

CERTIFICATIONS AS TOOLS FOR  
PROMOTING

# ECONOMIC MOBILITY

MARCH 2022



THE GEORGE WASHINGTON UNIVERSITY  
GEORGE WASHINGTON INSTITUTE OF PUBLIC POLICY



## AUTHOR

**Evelyn Ganzglass**, Senior Consultant, Corporation for a Skilled Workforce

## OTHER CONTRIBUTORS

**Kyle Albert**, Assistant Research Professor, George Washington Institute of Public Policy

**Isabel Cardenas-Navia**, Senior Director of Research, Workcred

**Stephen Crawford**, Research Professor, George Washington Institute of Public Policy

**Karen Elzey**, Associate Executive Director, Workcred

**Janet Forte**, Senior Manager of Operations, Workcred

**Melissa Goldberg**, Director of Competencies and Credentials, Corporation for a Skilled Workforce

**Larry Good**, President and CEO, Corporation for a Skilled Workforce

**Roy Swift**, Executive Director, Workcred

## CITATION

Ganzglass, Evelyn, Kyle Albert, Isabel Cardenas-Navia, Stephen Crawford, Karen Elzey, Janet Forte, Melissa Goldberg, Larry Good, and Roy Swift, *Certifications as Tools for Promoting Economic Mobility* (2022): <https://share.ansi.org/wc/Shared%20Documents/Workcred-Reports/Understanding-Certifications-Study/Certifications-as-Tools-for-Promoting-Economic-Mobility.pdf>.

### CORPORATION FOR A SKILLED WORKFORCE (CSW)

1100 Victors Way, Suite 10  
Ann Arbor, MI 48108

[www.skilledwork.org](http://www.skilledwork.org)

### GEORGE WASHINGTON INSTITUTE OF PUBLIC POLICY (GWIPP)

Media and Public Affairs Building  
805 21<sup>st</sup> Street, NW  
Washington, DC 20052

[www.gwipp.gwu.edu](http://www.gwipp.gwu.edu)

### WORKCRED

1899 L Street, NW, 11<sup>th</sup> Floor  
Washington, DC 20036

[www.workcred.org](http://www.workcred.org)

## ACKNOWLEDGEMENTS

The project team is indebted to the members of our project advisory committee who gave us thoughtful feedback on this series of reports:

**Stuart Andreason**, Assistant Vice President and Director of the Center for Workforce and Economic Opportunity, Federal Reserve Bank of Atlanta

**Vanessa Brown**, former Deputy Chief Data Officer, National Student Clearinghouse

**Michael Dalton**, Research Economist, Bureau of Labor Statistics, U.S. Department of Labor

**Frank Swanzy Essien Jr.**, Strategy Officer for Research, Lumina Foundation

**Van Freeman**, Regional Head for the Washington DC region, Opportunity@Work

**Sean Gallagher**, Founder and Executive Director of the Center for the Future of Higher Education and Talent Strategy, and Executive Professor of Educational Policy, Northeastern University

**Angie Graves**, Vice President of Talent Acquisition, Aegis Living

**Megan Healy**, former Virginia Secretary of Labor, Office of Governor Ralph Northam, Commonwealth of Virginia

**John Kessler**, Global Lead for Responsible Assessment, Credentialing, and Learning Measurement, Accenture

**Casey Marks**, Chief Product Officer, (ISC)<sup>2</sup>

**Mary Jean Schumann**, Associate Professor, Policy, Populations, and Systems Community, and a core faculty member of the Nursing Center for Health Policy and Media Engagement, George Washington University

**Joel Simon**, Vice President of Workforce Strategies, EMSI Burning Glass

**Jeff Strohl**, Director of Research, Center on Education and the Workforce, Georgetown University

**Michelle Van Noy**, Director, and Associate Research Professor, Education and Employment Research Center, School of Management and Labor Relations, Rutgers University

**Mary Walshok**, former Associate Vice Chancellor for Public Programs and Dean of Extension, University of California San Diego

**David Wilcox**, President, Global Skills X-Change

**Amanda Winters**, Program Director, Post Secondary Education, Center for Best Practices, National Governors Association

**Cynthia Woodley**, Vice President and Chief Operating Officer, Professional Testing, Inc.

Funding for this project was provided by Lumina Foundation. The views expressed herein are those of the authors and do not necessarily represent those of Lumina Foundation, its officers, or employees.

