Open Source Micro Diplomas: New Credentials for New Learning

Jack F. Powers
The Graduate Center, City University of New York

Recommended Citation
http://academicworks.cuny.edu gc_etds/2001

This Thesis is brought to you by CUNY Academic Works. It has been accepted for inclusion in All Graduate Works by Year: Dissertations, Theses, and Capstone Projects by an authorized administrator of CUNY Academic Works. For more information, please contact deposit@gc.cuny.edu.
OPEN SOURCE MICRO DIPLOMAS:
NEW CREDENTIALS FOR NEW LEARNING

by

FRANK JACK POWERS

A master’s thesis submitted to the Graduate Faculty in Liberal Studies in partial fulfillment of
the requirements for the degree of Master of Arts, The City University of New York

2017
Open Source Micro Diplomas:
New Credentials for New Learning

by

Frank Jack Powers

This manuscript has been read and accepted for the Graduate
Faculty in Liberal Studies in satisfaction of the thesis requirement
for the degree of Master of Arts.

____________________________________________________________
Date                                                Elizabeth Macaulay-Lewis
                                                    Advisor

____________________________________________________________
Date                                                Elizabeth Macaulay-Lewis
                                                    Acting Executive Officer

THE CITY UNIVERSITY OF NEW YORK
ABSTRACT

Open Source Micro Diplomas: New Credentials for New Learning

By

Frank Jack Powers

Advisor: Elizabeth Macaulay-Lewis

The standard model for college in America—a four-year bachelor’s degree that teaches critical thinking, analytic reasoning, and written communication skills—is unaffordable and unattainable for most Americans. Only about a third of citizens aged 25 and up have achieved a baccalaureate degree or better. Two-thirds are left behind in precarious jobs that pay substantially less and that are losing ground. Everyone from politicians to parents repeats the mantra of “college for all”, but the reality is more like “college for the socio-economically gifted.”

At the same time, the modern world of work is evolving into a more complex, technical, and computerized environment that requires specific practical skills more than it needs the traditional white collar college virtues. Society and the market have responded by creating a parallel education system of competency-based skills certifications in almost every industry area. Some 1,800 private, public and government institutions have create more than 3,900 industry certifications that are focused on career paths and technology skills that the economy needs. Over 46 million people have achieved these “Open Source Micro Diplomas” instead of, in addition to, or in spite of a conventional higher ed degree. This paper examines our education outcomes’, the evolving future of work, and exemplary industry certification programs to analyze today’s career-oriented education for all socio-economic classes.
# Table of Contents

Introduction:
Revolutions in teaching and learning, working and earning 1
  Teaching and learning 1
  Working and earning 3
  Open Source micro diplomas 6

Chapter 1:
America’s investments in education 8

Chapter 2
The standard model for college in America 10
  Academic content and career paths 11
  Collegiate learning assessments 13
  Unequal access and structural inequities 14

Chapter 3
The evolution of the workforce 17
  “College for all” vs. underemployed graduates 19
  Economic stagnation, the gig economy and algorithmic management 23
  Technology, application and globalization 26

Chapter 4
The Certification Landscape 28
  Certificates, certifications, licenses and competency-based education 28
  Case Study: AHELI Hotel Industry Career Certifications 32
  Case Study: Project Management Professional Certification 34
  Case Study: CompTIA IT Certifications 35
  Case Study: Microsoft product certifications 36
  Case Study: Stack Overflow social media recommendations 37
  Case Study: Open Badges 39

Chapter 5
Criteria and conclusions 40
  Judging Open Source Micro Diplomas 40
  Conclusions 43

Bibliography 49
List of Tables

Table 1
Employment by educational requirement, 2012 and projected 2022 (employment in thousands) 5

Table 2
Educational Attainment of the Population 25 Years and Over, by Race: 2015 11

Table 3
Certifications and issuing organizations listed by North American Industry Classification System (NAICS) industry code 31
List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Non-college workers have lost economic ground.</td>
<td>10</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Distribution by family income quartile of dependent family members age 18 to 24 who attained a bachelor’s degree by age 24: 1967 to 2014</td>
<td>15</td>
</tr>
<tr>
<td>Figure 3</td>
<td>New York City ninth graders rarely make it to college.</td>
<td>16</td>
</tr>
<tr>
<td>Figure 4</td>
<td>Lifetime learning trajectory by educational attainment (2009 dollars)</td>
<td>20</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Hospitality Certification Career Paths</td>
<td>33</td>
</tr>
<tr>
<td>Figure 7</td>
<td>IT certification roadmap of third party certifications for various career paths in information and communication technology.</td>
<td>36</td>
</tr>
</tbody>
</table>
Introduction: Revolutions in teaching and learning, working and earning

Historic developments in education, technology, social organization and the global economy are bringing about new ways of thinking about the world of work and generating new approaches to preparing young people for useful, productive and happy careers. In almost every field, traditional expectations about knowledge, labor, capital and the future of employment are being challenged.

Teaching and learning

In the Spring of 1999, the National Research Council’s Commission on Behavioral and Social Science and Education published a landmark study of the latest and best thinking on the science of teaching and learning, How People Learn: Brain, Mind, Experience and School drew on theoretical and empirical work in cognitive psychology, neuroscience, developmental psychology, and other fields to create a comprehensive catalog of theories and techniques for teachers and schools. The much-cited work by the country’s top education researchers brought new evidence-based rigor to the often subjective pedagogy experienced educators and sparked widespread discussion, debate and innovation with educators around the country.

The main focus of How People Learn is the individual student who comes to the classroom with preconceived notions about the world, and these notions that have to be engaged and corrected. Each student must be given both factual knowledge that must be memorized as well as conceptual frameworks that put all the facts into useful contexts. Importantly, individual ideally should become active learners, using a “metacognitive” (thinking about thinking) approach to define their learning goals and monitor their progress. The primary challenge to schools is not to transfer data into empty heads but to actively organize meaningful patterns of information into knowledge that students can modify, share and build upon.
In the last decades, a constant stream of education innovation has followed *How People Learn*, affecting teachers, curriculum writers, school administrators and policymakers at every level. K-12 school reformers have latched onto science-like assessments to usher in an age of constant testing and evaluation—not just of students but of teachers and schools, as well. The impetus for student-centered, culturally-sensitive curricula has launched new majors and area studies programs, squeezing out topics judged archaic or obsolete. And the perennial political pressure to improve educational outcomes has acquired a superstructure of metrics, frameworks and a Common Core.

New “edtech” technologies for managing coursework, delivering customized multimedia content, and producing online classes have flourished, in part by promising to lower the cost of schooling. In K-12, 69% of U.S. school districts offer the option of taking courses online. Most schools blend online learning with live instruction, although 41% deliver courses fully online. More than half of all school districts administer assessments and final tests electronically. At the college level, 27% of students take at least one class online, and about half take all of their classes digitally.

Education technologies—especially online courses—erode the connections between teachers and their students. Most online classes have no face-to-face interaction, substituting recorded lectures, text messaging, email, and sometimes video chat for live presence. Truly, online students are forced to become active learners, organizing their lessons, monitoring their progress and planning their own curriculum.

Simultaneous with the rise of edtech is the proliferation of for-profit schools that compete with traditional public and private non-profit colleges and universities. Unlike full-scale institutions of higher education, many for-profits focus on a small or specialized subset of subjects, and many adopt open admissions policies that do away with basic entry requirements, SAT and ACT scores, secondary school transcripts, recommendations or personal essays. For-profits attract about 9% of college enrollees, usually students who are older or come from
disadvantaged or minority populations. Students at pay-to-play for-profit schools enter less prepared for higher education, incur larger student loan debt and make less money after graduation than their peers at public institutions, but for many it is the last chance for a path to a white collar future.

College is worth more than ever, but it costs more than ever, and the price grows each year at double the rate of inflation:

The average net price of attendance for first-time, full-time students in 2013–14 was $12,750 at 4-year public institutions, $24,690 at 4-year private nonprofits, and $21,000 at 4-year private for-profit institutions.

