. Additionally, while some new training models propose a number of potential solutions, the rapidly growing and quickly evolving tech training field is still in the process of determining the best practices for developing the skilled and diverse workforce required to meet a growing need in our economy.

General Workforce Development Issues in ICT

Although a relatively new field, tech training, unsurprisingly, faces many of the same challenges of traditional workforce development programs. Whether training coders, help desk workers, or quality assurance analysts, successful programs have worked to address these entrenched training challenges and have created ways to assess potential participants, train for both hard and soft skills, and develop curricula that meet specific employer needs.

The best way to work with employers is to engage with them throughout the process.

Jane Oates, Apollo Education Group

There are a lot of places you can get the 'do the job' skill set—what we feel is under-invested in is the 'get the job' skill set.

Laura Weidman Powers, CODE2040

Matching Employer Needs

As in any workforce development program, ICT training organizations face the challenge of working with employers to ensure that they are providing participants with skills that meet a specific need.²⁹ In ICT jobs, these needs can vary widely given the numerous types of employers, from big corporations and consulting firms to startups and everyday businesses with technology needs. However, there is currently no systematized way for the market to signal its needs to training programs, and companies are sometimes reluctant to share this information.³⁰ In addition, given evolving technology, some employers do not have a clear conception of their current need or that need is not understood by those doing the hiring. As a result, the most successful training programs are able to have a potential job lined up for trainees before they begin by communicating with employers about the skills they want employees to have the moment they walk onto the job.

Training for Both Soft and Hard Skills

In order to be successful across all sectors, job seekers must have both the soft skills, or those that are relevant across professions, like collaboration, presentation skills, and punctuality, and the hard skills, or those that are specific to a profession, like coding. Although employers are willing to invest in training workers to learn the specific skills they need, they are unlikely to consider those who interview poorly or give weak presentations. A recent study illustrating this fact found that a quarter of the skills listed for tech jobs were soft skills.³¹ In the case of ICT trainees, it could be that a trainee is unable to break down technical issues or communicate about technology clearly. Employers and program leaders consistently say that communication skills are just as important for employees as hard skills.³²

Participant Readiness

Finding people who are ready to start an intensive skills training program and have the right mindset for a career in the field is essential to ensuring successful outcomes for workforce development programs. To excel in ICT, students need to have a baseline level of both math and reading skills, as well as problem-solving skills, curiosity, and determination. Many participants do not come to workforce development programs with this knowledge—in Illinois alone, for example, 21 percent of community college students had to take one or more remedial courses before engaging with coursework that gained college credit.³³ Many programs currently assess this either through traditional interviews and tests, or more creatively through puzzles and gaming tournaments. However, for those students who do not meet the threshold baseline skills, new programs are filling the gap to provide an on-ramp or bridge to the additional training.

Lack of Standardized Credentials

Training programs of all types do not always carry standardized credentials to signify completion, creating problems for employers and employees alike. While IT infrastructure jobs have some of the most developed certifications in any field, such as CompTIA or Cisco certifications, coding and development jobs have almost none. For example, while teaching similar subject matter and touting success for participants, coding bootcamps Hack Reactor, General Assembly, and others list a portfolio of projects as a primary output that can help with a job search, rather than a credential. As a result, on the whole, hiring managers may have difficulty identifying viable candidates without a thorough understanding of the field in which they are hiring, or may require experience or other evidence that applicants can perform the work required. Similarly, job applicants may feel unqualified for a given position due to a lack of standardized expectations. Credentialing systems are emerging, but it is unclear which ones will gain prominence and which will fade.

Even though our assessment process is involved, you still don't know someone until they've gone through the program.

Patrick Cohen, Technology Service Corps

Building out microcredentials can't solve the problem unless a critical mass of employers have reason to recognize them.

Sally Smyth, Opportunity@Work

Specific Challenges for ICT Training

In addition to the traditional challenges of workforce development, ICT training faces unique obstacles that can make developing successful programs particularly difficult. While some programs are creating innovative solutions to deal with these problems, there are clear challenges that still stand in the way of a broadly successful tech training landscape.

The rubber hits the road at employment. All this great stuff means nothing if you don't hire the people at the end.

Barbara Chang, Code to Work

You can't train your way out of a hiring bias.

James Chase, Startup Box

We're very aggressive and entrepreneurial, and it's driven by the fact that the industry is changing constantly.

Plinio Ayala, Per Scholas

Knowing the results of individual job-driven training programs—how many people are hired and stay employed, and how much they earn—is essential both for job seekers to choose training wisely and for programs to continuously improve results.

Ready to Work: Job-Driven Training and American Opportunity, The White House⁴¹

Rigid Hiring Requirements

While some organizations are starting to develop skills-based hiring practices for ICT roles, employers are generally slow to change how they evaluate candidates. The Bureau of Labor Statistics says programmers “usually” have a bachelor’s degree,³⁴ and many companies require one, even though the increasing consensus is that several months of training can give job seekers the skills they need to succeed in these positions.³⁵

Lack of Diversity

The tech training world is overwhelmingly male and white. A survey from Course Report found that 63 percent of graduates in 2014 were male and a similar percentage were white.³⁶ Furthermore, the pipeline for many of the top jobs go through 30 elite and highly selective universities, which have diversity problems of their own,³⁷ exacerbating the problem. Minorities or women looking to enter the field face the challenge of working with a limited network to find a job and may feel intimidated or isolated in the workforce when hired.³⁸

