

# BETTING ON BOOTCAMPS:

## How short-course training programs could change the landscape of higher ed

BY RICHARD PRICE & ALANA DUNAGAN

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# EXECUTIVE SUMMARY

Whirlwind growth in the technology sector has led to heightened demand for workers with specialized skills in coding and computer science. Projections for continued expansion of the sector feed a persistent fear that traditional educational offerings won't generate enough graduates with the skills the economy demands.

Bootcamps focused on coding and computer science have emerged as an important pipeline for tech talent. These short, intense, workforce-aligned training programs are already graduating over 36,000 students each year.

Studying the bootcamp model through the lens of Disruption Theory highlights its disruptive potential relative to traditional higher education. Bootcamps are addressing nonconsumption and overserved demographics with a product that is arguably inferior to traditional degrees—but one that is also simpler and cheaper. Bootcamps are leveraging technology for skills-based signaling, expanding their online presence, and seeing little response from traditional institutions. The ingredients for disruption are all there.

But, whether bootcamps disrupt higher education depends on whether and how federal funds enter the market, and on bootcamps' ability to expand into lifelong learning and beyond the technology sector. We identified five scenarios for how the future of bootcamps could play out.

1. **Bootcamps get stuck and fail to disrupt higher education.** Potential reasons include diminishing employer buy-in, inability to expand into new fields, and regulatory pressure.
2. **Federal funds could open up access to bootcamps—or destroy the model entirely.** The existing Title IV regime would likely allow low-quality programs to scale. However, an outcomes-based funding model could fuel innovation along a disruptive path, which would be a boon for bootcamps, students, and employers alike.

3. **Bootcamps expand into lifelong learning.** The market for workplace learning is large, and employer-pay models offer an opportunity for profitable expansion. Doing so will require continued employer investment in corporate learning, and beating out stiff competition already in the space.
4. **Bootcamps expand into industries beyond tech.** The search for increased profits will motivate bootcamps to move into fields like healthcare or finance. Doing so will require identifying favorable labor market dynamics and codifying field-specific competencies.
5. **Bootcamps achieve breadth and depth, and widespread disruption.** If bootcamps expand out to new fields and into lifelong learning, further fueled by outcomes-based federal funding, they can reshape higher education.

Traditional institutions can integrate professional and technical skills into their programs, but this will not protect them from disruption. A more foolproof way to address this disruptive threat is to invest in the bootcamp business model through an autonomous unit.

Successfully pushing into new industries and training contexts will require bootcamps to innovate continuously. But if they take on that innovation challenge successfully, the bootcamp model could disrupt and permanently change the landscape of education and training.

# INTRODUCTION

Whirlwind growth in the technology sector has led to heightened demand and hefty salaries for workers with specialized skills in coding and computer science. Student demand for computer science degree programs has grown so quickly that universities are struggling to keep up: the National Academies of Sciences describe the situation as a crisis.<sup>1</sup> Projections for continued expansion of the tech sector feed a persistent fear that traditional educational offerings won't generate enough graduates with the skills the economy demands.

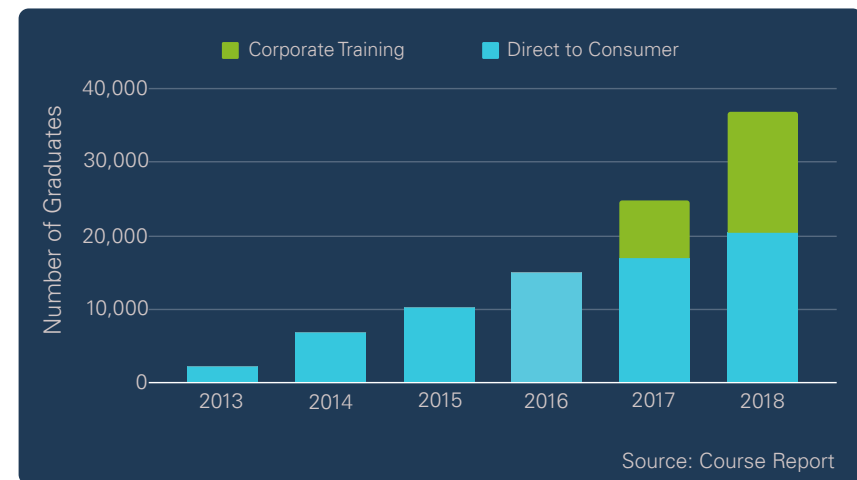
A new entrant is emerging to address the potential gap in education and training: bootcamps. Bootcamps are short, intense, employer-aligned training programs that have particularly appealed to career changers since they began cropping up in 2012. Initially focused on web and software development, bootcamps have expanded into other digital careers like user experience and user interface (UX/UI) design. Conservative estimates demonstrate that bootcamps are now graduating over 36,000 students per year, as of 2018.<sup>2</sup> Bootcamps have rapidly become an important pipeline for talent in coding and computer science.<sup>3</sup>

What does this phenomenon represent? Is it a mere stopgap response to employers' insatiable demand for tech skills? Or does it represent a permanent shift in how skills and knowledge are disseminated, and in the training experiences and credentials that employers value? Are bootcamp models only viable in computer science, or do they have potential in other fields as well? Are bootcamps simply an alternative path to the workforce, or do they stand to have a disruptive impact on traditional higher education institutions?

To answer these questions, we gathered data on 100 bootcamps (see Appendix A), contextualizing and fleshing out this data by conducting over 25 interviews with bootcamp founders and leaders, hiring managers, college administrators, financing providers, bootcamp students, and other stakeholders.

We also looked at other career-training providers adjacent to the space, given that a major challenge in discussing bootcamps is defining exactly what

Figure 1. Growth in annual bootcamp graduates



a bootcamp is in the first place. The challenge stems from entrepreneurs in the bootcamp landscape constantly tweaking their business models and modifying their course offerings. In this paper, we do not attempt to precisely define the bootcamp model,<sup>4</sup> instead operating on the general consensus about bootcamps: they are designed to help adults (often career changers) get a job in the tech industry, they last a handful of intensely busy months, and typically cost over \$10,000.<sup>5</sup>



## An evolving landscape

Even as the number of graduates has grown, bootcamps have begun consolidating in the past 18 months.<sup>6</sup> As bootcamps have progressed through the hype cycle, projections about the model have grown predictably less glowing. After a handful of high-profile bootcamps shuttered, *The New York Times* wrote, “The closings are a sign that years of heady growth led to a boot-camp glut, and that the field could be in the early stages of a shakeout.”<sup>7</sup>

Others see more potential. Ryan Craig, a partner at investment firm University Ventures Fund, believes that bootcamps will succeed because they have cracked the “last mile,” the critical training that connects students to employers.<sup>8</sup> In Craig’s view, bootcamps are succeeding because they are providing technical skills that the workforce increasingly demands, to students who highly prioritize employment.

Education consulting firm Entangled Solutions has taken on the thorny task of discerning where bootcamps fit within the broader higher education space. Entangled Solutions considers last-mile providers, among them bootcamps, as belonging to an overarching category it calls “Early Career Enhancers.” These are service providers that “help learners secure early jobs and advance in their careers.”<sup>9</sup> Entangled Solutions also collaborated with the Strada Institute to highlight the distinction between bootcamps and “on-ramps,” the latter carrying out a similar function but with an explicit focus on adult learners that lack postsecondary credentials.<sup>10</sup>

As the number, customers, and offerings of bootcamps continue to shift, *The Theory of Disruptive Innovation* can help us explore and contend with this potentially disruptive business model, even shedding light on how bootcamps could shape the broader higher education landscape.

# WHAT IS DISRUPTIVE INNOVATION?

The terms “innovation” and “disruption” are often associated with major technological breakthroughs that dramatically upend dominant industry players. Disruptive Innovation as originally conceived by Harvard professor Clayton Christensen, however, describes a process in which market entrants introduce seemingly inferior products that gradually steal consumers away from more sophisticated and established incumbents.

Incumbents typically struggle to respond because they are engaged in *sustaining innovation* battles, in which companies constantly race to produce better products to secure more demanding customers who are willing to pay higher margins. Whether these sustaining innovations are incremental improvements or dramatic technological breakthroughs, they accomplish the same purpose: making better products that can be sold for higher profits.

*Disruptive Innovations*, on the other hand, make products simpler, more affordable, and more accessible. They take root at the low end of the market by capturing those customers who are overserved by existing products and services. These tend to be low-margin consumers who would prefer a cheaper, more basic offering. Disruptive Innovations also appeal to nonconsumers—those who aren’t part of the market at all because they can’t afford or access current offerings. From there, disruptors employ a technological enabler and innovative business model to move upmarket, ultimately serving mainstream customers at a lower cost than their competitors can.

The disruption of the movie rental industry provides a recent and vivid example of this dynamic. Throughout the 2000s, while Blockbuster was stocking its retail shelves with movies fresh from the theaters, a new company called Netflix was mailing selections that weren’t in as high of demand directly to customers’ homes. Whereas Blockbuster charged their customers for each rental and commonly charged them late fees, Netflix charged a monthly fixed fee for DVD deliveries and never charged late fees.

Customers who craved the latest release were more than willing to make the trip to Blockbuster. On the other hand, less demanding customers were perfectly content putting the selection in their online queue and waiting for it to show up in the mail, at no additional cost aside from the membership. Netflix was able to capture this overserved market and improve its service

from there—reducing wait times for movies in high demand and increasing delivery speed.

Blockbuster, a dominant, well-oiled machine in the brick-and-mortar video rental market, was ill-designed to pivot into the mail-order market and fell victim to the classic Innovator’s Dilemma.<sup>11</sup> By the time Blockbuster could respond to the Netflix threat with a mail-order DVD rental service of its own, Netflix was preparing to launch its streaming service. The success of this fixed-fee-membership streaming service was the final nail in the coffin for Blockbuster. Netflix membership numbers more than doubled in the span of three years, as it catapulted from 7.5 million in 2007 to over 20 million in 2010, the year Blockbuster filed for bankruptcy protection.<sup>12</sup>


The disruption of higher education has been much slower than Netflix’s rise. That said, bootcamps have managed to attract the spotlight in a short period of time, raising serious questions about their future and what impact they might have on traditional higher education. In order to predict where the bootcamp market might go, it is necessary to first understand the disruptive potential of the bootcamp model. Do bootcamps represent a

Disruptive Innovations make products simpler, more affordable, and more accessible.

sustaining innovation to traditional higher education models? Or do they represent something new, and possibly disruptive?