### Rising Earnings Disparity Between Young Adults with And Without a College Degree

*Median annual earnings among full-time workers ages 25 to 32, in 2012 dollars*

<table>
<thead>
<tr>
<th>1965 (Silents)</th>
<th>1979 (Early Boomers)</th>
<th>1986 (Late Boomers)</th>
<th>1995 (Gen Xers)</th>
<th>2013 (Millenials)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor’s degree or more</td>
<td>$38,833</td>
<td>$33,655</td>
<td>$32,173</td>
<td>$40,000</td>
</tr>
<tr>
<td>Two-year degree/ Some college</td>
<td>$41,999</td>
<td>$36,496</td>
<td>$34,595</td>
<td>$45,000</td>
</tr>
<tr>
<td>High school graduate</td>
<td>$44,770</td>
<td>$32,299</td>
<td>$30,525</td>
<td>$43,663</td>
</tr>
</tbody>
</table>

Notes: Median annual earnings are based on earnings and work status during the calendar year prior to interview and limited to 25- to 32-year-olds who worked full time during the previous calendar year and reported positive earnings. “Full time” refers to those who usually worked at least 35 hours a week last year.


**Pew Research Center**

Figure 1. Non-college workers have lost economic ground. Source: Pew Research Center

**Working and earning**

As blue collar jobs in fields like manufacturing, construction, public services and manual labor have declined, the salary premium of a four-year college degree has grown over the last fifty years. Workers with only a high school diploma or a two-year degree have lost ground while graduates with a bachelor’s degree or higher have seen their earnings soar (Figure 1).
Over a lifetime of earning, a BA is worth almost a million dollars more than a high school diploma, in addition to greater employee benefits like medical coverage and paid vacation time, the less physically taxing environment of the modern office, and the enhanced social status of a white collar career.

It’s no wonder the percentage of adults over 25 years old with a four-year degree has more than tripled in the last 50 years, from 9.4% in 1965 to 32.5% in 2015. On the other side of the ledger, it’s easy to see why millions of young people strive mightily along the path to college, cramming with SAT tutors, rounding out resumes with attractive extra-curricular activities, vetting recommendation letters, crafting the perfect personal statement, and incurring life-long debt. Yet with all the effort, 45% of first-time college students drop out without a degree within six years of freshman orientation.

The U.S. economy has been good to college graduates with strong cognitive abilities. Through the 1970s, 1980s and 1990s, rapid developments in information and communications technologies, the increasing dominance of white collar service jobs over blue collar manufacturing positions, and the effects of globalization drove increases in high-paying job opportunities for young people with bachelor’s degrees.

In its most recent estimates of employment trends to 2022, the Bureau of Labor Statistics projected strong gains for advanced degrees but also gains for sub-baccalaureate education levels. High school graduates fared worst of all, even coming in below the growth projections for workers with less than high school educations (Table 1).

Below the bachelor’s degree are three post-secondary categories: associate’s degrees, post-secondary non-degree awards, and “some college, no degree”. Together they account for 2.6 million new jobs in the projected timeframe versus 3.1 million bachelor’s positions.

Associate’s degrees are provided by higher education institutions, often community colleges, and are generally designated as academic or occupational. The academic or Associate of the Arts (AA) is usually a prelude to a full four-year bachelor’s program. The occupational or
Associate of Applied Science (AAS) is often a terminal degree in preparation for a specific career. Presumably the employment projections consider AAS graduates. Post-secondary non-degree awards are one- and two-year career-oriented certificate programs also provided by institutions of higher education, often in the for-profit sector. “Some college, no degree” refers to young people who started but never completed a college degree but perhaps have attained one or more educational certificates.

Jobs at all education levels beyond the high school diploma are expected to grow through 2022, but jobs at the associate’s degree and post secondary non-degree levels will outpace bachelor’s degree jobs. Clearly, a high school diploma is not enough, but the millions of workers below the bachelor’s levels are studying for careers that require specialized technical, administrative or managerial skills.

In our increasingly complex economy, even higher level graduates need those skills, and millions of BAs, MAs and PhDs are adding post-baccalaureate certifications to their curricula vitae. In some cases, these are similar to the educational certificates described above, in other cases they are professional certifications provided by industry associations, employers, or government agencies. (Governments issue certifications as licenses, for example, pilot’s license, teaching license or medical license.) Over 32% of full-time employed adults, almost 30 million people, hold either a professional certification, a license or an educational certificate. 

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctoral or professional degree</td>
<td>4,002.4</td>
<td>4,640.8</td>
<td>638.4</td>
</tr>
<tr>
<td>Master’s degree</td>
<td>2,432.2</td>
<td>2,880.7</td>
<td>448.5</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>26,033.0</td>
<td>29,176.7</td>
<td>3,143.6</td>
</tr>
<tr>
<td>Associate’s degree</td>
<td>5,954.9</td>
<td>7,009.9</td>
<td>1,054.0</td>
</tr>
<tr>
<td>Postsecondary non-degree award</td>
<td>8,554.2</td>
<td>9,891.2</td>
<td>1,337.1</td>
</tr>
<tr>
<td>Some college, no degree</td>
<td>1,987.2</td>
<td>2,212.2</td>
<td>225.0</td>
</tr>
<tr>
<td>High school diploma or equivalent</td>
<td>58,264.4</td>
<td>62,895.2</td>
<td>4,630.8</td>
</tr>
<tr>
<td>Less than high school</td>
<td>38,127.6</td>
<td>42,286.0</td>
<td>4,158.4</td>
</tr>
</tbody>
</table>

Source: U.S. Bureau of Labor Statistics
Open Source micro diplomas

While educational certificates are awarded by institutions of higher education under traditional standards of accreditation, curriculum development and college governance, professional certifications have a less formal pedigree and are customized to their particular industries or sub-disciplines. The term “Open Source micro diploma” fits the broad category and links it to larger trends in education, technology, commerce and society.

In 1998, computer industry experts launched the Open Source Initiative (OSI), a volunteer organization to formalize the concept of open-source software, computer programs whose source code is available for anyone to inspect, modify, and enhance. Unlike proprietary software written, maintained and controlled by vendors, programs released with an OSI-approved license may be read, copied, extended, customized, and redistributed at no cost, as long as all subsequent versions are similarly licensed. Open Source has led to an explosion of development since every programmer is a potential collaborator, bug-fixer and distributor. Most of today’s Internet runs on Open Source products like the Linux operating system, the Apache web server, Firefox web browser, the C, Perl, PHP and Python computer languages, the MySQL database and the Moodle learning management system. Anyone can create an Open Source program and anyone else can build upon it.

In the two decades since OSI’s founding, many other disciplines have adopted and adapted “the Open Source way” as described on the organization’s web site:

“Open exchange”—We can learn more from each other when information is open. A free exchange of ideas is critical to creating an environment where people are allowed to learn and use existing information toward creating new ideas.

“Participation”—When we are free to collaborate, we create. We can solve problems that no one person may be able to solve on their own.

“Rapid prototyping”—Rapid prototypes can lead to rapid failures, but that leads to better solutions found faster. When you’re free to experiment, you can look at problems in new ways and look for answers in new places. You can learn by doing.
“Meritocracy” — In a meritocracy, the best ideas win. In a meritocracy, everyone has access to the same information. Successful work determines which projects rise and gather effort from the community.

“Community” — Communities are formed around a common purpose. They bring together diverse ideas and share work. Together, a global community can create beyond the capabilities of any one individual. It multiplies effort and shares the work. Together, we can do more.¹²

In the context of educational credentials, Open Source refers to certifications created and awarded by any issuing authority, not just accredited educational institutions. They should be constructed under transparent procedures and managed and updated in collaboration with stakeholders.

Micro Diploma: Unlike a two-year or four-year degree, targeted credentials focus on a specialized skill, technology, or process. “Just in time” learning happens on-the-job, in face-to-face tutorials, seminars and workshops as well as e-learning pathways like online classes, context-sensitive help systems, video tutorials and adaptive leaning systems. We use the term diploma for the documentation that a learner has acquired a certain set of skills and experiences. Diplomas can be awarded for time served or for competency proven or for a portfolio displayed. (Open Source Micro Diplomas are described more fully in Chapter 4.)
Chapter 1: America’s investments in education

For most of the last century, the United States has focused titanic resources on public education to prepare young Americans for productive and happy lives. For the most part, the process is decentralized and managed mainly at the local level with guidance and control from state and federal authorities. While the U.S. Department of Education spends over $46.5 billion per year the states spend $279 billion and local municipalities $636 billion. Following the money, cities and counties operate K-12 school districts overseen by state departments of education, states run public higher education institutions, and they regulate post-secondary institutions and private independent colleges. The federal agency measures, monitors and advises from the top.

The country’s education policy often follows cycles of boom and bust and contentious re-evaluations. At the beginning of the Twentieth Century, with immigration at historical peaks, policymakers pursued concepts of progressive education, citizenship building and universal access, expanding the student population as the country evolved from an agricultural to an industrial economy.