This series of reports were designed by Workcred and its affiliate, the American National Standards Institute.

# TABLE OF CONTENTS

About the Project	1
Introduction and Overview	4
What Makes Certifications Potentially Useful Vehicles for Promoting Career and Economic Mobility?	6
Competencies Represented by Certifications are Relevant to Industry and Professional Contexts	6
Certifications Cover a Range of Competencies Relevant to People at Different Stages in their Careers	7
Certifications' Relevance to Skills Needed in the Labor Market Increases their Potential Value for Employers and Credential Seekers	8
Certifications are Lifelong Credentials	8
Why is it Important to Look at Certifications within the Context of Career and Credentialing Pathways?	9
Starting Points of Career and Credential Pathways	9
Credential Connections	11
Portability	11
Stackability	12
Integrating Certifications and Educational Programs of Study	13
Steps, and Distance between Steps, in Career and Credential Pathways	16
Navigational and Other Supports	17
Exit Points to the Labor Market	18
Recommendations	19
Improve Data Collection	19
Transform and Better Align Workforce and Education Credentialing and Systems	21
Employers and Certification Bodies	21
Education and Workforce Systems	22
Bibliography	23

# ABOUT THE PROJECT

Many workers seek to acquire new skills and credentials that they hope will support their careers. They do so to enter or stay current in their field, obtain promotions, change careers, or find work after a layoff. In the process, however, they face a confusing landscape of credentials—degrees, certificates, certifications, licenses, and badges.<sup>1</sup> Among these, the least understood may be certifications, a type of credential that reliably indicates an individual has acquired the knowledge, skills, and abilities required to perform a specific occupation or job. In all, more than 43 million Americans hold a professional certification or a license.<sup>2</sup> Yet many employers, workers, students, policymakers, and education and workforce development practitioners know little about the use and value of certifications.

The Corporation for a Skilled Workforce, George Washington Institute of Public Policy, and Workcred embarked on a research project to provide an unprecedentedly clear picture of the dimensions, patterns, and trends among certifications, as well as how they currently or could interrelate with other types of credentials. To inform this project, the team conducted research from 2019–2021 on 16 certifications that spanned cybersecurity, healthcare, information technology, and manufacturing, and resulted in **five reports and separate overviews for each certification**.

The first report issued in December 2020, *Understanding Certifications*, is a primer to help policymakers and practitioners navigate the complex and little understood “wild west” of certifications. Three more in-depth issue briefs follow—*Certifications as Tools for Promoting Economic Mobility*, *Accreditation Standards: The Primary Source of Quality Assurance for Certifications*, and *Recertification: A Distinguishing Feature of Certifications*. The final publication, *Certifications: The Ideal, Reality, and Potential*, highlights questions that emerged during the research and topics that need further research. As a set, these reports are intended to help policymakers, practitioners, employers, and funders better understand the characteristics of certifications and their potential to help people enter the labor market for the first time or after a layoff, obtain a career goal, or reskill for a new career.

---

1 For more information on the types and differences among credentials, see Workcred’s [How do Credentials Differ?](#) graphic, or view the video, [“Differing Types of Workplace Credentials.”](#)

2 Cunningham, “Professional Certifications and Occupational Licenses: Evidence from the Current Population Survey” (2019).