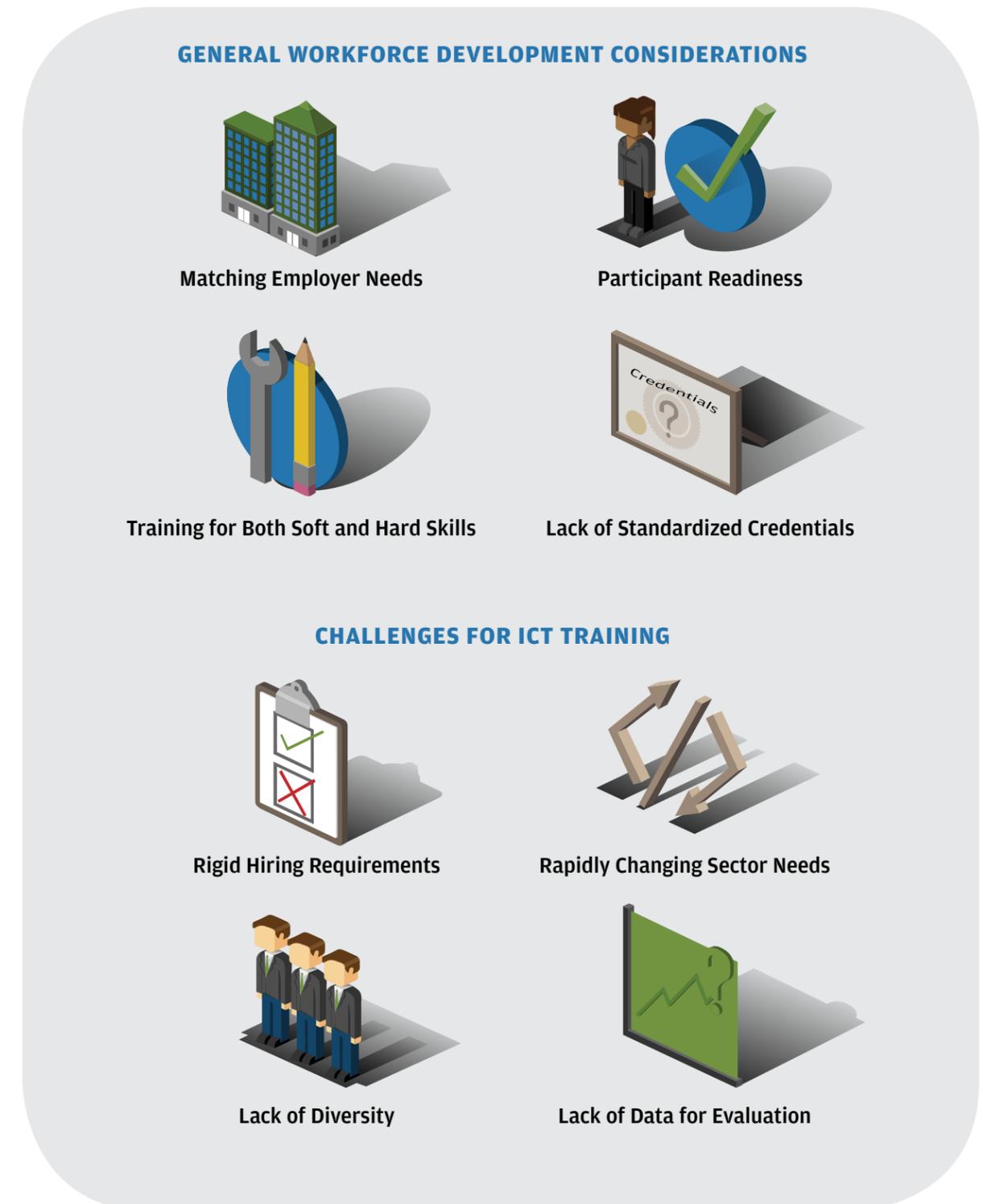
Rapidly Changing Sector Needs

Training job seekers to meet employers’ needs is especially difficult in the rapidly changing technology world. The needs of an employer, or the field in general, can adjust even in the time it takes for a student to complete a program. The creation of a new coding language, like Swift,³⁹ or WordPress’s shift to JavaScript⁴⁰ can change market demand. As new coding languages gain prominence, programs struggle to find ways to anticipate the changes and adapt to make sure they are producing employable graduates.

Lack of Data for Evaluation

As a relatively new field, complete data does not exist to evaluate which programs are most effective, making it difficult for employers, participants, and funders to determine their success. The data most programs release do not show whether graduates take jobs in the field, or whether they are still employed several years later. As a result, employers may be missing good job candidates due to limited resources for recruitment and job seekers must rely on anecdotes and unverified statistics to make decisions about whether to participate in a program and which one to choose.

Figure 1. General Workforce Development Considerations and Challenges for ICT Training



This tech training taxonomy is contingent on a shared understanding of what tech training programs are. For the purposes of this report, tech training programs are ones that meet the following criteria:

- Aim to teach the skills and traits necessary for success in the ICT workforce
- Require lower time commitments than a bachelor's degree, though the programs may provide credit applicable towards a degree
- Teach skills and traits that range from hard skills, like specific programming languages and network management, to soft skills, such as to obtaining and maintaining jobs

Additionally, although the programs in this taxonomy seek to address challenges in developing a supply of talent, there is also a need for proper signaling from employers of the skills in demand to match training to their needs. This report also examines employers' role in the landscape, as well as other intermediary organizations that have emerged to bridge the gap between trainers and employers.

It should be noted that while important progress has been made in teaching ICT skills in K-12 education, this report focuses on adult learners who have immediate employment needs.

PATHWAYS TO TECHNOLOGY TRAINING AND JOBS

Innovations in tech training programs have created new opportunities for people to pursue ICT careers. In some cases, students are able to learn the skills they need to start in these high-paying, in-demand jobs with only a few months of training. Several distinct pathways to these jobs exist, a number of which are described in Table 1 to help illustrate the different manifestations of a trainee.

Understanding the Tech Training Landscape

To address these challenges, organizations across the country have developed a number of promising interventions that offer solutions to obstacles facing workforce development and tech training in particular. These interventions vary in style, substance, and geography, creating a need to make sense of what can be a confusing system. To address this need, this report presents a taxonomy to better understand the diversity of tech training programs available in the U.S.

PATHWAYS

TRADITIONAL PATH

Path Description

Many ICT professionals are educated at four-year colleges, graduating with degrees in computer science. Often these students have several internships before they graduate, which employers use for both recruiting and trial periods before hiring.

Path Example

Rachal Royce, 29, graduated from a private university in New York with a degree in computer science. During college, she spent her summers interning at a multinational company and accepted a full-time job as a developer before she graduated.

CAREER BOOSTER

Path Description

In recent years, and particularly with the struggling economy, an increasing number of students with degrees in a field other than computer science, from the arts to economics, have been attracted to the high pay and stability of ICT careers. Many of these students take bootcamp courses to launch their new careers.

Path Example

Kelsey Murphy, 27, started looking into bootcamps to help advance her career after a switch from education to a data and analytics-focused position. Her company paid for her to attend a bootcamp, where she learned Java and Agile development, and returned to her company with a new skill set after her 12-week course.

EARLY- AND MID-CAREER CHANGE

Path Description

A parent looking to return to the workforce, or someone with a steady job looking to make more money or more flexibility can turn to tech training to upskill or change careers. For example, Course Report's latest data found that the average age of bootcamp attendees is just over 30.

Path Example

After working in manufacturing for 10 years, Brant Backes was looking for a job when the company he worked for went under. In his job search, Brant heard about an IT apprenticeship program, which gave him six months of on-the-job experience in IT support for a local hospital. He now works in desktop services at the same hospital and has been promoted several times in a couple of years.

NO ADVANCED DEGREE

Path Description

An avid gamer or a person with passion for technology without a college degree can take advantage of a growing number of programs that focus on training both the soft and hard skills needed for ICT careers. Employers and trainers alike are realizing that desire to learn and solve problems is as or more important than tech experience or education level.

Path Example

Brionne Lawson, 22, had taken some college courses and was working at a gas station when she learned about Year Up from an acquaintance and decided to advance her career. At Year Up, she learned IT skills, interned at a tech company, and expanded her professional network. Brionne now works full-time in client support at a bank, where she helps troubleshoot tech problems.

THE TECH TRAINING TAXONOMY

Tech training programs can be classified in a variety of ways, including by the content of the curriculum, the type of learner in the training, or the desired outcome of the training (i.e., from post-secondary degrees to exposure to technology).

This report elects to categorize tech training into five areas based on a locus of learning:



Traditional Education

Programs that are connected to traditional education that go beyond or are otherwise complementary to K-12, often through classroom instruction.



Bootcamps

Intensive programs that are usually less than one year in length and aim to teach a discrete skill or skillset. These programs may result in a certificate or nanodegree, but often not a postsecondary degree.



MOOCs

Massive open online courses are often free or low-cost and may or may not have an instructor at the helm of the training.



Internships & Apprenticeships

Programs that connect participants directly to a career pathway by enabling them to work with potential employers.



Integrated Technical and Experiential Programs

Programs that aim to provide multiple methods of training, often through a combination of accelerated learning, an internship or apprenticeship, and mentorship.



Traditional Education refers to workforce development programs tied to a degree, often hosted at a community college. Programs in this category tend to be more established than those in some of the other categories discussed in this report, given their use of models that have been refined over a number of years.

Programs that fall in this category typically involve classroom instruction of some variation and a time period of one or more years. A main marker of traditional education programs is their connection to a two- or four-year degree.

Traditional education programs are a stalwart of workforce development, forming a foundation of what some may think of when conceptualizing the field at large. As technology changes our economy, so too should it be reflected in our workforce development and training programs.