After World War II, the GI Bill, formally the Servicemen’s Readjustment Act of 1944, expanded higher education—colleges and vocational schools—for millions of returning soldiers, and the GI Bill continues in updated form to serve millions more today. In the 1960s, concern about Soviet competition in science and technology spurred major investments in K-12 programs, and President Lyndon Johnson’s Elementary and Secondary Education Act of 1965 (ESEA), part of the War on Poverty, greatly expanded federal funding for primary and secondary schools. ESEA’s 21st Century incarnations, the No Child Left Behind Act (NCLB) of the George W. Bush administration and the Race to the Top (RTTP) and Every Student Succeeds
Act (ESSA) of the Barack Obama administration, aimed to reform public education from above by focusing on high standards, strict accountability and teacher performance evaluations.

According to the National Center for Education Statistics, some 129,000 primary and secondary schools (about 30,000 privately run, 68% of which are faith-based) enroll almost 50 million K-12 students who graduate to 22 million slots at 4,700 post-secondary degree-granting colleges and universities. From kindergarten through to graduate school, we spend more than $1.1 trillion each year preparing young people for adulthood, but few would declare that the money is well spent or that the nation’s educational effort has been successful.

Only about 34% of America’s learners complete a four-year bachelor’s or a more advanced college degree (Table 2). About 40% quit with just a high school education, and the rest get by with two-year community college diplomas, certificates or with the catchall phrase for dropouts, “some college.” As the effects of technology and globalization transform the economy, only about half of young workers find jobs that match their level of education. All the while, college costs and college loan debt are skyrocketing.
Chapter 2: The standard model for college in America

The aspirational endgame of our multi-billion dollar educational effort is “college for all.” The prevailing notion declares that, as society becomes more complex and as jobs require higher levels of abstract thinking and analytical skills, a four-year college degree is necessary for a productive career, essential for students and important to a national economy that competes for talented workers around the world. Politicians, parents, celebrities, athletes and community leaders harangue young people toward a baccalaureate degree. Government agencies and popular publications calculate the lifetime salary premiums earned by college graduates, and a secondary market of tutors, prep material suppliers and college guides stokes the expectation that a four-year degree is indispensable. But for all of that effort, only about one in five Americans over 25 years of age has actually attained a bachelor’s diploma. (Another one in ten goes on to an advanced degree.)

Picture a cohort of 100 ninth-graders about to start their high school this September in New York City. Fresh-faced fourteen year olds jammed into an incoming freshman assembly in the high school gym, they are looking ahead to new academic challenges, to a new social environment, to sports teams, driving classes and the trek to their first important educational credential, their high school diploma. Beyond that lies college, and beyond that, a career.

But 30 out of our 100 teenagers will drop out of high school before graduation; maybe 4 will bounce back to eventually get a General Equivalency Diploma or GED. If all 70 high school graduates move on to college, 15 of them on average will get a two-year community college degree and 25 out of our 100 ninth-graders will eventually attain a four-year bachelor’s degree. The rest will end up with some college, no degree and perhaps a certificate in a technical field. The statistics for black and Hispanic teenagers are substantially worse.
The number who start a college career and drop out before completion is 43%. In the last 20 years, the cost of a college education has boomed at twice the rate of inflation, putting it outside most families’ ability to pay, and generating over a trillion dollars of student loan debt.

How can the gap between the near-universal aspiration of college for all and the meager reality of its attainment be explained? What happens to the millions of young people who fail to land a four-year degree and a path to a successful career despite years of effort and oceans of debt? Can the 143 million Americans without college degrees pursue fulfilling careers and productive lives outside the standard model?

### Academic content and career paths

Across all types of colleges—public, private, non-profit and for-profit—about 28% of full-time students drop out each year. The research firm Public Agenda surveyed more than 600 young adults in and out of college about their experiences at two- and four-year schools.¹⁷ For the drop outs, financial pressures were the primary reasons given for leaving school. Costs are

<table>
<thead>
<tr>
<th>Education Level</th>
<th>All races</th>
<th>Black</th>
<th>Hispanic</th>
<th>Asian</th>
</tr>
</thead>
<tbody>
<tr>
<td>11th grade or less</td>
<td>24,582,000</td>
<td>24%</td>
<td>3,297,000</td>
<td>33%</td>
</tr>
<tr>
<td>High school grad</td>
<td>62,575,000</td>
<td>29%</td>
<td>8,678,000</td>
<td>34%</td>
</tr>
<tr>
<td>Some college</td>
<td>35,164,000</td>
<td>17%</td>
<td>5,200,000</td>
<td>20%</td>
</tr>
<tr>
<td>Associate’s, occup</td>
<td>9,164,000</td>
<td>4%</td>
<td>1,123,000</td>
<td>4%</td>
</tr>
<tr>
<td>Associate’s, acad</td>
<td>11,703,000</td>
<td>6%</td>
<td>1,409,000</td>
<td>6%</td>
</tr>
<tr>
<td>Baccalaureate</td>
<td>43,500,000</td>
<td>21%</td>
<td>3,636,000</td>
<td>14%</td>
</tr>
<tr>
<td>Master's degree</td>
<td>18,471,000</td>
<td>9%</td>
<td>1,669,000</td>
<td>7%</td>
</tr>
<tr>
<td>Prof'l degree</td>
<td>3,365,000</td>
<td>2%</td>
<td>197,000</td>
<td>1%</td>
</tr>
<tr>
<td>Doctoral degree</td>
<td>3,609,000</td>
<td>2%</td>
<td>211,000</td>
<td>1%</td>
</tr>
<tr>
<td>Totals</td>
<td>212,133,000</td>
<td>25,420,000</td>
<td>31,020,000</td>
<td>12,329,000</td>
</tr>
</tbody>
</table>

high, and most students work to pay their own way. But other reasons include: “Classes were too difficult,” “I didn’t like sitting in class,” “classes were boring,” and “I had to take too many classes that I did not think were useful.” The study noted that, “Among students who don’t graduate, the college selection process is far more limited and often seems happenstance and uninformed.” For a wide variety of reasons, college life does not suit all students.

All baccalaureate degrees are not created equal. Not all students approach a four-year degree in the same way and with the same advantages in cognitive ability, social capital or financial resources. The standard model for a college student posits a recent high school graduate, living on campus or at home with parents, who spends as much time in extracurricular activities – sports, clubs, dating and so on – as in class pursuing a major. In the standard model, the four baccalaureate years are spent in discovery, socialization and career exploration and in acquiring skills in critical thinking, analysis and communications.

For many bachelor’s students, lack of focus in the early years of college leads to a program of study with no firm purpose or goals. A student who does not see the point of a curriculum – beyond the must-have ticket to employment – is often not emotionally or vocationally invested in the end result. For students in rigorous science, technology, engineering and math programs, the curriculum is full of essential building blocks, not just technical concepts and foundational learning but also analytical approaches, best practices and insights into the cultural aspects of the discipline. Similarly, medicine and the law transmit mountains of content but also provide instruction in ethical behavior, personal responsibility and social norms. In school, in the media and in life, students become familiar with appropriate role models like doctors, lawyers, scientists and inventors. They might even find mentors in nearby teachers, graduate students and post docs in the university setting.

But what about the student who picks a major without clear career goals? Students select majors based on many factors: demographics, parental influence, academic preparation, future views of the academic career, political views, and personality/goals. Different fields of study
have different attitudes, content, assessment expectations and post-college outcomes. How can students, teachers and policymakers measure the gains of a higher education?

**College learning assessments**

Since 2002, the non-profit Council for Aid to Education (CAE) has attempted to quantify higher education learning through the Collegiate Learning Assessment (CLA), a test administered to college students at or near graduation. CLA and its successor CLA+ examine critical thinking, analytic reasoning, problem solving, and written communication skills in a 90 minute online test. Originally designed to “assess the quality of undergraduate education by directly measuring student learning outcomes”, the CLA has been used by administrators as an independent third-party accountability metric that looks beyond an institution’s prestige and reputation, its evolving curriculum, and the creep of grade inflation to measure actual student performance on a set of standard exercises. To some, CLA is a second college diploma untainted by academic tradition, shifting learning standards or marketing hype. A 2013 Wall Street Journal article called it “the Post-College SAT”:

The new voluntary test, which the nonprofit behind it calls CLA +, represents the latest threat to the fraying monopoly that traditional four-year colleges have enjoyed in defining what it means to be well educated. Even as students spend more on tuition—and take on increasing debt to pay for it—they are earning diplomas whose value is harder to calculate. Studies show that grade-point averages, or GPAs, have been rising steadily for decades, but employers feel many new graduates aren’t prepared for the workforce.