The Christensen Institute has developed a six-question framework to analyze the disruptive potential of a particular innovation. This framework clarifies the target market, the nature of the offering, the business model that supports it, the underlying technological enablers, and the response of incumbents. Applying this framework to bootcamps helps us understand whether bootcamps are disruptive, and what variables of the bootcamp model are most critical to predicting its future.

## Will bootcamps disrupt traditional higher education?

-  1. Is the innovation geared toward nonconsumers or those overserved by existing offerings?  
**Yes.**

One of the primary gauges of disruptive potential is whether the company's target customer is either overserved by traditional options or can't access them. Bootcamps have two groups of consumers: the students they teach and the employers that hire those students. The particular students and employers that bootcamps target are ideal customers for a Disruptive Innovation.

**Students:** The typical coding bootcamp student is 30 years old, has a bachelor's degree, and has six years of work experience, none as a programmer.<sup>13</sup> Prior to the rise of coding bootcamps, there was no obvious path for this career-changer demographic to break into the tech industry.<sup>14</sup>

Learners who want to gain the skills needed to get a job in the technology sector, but who can't find a traditional higher education offering that meets their needs, are nonconsumers—and many bootcamp students meet this definition. Other students pursuing a tech-related traditional degree, and who find themselves spending more time and/or money than they would like for deeper knowledge than they need, are “overserved”. A bootcamp may be a better fit for their needs.

**Employers:** Bootcamps target employers as customers in two ways. The first is by designing programs to produce graduates that have the exact skills employers need. The second approach is to market learning solutions to employers directly. Employers can hire bootcamps to help reskill or upskill groups of existing employees with customized offerings, reducing new-hire costs and employee churn rates. Traditional higher education programs—especially degree-based ones—don't typically target these needs.<sup>15</sup>



2. Is the offering not as good as existing offerings as judged by historical measures of performance?  
**Yes.**

The traditional measures of college degree programs are those that show up in rankings: selectivity, student SAT scores, faculty salaries, research spending, and reputation among peers, among others. Bootcamps do not compete on these input metrics.<sup>16</sup> They also lack many of the traditional bells and whistles such as heavy physical infrastructure, athletics, performing arts ensembles, elite faculty, and social organizations.

Further, bootcamps are unaccredited, meaning they cannot confer degrees, and their students cannot access federal financial aid funds.<sup>17</sup> From a curricular perspective, bootcamps underperform traditional institutions by not providing general education courses and a grounding in the liberal arts. Bootcamps tend to delve much less into computer science theory and do not lay a foundation for research in the field.<sup>18</sup> In short, bootcamps aren't as good as traditional institutions in relation to traditional input-based metrics of postsecondary education—but they do seem to be preparing students to take on entry-level tech jobs.<sup>19</sup>



3. Is the innovation simpler to use, more convenient, or more affordable than existing offerings?  
**Mostly.**

### **Simplicity: Value proposition & student experience**

Colleges struggle with a complex business model that requires them to balance general education and a grounding in the liberal arts with career-relevant training, all while conducting cutting-edge research and serving as a hub for community and regional economic development. In comparison,

bootcamps have a straightforward and simple value proposition: they are designed to help their graduates find good jobs. Bootcamp students focus on one course, instead of facing the complex course and major selection process at traditional institutions that requires students to keep track of distribution requirements, cross-listings, prerequisite courses, and schedules with moving parts.<sup>20</sup> The bootcamp offering is shorter, clearer, and generally more streamlined than a traditional college degree.<sup>21</sup>

**Convenience: A question of time and place**

Whether bootcamps are more convenient than traditional degrees depends on several factors—and which bootcamp program is being considered. Bootcamps are short: the learning portion lasts less than a year in virtually all programs, with few extending beyond six months.<sup>22</sup> A traditional computer science degree typically takes multiple years. The convenience of a shorter duration program can be meaningful—shorter programs reduce the chances of life getting in the way as low-income students and adult learners try to earn a credential.

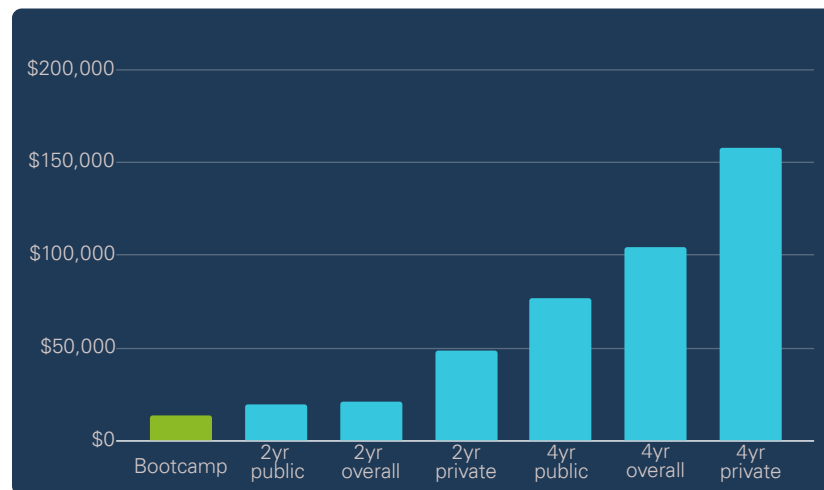
The flip side of this shorter duration is typically higher intensity. An immersive, full-time bootcamp fills the day with classroom time and coding projects for three months or more. Traditional computer science degree programs, stretched out over more time, are not as jam-packed, wall-to-wall on a typical day. If convenience is inversely correlated to intensity, bootcamps are less convenient in this regard.

Lastly, traditional institutions typically run a semester-based schedule. Enrolled students may have to wait until August or September to start. Some colleges offer additional flexibility, but in general there are fewer cohorts with which to start one’s studies. Bootcamps typically have multiple start dates throughout the year, in some cases even every few weeks, with both full-time and part-time options.

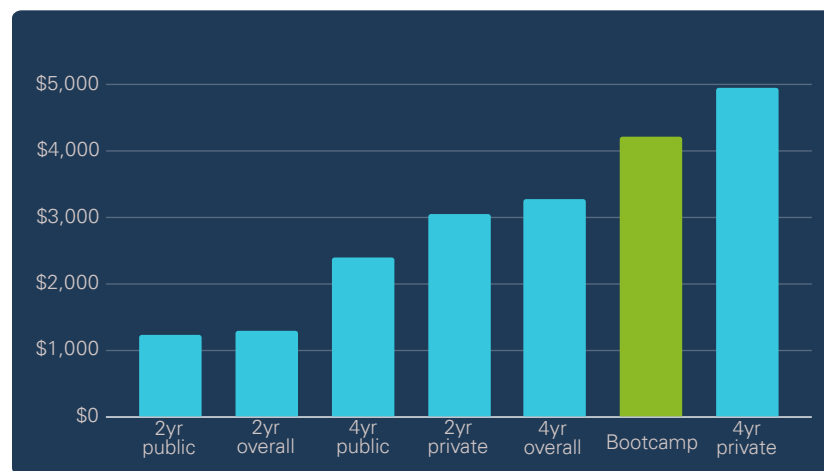
**Affordability: Cost, who pays, and how**

From a simple cost-to-credential perspective, bootcamps are typically far more affordable than the total cost of a traditional degree, although that reduced cost is largely a function of the reduced duration of the course of study.<sup>23</sup> Broken out on a monthly basis, the average cost of a bootcamp is comparable to that of a four-year degree.

**Figure 2. Total tuition cost**




**Figure 3. Tuition per month**



Note: Assumes eight-month school year for traditional institutions. Cost estimates for traditional institutions from College Board. Cost estimates for bootcamps based on an average cost per month in a database of 100 programs maintained by the Christensen Institute and listed in Appendix A.



Moreover, bootcamp programs do not qualify for federal financial aid, meaning that even though they are cheaper than a college degree, they are harder for many students to afford. In order to address this gap, a number of third-party financing providers have entered the space, and many bootcamps have partnered with private lenders to help their students finance tuition costs. Another increasingly available financing option for bootcamp students is the Income Share Agreement, or ISA, in which students initially pay either nothing or a small deposit, and then agree to pay a fixed percentage of their income for a fixed duration of time once employed.

 4. Is there a sustainable, innovative business model?  
Yes.

All organizations—whether for-profit or nonprofit—have a business model, which refers to more than just the revenues and expenses that define how an organization stays afloat financially. A business model includes four elements that determine what an organization can and cannot do: its resources, processes, value proposition, and profit formula (or revenue formula for nonprofits). Over time, and especially as organizations become successful, the elements of the business model become highly interdependent and resistant to change.





A closer look at the components of the bootcamp business model can help identify design decisions consistent with a disruptive strategy.<sup>24</sup>

**Value proposition**

As described above, bootcamps have fairly simple, clear value propositions for both students and employers: they promise to help students move into in-demand tech roles, and they promise to help employers build a pipeline of qualified talent. Traditional higher education, in contrast, has a number of often competing value propositions,<sup>25</sup> which have even been described as incompatible.<sup>26</sup>

Bootcamps teach in-demand skills and prioritize helping students meet employers and cultivate a professional network. To do so, in addition to teaching technical skills, bootcamps often teach professional skills that are specific to the kinds of roles employers are looking to fill, such as how to work on developer teams. Broadly speaking, bootcamps want to guide career changers into the technology sector. Some bootcamps focus especially on particular demographics, such as women or low-income populations.<sup>27</sup>

**Figure 4. Elements of a business model**

<b>Resources</b> 	<b>Processes</b> 	<b>Value Proposition</b> 	<b>Profit Formula</b> 
People, technology, products, facilities, equipment, brands, and cash that are required to deliver a particular value proposition to the targeted customers.	Ways of working together to address recurrent tasks in a consistent way; training, development, manufacturing, budgeting, planning, etc.	A specific promise to customers that a product or service will enable them to solve a problem in their lives.	Revenue and cost structure that enable either profitability or, for nonprofits, long-term fiscal sustainability.