Advantages

- **Recognized Credentials:** The eventual outcome of traditional education for successful students is an associate or bachelor’s degree, both of which are recognized and useful credentials in the job market.
- **Broad Skills Development:** In addition to technical skills development, other soft skills that employers find critical, like time management, writing, and critical thinking, are often taught.
- **Federal Funding:** Traditional education programs are established in the workforce development arena, sometimes creating more streamlined pathways to federal funding for students. Federal Pell Grants alone are provided to over 8 million undergraduates in the United States.⁴²

Challenges

- **Potentially Outdated Curricula:** Given the traditionally non-nimble nature of universities and the lag time of integrating employer needs into curricula, computer science curricula in these programs may not be preparing students for rapidly evolving employer needs and currently existing jobs.
- **Significant Time and Money Commitments:** Due to the large amount of time and fiscal commitments required to undertake higher education, traditional education may not be perceived as a feasible option for people with preexisting demands on their time and financial constraints. Only 5 percent of individuals who begin as full-time at community college students end up earning an associate degree within two years.⁴³
- **Connection to Jobs:** Although some schools have significant resources devoted to helping students apply for jobs, some experts have remarked that more work is required overall to build career pathways between traditional educational institutions and employers.

EXAMPLES



LAKE AREA TECH

Lake Area Technical Institute—Computer Information Systems

Target Participants: Interested students

Financing Mechanism: Student fees

Description: Lake Area Technical Institute is a community college located in South Dakota that offers a variety of programs, including computer information systems. Students can train for specializations in programming, networks, visual communications, and security. Lake Area Technical Institute also offers Cisco Certified Professional training and courses in topics such as mobile app development and ethical hacking.

Goal/Desired Outcome: Lake Area Technical Institute works to ensure postgraduate success, and 98 percent of Lake Area Technical Institute students continue into for the workforce or further education. The average wage for 2014 graduates of the computer information systems program after six months was \$18.11 per hour.

Website: www.lakeareatech.edu

**P·TECH
9-14 Model**

Pathways in Technology Early College High School (P-TECH)

Target Participants: Students interested in earning associate’s degrees, particularly those from economically disadvantaged or minority backgrounds.

Financing Mechanism: Public funding with in-kind corporate contributions

Description: P-TECH is a six-year model of public education designed to help students become college- and career- ready and ensure that they have in-demand technical skills and prepared for the workforce. Within six years, students will graduate with both a high school and industry-recognized associate level degrees at no cost. P-TECH schools work to align with employers on what skills are needed for their employees and paid internships and workplace readiness skills are a key aspect of the educational experience in P-TECH programs. There are currently over 40 schools throughout the country operating P-TECH programs.

Goal/Desired Outcome: P-TECH aims to prepare students for continued higher education and the workforce.

Website: www.ptech.org



Bootcamps, sometimes referred to as accelerated learning, form a new frontier of workforce development programs for technology. Driven by the promise of an increase in tech jobs and needed skills, these programs claim to teach students IT skills that make them job-ready in as little as 10 weeks. The curricula usually include classroom instruction, independent coding work, and team projects.

EXAMPLES

Bootcamps are intensive, full-time, and in-person, requiring students to forego any concurrent jobs, and sometimes move cities, for the duration of the course. Bootcamp tuition averages just under \$12,000, with costs varying depending on location and program type.⁴⁴ These programs are growing rapidly, with 16,000 people projected to graduate from 67 bootcamps nationwide in 2015.⁴⁵

Bootcamps are seen by some to be on the leading edge of ICT training. As with other innovative workforce development programs, they are attempting to create a new pathway to medium- and high-skill jobs—the kind of jobs that once required a specific bachelor’s degree from a university.

A Department of Education program launched in October 2015 now allows colleges to partner with bootcamps to make federal funding available to students.⁴⁶

Advantages

- **Short Time Frame:** As opposed to a four-year degree, students with no previous tech experience can learn specific tech skills in 10-12 weeks, making bootcamps attractive for career changers and employers looking to quickly train or upskill employees to meet changing business needs.
- **Nimble Curricula:** As small, independent programs, bootcamps are often able to develop and change their own curricula to meet changing employer or full sector demands. According to bootcamp advocates, this acute receptiveness to market demand results in students better equipped to acquire jobs. In just the past year, bootcamps have made a shift toward teaching JavaScript, which employers have indicated as one of their largest needs.⁴⁷

Challenges

- **Soft Skills Training:** With a heavy focus on hard skills training, some bootcamps leave little time to teach communication, project management, or other soft skills. In order to be successful both in these courses and in their careers, students need to either come equipped with these skills or learn them elsewhere.
- **Pre-selected Talent:** Most bootcamps have rigorous processes for assessment and acceptance, meaning many accept only a small fraction of the students who apply.⁴⁸ This exclusivity may leave behind the people that could benefit the most from upskilling. Some of the most successful bootcamps have acceptance rates below 10 percent, making them almost as selective as the top computer science college programs.⁴⁹
- **Unclear Credentials and Lack of Standardization:** With each bootcamp developing its own curriculum, employers and applicants do not yet have a clear way to know what skills each particular school teaches.
- **Limited Training:** Students will often only learn a specific skill set at a bootcamp, such as one or two languages, making them more prone to not having the needed skills sets or knowledge in the rapidly evolving ICT field. Additionally, if only one or a small amount of skills are needed by employers, that skill set could more likely be outsourced, as opposed to bringing in bootcamp hires.
- **Employer Hesitance:** Some employers may be hesitant to hire bootcamp graduates either because they want to see a longer track record of success or because of their reliance on traditional hiring metrics, including education and career path.



Detroit Grand Circus—Java Bootcamp and Front-End Bootcamp

Target Participants: Detroit area residents

Financing Mechanism: Student fees

Description: Detroit Grand Circus offers 10-week bootcamps that consist of two weeks of independent learning followed by eight weeks of classroom instruction and projects. Students can enroll in either the Java Bootcamp or Front-End Bootcamp, and both programs ensure that students gain both practical workplace skills in addition to technical experience. Grand Circus also works to help graduates with job placement, from coordinating with employers prior to the selection process to facilitating placement and providing continued support once on the job.

Goal/Desired Outcome: Grand Circus helps individuals build their skills set and helps businesses access the talent they need. In 2014, Detroit Grand Circus graduated over 80 individuals from its bootcamp programs.

Website: www.grandcircus.co



Flatiron School—Web Development Immersive

Target Participants: Individuals from varied backgrounds

Financing Mechanism: Student fees

Description: Flatiron School’s flagship Web Development Immersive program is a rigorous 12-week educational program in New York City for individuals from widely varied backgrounds seeking careers in software engineering. The admissions process is competitive, with approximately 6 percent of students accepted into the program. Prior to beginning the program, individuals are required to complete 120 hours of pre-training. Flatiron School recently launched a new online version of this immersive program, Learn-Verified. This program integrates self-paced online courses with instructor support and an online community. “We accept so few students because we want to make sure we can make good on the promise that you will leave here as a qualified software engineer,” said Rebekah Rombom, Vice President of Business Development. “If we believed that we could serve more students, we would. Now we do, with Learn-Verified.”

Goal/Desired Outcome: Flatiron School aims to place all students who finish the program. According to the organization’s audited job report, 99 percent of students were employed within six months of graduation.