## THE FOLLOWING CERTIFICATIONS WERE SELECTED FOR USE IN THIS PROJECT

American Academy of Healthcare Providers in the Addictive Disorders Certified Addiction Specialist

American Healthcare Information Management Association Registered Health Information Technician

American Nursing Credentialing Center Psychiatric-Mental Health Nursing - Board Certified

American Registry for Diagnostic Medical Sonography Registered Diagnostic Medical Sonographer

American Society for Clinical Pathology Board of Certification Medical Laboratory Technician

Association for Supply Chain Management Certified Supply Chain Professional

Behavior Analyst Certification Board Certified Assistant Behavior Analyst

Board for Global EHS Credentialing Certified Industrial Hygienist

CertNexus Certified Ethical Emerging Technologist

CompTIA A+ Core Series

EC-Council Certified Ethical Hacker

(ISC)<sup>2</sup> Certified Information Systems Security Professional

Manufacturing Skills Standards Council Certified Production Technician 4.0

Microsoft Certified Azure Fundamentals

Project Management Institute Certified Associate in Project Management

Smart Automation Certification Alliance Certified Industry 4.0 Associate - Basic Operations

Selection criteria for the certifications studied included:

- » a mix of more established certifications as well as certifications that have been developed recently to address emerging skills and occupations;
- » representation of certifications with a range of educational and experience prerequisites—from entry-level to post-baccalaureate specialization with particular attention to certifications that provide accessibility to workers without a prior college degree;
- » a mix of accredited and non-accredited certification bodies and certifications;
- » an opportunity to study the relationship between industry certifications and academic credentials; and
- » an opportunity to map career pathways.

For each certification, the project team reviewed the certification bodies' websites, and interviewed staff at all of the represented certification bodies. Each interview was conducted using a standard interview protocol and the questions were grouped around the following topics: purpose and scope; assessments and recertification; accreditation and quality assurance; data; employer engagement; candidate outreach; and relationships with educational institutions. In addition, the recommendations in each report are informed by a literature review of certifications and the project team members' experiences working with the certification community.



# INTRODUCTION AND OVERVIEW

Changes in the economy, demographic shifts, and increased inequities accelerated by the pandemic have increased attention on improving education and training systems so that they can better meet the credentialing needs of the diverse workers and employers in the United States. In response, education and training providers are exploring a variety of strategies, including expanding and increasing the relevance and adaptability of the learning opportunities and credentials they offer.

This paper discusses how the characteristics of quality certifications potentially make them useful tools for increasing the economic mobility of workers and expanding the talent pools for employers. It discusses opportunities for integrating certifications in credentialing and career pathways and further learning, as well as the pitfalls of focusing on certifications primarily as quick-fix, short-term credentials to get people into a job. The paper also looks at how certifications can help people gain needed skills to achieve their career goals at different stages in their careers, such as:

- » new workers seeking to enter the labor market;
- » mid-career and advanced workers seeking to keep up with changing skill requirements in order to keep their jobs or advance their skills within their industry or profession;
- » workers seeking to change careers from one profession or industry to another; and
- » workers seeking to broaden or deepen their skills and knowledge in a particular specialty area.

In addition, we draw on the conceptual underpinnings of career pathways and connected credentials, uses

**Unlike degrees and many certificates that represent the completion of a course or program of study, certifications—a type of non-degree credential—are time-limited, renewable, and revocable verifications of certification holders' ability to perform a set of competencies (knowledge, skills, and abilities) needed to perform specific roles in a professional/occupational setting. They are awarded by certification issuers—typically nonprofit organizations, professional associations, industry/trade organizations, or businesses—based on a standardized, third-party assessment of the certification seeker's competency relative to performance expectations that are set through a legally-defensible, industry- or profession-wide job task analysis process which is reviewed/revised regularly.**

examples to illustrate the shared characteristics and various differences among certifications, and highlights the complexity of credentialing pathways in which certifications are embedded. The paper concludes with a call for improved data collection and research on certifications and their outcomes, increased commitment to building a more interconnected credentialing system, and a greater role for employers in transforming this system.