Bootcamps promise to help students move into in-demand tech roles, and to help employers build a pipeline of qualified talent.

For employers, the value proposition is that bootcamps can either 1) source a diverse talent pool and prepare them for entry-level positions, or 2) help upskill and reskill existing employees through corporate training programs. Unlike in traditional higher education, where employers function as an indirect customer by hiring the graduates of colleges and universities, an increasing number of bootcamps partner directly with employers to help them address gaps in their talent pools.

**Resources: Faculty model, real estate**

The instructional model for traditional institutions revolves around a highly qualified professor who is a subject matter expert working as both instructor and researcher. Professors also serve as curriculum developers, creating bespoke, proprietary content for each course. In contrast, bootcamps employ instructors with a range of backgrounds, including college professors, high school teachers, and industry practitioners with a knack for teaching. Some bootcamps employ their own graduates to help as teaching assistants, or hire mentors to accompany students for the duration of the program.

Physical space is used differently in the bootcamp model—or not at all. In contrast to traditional universities with heavy investments in physical

infrastructure, bootcamps have experimented with offerings that are entirely online, entirely in-person, and everything in between. Bootcamps with in-person offerings have kept a light physical footprint by renting out classroom space, often in coworking spaces.<sup>28</sup>





**Processes: Curriculum development & supporting recruitment**

Most bootcamps consult regularly with employers, often through an advisory board, regarding the skills needed in the workforce. As those needs change, bootcamps quickly iterate their curriculum and course offerings, working backward to design learning experiences that help students master in-demand skills.<sup>29</sup> Given that employers demand many of the same skills throughout the country, bootcamps can quickly roll out new courses or changes to courses across multiple instructors and/or campuses. Rapid speed-to-market capabilities are integral to the model's success, proving advantageous relative to the proprietary, artisan curriculum and course design process at traditional colleges and universities.<sup>30</sup>

Bootcamps facilitate hiring, not just as graduation nears, but throughout the design of their programs. Bootcamps teach high-demand technical skills using pedagogical strategies structured to facilitate the development of professional skills, such as project-based learning and pair programming, drawing from real-world problems and creating a professional software development environment. This stands in stark contrast to college courses, which are typically designed with little to no input from employers.

Bootcamps have also established processes to minimize or eliminate other hiring-related frictions. Some host “demo days” and invite employers to network with graduates as the latter present their work. In a more integrated approach, some bootcamps line up internships for graduates, either in-house or with employer partners. A number of bootcamps are exploring the possibility of answering individual employers' requests for a specific number of graduates with a customized combination of programming languages and skills that may differ from the courses they offer to larger cohorts.

Figure 5. Business model breakdown: Traditional colleges vs. bootcamps

	Resources 	Processes 	Value Proposition 	Profit Formula 
Traditional Colleges	Academic faculty, bespoke curriculum, heavy physical footprint.	Slow course creation process, faculty-designed curriculum, limited focus on employers.	Deliver a comprehensive education, conduct cutting-edge research, provide a facilitated network where students help each other succeed and have fun.	Revenue from research, endowment, and tuition, for which federal subsidy is crucial; high fixed costs.
Bootcamps	Faculty from varied backgrounds, including industry; focus on helping students connect with employers; light physical footprint, if any.	Rapid speed-to-market for course creation, heavy employer input in curriculum design, students get extensive career support to minimize or eliminate hiring friction.	Help students move into in-demand tech roles, and help employers build a pipeline of qualified talent.	Revenue from student tuition, incorporating innovative financing models, increasing employer-pay models. No federal subsidy. Lean cost structure.

**Profit formula**

The simplicity of the bootcamp value proposition simplifies the profit formula: bootcamps are typically entirely tuition dependent, unlike traditional institutions which also pull in revenues from research activities, alumni generosity, and government subsidy in the case of public institutions. In a major departure from traditional college programs, there is almost no public subsidy of bootcamps through federal financial aid—but increasingly, employers play a role in paying for bootcamp offerings.<sup>31</sup>

Relative to traditional institutions, bootcamps have a lean cost structure. Bootcamp instructors typically earn no more than an assistant professor salary—far less than what a tenured professor earns.<sup>32</sup> Bootcamps also spend less on infrastructure and real estate.

In summary, bootcamps are reaching a market rich with nonconsumers, and they have built a differentiated and innovative business model to deliver an employment-oriented value proposition to their students and to the employers who hire them. They have pursued a more streamlined faculty model and real estate strategy, and included employers in the curriculum development process in order to lower costs and generate value for their consumers.



5. Are existing providers motivated to ignore the new innovation and not feel threatened by it at the outset?  
**Mostly.**

The typical bootcamp student already has a bachelor’s degree, thus many colleges and universities have viewed the bootcamp demographic as not

being part of their target market. The vast majority of institutions have entirely ignored the rise of the bootcamp model.

Among the small fraction of institutions that are exploring the bootcamp model, the most common approach has been to outsource most of the work through a partnership with an external provider such as Trilogy Education Services or The Software Guild.<sup>33</sup> These bootcamps bring their own curriculum and teach adult learners in noncredit programs. A handful of institutions grant college credit for work done at bootcamp partners at the undergraduate or graduate level, or have partnered with a bootcamp to help create a minor degree (see Appendix B).

An even smaller number of institutions have built their own bootcamps. Northeastern University created its own data analytics bootcamp, Level, as part of a larger effort to “future proof” the university.<sup>34</sup> Cuyahoga Community College adopted a similar approach when it opened its own low-cost bootcamp for adult learners, Cleveland Codes.



6. Does the offering have a technology that enables it to improve and move upmarket?  
**Yes.**

A company that wishes to forge a disruptive trajectory needs a technological innovation that possesses two properties. First, the innovation must enable the product or service to be more affordable and accessible than existing offerings. Second, it must enable upmarket movement on this lower-cost or more convenient foundation.

The bootcamp space actually makes use of two different technological enablers, namely online learning and online work portfolios. Each is effective in its own right, but the combination of the two is especially potent.

#### **Online learning: Reaching nonconsumers and leveraging economies of scale**

Online learning has been a disruptive force across higher education since its inception. Roughly 30% of all higher education students at traditional institutions are taking at least one course online, and the nation’s largest universities by enrollment are either predominantly or entirely online.<sup>35</sup>

Many bootcamps, though not all, have leveraged online learning. A number of bootcamps are either entirely online, or offer online programs in addition to their in-person offerings, with varying degrees of synchronicity.<sup>36</sup>

Running courses entirely online minimizes physical infrastructure costs, which allows some bootcamps to operate on a national scale without the costs and logistics of operating physical space. An exclusively-online model can also more easily reach students outside of major metropolitan hubs, the most saturated locations for bootcamps. Further, online instructional models allow

Online instructional models allow bootcamps to appeal to a wider variety of demographics and schedules, diversifying the customer base.

bootcamps to appeal to a wider variety of demographics and schedules, diversifying their consumer base.<sup>37</sup> A recent study found 54 bootcamps offering at least an online option as of June 2017, representing roughly 27% of North American bootcamps, with 29 of them exclusively online.<sup>38</sup> These numbers have likely increased.<sup>39</sup> This study does not capture online enrollments, but students learning online could easily represent more than 27% of total enrollment given the greater scale online modalities afford to education providers.

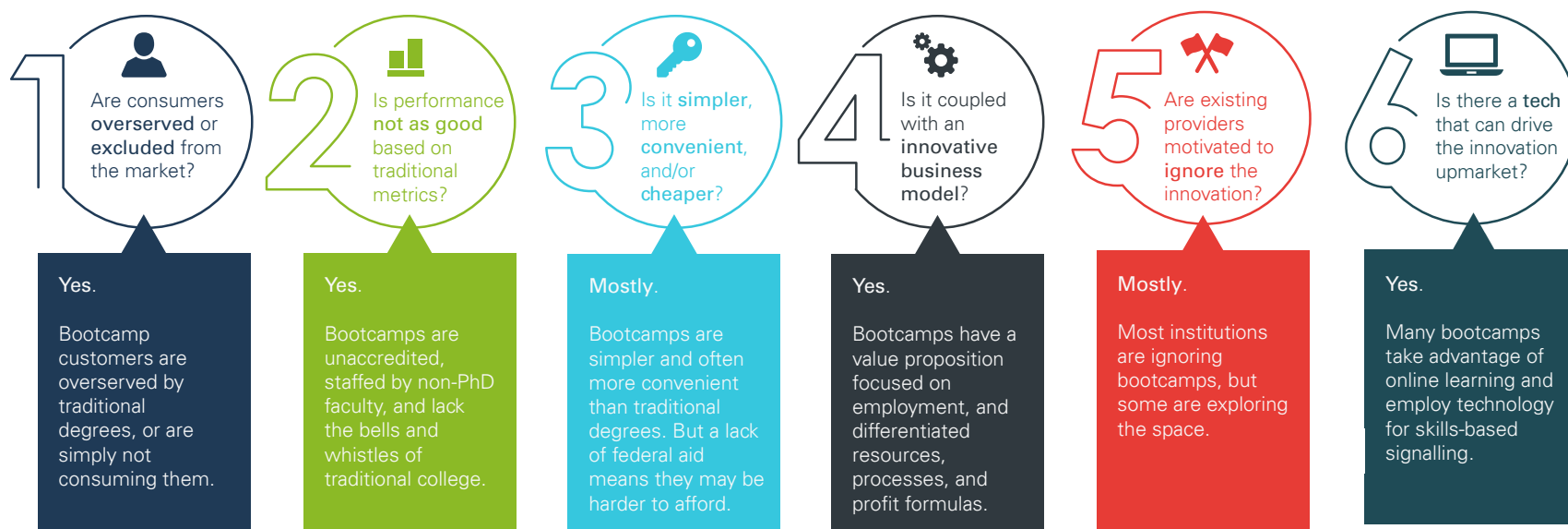
### Online work portfolios: A disruptive marketplace signal

Online work portfolios serve as another technological enabler. They provide a digital, transparent, competency-based signal detailing the skills a student

acquired. This stands in contrast to the current signaling mechanism, the diploma, often described as a black box that is more indicative of the institution's prestige than of its contributions to a student's abilities.