Website: www.flatironschool.com/web



EdX

Target Participants: Interested individuals of all ages

Financing Mechanism: University and foundation support, student certificate fees

Description: EdX is a nonprofit that provides free online learning opportunities from more than 85 partners around the world, including from founding members Harvard University and MIT. Participants who wish to receive a certificate verifying their completion of certain classes or earn college credit for a limited selection of coursework may do so for a minimal fee. EdX offers classes in many subject areas ranging from the humanities to the sciences, including 144 computer science classes such as Harvard University's Introduction to Computer Science course.

Goal/Desired Outcome: Greater accessibility of high-quality learning opportunities.

Website: www.edx.org



Udacity

Target Participants: Interested individuals of all ages

Financing Mechanism: Student fees

Description: Udacity is a free and low-cost online learning institution that helps students learn in-demand technical skills and earn industry-endorsed credentials and "nanodegrees." Udacity currently offers eight nanodegree programs. Presuming students spend 10 hours per week on their coursework, nanodegree programs vary in length from six to 12 months. Coursework is accessible for free, but students who wish to earn certificates and receive additional support may do so by paying tuition fees of \$200 per month. Although Udacity does not offer college credit, in partnership with Georgia Tech it conducts an online master's degree in computer science.

Goal/Desired Outcome: Udacity helps "bridge the gap between academia and the needs of the 21st century workforce."

Website: www.udacity.com



Code Louisville

Target Participants: Individuals without degrees in 13 counties in Kentucky and Indiana

Financing Mechanism: Government grants

Description: Enrolled students work independently using the online learning platform Treehouse and meet up weekly to review their work and learn from mentors in the community. Courses last 12 weeks and students are encouraged to enroll in more than one. At the end of each course, students have a portfolio of work that they can show to perspective employers. Code Louisville also offers career services training and other support services to help students overcome socioeconomic barriers to success. "The human approach to Code Louisville is part of what makes our program very special," said Project Coordinator Becky Steele.

Goal/Desired Outcome: Code Louisville "aims to build software talent in the Louisville/Southern Indiana region."

Website: www.codelouisville.org



Massive open online courses (MOOCs) are self-paced online courses that are free or low-cost and available to all individuals. Some MOOC platforms, such as Khan Academy, offer original innovative content, while others such as Coursera and edX allow students to access coursework from universities from around the world. The focus of each MOOC platform also varies. Many platforms feature a significant amount of content across multiple disciplines but a few others, like Udacity, focus on particular subject areas like computer science. The level of feedback and engagement by MOOC platforms with students varies and may depend on if students pay fees for certificates of completion.

Akin to traditional workforce training, MOOCs allow individuals to build up new in-demand skills at minimal cost. While a small number of MOOCs attempt to offer community interaction and minimal assistance with job placement, they typically do not provide the support traditionally associated with workforce training programs.

In addition, local organizations have begun working with MOOCs to develop hybrid programs that use online learning platforms and offer opportunities for regular in-person support. These programs rely on partnerships with local workforce development organizations and the MOOC may or may not participate directly in the program.

Advantages

- **Cost:** MOOCs are typically free, or if individuals choose to have proof of completing coursework, very low-cost. This minimal cost maximizes MOOCs' accessibility for individuals regardless of their financial situations.
- **Flexibility:** MOOCs allow students to learn at their own pace and accommodate their existing schedules, commitments, and geographic limitations.
- **Access:** MOOCs can provide high quality instruction to people who might not otherwise have access. For example, although Harvard University only accepts a small percentage of applicants, its popular CS50 program is available to the public through edX.⁵⁰

Challenges

- **Lack of Structure and Guidance:** Due to the lack of external structure and guidance, students must be self-motivated in order to select and complete MOOCs. Many people may find the lack of structure and accountability result in their never finishing the courses they start. A Harvard study of edX found that less than 10 percent of the students who registered actually completed a given course.⁵¹
- **Limited Community:** While some people are able to independently persevere through challenging coursework, others may find in-person support from colleagues and teachers to be more helpful for their learning processes.
- **Limited Job Placement Support and Credential Value:** Students that complete MOOCs and gain job skills may still have problems finding jobs due to the lack of systematization of credentials and little to no job placement assistance from MOOC platforms.
- **Requires Personal Infrastructure:** Individuals who might benefit the most from upskilling may lack sufficient resources to afford broadband Internet or a computer. Since MOOCs require both of these resources for people to participate, this limits their accessibility.



Internships and apprenticeships provide opportunities for individuals to use their technical skills and gain workplace experience, as well as prove their abilities to employers and build their professional networks. In these programs, participants are embedded within a business in order to learn important skills and context experientially.

While they both take place in work setting, internships and apprenticeships have key distinctions and can be best imagined as a spectrum.

Internships, paid or unpaid, can vary from experiential, where students are exposed to a working environment, to short-term on-the-job training programs, to the equivalent of full-time coding jobs, which many employers use as trial or screening periods for potential employees.

Apprenticeships include formal training to meet defined competencies as well as levels of work experience. In many apprenticeships, participants also receive an industry certification upon completion. While traditional trade sectors have heavily relied on apprenticeships for skills training, they are fairly new in the tech training field, and structures still need to be developed.

Internships and apprenticeships can vary in length from a few weeks to several months or years and often serve as an on-ramp into a full-time position for successful participants. A key component for many programs is compensation, enabling participants to be treated as employees and cover living expenses while gaining valuable skills.

Advantages

- **Building Relevant Skills:** Apprenticeships or internships enable participants to put their skills to work in an environment where additional mentorship or training is provided. This allows participants to engage in practical use of their hard skills while continuing to develop the soft skills needed for long term workplace success.
- **Low Risk to Employers:** Employers who are reluctant to hire job seekers from outside their traditional pipelines or who do not meet standard hiring requirements can give them a trial before hiring individuals permanently. At the same time, participants gain real experience and prove that they have the skills needed to do the job.
- **Exposure to Untraditional Candidates:** Apprenticeship and internship programs can help candidates who may be typically overlooked by human resources to gain exposure to companies and prove themselves in the workplace. Some programs, such as CODE2040, target these populations specifically in an effort to increase diversity.
- **Focus on Competencies:** Apprenticeships are operated on a case-by-case basis, meaning individuals can be evaluated independently from one another. To take advantage of this, many tech apprenticeships are using competency-based evaluation and focusing on skills learned, rather than the time spent using the skills. This allows participants to progress at their own pace, often completing the program faster than previously required.

Challenges

- **Going to Scale:** While apprenticeships and internship opportunities can provide a helpful opportunity for individuals and companies to gain exposure to one another, these programs are limited by employers' willingness to onboard and take on participants. IT programs in particular must rely on employer relationships to secure placement for their trainees.
- **Employer Burden:** Internships and apprenticeships require a significant investment of resources for employers to hire and train apprentices. Programs need to convince potential partners that their investment will result in successful and valuable employees.
- **Employer-Specific Training:** Gaining insight into how a specific employer uses and thinks about technology is invaluable, but at times may differ from how other businesses in the field operate. In these cases, it may be difficult for employees to transfer their newfound skills to other opportunities. Apprenticeships generally follow established standards for training to mitigate this.
- **Need for New Model:** As apprenticeships have only recently begun to be used to teach tech skills, new models will be helpful in determining and assessing the competencies needed for apprentices to be successful and what credentials, if any, should be received.

EXAMPLES



CODE2040 Fellowship

Target Participants: Black and Latino college level computer science students

Financing Mechanism: Foundation support, company contributions

Description: While 18 percent of Black and Latino students graduate with college degrees in computer science, only about 5 percent end up in the industry. CODE2040, a nonprofit in San Francisco, works to bridge this gap by creating pathways for black and Latino students to get into the tech sector. CODE2040's flagship fellowship program places students in full-time summer internships at top tech companies throughout Silicon Valley. Participants also engage in workshops and networking opportunities on evenings and weekends to build up their professional skills and network and confidence through cultural identity. All fellows also have one-on-one mentorships with tech professionals, and fellows who complete the program are offered ongoing opportunities through an alumni program.