# WHAT MAKES CERTIFICATIONS POTENTIALLY USEFUL VEHICLES FOR PROMOTING CAREER AND ECONOMIC MOBILITY?

## COMPETENCIES REPRESENTED BY CERTIFICATIONS ARE RELEVANT TO INDUSTRY AND PROFESSIONAL CONTEXTS

Since quality certifications are based on legally-defensible, industry- or profession-wide job task analyses that are updated regularly, a credential seeker can be assured the assessed competencies in the certification represent current skills of the occupation. Beyond this, certifications recognize the importance of the industry and professional context in which the knowledge, skills, and abilities will be used. For example, in the information technology (IT) and manufacturing sectors, vendor-based systems sold by companies such as Microsoft, Amazon, and Siemens often create the context within which professional roles are performed in workplaces. In both fields, there are vendor-neutral and vendor-specific certifications. For instance, CompTIA, an organization that has vendor-neutral certifications in IT, offers a series of certifications—core, infrastructure, cybersecurity, and additional professional—that define five job roles—IT support specialist, IT networking specialist, cybersecurity specialist, server and cloud engineers, and data specialist—in which individuals can use the skills gained through these certifications in performing these jobs at different companies. Microsoft, on the other hand, offers a suite of vendor-specific certifications that are tailored to the ways in which people performing various IT roles (e.g., administrators, solutions architects, data engineers, data scientists, artificial intelligence engineers, DevOps engineers, security engineers and functional consultants) use Microsoft products and services in their workplaces. Since some vendor-specific certifications focus on fundamental concepts and role-related knowledge and skills, many of the competencies they represent can be transferrable to other vendor environments.

In addition, some certifications are tied to licensing for entry into regulated fields, like health care. For example, obtaining the Psychiatric Mental Health Nurse Practitioner-Board Certified (PMHNP-BC) certification is a requirement to become a licensed mental health nurse practitioner. Certifications in high-risk occupations such as this, restrict the scope of practice allowed for the certification holder and specify an amount of professional supervision required by a more experienced or higher-level certified professional in the field.

## CERTIFICATIONS COVER A RANGE OF COMPETENCIES RELEVANT TO PEOPLE AT DIFFERENT STAGES IN THEIR CAREERS

While some classify certifications as short-term credentials that can be obtained quickly and at low cost, that is certainly not the case for all. Certifications span levels of competencies from foundational to highly-advanced and specialized knowledge and skills, though what is considered foundational in one field may be considered a higher or more advanced skill in another. Also, while there is often a hierarchical relationship between career stage and the level of competency required, some certifications are equally useful for people with different levels of education and career needs. For example:

Someone entering the IT field may get a certification such as the CompTIA A+ certification or Microsoft Azure Fundamentals certification focused on broad foundational knowledge and skills. Or, a person could choose to get a Certified Information Systems Security Professional-Information Systems Security Engineering Professional (CISSP-ISSEP) certification from (ISC)<sup>2</sup> to focus on specific professional knowledge. Likewise, a current cybersecurity professional could get that same CISSP-ISSEP certification to achieve an even higher level of knowledge in the field. Others such as the EC-Council Certified Ethical Hacker (CEH) are geared to current information security specialists with different educational backgrounds and at various stages in their careers, who are interested in gaining expertise in the evolving ethical hacking field.

In the healthcare field, the Certified Occupational Therapist Registered (OTR) certification offered by the National Board for Certification in Occupational Therapy (NBCOT) is designed for a highly-trained graduate of an accredited, post-secondary academic program, and is a prerequisite for obtaining a state license. On the other hand, certifications offered by the Behavior Analyst Certification Board (BACB) range from the paraprofessional-level Registered Behavior Technician (RBT) that requires a high school diploma or equivalent and entry-level training and assessment, to the Board Certified Assistant Behavior Analyst at the undergraduate level, or the graduate-levels Board Certified Behavior Analyst and Board Certified Behavior Analyst-Doctoral. And in the field of nursing, a practicing, registered nurse can obtain the Psychiatric Mental Health Nurse-Board Certified (PMH-BC) specialty certification to demonstrate expertise in this content area or complete an accredited graduate education program to become Psychiatric-Mental Health Nurse Practitioner (PMHNP-BC).