Online work portfolios consist of the major projects students create during a bootcamp program. Bootcamp students typically develop websites and tools during their courses that they can then show to potential employers. Students can also use tools like GitHub to show the actual code behind these projects and a complete history of the steps they took to improve on that code over time to employers.<sup>40</sup> Instead of graduating with letter grades, they graduate with evidence of the skills they have learned in a format that employers understand: concrete outputs.

Figure 6. Six question framework to analyze disruptive potential



Bootcamps are addressing nonconsumption and overserved demographics, offering a product that is arguably inferior to traditional degrees—but one that is also simpler and cheaper.

## HOW THE FUTURE OF BOOTCAMPS COULD PLAY OUT

Based on the six-question analysis, the bootcamp model has the potential for a disruptive trajectory. Bootcamps are addressing nonconsumption and overserved demographics, offering those consumers a product that is arguably inferior to traditional degrees—but one that is also simpler and cheaper. Bootcamps are currently filling an important role in creating a talent pipeline for the tech industry—but their ultimate market could be much bigger.

If bootcamps embody their disruptive potential, they could serve a wide range of industries, rapidly adapt to changing market conditions, facilitate a seemingly frictionless hiring pipeline, and help students address stubborn affordability challenges by providing them with outcomes-based financing options or tuition-free programs. Bootcamps seeking disruptive scale will likely offer entirely online or hybrid options, granting them the flexibility to pursue various strategies and to weather different market scenarios.

Whether bootcamps achieve their disruptive potential, and how they eventually impact the broader higher education landscape, depends on two key questions. First, how might an influx of federal money change the profit formula for bootcamps—and thus the entire bootcamp business model? Second, how will bootcamps innovate to meet additional needs in lifelong learning and in industries outside of technology? The following scenarios explore how these possibilities could play out, and how bootcamps could catalyze significant changes in higher education. We also explore what could potentially hamper or halt the growth of the bootcamp market.

### Scenario 1: Bootcamps get stuck, and fail to disrupt traditional higher education

Despite their considerable disruptive potential, it is possible bootcamps will fail to significantly change the higher education landscape. After all, Disruptive Innovations only succeed in a minority of instances.<sup>41</sup> There are a few possible ways that bootcamps could go off-track, including macroeconomic factors that limit the acceptance of alternative credentials, challenges

in addressing industries beyond technology, and the—albeit unlikely—possibility that regulators shut down the market altogether.

### **Employers don't buy in**

A steady, decades-long increase in the number of college graduates has led to degree inflation, whereby employers require college degrees for roles that don't require college-level skills.<sup>42</sup> Without a credible alternative means of identifying capable candidates, employers have relied on degrees as a rough filter, leading to overserved employers with overcredentialed employees.

The success of bootcamp graduates in finding jobs has demonstrated that employers, at least in the tech industry and in the current labor market, are open to nondegree credentials. If macroeconomic factors shift and labor markets loosen up, employers hiring for tech skill sets may revert to demanding degrees. This would lower the value of bootcamp training and slow the growth of the model.

### **Bootcamps can't tackle new fields**

One premise of the bootcamp model is that employers know what competencies they want, and that bootcamps can work backward from those known skills to develop learning experiences. There has already been some growth into non-tech markets: a few bootcamps have ventured into teaching sales, and there is even a medical device specialist bootcamp. But moving into additional career fields requires bootcamps to translate job requirements that are, in many cases, considered “soft” into specific skills and competencies, and to then build a curriculum to teach those skills quickly and efficiently. This will require continuous innovation, and it is not inevitable that bootcamps succeed.

It is also not inevitable that the bootcamp value proposition will make sense in every field. Part of what has made bootcamps successful in tech is a compelling ROI for students: bootcamps cost approximately \$10,000, but bootcamp graduates can expect over \$20,000 in salary increases in the first year,<sup>43</sup> which compares favorably to the overall value proposition of college.<sup>44</sup> But as bootcamps move into other industries, salaries may not justify the cost of attending a bootcamp.

### **Regulators shut the market down**

A third—unlikely but possible—obstacle to bootcamps' disruptive trajectory is regulation. Disruptive Innovations have a long history of succeeding

despite regulation,<sup>45</sup> but it is always possible for regulators to effectively stop innovation in its tracks. To date, the regulatory pressure faced by bootcamps has been limited, outside of the efforts of some states to require bootcamps to register with state higher education authorities.<sup>46</sup>

One premise of the bootcamp model is that employers know what competencies they want, and that bootcamps can work backward from those known skills.

## **Scenario 2: Federal funds could open up access to bootcamps—or destroy the model entirely**

Given the increasingly important role that higher education plays in social mobility, the government provides billions of dollars to subsidize greater access to colleges and universities across the country. Without these subsidies, traditional institutions would be unable to serve millions of students.

The bootcamp market currently operates without federal subsidy.<sup>47</sup> For the typical bootcamp, this has limited whom they can serve to those with a few thousand dollars cash at their disposal, or to those who aren't loan averse.<sup>48</sup> In the absence of subsidy, bootcamps have developed a workforce-oriented value proposition, which has made them beholden to their students and the employers that hire bootcamp graduates, rather than to the onerous input-based regulatory framework to which traditional colleges must adhere.<sup>49</sup>

Access to federal dollars would offer the industry a huge pool of cash that could considerably and immediately broaden access to bootcamps. That said, whether this access facilitates a disruptive trajectory *depends on how it is*



*disbursed.* Under the current funding regime, Title IV funds could generate the same enrollment-driven incentives that drive low outcomes in the traditional higher education system. Although bootcamps could use these funds to extend their reach, a lack of outcomes-based funding criteria would fundamentally change the nature of competition in the bootcamp space, which would allow low-quality programs to scale quickly on federal dollars.<sup>50</sup>

If, on the other hand, the government moved to extend funding to bootcamps using an innovative, outcomes-based funding system, the bootcamp market could become accessible to many more students and still retain a laser focus on moving students into the workforce.<sup>51</sup> In so doing, federal funds could potentially fuel innovation along a disruptive path, which would be a boon for bootcamps, students, and employers alike.

### Scenario 3: Bootcamps expand upmarket into lifelong learning

Employers already invest considerable resources in internal learning and training efforts,<sup>52</sup> but traditional higher education programs are not designed to address workplace learning.<sup>53</sup> As the need for digital skills grows, the pool of nonconsumers seeking training solutions will grow also.

Like all companies, bootcamps are motivated to expand and pursue profits. The lifelong learning market holds promise for bootcamps, not only because it offers the opportunity for more training opportunities, but also because, in most cases, employers pay.<sup>54</sup> Whereas the market for entry-level training is largely paid for by a combination of students and the government, workplace learning is generally paid for by employers. As the consumer bootcamp market has become crowded and less profitable, the market for workplace learning is large, and offers bootcamps a new source of profits. This strategy has been vital to the success of the largest bootcamp provider, General Assembly.<sup>55</sup>

The workplace learning market moves quickly, and often requires bootcamps to create bespoke curricula to meet the emerging needs of employers. But bootcamps have already demonstrated at the entry level that their business models are optimized around these abilities. This employer training market is also characterized by different customer acquisition dynamics than the high-churn consumer bootcamp market. Rather than expensively marketing to individual students in order to constantly fill new cohorts, bootcamps in the employer market can fill cohorts with entire teams of employees in accordance with internal corporate learning initiatives.

For example, a number of bootcamps have been shifting more resources toward the lifelong learning market by facilitating career changes and upskilling initiatives with an employer-



sponsored stream of learners.<sup>56</sup> These partnerships with employers can include large-scale digital literacy initiatives, such as L'Oréal partnering with General Assembly to train 7,000 employees on digital marketing skills.<sup>57</sup> Other models include companies relying on bootcamps to identify and train new employees, or employing bootcamps to provide upskilling to small teams.

Bootcamps will expand in the lifelong learning market to the extent that employers continue to increase their investments in corporate learning, and that bootcamps can beat out some stiff competition already in the space. This competition includes Pluralsight and LinkedIn Learning, companies which each provide large repositories of video tutorials on a number of workplace skills, including programming. Other competitors include “onshore outsourcing providers,” such as Revature, Tectonic, and Catalyte, which recruit and train new employees using a curriculum and compressed learning cycle comparable to those of traditional bootcamps. These providers then hire their own graduates as employees for a period of time to do consulting work for employer clients, giving employers an opportunity to “try before you buy.”

## Scenario 4: Bootcamps expand out to other markets in new fields

Bootcamps will be motivated to move into new industries with strong employer demand and a shortage of labor supply in order to preserve their profit margins—a common theme in Disruptive Innovations.<sup>58</sup> Despite bootcamps' short history, they have already started to exhibit this progression.

In 2012, the nascent coding bootcamp space grew from two schools to 13. With so few bootcamps competing for the same students, and no established incumbent in the space, these bootcamps could charge premium prices, albeit still cheaper than a traditional degree, to early adopters. Over the next two years the number of bootcamps more than tripled, and enrolled students increased by a factor of 20. Although bootcamps began popping up in cities across the country, they were mostly concentrated in large metropolitan centers like San Francisco, Chicago, and New York, where what was initially a rather sparse market quickly grew crowded. This inevitably led to increased marketing costs and the need to price competitively. With

profit margins getting squeezed, coding bootcamps needed to find a new profit driver.