Goal/Desired Outcome: CODE2040 aims to increase opportunities for black and Latino students in the tech sector and diversify the overall tech workforce. Over 2,000 students have applied for the program and over 200 companies have expressed interest in participating.

Website: www.code2040.org



LaunchCode

Target Participants: Skilled individuals of all ages who are unemployed or underemployed

Financing Mechanism: Foundation support, company contributions

Description: LaunchCode is a nationwide nonprofit program based in St. Louis that helps skilled unemployed or underemployed individuals access employment opportunities through full-time paid apprenticeships that typically last three months. "Ultimately, this all comes down to jobs: we help employers reconfigure their typical hiring practices in order to give talented, driven people the opportunity to develop and demonstrate their skills. We've proven this apprenticeship model works on all levels - and in doing so, we're empowering companies, communities, and our country," said Brendan Lind, Executive Director at LaunchCode. Additionally, for individuals who are do not yet have sufficient skills to undertake an apprenticeship, LaunchCode connects individuals to external and internal learning and mentorship opportunities.

Goal/Desired Outcome: Of the people LaunchCode connects to apprenticeships, 90 percent stay on in full-time positions and their median starting salaries are 2.4 times higher than their previous salaries. Over 1,000 individuals have also accessed LaunchCode's mentorship and learning opportunities.

Website: www.launchcode.org



Code to Work

Target Participants: Diverse individuals with non-traditional educational backgrounds

Financing Mechanism: Foundation support, company contributions

Description: Code to Work is a startup based in NYC that helps connect skilled, diverse job seekers with both full-time and paid internship opportunities in software development and infrastructure. Code to Work specializes in identifying employer needs and matching them with the right candidates that the employer may otherwise overlook, as well as fostering dialogue between employers and educational programs. "Employers tend to assume or want to assume that educators are going to create what they are looking for, but they don't follow through to ensure that educators are doing so," said Barbara Chang, CEO of Code to Work.

Goal/Desired Outcome: Code to Work aims for successful job and internship placement.

Website: www.codetowork.org



Integrated technical and experiential programs aim to combine elements from many of the categories above to better train participants. These programs often first involve an intensive accelerated learning component to prepare students and provide the background skills necessary to succeed in the technology workforce. Participants are then placed in an apprenticeship, internship, or other experiential learning opportunity to apply the skills that have been learned

Successful participants are often matched with job opportunities or employers and some programs maintain support through the early stages of employment. Funding models vary for integrated and experiential programs, with some requiring participant fees from employers and others drawing on outside funding.

These programs offer a comprehensive suite of training opportunities to ensure that participants have the support they need to succeed.

Advantages

- **Suite of Skills:** Integrated technical and experiential programs typically aim to teach all of the skills necessary to be a successful employee, including hard technical skills and soft job application and maintenance skills.
- **Potentially Adaptive to Learning Styles:** With a variety of ways to learn the skills being taught by the program—including both accelerated and experiential training—students may have better success finding a teaching approach that resonates with them, given a variety of learning styles.
- **Providing More Pathways for Diverse Candidates:** Integrated technical and experiential programs may help provide more complete on-ramps to technology for underrepresented communities, given that many of the programs aim to serve these communities and tailor their programs to their participants' needs.

Challenges

- **Potential for Mission Creep and Confusion:** External parties examining integrated technical and experiential training can find programs difficult to understand given their multifaceted nature. Similarly, programs face difficulty in ensuring that they are well-positioned to provide every element of training they include.
- **Large Startup Costs:** The amount of resources needed to establish a new integrated technical and experiential training program often increase as the number of interventions included in the program increase. Scaling these programs as they become successful can then become cost prohibitive.
- **Need for Strong Employer Relationships:** Due to the experiential component of these programs, they require strong employer relationships to ensure that the curriculum is current and that there are an adequate number of placements available for program participants.
- **Difficult to Replicate:** These programs require significant infrastructure and community support in order to run, such as support services for students and employer connections. The programs are often created on a case-by-case basis and may be difficult to adopt for many communities or to scale more generally.

EXAMPLES

npower

NPower—Technology Service Corps

Target Participants: Young adults from low-income backgrounds and veterans

Financing Mechanism: Foundation and governmental support, private contributions, corporate donations

Description: NPower's Technology Service Corps is an information technology-training program with seven branches across North America. Programs are tailored to meet the needs of the local community, and generally last approximately 20 weeks. Each program has a classroom-based training component followed by an internship, and participants receive mentorship support. Additional social services are offered as well if needed. NPower works with employers to ensure their curriculum is up-to-date. "We have advisors in each region so we're able to integrate feedback into our curriculum fairly easily," said Patrick Cohen, Director of Technology Service Corps.

Goal/Desired Outcome: Technology Service Corps aims to help graduates gain employment or continue their educations, and 85 percent are successful one year after graduation. Certifications depend on program location and may include A+, ITIL, Network +, Security +, Linux + and ServiceNow Administrator.

Website: www.npower.org/Our-Programs/Technology-Service-Corps.aspx

PER SCHOLAS

Per Scholas

Target Participants: Individuals from underserved communities who are below 200 percent of the poverty line

Financing Mechanism: Foundation and governmental support, private contributions

Description: Per Scholas is a nonprofit technology training workforce development organization with programs throughout the East Coast and Midwest. Programs are full-time and range in length from eight to 18 weeks, depending upon the track, and participants can choose between IT support, network engineering, and software testing. In addition to teaching technical skills, Per Scholas also integrates essential professional soft skills training into each track. Once participants complete the program they are placed into jobs. "We're very employer-focused," said Plinio Ayala, President and CEO. "They not only help us with our curriculum, but also embed us in their companies so that we understand their culture and have some influence over their hiring practices." Per Scholas also has a two-year commitment to help up-skill or re-place graduates into advanced positions if needed to ensure their success.

Goal/Desired Outcome: Per Scholas aims to launch graduates into successful careers, increase participants' salaries, and ensure job retention. The average increase for graduates' post-training income is 429 percent.

Website: www.perscholas.org

yearup

Year Up

Target Participants: Low-income young adults ages 18-24 who have a high school diploma or GED

Financing Mechanism: Foundation and corporation support, internship fees

Description: Year Up is a full-time, free, yearlong program that aims to prepare graduates for either the workplace or continuing their education. Participants begin the program with six months of professional training in IT, finance, or customer service and are placed in six-month corporate internships after their training. "What we find with our employers is that if you combine grit and persistence and fundamental technical skills, these are people that companies want to build up," said Jay Banfield, Executive Director of Year Up Bay Area. Year Up also provides participants with ongoing support and mentorship throughout the program and students receive stipends and the option of earning up to 24 college credits.

Goal/Desired Outcome: Year Up works to ensure successful job placement. Eighty-five percent of individuals who complete the program are either employed or pursuing full-time higher education. Those who are employed have an average starting salary of \$16 per hour.

Website: www.yearup.org



Vermont HITEC

Target Participants: Programs are open to all individuals 18 and older

Financing Mechanism: Nonprofit, governmental, and employer support

Description: Vermont HITEC provides free professional training to individuals in a variety of in-demand fields, including information technology. Programs are tailored to specific jobs and employers, and employers are expected to participate in every phase of the program from recruitment to curriculum development to placement. In return, employers have access to top-trained talent. "Once an employer is willing to make an investment in raw talent, there are no challenges," said Dr. Gerald Ghazi, President, CEO, and Chief Academic Officer of Vermont HITEC. Once students complete the full-time educational programs, they participate in employer-sponsored apprenticeships. The information technology program typically takes four months to complete.