## **CERTIFICATIONS’ RELEVANCE TO SKILLS NEEDED IN THE LABOR MARKET INCREASES THEIR POTENTIAL VALUE FOR EMPLOYERS AND CREDENTIAL SEEKERS**

Employers’ use of certifications for hiring and promotion differs substantially among industries, professions, geographic areas, and size of establishment, and often reflect industry and professional policies and practices with their different pay scales, working conditions, and inherent gender, race and other biases. These factors impact the labor-market value of the certification to the individual and its utility as a vehicle for promoting economic mobility. Yet, employers can trust that the certification holder has the knowledge, skills, and abilities required to perform different jobs because of the rigorous testing processes undertaken with certifications.<sup>3</sup> The clarity and specificity with which certification competencies are validated and articulated helps “learners understand and document their own knowledge, skills, and abilities relative to labor market requirements, thereby increasing their competitive advantage, qualifying for new and evolving jobs in labor markets, and advancing in their careers over time.”<sup>4</sup>

## **CERTIFICATIONS ARE LIFELONG CREDENTIALS**

Unlike other types of credentials, most certifications promote lifelong learning through their recertification or renewal processes.<sup>5</sup> These processes typically require certification holders to demonstrate that they have up-to-date knowledge and skills either through re-examination and/or participation in a specified learning activity. Some certification renewal processes also require the certification holder to provide assurances of having met or maintained professional ethics or other standards needed to renew the certification.<sup>6</sup>



---

3 For more information on how certifications are developed, see Good et al., *Understanding Certifications* (2020).

4 Everhart et al., *Quality Dimensions for Connected Credentials* (2016).

5 Author’s note: some certifications, such as the Microsoft Azure Fundamentals certifications, do not have recertification requirements.

6 Albert et al., *Recertification: A Distinguishing Feature of Certifications* (2022).

# WHY IS IT IMPORTANT TO LOOK AT CERTIFICATIONS WITHIN THE CONTEXT OF CAREER AND CREDENTIALING PATHWAYS?

Looking at certifications in the context of career and credentialing pathways provides a map of systemic connections—or lack thereof—among certifications and other credentials, and between credential attainment and actual career mobility.<sup>7</sup> It can help shed light on how people potentially can and actually do earn credentials, along with the employment, earnings, and further education outcomes they achieve after obtaining specific credentials. The pathways view of certifications also aids in identifying the barriers that may hinder individuals' abilities to make decisions about what certifications to seek; gain the knowledge, skills, and experiences needed to earn certifications; and ultimately improve their economic situation.

Just as certifications differ substantially along multiple dimensions, so do the career and credentialing pathways one can take. These differences make some certifications more useful to promote economic mobility as part of career pathways than others. Career and credentialing pathways vary as to:

- » the starting points of the pathways as determined by the level and scope of the competencies assessed by certifications and any educational and work experience prerequisites that may exist;
- » the ways certifications are connected to each other and other credentials;
- » how certifications are being integrated with educational programs of study;
- » the number of steps in a pathway and the distance between steps—in terms of knowledge, skills, educational attainment, and work experience required to move from one step to another;
- » the navigational and other supports provided to certification seekers by certification bodies; and
- » pathway exit points to the labor market.

## STARTING POINTS OF CAREER AND CREDENTIAL PATHWAYS

In addition to the knowledge, skills, and abilities that must be demonstrated through a certification assessment or examination (e.g., oral, written, and/or performance-based), certification seekers also may need to meet a range of education and work experience prerequisites before they are even

---

<sup>7</sup> Author's note: this discussion of credentialing pathways draws on the concept of career pathways, as defined in the Center for Law and Social Policy's *Shared Vision, Strong Systems* framework, as well as concepts articulated by Lumina Foundation's "Connecting Credentials" campaign, and the *Quality Dimensions for Connected Credentials* report.

eligible to take the examination (exam). The extent of these prerequisites is largely driven by two imperatives: to ensure applicants have an equal opportunity to successfully pass the exam, and, in the case of high-risk occupations such as health care, finance, and engineering, to protect public health and safety.