In addition to coding, another area with considerable employer demand, and in which some bootcamps were able to develop a skills-based curriculum with employer input, was UX/UI design. The first bootcamps to add this course to their portfolios once again enjoyed the advantage of less competition and a new wave of interest from learners: more attractive profit margins than the saturated web development market could then generate. However, these higher profit margins have a way of eroding themselves by attracting other bootcamps into the space, and it was time for bootcamps to bring their model into the data science and analytics arena. The pattern is already repeating itself again, and cybersecurity may be the next frontier.<sup>59</sup>

For bootcamps, expanding further afield from programming and data science could lead to messier subject matters, with more subjectivity and a less codified and granular understanding of the competencies needed to excel in these fields, like finance or healthcare. Sussing out the relevant skills for these fields and figuring out how to teach them will become an increasingly sophisticated task, but one that bootcamps will nonetheless be motivated to take on, given that the commoditization of programming, data science, and design courses will erode profit margins in these increasingly saturated fields. Bootcamps that can innovate to successfully implement their business model in new fields can exploit profitable first-mover advantages and leverage an increasingly trusted reputation and brand. It seems inevitable that some of these new fields will start to encroach on territories typically associated with traditional institutions and the liberal arts.

It seems inevitable that some of these new fields will encroach on territories typically associated with traditional institutions and liberal arts.



## Scenario 5: Bootcamps achieve breadth and depth, and widespread disruption

There is a great likelihood that a combination of the previous scenarios occurs, with bootcamps innovating to enter several new fields at the entry level, then establishing lifelong learning pathways for each of them. If the bootcamp model proves to be an effective means to solid jobs and career advancement in multiple fields and gains traction with employers, many traditional degree programs will see their enrollments drop substantially over time. Should outcomes-based federal financial aid become available to the bootcamp market, this growth would be amplified. Over time, bootcamps would force a widespread reshaping of the traditional higher education landscape.

This disruption would likely occur gradually. With fewer students turning to community colleges as their quickest route into the labor force, state systems would likely consolidate, whittling community colleges to a singular role as low-cost on-ramps into four-year institutions. Traditional colleges and universities, especially less prestigious ones, will find many of their programs struggling. More prestigious institutions may find that their greatest value-add is knowledge creation and creating a pipeline for individuals that want to pursue academic research. In the process, they may also be able to disseminate this liberal arts knowledge to lifelong learners in a modular format, for a fee. Schools that don't excel in research and don't have a compelling way of sharing that research could close or consolidate.

There will likely continue to be some demand for a residential college experience. The minority of institutions that survive to provide this experience will no longer reside in the public conscience as the default college experience—already it is the experience of only a small minority of college-attendees. Rather, it will be viewed as a particular offering in a larger, more modular and unbundled higher education system whose focus is on helping learners earn and learn, as opposed to the existing pattern of learn and then later, maybe, earn.

# HOW CAN HIGHER EDUCATION RESPOND?

Matthew Rascoff, the associate vice provost for digital education and innovation at Duke University, argued in a widely read commentary that bootcamps don't pose a disruptive threat to traditional schools—instead, higher education should learn from bootcamps' success and emulate them. He writes, “While the intensity, flexibility, and experiential learning of bootcamps are compelling, those features are complementary to four-year undergraduate education. For most colleges, bootcamps are a sustaining innovation that can be absorbed into the core—not a Disruptive Innovation that must be developed or acquired and protected on the margins.” In Rascoff's vision, the delivery of technical skills needed by employers can—and should—be woven into traditional higher education offerings: “Skills are essential. We should not outsource their provision to bootcamps, nor should we upend liberal arts education to provide them. Rather, we should integrate into the college experience the technical skills necessary for professional success.”<sup>60</sup>

What makes bootcamps disruptive, however, goes beyond technical skills. Universities typically have some programming or statistics in their course listings and update their curricula on a regular basis—though at a fraction of the speed of a typical bootcamp. Bootcamps are disruptive because of whom they target (those who are overserved by a degree), and how they teach them (short, cheap, modular programs designed around the experiences and skills—technical and soft—employers need). The pared-down bootcamp model is also nimble and hyper-attuned to workforce needs. Unencumbered by the requirements of accreditation and the complex business model of traditional colleges and universities, bootcamps can bring new, in-demand offerings to market—and shutter irrelevant ones—with lightning speed. Through sustaining innovation, universities can and should integrate professional and technical skills into their programs. But this will not protect them from disruption.

Bootcamps have a disruptive business model that supports the value proposition these organizations offer students and employers. Traditional higher education can't achieve the same value proposition without fundamentally changing its business model—and years of observations of companies in a wide range of industries demonstrate that such a shift is monumentally unlikely, if not impossible.

A more foolproof way for traditional higher education to address the disruptive threat of bootcamps is by investing in new business models through autonomous units. The most prominent example of this is Northeastern University, which has built its own bootcamp, Level.<sup>61</sup> Building an autonomous unit allows incumbents to build a new, disruptive business model. This strategy is how IBM, historically a producer of mainframe computers, was able to disruptively move into PC computers: by building a totally autonomous business unit in Florida, far away from the established processes and norms of its headquarters in New York.<sup>62</sup> None of IBM's competitors in the mainframe business took this approach, and none but IBM became a significant factor in the personal computer market.

But building a disruptive strategy through an autonomous unit isn't a one-stop process. Incumbents must keep investing in those units, ultimately at the expense of the traditional business model. As pressure builds on the higher education business model, colleges and universities building disruptive, autonomous units need to be prepared to invest in them—at the expense of the traditional model.

## CONCLUSION

Bootcamps emerged during the past decade, in response to severe supply-demand imbalances in the market for employees with coding and computer science skills. But the model that bootcamps developed, which provides workforce-aligned technical and soft skills in short, affordable courses, has shown signs of expanding beyond entry level skills, and beyond the technology industry. Successfully pushing into new industries and new training contexts will require bootcamps to continuously innovate. But if they take on that innovation challenge successfully, bootcamp models could disrupt higher education and dramatically and permanently change the landscape of education and training.



# APPENDIX A: BOOTCAMPS RESEARCHED

4Geeks Academy	devCodeCamp	Level	The Grace Hopper Program
Actualize	DevLeague	Metis	The Software Guild
Ada Developer's Academy	DevMountain	Montana Code School	Kent State University
Always Hired	DevPoint Labs	Nashville Software School	Thinkful
App Academy	DigitalCrafts	Nucamp	Tradecraft
Austin Coding Academy	Eleven Fifty Academy	NYC Data Science Academy	Trilogy partners:
Bloc	Epicodus	Orange County Code School	Rutgers Bootcamps
Bottega	Flatiron School	PrepMD	UCLA Extension
Brainstation	Fullstack Academy	Prime Academy	Northwestern Univ
Byte Academy	Galvanize	Product School	UT Austin
C4Q	General Assembly	Project Shift	UCF
Cincy Code IT	Grand Circus	Redwood Code Academy	Georgia Tech
Claim Academy	GrowthX Academy	Rithm School	UNC Chapel Hill
Code Career Academy	Hack Reactor	rmotr.com	UC Berkeley
Code Fellows	Hackbright Academy	Sabio	UNC Charlotte
Code Platoon	Helio Training	Secure Set	UC Irvine
Coder Foundry	Insight Data Science	Skill Distillery	University of Denver
Codesmith	Ironhack	Springboard	Turing
Codeup	K2 Data Science	Startup Ignition	V School
CodeWorks	Kenzie Academy	Startup Institute	We Can Code It
Coding Dojo	Lambda School	Tech Academy	Woz U
Coding Temple	Launch Academy	Tech Elevator	Wyncode Academy
Covalence	LaunchCode	Tech Talent South	Year Up
Deep Dive Coding	Learn Academy	The Data Incubator	Zip Code Wilmington
Designation	LearningFuze	The Firehose Project	

# APPENDIX B: EXAMPLES OF TRADITIONAL COLLEGE RESPONSE

The vast majority of traditional institutions are not addressing the challenges that bootcamps pose. Of those that are, their responses range from outsourcing bootcamp implementation and sharing the revenue to creating their own bootcamps. Below are several examples.

## Partnering

### Non-credit bearing

- Harvard University: one of 40+ universities partnering with Trilogy Education Services
- University of Georgia: one of 11 universities partnering with Software Guild
- California Polytechnic State University: partnering with Fullstack Academy

### Credit bearing

- Yale University: offering for-credit Flatiron School course during summer program
- Lynn University: offering credit to grad students who attend Wyncode Academy

### Incubating

- Dominican University of California: incubating college alternative Make School, allowing the latter to become a fully-accredited accelerated bachelor's degree provider through a regulator-approved model that could become significant going forward

### Partnering with industry

- Howard University: one of 11 institutions partnering with Google's Tech Exchange initiative to supplement academic learning with hands-on experience, thus leveraging an employer partner as the last-mile training provider, instead of a bootcamp

## Building from scratch

- Northeastern University: offering its own data analytics bootcamp, Level. Level has spread to five locations, added an online option, and kept its tuition under \$8,000 for its primary course offering. Level graduates also earn credit that can go towards a graduate degree at Northeastern.
- Cuyahoga Community College (Tri-C): offering its own bootcamp, Cleveland Codes. For Cleveland Codes students who do not yet have a degree, Tri-C grants college credit that builds towards an associates degree in programming and development.

# NOTES

1. Describing the strain that the demand for computer science degrees is placing on traditional institutions, a committee charged with addressing the issue wrote, “The centrality of computing has manifested itself in dramatic increases in enrollment in undergraduate computer science courses in colleges and universities. Institutions have to make decisions ranging from allocating resources to accommodate demand to imposing limits on course enrollments and course offerings, and managing increasing enrollment of non-majors. In addition, with industry hiring the majority of new Ph.D.s, growing the number of faculty is a challenge for many departments.” National Academies of Sciences, Engineering, and Medicine, *Assessing and responding to the growth of computer science undergraduate enrollments* (National Academies Press, 2018), p.xi, <https://www.nap.edu/read/24926/chapter/1>.