In 2011, sociologists Richard Arum and Josipa Roksa used CLA results from tests given at 24 institutions to more than 2,300 undergraduates in their first semester and again at the end of their second year. The researchers found that 45 percent of the rising juniors tested showed no significant improvement after two years of college. Controversy ensued: Why did so many undergrads not improve? Were they unprepared for serious learning? Was it the non-academic
hours spent in sport and parties? Or the emphasis on branding and reputation – individual and institutional -- over hard work? A follow-up study by CAE24 looked at the numbers differently and softened Arum and Roksa’s hard edges, but the tumult about academic integrity, faculty judgment, coddled youth and rising prices continues to this day.

CAE’s work as a non-profit in defining, promulgating and administering thousands of tests of higher education graduates may also pay off big. Through a for-profit subsidiary, Assessments International LLC, CAE has formed CLA+ CareerConnect, an initiative to sell access to CLA diplomates to corporate recruiters. The online brochure poses the problem:

Today’s bachelor’s degree no longer conveys sufficient information about the skills graduating seniors possess. GPAs and SAT scores are no longer reliable measures of post-collegiate success.
In the age of grade inflation, how do hiring managers decide whom to interview in the first place? 25

And touts the CLA+ CareerConnect solution:

Employers are offered the opportunity to recruit the best and brightest students, by providing access to students who have been “pre-screened” through CLA+ to have reliable critical-thinking and written-communication skills.

Prospective employees are rated “Advanced,” “Accomplished” or “Proficient” and will be presented to industry in a virtual career fair through times online chat software. To construct the online system, CAE “has partnered with Brazen Careerist, a leading educational technology firm.”26

Unequal access and structural inequities

Higher education’s function as job preparation has always been coupled with ideals of personal fulfillment, character development, social mobility and good citizenship. For students from disadvantaged backgrounds, crafting a higher education strategy, fitting into the white collar college lifestyle and doing the hard academic work required is doubly difficult. Most urban K-12 school systems are not preparing young people for a rigorous life of the mind. In New York
City, for example, just 37% of high school graduates are considered college ready,\textsuperscript{27} able to enroll in a CUNY community college without the need for academic remediation. The achievement gap is also demonstrated by the percentages of U.S. adults 25 and over who complete their degree: 21 percent of the overall population has a bachelor’s degree versus 14 percent for black and 11 percent for Hispanic cohorts (Table 2).

\begin{figure}
\centering
\includegraphics[width=\textwidth]{diagram.png}
\caption{Distribution by family income quartile of dependent family members age 18 to 24 who attained a bachelor’s degree by age 24: 1967 to 2014}
\label{fig:diagram}
\end{figure}

\textsuperscript{27}Figure reads: of those dependent family members reporting attaining a bachelor’s degree by age 24 in 2014, 54 percent were in the top quartile of family income and 10 percent were in the bottom quartile.

Income inequality has a major correlation in the unequal distribution of baccalaureates. Over half of bachelor’s degree holders come from the richest 25 percent of families; just one in ten come from the lowest income quartile.
Differences in social capital also affect the college selection process. First generation college students do not have access to college graduate mentors and role models, cannot draw on family experience to pick a major or develop a career goal, may not have the administrative skills to puzzle though a university bureaucracy or scholarship application process.\textsuperscript{28}

Inadequate preparation, social and cultural inequality and lack of financial resources dissuade disadvantaged segments of the population from access to the ladder of educational attainment. Most poignantly, even students who get on track for college often get derailed. Among low-income college-intending high school graduates who have been accepted into a college program, as many as 40% fail to enroll and fail start freshman year, disappearing over the summer in a process so common it has a name, “summer melt”\textsuperscript{29}.
Chapter 3: The evolution of the workforce

In the standard model for college, graduating with a B.A. leads to full-time employment at a job where critical thinking, problem solving and good communications skills translate into a steady, well-paid career lasting 40 years or more, from graduation at 22 to retirement at 65. The Great American higher education machine churns out over 1.7 million bachelor’s degrees every year, up from about half-a- million per year in 1990. While millions of American workers followed that path to success, in recent times millions more have been disappointed by the college promise. In the Twenty-First Century, two major recessions, changing demographics, upheavals in technology, and a global business revolution have shaken the tight historical link between higher education and a happy, productive career.

Historically, about one-third of bachelor’s degree holders are “underemployed”, working in jobs that do not require a bachelor’s degree. Since the last recession, that number has grown to over 40%, according to a Federal Reserve Bank of New York study of workforce trends. A degree makes a difference: the overall unemployment rate for college graduates is usually about half that for the general population, but the salary and lifestyle advantages are diminishing.

Looking forward to 2024, the Department of Labor’s Bureau of Labor Statistics (BLS) forecasts a changing occupational outlook based in part on broad changes in the demographics of the U.S. economy. The average age of the U.S. workforce will grow to 42.2 in 2024, up from 37.2 in 1994. As the Baby Boomers hang on past retirement, the labor force participation rate of workers 65 and over will grow to 21.7 percent from 12.4 over the same period. At the same time, the percentage of young people age 16 to 24 will drop to 49.7 percent from 66.4 percent today. The U.S. will have a smaller percentage of eligible workers in the labor force and they will be older than at any time in history. They will also be faced with learning new jobs and new ways of doing things.
As the composition of the workforce changes, so does the kind of work that needs to be done and the educational requirements for those workers. BLS forecasts strong growth in health care and social assistance occupations through 2024, a large increase in construction employment (although not to pre-recession levels) and a continued decline in the manufacturing sector. Information and communications technology jobs (ICT) are expected to grow faster than average and to deliver above-average salaries, “in part due to a greater emphasis on cloud computing, the collection and storage of big data, more everyday items becoming connected to the Internet in what is commonly referred to as the ‘Internet of things,’ and the continued demand for mobile computing.”

But the workforce of 2024 needs more than just computer scientists, programmers and technicians. In every field, ICT forces a re-evaluation of first principles, destroys some job functions and creates others, and provides new opportunities to expand every core business mission in creative as well as productive ways.

Computers in publishing, for example, brought word processing, desktop design and electronic pages to transform ink-on-paper formats into digital printing, interactive web sites, e-books and global document databases. Computers in photography banished film processing, exploded the universe of online images and gave creative professionals powerful and complex new tools for communicating visually. Computers in the Digital Humanities spawned many new ways of studying history, analyzing texts and discovering new connections between authors and audiences. Across all disciplines, the productivity benefits of ICT seem self-evident but the creative possibilities can only be unlocked by deep domain understanding coupled with up-to-date technical skills. Where and how to acquire these skills is the challenge of modern higher education.
“College for all” vs underemployed graduates

Consistent with the aspirations of parents, politicians and students themselves, the four-year degree has been a stable marker for a life in the upper middle class. Economic conditions since the turn of the century, however, have added to the greatly increased cost of college, and have caused many to reassess the validity of the standard model. Two labor economists represent the opposite poles of the debate about the economic returns of higher education: Anthony Carnevale, Research Professor and Director of the Global Institute on Education and the Workforce at Georgetown University, believes that education is now more than ever the pathway to higher income and lifetime satisfaction; Richard Vedder, director of the Center for College Affordability and Productivity and a Distinguished Professor of Economics Emeritus at Ohio University, argues that college costs too much time and money and delivers too little career-long value in its current form.

Carnevale and colleagues Stephen J. Rose and Ban Cheah estimated the salary impact of educational attainment in “The College Payoff: Education, Occupations, Lifetime Earnings” published in 2011. They charted big earnings growth for bachelor’s degrees and higher and relatively small gains for sub-baccalaureate graduates. Over a life of work – full time from 25 to 64 years of age – the median earnings for all workers are $1.7 million, just under $42,000 per year, but a bachelor’s degree is worth $2.268 million while a high school diploma returns just $1.3 million. Doctoral and professional degrees peak above $3.25 million lifetime (Figure 4). They are expensive and hard to come by, but clearly, diplomas pay off, and the more the better—BA, MA, PhD, JD, MD.