Goal/Desired Outcome: Vermont HITEC guarantees job placement for all graduates.

Website: www.vthitec.org

Summary Chart of the Tech Training Taxonomy

<p>TRADITIONAL EDUCATION</p> <p>Advantages:</p> <ul style="list-style-type: none"> • Recognized Credentials • Broad Skills Development • Federal Funding <p>Challenges:</p> <ul style="list-style-type: none"> • Potentially Outdated Curricula • Significant Time and Money Commitments • Connection to Jobs 	<p>BOOTCAMPS</p> <p>Advantages:</p> <ul style="list-style-type: none"> • Short Time Frame • Nimble Curricula <p>Challenges:</p> <ul style="list-style-type: none"> • Soft Skills Training • Preselected Talent • Unclear Credentials and Lack of Standardization • Limited Training • Employer Hesitance
<p>MOOCS</p> <p>Advantages:</p> <ul style="list-style-type: none"> • Cost • Flexibility • Access <p>Challenges:</p> <ul style="list-style-type: none"> • Lack of Structure and Guidance • Limited Community • Limited Job Placement Support and Credential Value • Requires Personal Infrastructure 	<p>INTERNSHIPS & APPRENTICESHIPS</p> <p>Advantages:</p> <ul style="list-style-type: none"> • Building Relevant Skills • Low Risk to Employers • Exposure to Untraditional Candidates • Focus on Competencies <p>Challenges:</p> <ul style="list-style-type: none"> • Going to Scale • Employer Burden • Employer-Specific Training • Need for New Model
<p>INTEGRATED TECHNICAL AND EXPERIENTIAL PROGRAMS</p> <p>Advantages:</p> <ul style="list-style-type: none"> • Suite of Skills • Potentially Adaptive to Learning Styles • Providing More Pathways for Diverse Candidates <p>Challenges:</p> <ul style="list-style-type: none"> • Potential for Mission Creep and Confusion • Large Startup Costs • Need for Strong Employer Relationships • Difficult to Replicate 	

**BRIDGING THE GAP:
INTERVENTIONS ON THE DEMAND SIDE**

As these training programs develop new pathways for individuals into IT careers, their ultimate success will be in meeting the needs of employers and producing graduates who obtain jobs. Two major groups, employers themselves and intermediaries, are taking steps to improve and impact the system as a whole in order to make sure that the supply of newly trained job seekers meets the demands of businesses.



EMPLOYERS

Many employers have recognized the value of less traditional tech training programs and are taking steps to incorporate such program trainees into their talent pipeline.⁵² These employers are changing their recruiting or training processes or are communicating directly with training programs to help shape curricula.

Employer involvement carries multiple dimensions:

- Building Meaningful Partnerships:**
 By working directly with training programs, employers can ensure that students will acquire the hard and soft skills that the employer is looking for in potential employees.
- Adjusting Hiring Standards:**
 Talent is automatically dismissed by some employers based on their own rigid hiring standards. By connecting with their human resources departments to revise some requirements, such as a bachelor's degree, employers can open themselves up to a pool of qualified candidates that may have previously been overlooked.
- Investing in Current and Future Employees:**
 Employers can take an active role in the recruitment and training of future employees rather than waiting for programs to produce exactly the types of individuals they seek. This is true both of acquiring new employees and upskilling current ones and is a common topic of discussion in workforce development.
- “Raise the Floor” for Employees:**
 Across sectors, in addition to building pathways for potential employees, work can be done to structure entry-level jobs to ensure better conditions to support stability and growth. As discussed in a 2014 Aspen Institute brief, employers have many leverage points, from compensation and benefits to job structure and on-the-job training.⁵³
- Intra-Organization Mentorships:**
 In order to improve mobility at the entry level, employers can restructure jobs to support mentorship and help lower-level employees develop needed skills. This can help improve skills for both mentor and mentee, as well as help employers develop overall talent and upskill employees.

EXAMPLE INITIATIVE



StartUp Box

Program Category: Employer

Target Employees: South Bronx community members

Financing Mechanism: Business-to-business model

Description: StartUp Box provides an on-ramp to tech jobs for South Bronx residents South Bronx by offering direct employment in quality assurance and customer care positions. Employees are recruited based on their teamwork and problem-solving skills, rather than educational attainment or job experience. StartUp Box also gives free job training opportunities to prospective employees. StartUp Box's approach of employing local community members benefits companies by providing quality assurance testing from people who fit their market demographics. StartUp Box offers entry-level jobs, which can lead to a careers in project management, serve as an on-ramp to other tech positions, or help employees seek further education with real experience in the field.

Goal/Desired Outcome: StartUp Box aims to foster greater economic opportunities for South Bronx residents and motivate U.S. companies to “on-shore” their quality assurance positions.

Website: www.sbsq.org

INTERMEDIARIES

Intermediaries also can play a crucial connecting role in the technology training landscape. Once individuals complete their training, it can still be challenging for them to find jobs despite their marketable skills, either due to their limited professional networks or their untraditional educational backgrounds.

While this intervention is relatively new and far-between, some programs currently exist to act in a “middle-man” role, building better pathways from training to career placement. Intermediaries can come in many forms, including explicit programs, as well as an intermediary function being played by other actors on the training or employer side. There is also a sliding scale of involvement in the lead-up to placement and post-placement follow-up.

Some opportunities and considerations for intermediaries within the tech training ecosystem include the following:

- Forging Connections:** Intermediaries can overcome an information gap in the marketplace by forming connections between employers, tech training programs, and participants.
- Facilitating Placement:** Once reviewing a candidate's qualifications and understanding an employer's need, intermediaries can place people in either short-term or long-term employment opportunities. This extra layer of screening can instill confidence in employers and ensure a successful match between employers and a potential employee.
- Coaching Employers:** Some intermediaries also help coach employers through the placement process, navigating around employers' often rigid hiring requirements or human resources policies.
- Scaling:** Intermediaries generally act on a small scale, directly connecting job seekers to employers or working with individual companies on their practices. As the number of programs and job seekers increase, intermediaries may not be able to scale to fill this role.
- Potential for Phase Out:** In a relatively new field, intermediaries are needed to facilitate communication and improve hiring processes. However, once the tech training field reaches scale and becomes more widely understood, there could be less of a role for these organizations to play.

EXAMPLE INITIATIVES



Program: NYC Tech Talent Pipeline

Target Participants: Employers and tech training program practitioners in New York City

Financing Mechanism: Foundation support and company contributions

Description: Founded in 2014, the NYC Tech Talent Pipeline works with public and private partners to define employer needs, develop training and education models to meet these needs, and scale solutions throughout the city, delivering quality talent for the city's businesses and quality jobs for New Yorkers. The NYC Tech Talent Pipeline is delivering on these goals together with 150 of the City's leading tech employers, including an advisory board of 28 CEOs, CTOs, and CIOs representing five sectors and over 40,000 employees. "Each employer is dedicated to New York City and supporting the industry here," said founding director Kristen Titus.

Goal/Desired Outcome: NYC Tech Talent Pipeline helps prepare and connect New York City residents to high-paying technology jobs.