2. Course Report, which bills itself as a third-party resource for bootcamp students, is among the more comprehensive sources of information and statistics on the bootcamp industry. However, its definitions of “bootcamp” are quite narrow. In an ironic parallel with the methodology of federal data collection efforts in traditional higher education, Course Report numbers exclude students in part-time bootcamps (roughly half of bootcamps provide a part-time option, and all 40+ of Trilogy’s university partners do so as well), and only this year began to include students in online programs. Course Report also focuses exclusively on *coding* bootcamps, excluding bootcamp programs which focus on other disciplines. Thus, Course Report numbers should be taken as a minimum estimate of the size of the emerging bootcamp market. See Liz Eggleston, “2018 Coding Bootcamp Market Size Study,” Course Report, August 21, 2018, <https://www.coursereport.com/reports/2018-coding-bootcamp-market-size-research>.

3. In the meantime, higher education has been ramping up degree production in computer science. The National Center for Education Statistics reports 44,142 graduates with bachelor’s degrees in “Computer and information sciences” in 2000-01 and 71,420 in 2016-17, the most recent year data is provided. The number of master’s degrees has almost tripled in that same time frame, reaching a peak of 46,555 in 2016-17. National Center for Education Statistics, “Table 322.10. Bachelor’s degrees conferred by postsecondary institutions, by field of study: Selected years, 1970-71 through 2016-17,” U.S.

Department of Education, *Digest of Education Statistics: 2018*, [https://nces.ed.gov/programs/digest/d18/tables/dt18\\_322.10.asp?current=yes](https://nces.ed.gov/programs/digest/d18/tables/dt18_322.10.asp?current=yes) (accessed February 13, 2019). See also the table for master’s degrees, “Table 323.10. Master’s degrees conferred by postsecondary institutions, by field of study: Selected years, 1970-71 through 2016-17,” [https://nces.ed.gov/programs/digest/d18/tables/dt18\\_323.10.asp](https://nces.ed.gov/programs/digest/d18/tables/dt18_323.10.asp).

4. We exclude training providers like Revature, which is also a staffing agency, and massive open online courses (MOOCs) or MOOC-like providers, such as Udacity.

5. RTI recently published a report that identified 270 bootcamps worldwide, 198 of which were in the U.S., Canada, or online. The report excluded bootcamps with the following characteristics: “1. Programs that were no longer offered and bootcamps that had closed before June 30, 2017. 2. Content was not related to science, engineering, math, or technology. 3. Programs were too short (less than one week). 4. Programs or bootcamps did not target adult learners. 5. Courses were eligible for university credit (unless a bootcamp developed the content and partnered with traditional institutions to provide it). 6. Programs or bootcamps provided insufficient information on our key data elements.” We differ on the second point above, given that we are not looking exclusively at *coding* bootcamps, but generally concur with these delineations. See Caren Arbeit, Alexander Bentz, Emily Forrest Cataldi, and Herschel Sanders, “Alternative and Independent: The Universe of Technology-Related ‘Bootcamps,’” RTI International, February 2019, <https://doi.org/10.3768/rtipress.2018.rr.0033.1902>.

6. Significant moves include the \$413-million acquisition of General Assembly, one of the first bootcamps and by far the largest, by staffing giant Adecco; the acquisition of New York-based bootcamp Flatiron School by WeWork of coworking space fame, and then of UX/UI-focused bootcamp Designation by Flatiron School; the acquisition of Hack Reactor, considered one of the more prestigious bootcamps, by competing bootcamp and coworking space provider Galvanize, after Hack Reactor acquired two other bootcamps a year prior; and the closures of Dev Bootcamp, owned by Kaplan, and of Iron Yard, two prominent early bootcamps. Because a handful of bootcamps open each year, balancing out some of the closures,

the overall number of bootcamps has not dipped dramatically. However, the high-profile nature of some of these closures, and the admissions that the struggles were business model-based, cast a pall over the space.

7. Steve Lohr, “As Coding Boot Camps Close, the Field Faces a Reality Check,” *The New York Times*, August 24, 2017, <https://www.nytimes.com/2017/08/24/technology/coding-boot-camps-close.html>.

8. Craig writes that this “last mile” provides a competitive advantage in multiple industries: “The concept of the last mile—the final leg of the connection to each home—originated in telecom, but is now a primary focus for supply chain management and e-commerce, in particular. The general principle applicable to all contexts is that the last mile is the most difficult and expensive to build, but equally the most valuable: Dominating the last mile can provide a nearly unassailable competitive position. In telecom and other utilities, the cost of building the last mile is what results in natural monopolies, thereby requiring regulation.” Ryan Craig, “The ‘last mile’ in education and training,” *TechCrunch*, June 25, 2017, <https://techcrunch.com/2017/06/25/the-last-mile-in-education-and-training/>. For further elaboration on the subject by this author, see also Ryan Craig, *A New U: Faster + Cheaper Alternatives to College* (Dallas: BenBella Books, 2018).

9. Lauren Dibble, Michael Horn, and Rob Urstein, “The Rise of Early-Career Enhancers in Education,” *EdSurge*, November 7, 2018, <https://www.edsurge.com/news/2018-11-07-the-rise-of-early-career-enhancers-in-education>.

10. Michelle R. Weise, Andrew R. Hanson, Allison Salisbury, and Kathy Qu, “On-ramps to Good Jobs: Fueling Innovation for the Learning Ecosystem of the Future,” Strada Institute for the Future of Work and Entangled Solutions, January 2019, <https://go.stradaeducation.org/on-ramps>.

11. The Innovator’s Dilemma is a phenomenon in which established, well-run companies understandably and rationally implement resource allocation strategies according to the demands of their largest and highest-margin consumer markets. These powerful processes propel incumbents away from disruptive opportunities. See Clayton M. Christensen, *The Innovator’s Dilemma: When New Technologies Cause Great Firms to Fail* (New York: Harper Business, 2011).

12. There is still one Blockbuster location open in the United States, in Bend, Oregon. Its Twitter account is poignantly hilarious.

13. Liz Eggleston, “2018 Coding Bootcamp Alumni Outcomes & Demographics Report,” Course Report, December 19, 2018, <https://www.coursereport.com/reports/coding-bootcamp-job-placement-2018>.

14. Even online post-baccalaureate programs focused exclusively on career changers cover over a year’s worth of material. Oregon State University’s online post-baccalaureate program in computer science takes one year to complete full-time, and up to four years part-time. Total tuition is around \$30,000. See “Tuition and Fees,” Computer Science B.S. (Post-baccalaureate), Oregon State University, <https://ecampus.oregonstate.edu/online-degrees/undergraduate/computer-science/> (accessed November 22, 2018).

Traditional degree options are impractical for professionals who often have families and considerable time constraints, and a costly physical campus with impressive amenities has little to offer career changers. Traditional offerings also cover more material than career changers need, including general education courses and theoretical material not needed for junior level software development positions. As late as 2009, common advice on chat forums included self-study on common programming languages or attending evening classes, followed by seeking out open source projects online where one could contribute and start building up a portfolio of work. With some open source work under one’s belt, the next step might be paid freelancing for small businesses. See “From an Unrelated Career to IT/Programming?” Slashdot, <https://developers.slashdot.org/story/09/03/20/1518248/from-an-unrelated-career-to-itprogramming> (accessed October 3, 2018).

15. Some colleges are beginning to build programs around employer needs in this area, such as Southern New Hampshire University. But the cohort of colleges taking on this problem is tiny, and tends to be those who are already focused on developing disruptive—and self-disruptive—innovations. For more, see “Workforce Partnership,” Southern New Hampshire University, <https://www.snhu.edu/workforce-partnerships> (accessed January 20, 2019). See also Alana Dunagan, “College Transformed: Five Institutions Leading the Charge in Innovation,” Clayton Christensen Institute, February 2017, [www.christenseninstitute.org/publications/college-transformed](http://www.christenseninstitute.org/publications/college-transformed).

16. Some bootcamps do try to differentiate themselves as elite by touting their selectivity numbers and intensity. However, even the most elite and selective bootcamps lack the general brand recognition of most traditional institutions.



17. There is considerable experimentation on this front. The U.S. Department of Education (ED) invited partnerships between traditional universities, bootcamps, and quality assurance entities to submit proposals in which federal financial aid could be funneled to bootcamps through accredited entities. This initiative was labeled Educational Quality through Innovation Partnerships (EQUIP). However, none of these partnership experiments has launched as of February 2019. For more, see “Fact Sheet: ED Launches Initiative for Low-Income Students to Access New Generation Of Higher Education Providers,” U.S. Department of Education, Aug. 16, 2016, <https://www.ed.gov/news/press-releases/fact-sheet-ed-launches-initiative-low-income-students-access-new-generation-higher-education-providers>.

Further, Yale University is providing a Flatiron School-powered summer bootcamp for college credit, and Bottega, a bootcamp based in Utah, is accredited as a nondegree granting institution by a private accreditation body, albeit one that is not recognized by ED. Another bootcamp, Make School, is pursuing accreditation through an ED policy called the “Incubation Policy,” partnering with Dominican University of California to offer a Bachelor in Applied Computer Science degree. Many of these initiatives are discussed in more detail in Question 6.

18. Because many employers perceive this lack of deeper theoretical grounding as a shortcoming, some bootcamps have lengthened their programs to make room for it in the curriculum. Lambda School’s fullstack immersive courses run 30 weeks long, as opposed to the more common 12-14 week duration found throughout the space. Eight of those additional weeks are dedicated to data structures, algorithms, networks, and computer architecture, areas of study that are likely unnecessary for entry-level coding jobs, but which can help solve a wider array of problems.

19. Of employers surveyed, 84% consider coding bootcamp graduates just as (or more) prepared to be high performers as graduates of more traditional programs. While data in this space is somewhat limited, employer satisfaction with bootcamp graduates seems to be high. See “What Do Employers Really Think About Coding Bootcamps?” Indeed Blog, May 2, 2017, <http://blog.indeed.com/2017/05/02/what-employers-think-about-coding-bootcamp/>.