The right choice of occupation also pays off. A bachelor’s degree holder in a STEM field (science, technology, engineering and math) earns more in a lifetime of work than a doctoral or professional degree holder in the arts, community service, sales or
office work, and even a high school graduate in STEM earns more than the best educated workers in blue collar and personal services fields.36

Gender, race and ethnicity race also play a role. At all levels of educational attainment, women earn about 25% less than men in full time jobs, not accounting for women who leave the work force for maternity leave.37 Similarly, African American and Hispanics lag behind whites at all levels of education; the gap for bachelor’s graduates is about 20%.38 But occupation matters: a medical technician with an associate’s degree earns about the same as an elementary or secondary school teacher with a master’s.39

Figure 4. Lifetime learning trajectory by educational attainment (2009 dollars)
The powerful earnings effects of education can be seen in the estimates of Asian lifetime earnings. At the lowest educational levels, the income gap with white workers is about 20%, but the gap decreases with higher levels of education and at master’s levels and higher, Asians earn more than whites.\textsuperscript{40}

Carnevale’s aggregate view of lifetime earnings shows that more education leads to more income, but it papers over many important details that affect an individual student’s calculations. The average net price of pursuing a four-year degree vary widely, from $12,750 per year for a public commuter college to $24,690 for an on-campus experience at a private, non-profit school,\textsuperscript{41} but the choice of career path and gender, ethnicity and socio-economic status play a big role.

In opposition to Carnevale’s big picture, Richard Vedder and colleagues at the Center for College Affordability and Productivity drill down on the qualitative aspects of students’ career decisions. Using data from the U.S. Bureau of Labor Statistics, they claim that substantial numbers of college graduates are “underemployed” in occupations that do not require a four-year degree:

- About 48 percent of employed U.S. college graduates are in jobs that the Bureau of Labor Statistics (BLS) suggests requires less than a four-year college education.
- Eleven percent of employed college graduates are in occupations requiring more than a high-school diploma but less than a bachelor’s, and 37 percent are in occupations requiring no more than a high-school diploma.\textsuperscript{42}

Vedder, et al point to the imbalance between the number of newly-minted B.A.s and the number of well-paying jobs that require such a level of education. The result, they say, is that four-year graduates displace lesser-educated competitors in the workplace, whether their additional skills are needed or not. This displacement increases the market value of advanced degrees, reinforcing the inequality of income already in force. The workforce is polarizing with high paying cognitive occupations at one and lower paying manual-service jobs at the other.
Turning to diplomas, Vedder describes three primary justifications for higher education: 1) as a marker for human capital formation; 2) as a signaling/screening device for employers; and 3) as a consumption good/socialization device. Human capital formation refers to a student’s acquisition of specific facts and skills that prepare him for work in a given discipline. Some institutions of higher education have greater prestige in certain fields or follow particular academic approaches, and so a degree from such institutions has more relevance to employers in those disciplines. The Massachusetts Institute of Technology, the Parsons School of Design and the Colorado School of Mines are examples of such schools.

College completion as a signaling/screening device refers to a diploma as a rite of passage, indicating that the graduate exhibits above-average intelligence in order to win a place at a reputable college and above-average persistence in order to complete a degree. Employers use the bachelor’s degree as a marker for a smart and reliable worker who can be trained in company-specific procedures and technologies on the job. In this application, the graduate comes to work with non-specific skills, so the brand name and the prestige of the university is more valued than knowledge of any specific discipline. Vedder asserts that the increasing reliance on the signaling/switching aspects of college completion leads to a credentialing arms race for higher prestige like Ivy League status, multiple B.A.s and ever higher graduate degrees.43

More controversially, Vedder and colleagues describe college as a consumption good/socialization device in which some human capital formation may occur but “students go to college also to have fun—to meet new friends, to use top-of-the-line exercise machines to relax, to party, to get drunk, and have sex.”44 Vedder decries the transformation of college from an intense learning opportunity to a comfortable parent-funded four-year transition to adulthood as the “country-clubization” of the academy, an exercise in consumer culture. Nevertheless, Vedder et al. admit that the networking and socialization opportunities of a country-club university have definite vocational benefits, and they conclude that there will always be “a
segment of the population willing and able to pay for the elite diploma offered by Harvard University or Williams College." Whether they spent their college years grinding away to increase their human capital or luxuriating in a collegiate bacchanal, the college graduates of 2020 and beyond will need more than just four years of book learning and test taking to thrive in the new world of work.

Economic stagnation, the gig economy and algorithmic management

We believe we live in a world of astonishing innovation, but previous technology revolutions have had far bigger and wider-ranging effects and more extensive economic impacts. In the Eighteenth and Nineteenth Centuries, the First Industrial Revolution sparked by the steam engine, modern cotton manufacturing, the railroad and steamships brought great improvements to the world of human and animal muscle power. In the Twentieth Century, as economist Robert Gordon has shown, the eighty years from 1892 to 1972 saw a 2.0 percent average annual growth rate of real GDP per capita built on the Second Industrial Revolution, the world-changing innovations of electricity, the internal combustion engine, running water, communications, entertainment, chemicals and petroleum. But since 1972, the disappointing Third Industrial Revolution based on information and communications technology and mobile computing has seen productivity growth slow to just 1.59 percent per year. Gordon notes that computers, the Internet and universal computing don’t generate the economic power we are used to, and that the U.S. faces strong “headwinds” in demography, education, inequality, and government debt that even a new round of innovation will not be able to conquer. Real median household income in the U.S. peaked in 1999. Lower economic growth, in this view, is the “new normal.”

The American economy and American employers have already adapted to lower economic expectations. Prompted first by the dot-com crash of 2001 and then the housing
bubble and Great Recession of 2007, employers have adopted new strategies for reducing the costs of doing business, especially payroll expenses. Like the standard model for college, the standard model for employment—a steady 9-to-5 job with paid vacations, benefits, medical coverage and a retirement plan—has splintered into many different and mostly lesser variations.

Full-time jobs are being replaced with part-time and contingent work. In August 2016, the payroll services firm Paychex analyzed over 400,000 freelancers’ resumes posted on job site Indeed.com and reported the results on-line:

By tracking the start dates of freelance positions people listed on their resumes, we were able to paint a picture of freelance trends in the United States for the past 45 years. For the majority of the 1970s, ’80s, and even ’90s, working generally meant heading off to a typical 9-to-5 job. But during the new millennium, the freelance economy took flight: **Between 2000 and 2014, freelance jobs listed on the resumes we examined increased by over 500 percent.**

In 2015, the U.S. Government Accounting Office (GAO) analyzed the available data from the Census Bureau, the Department of Labor and outside organizations to estimate the number of workers in jobs who “do not have standard work arrangements -- permanent jobs with a traditional employer-employee relationship.” GAO included six different employment relationships in the category of “contingent workers”: Agency temps; On-call workers (people called to work when needed); Contract company workers; Independent contractors who provide find their own customers; Self-employed workers such as shop and restaurant owners; and Standard part-time workers. GAO estimated that 40.4 percent of the employed workforce fit these characteristics in 2010.

As jobs become less stable and less remunerative, employees in the emerging gig economy” find they must constantly compete for work, not just from company to company but within a regular work arrangement, as well. On-the-job training that was once provided by the employer becomes the responsibility of the employee. Economist Gerald Friedman describes other social costs of working gig to gig:
Gig employments can create a class of isolated individuals living from job to job, without lasting financial or social connections to workplaces or to other workers. Dubbed the ‘precariat,’ this class of individuals not only suffer from precarious employment and income, they also lack the workplace social connections that bound together unionized workers during the capitalist Golden Age after World War II; the loss of these social connections is not only a problem for the health and income stability of the workers involved but threatens social cohesion and community stability in general.51

Freelancers, independent contractors and consultants in the emerging gig economy depend on their digital dossiers to get and keep their contingent jobs. Gig employers implement robotic “algorithmic management” systems that assign work, monitor its completion, enforce standards, reward effort and punish misconduct automatically without human intervention. The popular ridesharing systems Uber and Lyft connect customers with taxi drivers digitally. Computer software manages ride requests, routes them to nearby drivers, monitors the ride, processes the payment and measures the success of the experience all algorithmically. Events like concerts and rain storms automatically boost the price per ride. Drivers with less than stellar ratings are assigned to re-education webinars and activities, and hostile or repeatedly miscreant drivers are automatically dropped from the network. Algorithmic workforce management systems are spreading throughout U.S. businesses, not just in public-facing sharing economy applications like taxis and cleaning services but in back-office operations like webs shopping warehouses, phone line installation teams and fast food staffing agencies.