Website: www.techtalentpipeline.nyc

TechHire Initiative

Program: TechHire

Program Category: Multisector initiative

Description: TechHire is a White House-led, multisector initiative that aims to connect Americans with training and jobs in technology. The initiative is community-based and operates on a number of levels, including promoting partnerships between traditional and non-traditional educational organizations and employers, and helping expand tech training models. The initiative also works with employers to increase their openness to non-traditional hiring practices based on data and competency. The initiative was launched mid-2015 with 20 communities across the country, and expanded to 40 by year's end. As part of the program, \$100 million in grants have been made available through the Department of Labor to support innovative approaches to training low-skill individuals with barriers to training and employment. "One major goal of TechHire is creating a network of people who are sharing information with each other," said Ryan Burke, Policy Advisor at the National Economic Council.

Website: www.whitehouse.gov/issues/technology/techhire

BEST PRACTICES AND OPPORTUNITIES FOR IMPROVEMENT

While the ICT training field is still developing, the most innovative and successful programs have begun to coalesce around a number of key best practices and opportunities for innovation. As previously discussed, these programs share a large number of challenges, and the best practices outlined here serve as a first step towards better outcomes for programs, employers, and trainees.

As programs mature, some elements of the tech training taxonomy may blur, often with some programs in one category taking elements or best practices from the other categories. As we move into the future in this new field, this crossover may become more common, whether it is community colleges adopting some MOOC programming or bootcamps using stackable credentials more commonly found in traditional education. Defining and refining best practices for the field as a whole will help programs share advantages across different models.

The Future of Tech Training

The current ad hoc nature of the tech training world has led to a variety of programs that interact in disparate networks with each other and employers. While some organizations have created successful models to train and place students, no formal standard or blueprint exists for a good program, and employers, governments, and funders are often unsure of how they can support the development of the field. This section identifies best practices collected from interviews with leaders in the field, as well as obstacles and gaps that will need to be addressed in order to create a tech training landscape that efficiently matches skilled job seekers with employer needs.

NEW PATHWAYS

Challenges Addressed:

- ✓ Matching Employer Needs
- ✓ Rigid Hiring Requirements
- ✓ Participant Readiness
- ✓ Lack of Diversity

There is a clear need to create new pathways into technology jobs, particularly as employers seek to both expand and diversify the tech workforce. To create such pathways, programs can find new ways to attract candidates and provide additional opportunities for upskilling, while employers can search for talent beyond traditional sources.

Improvements include:

- **Starting Tech Education Earlier:** Students who have exposure to tech training in high school or earlier will begin learning the skills they need to succeed and gain awareness of technology as a career path. Early exposure can draw students to study computer science in college or to an alternative educational program while also teaching skills that enable students to be adaptive and think nimbly in their technology jobs.⁵⁴
- **Onramps and Bridge Programs:** Many adults who could be successful in ICT careers need additional training before joining an ICT training program or coding bootcamp. Programs like the South Bronx's StartUp Box teach students the basic tech skills or knowledge needed to join these programs, or provide a bridge from entry-level ICT careers into software or web development. The bridge programs help build a new cohort of individuals who may otherwise be excluded.
- **Ability to Work and Learn Concurrently in the Same Field:** The progressive nature of tech jobs means that students can work in tech jobs while they advance their learning. By sequencing courses or providing stackable credentials, programs can allow students to work in their field of study while they gain additional training, credentials, or degrees. While this could be said for many workforce development fields, it was noted that tech training is uniquely situated for this option given the skills-based focus and sequenced learning of ICT training and jobs.
- **Intermediaries:** Organizations that independently assess job seekers and match them to employer needs can help alleviate employers' strained recruiting teams and tap new sources of talent that may be missing.

You have to have faith in human potential that a person who has no background in IT can be your best programmer.

Dr. Gerald Ghazi, Vermont HITEC



EARLY ED TECH INITIATIVES

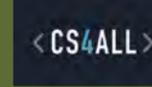
A number of new programs are working to create interest in technology in younger students or teach them basic coding skills. Exposing students to these opportunities earlier in life can help them choose technology as a career and get a head start on learning.

Examples of early education technology initiatives include:



Code.org

National nonprofit Code.org aims to increase computer science education opportunities for students, particularly women and underrepresented students of color. Among Code.org's programs is the Hour of Code, which offers hour-long coding tutorials targeted at different age groups that teachers can implement in the classroom with minimal preparation.



Computer Science for All Initiative

In the fall of 2015, New York City Mayor Bill de Blasio launched a new public-private initiative that will require all New York City public schools at all levels to offer computer science within 10 years. Half of the 10-year cost is expected to come from private funding.⁵⁵



Girls Who Code

Girls Who Code, a nonprofit, teaches computer science to girls from grades six to 12 through its national club program and summer immersion program. Over 10,000 students have learned through Girls Who Code and 90 percent of alumnae have declared or intend to declare a major or minor in computer science in college.⁵⁶

SKILLS MATCHING

Challenges Addressed:

- ✓ Matching Employer Needs
- ✓ Training for Both Hard and Soft Skills
- ✓ Participant Readiness
- ✓ Rigid Hiring Requirements
- ✓ Rapidly Changing Sector Needs

Tech training programs face the ongoing challenge of ensuring that participants are learning an in-demand skillset desired by employers. Some successful programs are training students with specific employers in mind, helping to ensure students meet the breadth of employers' needs before they start training.

Best practices include:

- **Pre-placing Students:** Several programs work with employers to identify job openings or internships before students begin training, ensuring both that students have jobs when they graduate and that they meet employers' specific needs in terms of preparedness.
- **Employer Input:** Other successful training programs work with employers to set up their curriculum to make sure what they are teaching reflects their current needs. These curricula can be developed either with feedback from employers or directly in conjunction with their teams to meet specific demands, and often involve both soft and hard skills. Additionally, many of these programs are nimble enough to adapt their curricula to respond to real-time market dynamics. Just-in-time training at scale can meet the needs of job seekers and employers alike.



SYSTEM OF NEW CREDENTIALS

Challenges Addressed:

- ✓ Training for Both Hard and Soft Skills
- ✓ Rigid Hiring Requirements
- ✓ Lack of Standardized Credentials
- ✓ Lack of Diversity

As mentioned earlier, some ICT fields have advanced systems of credentials. However, others, especially coding, have no industry-recognized standard to show proficiency or mastery of a language or skill. In the absence of widespread accreditation organizations or industry-recognized certificates, it can be difficult for employers to understand the skills of tech training program graduates, particularly for employers that have been more reliant on traditional accreditations like academic degrees. Programs have devised several solutions to help reduce uncertainty for employers and show that their students are trained to the standards they need.

These include:

- **Trainee Portfolios:** Instead of relying on a credential, program graduates sometimes build portfolios of their work so potential employers can review the code they wrote or the projects they developed and evaluate them based on tangible products.
- **Reputation as a Stopgap:** Currently, in the absence of standardized credentials for much of the field, many bootcamps rely on personal connections or the success of their previous graduates to show their value. As these training networks grow, many students hope that a certificate from their program will receive the same value and brand recognition that a bachelor's degree from a recognized university does now.
- **Standardized Curricula:** Some experts in the field have suggested working toward standardizing curricula across programs. If developed in conjunction with employers and a network of programs, standardized curricula could leave room for programs to adapt the curricula to meet specific needs.
- **Continue to Explore Innovations in Credentialing:** Efforts like Mozilla's Open Badges initiative have shown early promise in building a set of meaningful, free credentials that can be adopted by programs, highlighted by graduates, and recognized by employers.⁵⁷

A company that hires one bootcamp graduate is a hundred times more likely to hire another one.