20. The complexity of this system contributes to nearly 60% of students not managing to graduate in four years. This increases costs for many students,

as well as the likelihood of “life getting in the way.” Students graduate with an average of 135 credits when all they need is 120, and students that transfer between institutions can accumulate more, losing 27 credits on average in the transfer process. See Meredith Kolodner, “6 Reasons You May Not Graduate on Time (and What to Do About It),” *The New York Times*, April 6, 2017, <https://www.nytimes.com/2017/04/06/education/edlife/6-reasons-you-may-not-graduate-on-time.html>. For a stronger focus on community college students, see also Jill Barshay, “Wasted time and money on undergraduate classes,” *The Hechinger Report*, September 4, 2017, <https://hechingerreport.org/wasted-time-money-undergraduate-classes/>.

21. At its most flexible and arguably complex, the bootcamp model has been partially unbundled by some providers like Tech Talent South, allowing students to pick from a handful of different specializations. This is still orders of magnitude simpler than what it takes to earn a computer science degree.

22. A typical coding bootcamp course lasts roughly three months full-time, or six months part-time. A number of bootcamps have chosen to provide longer, more in-depth courses that last anywhere from six to ten months. Course Report describes the average full-time course length as 14.3 weeks. See Liz Eggleston, “2018 Market Size Study.”

23. There are a small handful of bootcamps that don’t charge students any tuition at any time, thanks to employer sponsorships, donations, or models in which the bootcamp immediately hires graduates as paid in-house apprentices for a contract period. From the learner’s perspective, this is as affordable as bootcamps can get. The employer-pay and in-house apprenticeship models are also intriguing for their potential to scale.

24. It’s important to note that bootcamps are furiously iterating around several elements of their business model. Darrell Silver, cofounder and CEO of prominent bootcamp Thinkful, had this to say about the challenges in the space: “Education businesses are very tough. The unit economics and cash flow are very sensitive. Quality comes down to specific processes built around specific people, and you have to have a great educational machine.... While you are building this machine that serves many, many students, you also have to be innovating on how the financing works, how the marketing works, etc. The model is so new, and these things take time in education.” Darrell Silver, interview by Richard Price, July 6, 2018.

25. The 2016 Gallup College and University Presidents Study set out to identify, among other things, what factors presidents considered important in evaluating their own success. Among those factors, 13 of them were considered at least very important by more than half of presidents. Skills and job placement were on the list, at #2 and #8 respectively, but the dozen other competing priorities evidence the complexity of the traditional higher business model. “2016 Gallup College and University Presidents Study,” Gallup, August 24, 2016, <https://news.gallup.com/reports/194783/gallup-college-university-presidents-study-2016.aspx>, p. 6-7.

26. This problem with the business model of traditional universities has been aptly described by Clayton Christensen and his coauthors: “Universities emerged in the 17th and 18th centuries primarily as teaching institutions, but most gradually evolved to become expensive confluents of all three types of models with three value propositions: research, organized as a solution shop model; teaching, which is a value-adding process activity; and facilitated networks, within which students work to help each other succeed and have fun. A typical state university today is the equivalent of having merged major consulting firm McKinsey with Whirlpool’s manufacturing operations and Northwestern Mutual Life Insurance Company. They have three fundamentally different and incompatible business models all housed within the same organization.” Clayton M. Christensen, Michael B. Horn, Louis Caldera, and Louis Soares, “Disrupting College: How Disruptive Innovation Can Deliver Quality and Affordability to Postsecondary Education,” Center for American Progress and Innosight Institute, February 2011, [https://cdn.americanprogress.org/wp-content/uploads/issues/2011/02/pdf/disrupting\\_college.pdf](https://cdn.americanprogress.org/wp-content/uploads/issues/2011/02/pdf/disrupting_college.pdf), p.35.

27. Pursuit, formerly C4Q, specifically encourages those without college degrees to apply. General Assembly partners with workforce development-oriented non-profits Per Scholas and Opportunity@Work, among others, to focus on students with nontraditional backgrounds in tech and design. Bootcamps like Fullstack Academy’s Grace Hopper Program and Ada Developers Academy focus on shrinking the gender gap in tech.

28. Before being acquired by WeWork, Flatiron School had only its New York City location. Since the acquisition in October 2017, the bootcamp has expanded to 10 sites, predominantly in WeWork spaces. Galvanize has also joined the coworking space and bootcamp models. This light-footprint

strategy came through in several interviews, as shown in the following statements from bootcamp CEOs:

“We never wanted to make a real estate play. We wanted to move quickly. Partnering with coworking spaces has been our main play, and we have no interest in building out a space.” Betsy Hauser Idilbi, cofounder and CEO of Tech Talent South, interview by Richard Price, July 27, 2018.

“Real estate is really expensive. There are two types of winners in the market, those that find a way around those problems, and those that grow organically in a very central, local place.” Darrell Silver interview.

29. One bootcamp CEO described having a data science course up and running roughly four months after deciding to offer it: “We are still working on the second half of the program while teaching the first half. We never stop working on these programs.” John Wark, founder and president of Nashville Software School, interview by Richard Price, July 10, 2018.

30. The rapid pace at which bootcamps can respond to employer needs is facilitated by their lack of accreditation. A recent description of one bootcamp illustrated how its business model would be hampered by traditional college accreditation: “And General Assembly needs to be able to create these programs rapidly to foster and maintain positive relationships with employers—so that their students will have access to good jobs—by keeping up with their evolving demands. Having to work with an accreditor every time it wanted to create a new, innovative program that deviated from its prior educational models, with a risk that the accreditor might not approve the program, would create delays—which would, arguably, be unacceptable for General Assembly’s model.” Alana Dunagan, “Coloring outside the lines: Why innovation in higher ed is happening beyond traditional schools,” Christensen Institute, June 28, 2018, <https://www.christenseninstitute.org/blog/coloring-outside-the-lines/>.

31. Course Report found a 111% increase in corporate training offerings. Liz Eggleston, “2018 Market Size Study.”

32. Comparing salaries on Glassdoor for a smattering of bootcamps and traditional institutions revealed salaries within striking distance of each other. For bootcamps, we looked at salaries for the title “Instructor,” although “Lead Instructors” earned more. For traditional institutions, we filtered for the title “Assistant Professor.” Granted, this small sample

is hardly robust, but is just meant as an overview of annual salaries: Galvanize: \$81,000; Flatiron School: \$72,500; General Assembly: \$90,000; Pennsylvania State University: \$82,234; University of Utah: \$97,032; and Cuyahoga Community College: \$55,000-\$89,000. Glassdoor, <https://www.glassdoor.com/index.htm>, accessed March 4, 2019.

33. Institutions that are partnering with bootcamps may find that, rather than insuring themselves against their own disruption, they are in fact complicit in it. These arrangements have parallels to the relationship between Dell and Asus, whereby Dell outsourced production of more and more components to Asus, until one day Asus was able to compete head to head with Dell. See Clayton M. Christensen, James Allworth, and Karen Dillon, *How Will You Measure Your Life?* (New York: Harper Business, 2012), p.120

34. We first profiled Level in our 2017 paper, *College Transformed*. See Alana Dunagan, “College Transformed.”

35. National Center for Education Statistics, “Table 311.15. Number and percentage of students enrolled in degree-granting postsecondary institutions, by distance education participation, location of student, level of enrollment, and control and level of institution: Fall 2015 and fall 2016,” U.S. Department of Education, *Digest of Education Statistics: 2017*, [https://nces.ed.gov/programs/digest/d17/tables/dt17\\_311.15.asp?current=yes](https://nces.ed.gov/programs/digest/d17/tables/dt17_311.15.asp?current=yes) (accessed February 3, 2019).

36. For example, Bloc primarily leverages online learning for live individual mentoring sessions and some live teaching. Most of the learning material is presented asynchronously. Some, like Epicodus, post their lessons online for students to study as homework, reserving in-person time during the day to put the lessons into practice. On the other hand, Thinkful offers live, synchronous lectures at a distance, and even facilitates live remote group work. They have added in-person meetups to supplement the training.

37. The RTI International study’s authors reported that half of the intensive bootcamp programs they found in the U.S. were located in just 10 metropolitan areas, accounting for just 29% of computer and mathematical jobs in the United States, “suggesting that many students who could benefit from technology-related workforce training do not have access to a comprehensive career preparation program. A study of Georgia Tech’s online computer science master’s program suggested that program location

could be a significant barrier; Goodman, Melkers, and Pallais (2017) found that the increased flexibility of an online program for mid-career students was key to their enrollment in any additional education.” Arbeit, Bentz, Cataldi, and Sanders, p.21.

38. Arbeit, Bentz, Cataldi, and Sanders, p.10.

39. In our own internally-generated database, we found a number of bootcamps have added online offerings since 2017, or have transitioned entirely online. While this database is not as comprehensive as the RTI study, we estimate that close to one-third of bootcamps now have online options. Further, Trilogy Education Services, which offers its in-person bootcamp curriculum through over 40 university partners, recently acquired the Firehose Project so as to start offering online programs in 2019 as well.

40. GitHub is arguably the industry standard for platforms that track the progress of coding projects, allowing users to specify their contributions to group efforts and allowing employers to take a peek under the hood, so to speak. Assessing code at a more granular level allows employers to judge skill level and ask the candidate to explain design decisions. One industry professional who has hired bootcamp graduates described the importance of visibility into a candidate’s code as follows: “Resumes all look the same, no matter where they come from. Front-end [development] is all the same on paper. When you look at their code and talk to them about their actual experience, it makes a big difference.” Dustin Beltramo, director of customer experience design at Cisco, interview by Richard Price, December 5, 2018.

41. According to Clayton Christensen, pursuing a disruptive strategy still only led 37% of market entrants to establish a successful growth company, up from 6% of entrants that chose a sustaining strategy. See Christensen, *Innovator’s Dilemma*, p.146

42. Joseph B. Fuller and Manjari Raman, “Dismissed by Degrees: How Degree Inflation Is Undermining U.S. Competitiveness and Hurting America’s Middle Class,” Accenture, *Grads of Life*, Harvard Business School, October 2017, <https://www.hbs.edu/managing-the-future-of-work/Documents/dismissed-by-degrees.pdf>.