One of the first studies of algorithmic management in the field was performed by Min Kyung Lee and colleagues at the Human Computer Interaction Institute, Heinz College, Carnegie Mellon University in 2015. They found that the Uber and Lyft drivers they studied were generally comfortable being assigned work by a machine, and that surprisingly they did not want direct control over the assignment algorithms. Like any workplace, however, drives banded together in social media to gossip about management and share tips and tricks for maximizing their profits from the system.52
Technology, application and globalization

Success in the emerging workplace depends on a combination of skills integrating technology with its applications in a globalized (or commoditized) environment. As computer and communications technologies have matured, information technology comes in a wide variety of forms, from brute force computation engines to visually-rich multimedia communications systems to pocket-sized and even wearable sensors and displays. Outside of computers, innovations at the micro- and nano-scales are enabling new kinds of materials and chemical processes, and in life sciences advances in genetic manipulation and bio structures are solving age-old problem in health. Every one of these technologies and countless others are bustling with innovation, and chances are that every one is far more advanced and complex to operate today than when the best credentialed graduate learned about it in school. Every tech discipline requires lifelong learning just to keep up, and critical professions like medicine and law require formalized continuing education of its practitioners for the life of their practices.

But operating the raw technology is only the foundation. Innovation requires insightful domain-specific application, the ability to exploit any technology to solve specific problems. A financial analyst can learn how to use the Excel spreadsheet program to add, subtract and divide numbers. Applying it uniquely to tie together a half-dozen databases, and Internet news channel plus a stock market feed and a home-made analysis algorithm unlocks the real value of the tech. It’s up to the experts in every field to apply the latest relevant technologies to create value.

And once the application is built, technology often enables us to globalize it, formalize it and de-skill it so that it can be used by anyone in the world. Advanced customer service systems, for example, route troubleshooting calls to technical representatives in different countries, sending chunks of service work off to locations where the work can be done cheaper, faster or more conveniently. Software developers, in another example, often ship programs in progress from time zone to time zone so that development proceeds around the clock around the planet.
Globalization or commoditization also vastly extends access to a given innovation. Mobile phone technologies married to digital imaging modules applied to the task of videography and then simplified for any user anywhere has transformed news gathering, moviemaking and holiday snapshots. It’s likely that all of the people necessary to develop that process learned their operating skills and developed their business insights long after they graduated from college. Some probably didn’t need a four-year bachelor’s degree at all, others might have require post-doc levels of advanced study, and most needed continuing education in relevant subjects. A global market in education is developing to satisfy the educational needs of our increasingly complex workplace, and a developing market in educational credentials is following in its wake.
Chapter 4: The Certification Landscape

Open Source micro diplomas are credentials for post secondary education programs that have emerged in response to society’s needs for specialized training in hundreds of different disciplines. For the most part, these programs operate outside of traditional institutions of higher education. The curriculum is developed, maintained and delivered by the issuing authorities like professional associations, trade groups, technical schools, government agencies, manufacturers, private companies, and non-governmental organizations. Most certifications are available to applicants with no prerequisites.

Often education policymakers call these micro diplomas “sub baccalaureate” credentials, implying that they are inferior to a full four-year degree, but some could be called “post baccalaureate” since they require a BA or better to apply. Up until recently, federal studies have not examined these educational credentials and their effect on the workforce, but in 2014 the Census Bureau issued its first-ever report on non-degree credentials. It found that 28 percent of employed adults (46.3 million workers aged 18 and over) held professional certifications or licenses. In this chapter, we survey the field, explore case studies of exemplary micro diplomas, and describe the developing digital infrastructure for managing educational credentials.

Certificates, certifications, licenses and competency-based education

Certificates are not certifications. A certificate from a college or university measures input, the transfer of material from teacher to student. Conversely a certification identifies the student’s
tested competence is a specific set of skills. The 2014 Census study provides the following definitions:

Educational certificate:
A credential awarded by a training provider or educational institution based on completion of all requirements for a program of study, including coursework and test or other performance evaluations. Certificates are typically awarded for life (like a degree). Certificates of attendance or participation in a short-term training (e.g., 1 day) are not in the definitional scope for educational certificates.

Certification:
A credential awarded by a certification body based on an individual demonstrating through an examination process that he or she has acquired the designated knowledge, skills, and abilities to perform a specific job. The examination can be either written, oral, or performance-based. Certification is a time-limited credential that is renewed through a recertification process.

License:
A credential awarded by a licensing agency based on predetermined criteria. The criteria may include some combination of degree attainment, certifications, certificates, assessment, apprenticeship programs, or work experience. Licenses are time-limited and must be renewed periodically.\(^{54}\)

Certificates are awarded by colleges for the successful completion of a course of study usually measured in contact hours or “seat time”. Certifications are tied to an applicant’s demonstrated ability to do a specific job, They can include oral or written tests, practical demonstrations, a portfolio, time spent in apprenticeship, reputation, and traditional educational degrees. Licenses are government-issued certifications that are required for jobs in regulated fields like health care, finance or law enforcement. Based on a 2008 survey, the 2014 Census report found that the most popular certifications were in education (17 percent), nursing and nurse assisting (13 percent), and other health care fields (12 percent), although the largest category was “other” (21 percent). For most respondents (76 percent), their license or certification was required for employment, and most (66 percent) had to periodically re-certify with continuing education coursework.\(^{55}\)
The majority of certifications and licenses were post baccalaureate (31 percent of the employed) for licenses to teach, to nurse, to practice medicine, to pilot a commercial airliner and so on, but 17 percent representing 23 million workers were credentials in fields like construction and manufacturing, protective services, and business and financial management. While the greatest certification boost to wages came to employees with professional degrees (e.g. MD, JD, and DDS), the next highest earnings premiums came in the sub baccalaureate educational attainment categories of high school diploma and less than high school.\textsuperscript{56}

Certifications come from many different public and private providers, and they are usually integral to specific disciplines and occupations. While the U.S. Department of Education maintains robust statistics on K-12 and higher education outcomes, it struggles to keep track of the more diverse landscape of college certificates and it completely ignores the universe of third-party certifications.\textsuperscript{57} Instead, up-to-date information on certifications is maintained by the U.S. Department of Labor under the Workforce Investment Act (WIA) Common Performance Measures publishes CareerOneStop.org, an on-line database that tracks more than 3,900 certifications from 1,822 issuing authorities spread across 20 industry segments (Table 4).

What value do these credentials offer? How can we judge their efficacy and relevance? What are the characteristics of a successful certification? Below we examine the performance of exemplary products to extract a rubric for analysis.
<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Industry Description</th>
<th>Issuers</th>
<th>Certifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Agriculture, Forestry, Fishing and Hunting</td>
<td>30</td>
<td>63</td>
</tr>
<tr>
<td>21</td>
<td>Mining, Quarrying, and Oil and Gas Extraction</td>
<td>9</td>
<td>26</td>
</tr>
<tr>
<td>22</td>
<td>Utilities</td>
<td>24</td>
<td>137</td>
</tr>
<tr>
<td>23</td>
<td>Construction</td>
<td>78</td>
<td>325</td>
</tr>
<tr>
<td>31</td>
<td>Manufacturing</td>
<td>14</td>
<td>21</td>
</tr>
<tr>
<td>42</td>
<td>Wholesale Trade</td>
<td>36</td>
<td>69</td>
</tr>
<tr>
<td>44</td>
<td>Retail Trade</td>
<td>33</td>
<td>57</td>
</tr>
<tr>
<td>48</td>
<td>Transportation and Warehousing</td>
<td>43</td>
<td>92</td>
</tr>
<tr>
<td>51</td>
<td>Information</td>
<td>50</td>
<td>151</td>
</tr>
<tr>
<td>52</td>
<td>Finance and Insurance</td>
<td>81</td>
<td>224</td>
</tr>
<tr>
<td>53</td>
<td>Real Estate and Rental and Leasing</td>
<td>42</td>
<td>96</td>
</tr>
<tr>
<td>54</td>
<td>Professional, Scientific, and Technical Services</td>
<td>399</td>
<td>500</td>
</tr>
<tr>
<td>55</td>
<td>Management of Companies and Enterprises</td>
<td>100</td>
<td>359</td>
</tr>
<tr>
<td>56</td>
<td>Administrative and Support and Waste</td>
<td>177</td>
<td>389</td>
</tr>
<tr>
<td>61</td>
<td>Educational Services</td>
<td>92</td>
<td>194</td>
</tr>
<tr>
<td>62</td>
<td>Health Care and Social Assistance</td>
<td>364</td>
<td>500</td>
</tr>
<tr>
<td>71</td>
<td>Arts, Entertainment, and Recreation</td>
<td>56</td>
<td>166</td>
</tr>
<tr>
<td>72</td>
<td>Accommodation and Food Services</td>
<td>24</td>
<td>66</td>
</tr>
<tr>
<td>81</td>
<td>Other Services (except Public Administration)</td>
<td>112</td>
<td>360</td>
</tr>
<tr>
<td>92</td>
<td>Public Administration</td>
<td>58</td>
<td>127</td>
</tr>
</tbody>
</table>

Source: U.S. Department of Labor Certification Finder
Case Study: AHELI Hotel Industry Career Certifications

Established in 1953 by the American Hotel and Lodging Association, an industry trade group, the American Hotel & Lodging Educational Institute (AHLEI) develops industry standards and creates curricula for “more than 20 positions in the hospitality industry, designations from front-line to general manager, including the prestigious CHA® - the Certified Hotel Administrator.”