Liz Eggleston, Course Report

INTENTIONAL INTERVENTIONS FOR WORKFORCE DIVERSIFICATION

Challenges Addressed:

- ✓ Matching Employer Needs
- ✓ Rigid Hiring Requirements
- ✓ Participant Readiness
- ✓ Lack of Diversity

Programs, employers, and governments have all recognized that action must be taken to include more students from disadvantaged or underrepresented communities in tech training. Some programs advocate for focused programming and continued support for individuals throughout their time in the field.

- **Diversity-Oriented Programs:** Programs have begun to launch low- or no-cost programs open only to underrepresented groups—people without degrees, women, or minorities—to encourage their participation.
- **Continued Support:** Individuals from non-traditional tech backgrounds often face additional challenges once they are a part of the tech workforce. Building in continued mentorship or skills training even after students have found employment can help them to be successful.
- **New Pathways:** As noted above, new pathways like earlier technology education, more complete on-ramps, and intermediaries can help bring technology opportunities to those who have traditionally had less access.

INSTITUTIONALIZED DATA COLLECTION

Challenges Addressed:

- ✓ Matching Employer Needs
- ✓ Lack of Standardized Credentials
- ✓ Rigid Hiring Requirements
- ✓ Lack of Diversity
- ✓ Rapidly Changing Sector Needs
- ✓ Lack of Data for Evaluation

Given the rapid growth of the tech training field, we currently lack enough real data for evaluation both within and across the programs. Ensuring that tech training programs across the country routinely collect similar data will help the field of tech training gain greater maturity while signaling to participants, employers, and funders alike the potential benefits of tech training. Initial progress can be seen in the March 2015 formation of the New Economy Skills Training Association, which brings together 10 bootcamps to pursue better evaluation, and much more can be done.⁵⁸

Steps include:

- **Standardized Data:** Employers and governments can encourage tech training programs to report against common indicators in order to accurately display differences between programs. Some experts interviewed suggested that securing, maintaining, and growing within a job are positive indicators that could help illustrate the efficacy of programs. Eventually, some experts see the possibility of using randomized controlled trials in tech training to help determine the impact of a program by comparing to a control group.
- **Impartiality and Transparency:** In publishing programmatic outcomes with government agencies or other third-party evaluators, tech training efforts can build their own reputations and tout successes while minimizing a perception of partiality. This may be particularly important as tech training programs seek to mature as a field in the near future.



FUTURE IMPROVEMENTS FOR THE FIELD

The rapid expansion of the tech training field is relatively new, but if trends in tech skill needs continue and job projections hold, the training program expansion will likely continue over the next decade. Yet, if one thing is constant, it is that what a “tech job” consists of is always changing; the pace of innovation continues to increase, and the role of technology in the workplace continues to evolve. With this in mind, the challenges that the tech training field faces today are likely to change as well.

As the field continues to learn, grow, and prepare for the future, there are significant considerations for programs and those that support them.

Avoiding a Training Bubble:

Turn Data into Action

A change in demand or a dramatic increase in tech training programs without thoughtful preparation may create a tech training bubble and challenge the whole tech ecosystem. With increased investment from government initiatives and philanthropy, there is a real possibility of a feedback loop that creates a bloated training landscape that traps job seekers with unneeded skills and wastes money. Training programs and the organizations that support them will need to keep an eye on larger trends to ensure that training programs are filling a real demand and evolving to meet the skills demands of the moment.

Sophisticated data collection, evaluation, and transparency can help mitigate this concern. This will require effort both on the part of employers and training programs. In order to support this, employers will need to engage in collaborative demand planning to forecast need for tech talent and better predict open positions and skill needs.⁵⁹ With this information, tech training programs may be able to better pivot and remain responsive to and supportive of the economy. Third-party audited data on program outcomes will likely help evaluate which programs are effective and attract employers, funders, and students.

Scaling for Success:

Replicate Intentionally

The current number of programs in this field, and their pace of training, seem unlikely to be able to meet projected employer needs. In order to do so, programs across the country should undergo rigorous evaluation to better understand leading examples of effective interventions and to determine metrics for success for these programs.

Examining examples, training programs, and outside supports can help identify component parts that form a foundation

for success. This entails looking at what works, including the curriculum, methods, participant demographics and readiness level, and the model for communication with employers. Best practice information can be distributed to the field through formal and informal channels, enabling funders and program leaders to make the best decisions possible and to ensure that their investments are driving change.

Unforeseen Models and Opportunities:

Form a Community of Practice

While best practices are emerging from the tech training world, it is still conceivable that the best model for these programs has not yet been developed. New pathways for participants, innovative partnerships with employers, and new training models that expand beyond the classroom could help to create a more effective system overall. Moreover, the information gleaned from these new elements of tech training can be better shared among those in the field.

A network of experts, practitioners, and employers should come together regularly to learn from mistakes, identify areas of opportunity, and form a community of practice. Currently,

the vast majority of programs operate independently and do not share information or collaborate with others.

Developing a network for training programs and employers to collaborate on curriculum, streamline job placement, or even create a standard for accreditation could help make the system more coherent and efficient while addressing many of the common challenges these programs face. A clear network would also allow communities to tap into the system and begin building their own network to meet employer demand on the local level.



At the same time, however, the newness and fast-changing nature of the tech training system makes it difficult to capture the field as a whole. This report is intended to serve as an overview of the types of programs that currently exist and to identify the challenge and obstacles that face this new training frontier.

With the tremendous hype around the growth of tech jobs and training opportunities, those supporting the growth of the field will need to continue to make sober assessments of its progress. Careful and continued evaluation is needed to make sure that these programs are achieving these promises. Data and anecdotal evidence show that the graduates of coding bootcamps are no more diverse than the tech field at large. While tech jobs are seen as the path to high-paying jobs for people from nontraditional backgrounds, a reliable pathway for this has not yet been created. A concerted effort is still needed to make the tech training dream a reality for more people, especially those less served by traditional education.

With this in mind, trends are emerging among programs that hint at the future of tech training. Successful programs will be the ones that are able to take their employer connections and effective training models to scale, creating a pipeline that delivers skilled individuals directly to employers. Taking new approaches to training and hiring processes can both ensure employers hire people who meet their needs, while breaking down the barriers and biases that have made it difficult for people from diverse and underserved backgrounds to enter these careers.

The explosion of new tech training programs is an exciting moment not only for the tech world but also for workforce development more broadly. The lessons learned and new models created, if successful, could one day be applied to improve workforce development in industries beyond technology. Programs and individuals will inevitably continue to develop new solutions for the challenges this field faces, but the success of the field more generally will be found in its ability to adjust to changes in the marketplace and business demand.

Conclusion

As the collective tech training system continues to grow in the U.S., it will need to better address challenges in a more cohesive and systematic way to achieve the goal of creating a diverse workforce that meets employers' changing needs. Right now, with little data and a short track record, it is all but impossible to tell what progress, if any, ICT programs are making toward such goals. If the field is to move forward, it will need to find concrete ways to measure its impact and success, proving that the reality of tech training programs truly lives up to the rhetoric.

A really important area of research will be: as bootcamps are expanding to serve more job seekers who are facing barriers to accessing training and skilled work, what is the structure that ensures that completion and job placement rates remain as high as they are?

Sally Smyth, Opportunity@Work

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APPENDIX

LIST OF INTERVIEWEES

Lauren Andersen

Director of Strategy,
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Patrick Cohen

Director, Technology Service Corps
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CEO, Creating IT Futures Foundation
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President, Chief Executive Officer,
Vermont HITEC
Williston, VT

Michael Gritton

Executive Director, KentuckianaWorks
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Jane Oates

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Rebekah Rombom

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Rachal Royce

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Martin Scaglione

President & CEO, Hope Street Group
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