43. Course Report’s most recent data shows bootcamp graduates earning an average salary increase of 50.5%, or \$23,724. See Eggleston, “2018 Coding Bootcamp Alumni Outcomes & Demographics Report.”

44. The cost of college varies significantly by sector. At public institutions, annual tuition averages \$10,230, but soars to \$35,830 at private nonprofits, equating to a four-year cost to degree of roughly \$40,000-\$140,000. Median earnings for all college graduates (not just those right out of school) equate to just over \$60,000. See College Board, “Average Published Undergraduate Charges by Sector and by Carnegie Classification, 2018-19,” *Trends in College Pricing 2018*, October 2018, <https://trends.collegeboard.org/college-pricing/figures-tables/average-published-undergraduate-charges-sector-2018-19>, accessed February 8, 2019. For wage information, see Bureau of Labor Statistics, “Unemployment rates and earnings by educational attainment,” *Employment Projections*, March 2018, <https://www.bls.gov/emp/chart-unemployment-earnings-education.htm>, accessed February 8, 2019.
45. Southwest Airlines provides a compelling example of innovating just outside the purview of regulatory bodies, initially operating only within the state of Texas and therefore not being subject to federal regulation of interstate travel. See Michele R. Pistone and Michael B. Horn, “Disrupting Law School,” Clayton Christensen Institute, March 2016, <https://www.christenseninstitute.org/publications/disrupting-law-school/>.
46. See Doug Lederman, “Crackdown on Coding Academies,” *Inside Higher Ed*, February 3, 2014. <https://www.insidehighered.com/news/2014/02/03/california-agency-scrutinizes-newfangled-providers-tech-training>.
47. There is some innovation in certain quarters of the bootcamp market trying to serve low-income students despite the lack of federal subsidy, but this minority of cases has struggled to scale. See Weise, Hanson, Salisbury, and Qu.
48. Ada Developers Academy is a notable example of leveraging employer subsidies to sidestep this issue, charging zero tuition to its students and passing the cost of instruction onto employer partners.
49. A number of bootcamp founders have expressed reservations about the cumbersome bureaucracy inherent to the accreditation process, which were shared in our interviews.
- “In the beginning, I thought we would strive for mainstream accreditation, until I actually looked into it and the requirements...the hoops we would need to jump through would break the school.” Austen Allred, CEO of Lambda School, interview by Richard Price, November 19, 2018.
- “If the system stays the way it is today, where we’d have to get accredited, I don’t see it as something we’d pursue in the short to midterm. The overhead costs associated with the accreditation system are pretty steep.” John Wark interview.
50. Alana Dunagan, “Federal financial aid could kill alternative credentials—Here’s why,” Clayton Christensen Institute, May 14, 2018, <https://www.christenseninstitute.org/blog/federal-financial-aid-kill-alternative-credentials/>.
51. Michael B. Horn and Alana Dunagan, “Change the Rules to Unleash Innovation,” *EdNext*, Fall 2018, Vol. 18, No. 4, <https://www.educationnext.org/change-rules-unleash-innovation-forum-rethinking-rules-federal-higher-ed-spending/>.
52. Estimates on the size of the workplace training industry vary. *Training Industry* estimates that companies spent over \$160 billion on training in the US in 2017. Approximately one-fifth of that spend was on employee courses and courseware, and another 12% was for tuition reimbursement. See *Training Industry*, “Size of the Training Industry,” April 20, 2017, <https://trainingindustry.com/wiki/outsourcing/size-of-training-industry/>. *Training* magazine estimates a number closer to \$90 billion total U.S. training expenditures. See *Training*, “2017 Training Industry Report,” November/December 2017, <https://trainingmag.com/trgmag-article/2017-training-industry-report/>. Josh Bersin estimates \$130 billion. See Josh Bersin, “Watch Out, Corporate Learning: Here Comes Disruption,” *Forbes*, March 28, 2017, <https://www.forbes.com/sites/joshbersin/2017/03/28/watch-out-corporate-learning-here-comes-disruption/#24eec5a5dc59>.
53. A handful of institutions offering traditional degrees are also pushing forward efforts to build out offerings that do address workplace learning. These include Southern New Hampshire University (SNHU) and Western Governors University (WGU)—both of which have built disruptive models. For more, see our profiles of SNHU and WGU in Alana Dunagan, “College Transformed.” See also Alana Dunagan, “Aligning the business model of college with student needs: how WGU is disrupting higher education,” Clayton Christensen Institute, September 2018, <https://www.christenseninstitute.org/publications/wgu/>.

54. While the enterprise/corporate training market has been the biggest draw, bootcamps are also looking at ways to upskill their own alumni. “We’ve got some [graduates] that have been in their positions for three years, and may want to become engineering leads...How do you help them take the leap as they progress upwards in an organization? We’re creating a program around that now.” Nicole Buchanan, former executive director of Ada Developers Academy, interview by Richard Price and Alana Dunagan, July 12, 2018.

55. About half of General Assembly’s business is now in corporate training. As General Assembly investor and Maveron partner Jason Stoffer writes, “But it turns out it’s not that hard to hang a shingle and launch a ‘coding class.’ GA’s programs were higher quality but local competitors just kept nipping at our heels and driving up the cost of customer acquisition. It turned out there were no moats at all in the coding school market—that made driving significant sustainable economic profit in the coding boot camp market difficult...When General Assembly started focusing on selling next-gen skills training to enterprises, it was clear none of its smaller competitors could compete with General Assembly’s brand and global footprint across N America, Asia and Europe. Big corporate clients like L’Oreal and Booz Allen wanted GA, as the market leader, to train their employees. So, ironically, the consumer business turned out to be hard economically and competitively intensive, but opened the door to build an incredibly lucrative and defensible enterprise business.” Jason Stoffer, “How I’d Approach General Assembly Again as a VC: 9 Key Lessons,” *Medium*, April 18, 2018, <https://medium.com/@jstoffer/how-id-approach-general-assembly-again-as-a-vc-9-key-lessons-2f07ff901db0>.

56. There are 24 bootcamps in the employer training space. See Liz Eggleston, “2018 Market Size Study.” Further, in describing the rationale for merging with Galvanize, Shawn Drost, cofounder of Hack Reactor explained, “We saw a lot of potential growth strategies on [Galvanize’s] end, and that Galvanize was very oriented toward and successful at corporate training...Our combined company is focused on growth through corporate training.” Shawn Drost, interview by Richard Price, September 25, 2018.

Austen Allred from Lambda School also sees the potential in the employer training market: “Everyone in the space is moving to enterprise...Long term, I view Lambda School as an economic clearinghouse, where we create a customized talent pipeline for employers.” Austen Allred, interview by Richard Price, November 19, 2018.

57. L’Oreal press release, “L’Oreal signs partnership agreement with digital training specialist General Assembly Group,” October 20, 2015, <https://www.loreal.com/media/press-releases/2015/oct/loreal-signs-partnership-agreement-with-digital-training-specialist-general-assembly>.

58. A particularly instructive example is the disruption of integrated steel mills by minimills, which melted scrap steel in electric arc furnaces that required far less power than the blast furnaces used by integrated mills. Minimill technology was more geographically flexible, which facilitated employing cheaper labor. The design was also less labor-intensive, requiring a quarter of the man-hours. Minimills were dramatically cheaper to build and could easily be idled if demand slackened. All of this added up to a huge cost advantage for minimills. Initially restricted to the most rudimentary steel products in the 1960s, minimills were motivated to move upmarket by tantalizing profit margins in more sophisticated product markets. By the late 1970s, they moved up from rebar to angle iron. In the late 1980s, they moved into a higher yet market tier, with integrated steel mills abandoning each market in turn. By the mid-1990s, minimills were producing sheet steel, the most challenging to produce, and have dominated the steel market ever since. As Clayton Christensen observed, “Although you could never have predicted what the technical solution would be, you *could* predict with perfect certainty that the minimills were powerfully motivated to figure it out.” See Clayton M Christensen and Michael E. Raynor, *The Innovator’s Solution: Creating and Sustaining Successful Growth* (Boston: Harvard Business Review Press, 2013), p.38

59. Robert Ackerman, “Too few cybersecurity professionals is a gigantic problem for 2019,” *Tech Crunch*, January 27, 2019, <https://techcrunch.com/2019/01/27/too-few-cybersecurity-professionals-is-a-gigantic-problem-for-2019/>.

60. Matthew Rascoff, “Bootcamps Go To College,” *The EvoLLLution*, June 6, 2018, [https://evollution.com/revenue-streams/workforce\\_development/bootcamps-go-to-college/](https://evollution.com/revenue-streams/workforce_development/bootcamps-go-to-college/).

61. See Alana Dunagan, “College Transformed.”

62. The story of IBM—and of DEC, a competitor of IBM’s that at various times tried to build a personal computer business within its existing mainframe business—is profiled in Chapter 5 of *The Innovator’s Dilemma*. See Christensen, *The Innovator’s Dilemma*, p. 127.



## About the Christensen Institute

The Clayton Christensen Institute for Disruptive Innovation is a nonprofit, nonpartisan think tank dedicated to improving the world through Disruptive Innovation. Founded on the theories of Harvard professor Clayton M. Christensen, the Institute offers a unique framework for understanding many of society's most pressing problems. Its mission is ambitious but clear: work to shape and elevate the conversation surrounding these issues through rigorous research and public outreach.

## About the authors



Richard Price is a research associate at the Christensen Institute where he focuses primarily on researching how new and innovative models can reshape higher education. Richard's work delves into some of the most pressing topics in higher education today, including policy initiatives, alternative financing mechanisms, and innovative business models.



Alana Dunagan leads the Institute's higher education research and works to find solutions for a more affordable system that better serves both students and employers. In this role, Alana analyzes disruptive forces changing the higher education landscape. Her research includes studying business model innovations, public policies, and investment strategies that can give rise to new and sustainable postsecondary models.