For $85, individuals can sign up for a two-hour on-line training program to become a Certified Guest Service Professional (CGSP), the entry-level credential in the field. At the completion of the class, the CGSP certification test is issued: 30 multiple-choice questions to be answered in 60 minutes. With a minimum score of 70 percent, the applicant receives Certified Guest Service Professional certificate and lapel pin and is listed on the organization’s web site with other CGSPs. Similar entry-level certification are offered for positions such as Front Desk Attendant, Kitchen Cook and Restaurant Server. In the seven months January to August, 2016, AHELI designated over 5,000 guest service professionals.

A more advanced credential for executives, the Certified Hospitality Administrator (CHA), requires a $700 fee for one year on on-line learning. It also requires specific work experience, a minimum of two years as a) a general manager, owner/operator or corporate executive of a lodging hospitality company, or b) an assistant general manager or Director of Operations/Rooms Division plus an AHLEI Certified Rooms Division Executive (CRDE®). A degree from an accredited academic institution takes one year off the work experience requirement. Other executive-level credentials are issued for specialties like Food and Beverage, Housekeeping and Security, and they require recertification every five years to keep skills up to date. Taken on the whole, the AHLEI certifications provide relevant education at every skill level (Figure 5).
Once all the customer-facing staff have been certified, the hotel or venue itself is then designated an AHLEI Certified Guest Service Property. Hotels promote their adherence to these international industry standards a competitive advantage in the market.

Remarkably, AHLEI has augmented the on-line study courses, associated textbooks and quizzes with both in-person workshop and on-the-job training formats. The institute offers curriculum packages to hotel and lodging companies that want to train up and certify their own
staffs, but the curriculum is also made available to high schools and colleges that want to offer hospitality training – and industry certification – to their student bodies. The organization licenses its material to companies and educational institutions in 11 countries.\textsuperscript{59}

For a global industry like the hotel business that depends on employees delivering a high level of customer service across cultural and geographical boundaries, AHLEI’s intense focus on education helps its members – and students around the world – develop their human capital and build career paths that have lasting value.

\textit{Case Study: Project Management Professional Certification}

A certification that cuts across many different industries is the Project Management Professional (PMP) certification developed by the Project Management Institute (PMI) in 1969. Based on a standardized methodology for getting big, complex and technically challenging projects done, project managers work in every business but thrive in construction, energy exploration, healthcare, management consultancies and information technology and work on jobs around in every country. The PMP is often a post baccalaureate certification, added on top of a science, engineering or business degree, but applicants can substitute on-the-job experience and study in-person or on-line. Annual salaries start at about $62,000, breaking the $100,000 mark at 10 years of experience and reaching $122,000 after 20 years in the field.\textsuperscript{60}

At the heart of the PMP is the BOK, the Book of Knowledge, a comprehensive set of standards, conceptual frameworks and ethical rules for the discipline. The four-hour, 200 multiple choice question PMP test costs $555 and must be recertified every three years. Prerequisites are either a) a secondary degree (high school diploma, associate’s degree or the global equivalent), 7,500 hours leading and directing projects and 35 hours of project management education or b) a four-year degree, 4,500 hours leading and directing projects, and
35 hours of project management education. Over 750,000 PMP holders are at work around the globe, and PMI offers seven certifications in related specialties.\textsuperscript{61}

The standards in the Book of Knowledge are developed through a transparent and collaborative process that includes members in regular local and national meetings. A separate Code of Ethics and Professional Conduct Advisory Group develops guidelines across cultures and monitors ethics complaints about PMP holders.

\textit{Case Study: CompTIA IT Certifications}

A wide selection of information and communication technology skills is standardized and certified by the Computing Technology Industry Association (CompTIA). In fifteen categories that range from beginner to professional to specialty to master, CompTIA offers on-line self study courses as well as authorized instructor-led training from technical training companies, workforce development organizations, and secondary and post secondary schools. From IT fundamentals to the popular CompTIA A+ technology foundation to Security, Networking, Servers, and Document Management, the vendor-neutral CompTIA certifications prepare young people for well-paying careers.\textsuperscript{62} Testing fees range from $115 to $426. Prerequisite are usually on-the-job experience but also a basic CompTIA stackable certification. Annual salaries start at about $63,000, breaking the $82,000 mark at 10 years of experience and reaching $92,000 after 20 years in the field.\textsuperscript{63}

As a non-profit independent trade association, CompTIA is careful to be agnostic about specific companies or products in their own training, but most disciplines within information and communication technology focus on products from specific vendors, for example PCs running Microsoft Windows, or networks using Cisco routers, or cloud computing based on Amazon’s Elastic Computing Cloud. For its members seeking education advice about certification in the field, CompTIA published a colorful and complex roadmap of recommended
credentials for eight major disciplines. Similar to a college course catalog, the roadmap identifies
four levels of proficiency and lists the relevant certifications from 36 for-profit developers that
align with a given career path.

Case Study: Microsoft product certifications

One of the for-profit firms listed in the CompTIA recommended education roadmap is
Microsoft Corporation. Like all developers of complex inventions, Microsoft depends on
customers knowing enough to use their products successfully and the firm devotes substantial
resources to creating curriculum, textbooks and certification pathways for customers at all
levels. Similar efforts by Adobe in media production, Cisco in networking, and Oracle in
databases have established these companies as market leaders and their products as de facto
industry standards. Education is a competitive edge: a remarkable new product is not viable without the substantial backing of a robust and effective education infrastructure.

Microsoft offers 31 technical certifications in 6 categories at up to 4 levels of proficiency. The categories are defined by application—Mobility, Cloud, Productivity, Data, App Builder and Business—but they all relate to specific Microsoft products. At the entry level, the Microsoft Office Specialist rating tests competency in the use of Windows products like Word, Excel and PowerPoint. For advanced users, “enterprise applications” like the SharePoint server, Office 365 and Azure Active Directory. Tests cost $165 and are administered on-line by commercial testing centers or by accredited colleges.

Microsoft certifications usually have no prerequisites outside of previous stackable Microsoft credentials; tests at some expert levels also have specific on-the-job requirements. Citing a 2015 IDC/Microsoft report on earnings, the company claims, “In high-growth industries, entry-level employees who hold a Microsoft Certified Solutions Associate (MCSA) certification or Microsoft Office Specialist (MOS) certification can earn up to $16,000 more, annually, than their peers.”

Microsoft’s on-line tests are not only multiple-choice exams like many of the certifications described above. Because they are administered on a computer and are targeting computer applications, they are performance-based tests using a simulated business environment. Applicants may be asked to edit a page or debug a spreadsheet or write some code that runs to completion. For an additional charge, applicants can order an Exam Replay that takes them through their responses so they can prepare to retake the tests in the future.

Case Study: Stack Overflow social media recommendations

A different approach to verifying competency arises from social media interactions. On the popular LinkedIn social media network, for example, contacts can “endorse” the skills of the
people they know on-line. Endorsement counts are displayed in the user’s on-line profile, and endorsers’ endorsements are given extra weight with the caption “Endorsed by John Doe and 3 others who are highly skilled at this.” As LinkedIn has developed the feature, new tools for adding or removing skills and hiding endorsements or individual endorsers have been added.

A more technically-oriented social network, Stack Overflow, operates a more rigorous and more useful reputation monitoring system. For information and communication technology developers, reading the manual or trying to contact the manufacturer has been replaced by “asking the Internet”, posting specific question to answer sites like Stack Overflow and hoping for a good response. Readers browsing the questions will post their suggestions, which are read, reviewed and rated by other readers. To date, over 13 million questions have been asked: 1.3 million on JavaScript coding, 641,533 on the web page programming language HTML, and 501,292 on the Apple operating system iOS.65

In the course of asking and answering, Stack Overflow keeps track of views and responses and awards badges that are displayed on user's profile like “Favorite Question” for questions favorite by 25 users, “Famous Question” for questions with 10,000 views and “Great Answer” for answers scored by 10 or more readers. People achieve ratings like “Explainer” for answering one question, “Refiner” for editing or answering 50 questions, and “Pundit” for leaving 10 comments with scores of 5 or more. An overall reputation score is continuously computer and posted to the user's profile. The all time top scorer is Shog9, a Stack Overflow community manager with 112,713 points, but most users are in the less than 10,000 range.

Technologists question whether the Stack Overflow reputation score is a legitimate credential that should be included on profiles and resumes. For highly technical jobs, a high reputation in a specific area like JavaScript might indicate proficiency, but most hiring managers are not aware of the site or convinced of the rigor of its methodology. A high Stack Overflow score may just mean that the person spend too much time on social media, even if is related to work.
Case Study: Open Badges

A different digital approach to credentials is the Open Badge initiative developed initially by the Mozilla Foundation and the MacArthur Foundation and now managed by the IMS Global Learning Consortium. In true Open Source fashion, any individual or organization can define a certification for an educational program or event and post it on the Internet, just like a web page. Like a web page, an Open Badge must follow a digital specification that includes its ownership, criteria, alignment with other badges and standards, and its expiration date. The credential lives n-line whether on the issuer’s server or third-party badge issuing platforms similar to web hosting firms.

The vision for Open Badges is a digital resume called a Backpack, a collection that contains all of a person’s educational credentials in machine-readable form. Companies that issue conventional certifications like Adobe’s ACA already issue badges in addition to their regular certificates, and a new infrastructure of badge development and hosting companies has been spawned. Badges are also being created by schools, professional associations, companies, and event firms to recognize and track learning achievement in their domains. The Open Badges digital infrastructure is making the creation and administration of alternative educational credentials friction free.
Chapter 5: Criteria and conclusions

The thousands of Open Source Micro Diplomas available today are counted by the U.S. Census, not regulated by the U.S. Department of Education. As more technology and more complexity is added to our economy, it seems reasonable to expect that more certifications will be added in the future, especially if low-cost Open Badges are widely adopted. How can we tell a good certification from a bad certification, and how can they be adapted to other industries?

Judging Open Source Micro Diplomas

The case studies presented in Chapter 3 reveal a diversity of approaches to constructing a curriculum and testing competence, and each certification is ultimately customized to fit the unique needs of its target industry, but what rubric can we distill from examining successful industry certifications. The following list presents a starting point. Twelve principal features are listed below along with a range of options and key questions about their application:

Issuer: Private company, non-profit organization, or government agency

Is the credential promulgated by a for-profit firm for the benefit of its customers, a professional or trade association for the sake of industry standards of practice, or a government agency as a license to perform certain regulated occupations?

Scope: An individual skill, a collection of process guidelines, or industry-wide standards

How much activity does the credential certify? A Microsoft Office certification comprises a limited number of software features, while the Project Management Book of Knowledge encompasses an entire set of procedures, standards and even ethical considerations for a complex occupation.

Rigor: The validity of the skills covered for the certified activity

How completely does the certification test reflect the current real world experience of
practitioners, and has it been tested against changing business practices and common workarounds? Does a CompTIA-certified Server Administrator, for example, implement the full set of security and backup procedures recommended in the standard curriculum, or do most Server Administrators use a common third-party hack downloaded from a contact on Stack Overflow?

Marketability: Industry acceptance of the certification

Outside of the human capital improvement derived from the curriculum, does the certification have a signaling/screening effect for prospective employers, and does it result in a measurable increase in income for its recipients?

Validation: *Market acceptance, international standard, or contract requirement*

Whether by bottom-up user enthusiasm or top-down regulatory requirement, has the certification become an important part of economic transactions?

Competitiveness: *Unique credential, best in class, or routine documentation*

Either through market dominance, unique focus, curricular rigor, issuer promotion, or other means, does the certification rise above alternative credentials including higher ed diplomas?

Community of practice: *solo practitioners, local or industry enthusiasts, or global audience*

Beyond the skills tested, does the certification and the certifying agency foster a community of like-minded individuals united by vocation? The Project Management Institute runs local chapters as well as international events, for example, and both AHELI and CompTIA regularly participates in expositions and conferences of certification-holders.

Transparency: *Closed curriculum, industry-derived standards, or formally scheduled updates*

Is the process of compiling certification standards and keeping them up to date public, accessible and debatable?
Training resources: *sole source, authorized dealers, or accredited educators*

Where does an applicant get the training reflected in a certification: from its issuer, from independent training firms (authorized or not), or from an accredited and issuer-certified professional education organization? Is training available in person, on the job, and on-line?

**Portable: applicable across vendors, across discipline, across industries, across boundaries**

Is the certification valid for employment in situations beyond its native application? A Microsoft Office Specialist can work in any discipline, in any industry, and in any country that speaks the right language, but only on Microsoft products.

**Alignment: standalone, stackable, compatible**

Is the certification part of a program of study that extends to further certifications in higher levels of complexity or in related disciplines, and can the credit accrued be translated into other education venues? In New York State, for example, certain industry certifications can count toward high school graduation in place of standardized tests. The CompTIA IT Certification Roadmap is a multi-vendor, multi-discipline

**Ethical dimensions: implicit, explicit, or industry-based**

Does a curriculum include ethical guidelines for practitioners beyond social norms, do some occupations require different or explicitly acknowledged ethical rules, and do some industries require a greater consideration of good ethical practice certified by the credential?

These twelve features and the range of possibilities for each offer a set of metrics for judging the value of an individual certification program. Each will be more or less adaptable to different disciplines and different industries. Educators, administrators and policymakers will pick and choose the criteria they require to serve their needs.
Conclusion

Over 46 million Americans, 28 percent of working adults, now use Open Source Micro Diplomas to support their careers and validate their learning. With few prerequisites, abundant on-line, in-print and in-person education programs, and affordable testing fees, certifications have expanded the prospective universe of well-paid, well-educated citizens.

While the conventional education system has evolved into a costly and slow-moving institution that serves only a small part of the socio-economic spectrum, the open world of competency-based certifications, now augmented by digital productivity, offers an affordable alternative path for individuals from every corner of society to plot their careers and find fulfilling work.

Most analysts of the future of work envision a more fluid workplace, with many in the gig economy jumping from job to job and company to company, often across occupations and core competencies. Regulatory compliance that’s now common in healthcare and financial occupations will spread to other fields that require workers to be trained in issues like diversity, privacy and accountability. Workers in that future world will need to quickly skill-up on new products and processes through lifelong learning from many sources, and they’ll need to validate their skills digitally in an on-line world.

Compared to a standard model BA, the emerging world of Open Source Micro Diplomas will be a diverse, vibrant, complex and interdependent that values all kinds of work and all kinds of learning.
NOTES


8 U.S. Census. Percent of People 25 Years and Over Who Have Completed High School or College, by Race, Hispanic Origin and Sex: Selected Years 1940 to 2015. Table A-2.


15 Carnevale, Anthony P., Rose et al. The College Payoff: Education, Occupation, Lifetime Earnings. 5.


18 Ibid., 7.


36 Ibid., Figure 4.

37 Ibid., Figure 5.

38 Ibid., Figure 6.
39 Ibid, Table 6, Tble 8.

40 Ibid., Figure 6.


43 Ibid., 9.

44 Ibid., 9.


50 Ibid., 16.


54 Ibid., 2.

55 Ibid., Table 7.

56 Ibid., Figure 2.


BIBLIOGRAPHY

https://www.ahlei.org/About/

https://edex.adobe.com/discussion/75d15054/


https://nces.ed.gov/programs/digest/d13/ch_2.asp


https://opensource.org/history

“History”. Council for Aid to Education. http://cae.org/about/history/

https://meta.stackoverflow.com/questions


https://www.pmi.org/certifications/types/project-management-pmp


https://www.insidehighered.com/news/2013/05/20/studies-challenge-findings-academically-adrift


Percent of People 25 Years and Over Who Have Completed High School or College, by Race, Hispanic Origin and Sex: Selected Years 1940 to 2015.