Some prerequisites, especially in high-risk occupations, require completion of specific accredited educational programs of study, as in the case of the PMHNP-BC certification, which requires completing graduate level preparation. Other certifications, such as many in IT, are agnostic about how a certification seeker meets the prerequisites as long as they are met. Still other certification prerequisites allow an individual to choose between meeting formal education or work experience requirements, though it is unclear what the basis is for such trade-offs between different educational attainment levels and work experience. For example, to be eligible to sit for the Certified Supply Chain Professional (CSCP) exam from the Association for Supply Chain Management (ASCM/APICS), a person can choose to qualify with one of the following: three years of business experience; a bachelor's degree or an international equivalent; or hold an active certification from ASCM/APICS.

Prerequisites are relevant to the utility of certifications as tools for promoting economic mobility because of the time and costs—both direct and indirect (e.g., potential cost of foregone earnings)—associated with meeting these requirements, which may serve as barriers to access for some individuals. Further, there is a lack of publicly-available data regarding the impacts of prerequisites or the education/work experience trade-offs on individual's decisions to pursue a certain certification, their success in passing the certification exam, and/or their ultimate performance on the job. It is also unclear what the impact of these prerequisites is in the labor market. Reliance on educational prerequisites makes certification bodies dependent on the education system for the quality and supply of people eligible to sit for the exams, which in turn has impacted employers' ability to grow and diversify their workforces.

The following examples illustrate the breadth of certification prerequisites—ranging from advanced degrees and many years of experience to no prerequisites:

- » The Board for Global EHS Credentialing requires Certified Industrial Hygienist seekers to hold a four-year bachelor's degree with certain coursework in STEM (science, technology, engineering, and math), ethics, industrial hygiene toxicology, fundamentals, measurements, and controls; at least four years of professional-level comprehensive industrial hygiene practice exercising independence, depth, breadth, and accountabilities for position-related responsibilities, and professional relationships with practicing Certified Industrial Hygienists, mentors, or networks who can teach the nuances in applying the educational knowledge in real world situations.
- » The American Academy of Healthcare Providers requires candidates sitting for the Certified Addiction Specialist certification exam to have three-to five years of relevant professional experience, 60 hours of education in at least one of five specialty areas (alcohol, other drugs, sex addiction, eating disorders, and gambling disorders), and 30 hours of education in some combination of serving special populations, ethics, communicable diseases, and sexual harassment. Although most applicants have advanced degrees, applicants with an associate

degree or no degree may apply if they have a minimum of five years of clinical experience and documentation of the other requirements.

- » The Project Management Institute (PMI) requires applicants for the Certified Associate in Project Management (CAPM) certification to have a high school diploma, an associate degree, or equivalencies, and completion of 23 hours of project management education, which can also be fulfilled by taking the PMI Project Management Basics online course.
- » EC-Council requires CEH applicants to have a minimum of two years of work experience in the information security domain and pay a \$100 application fee. However, individuals that have attended an official EC-Council training course may bypass these requirements entirely.
- » CompTIA has no prerequisites for its A+ certification, but it recommends that candidates have 9–12 months of laboratory or field experience prior to taking the exam.
- » The Certified Production Technician certification issued by the Manufacturing Skill Standards Council and Microsoft’s Azure Fundamentals certifications have no prerequisites. Microsoft’s courses preparing candidates for Fundamentals and higher-level, role-based certifications also have no prerequisites, but people without relevant work experience tend to struggle in higher-level courses.

## CREDENTIAL CONNECTIONS

Connections among certifications, as well as with other credentials, are often described in terms of the following concepts.<sup>8</sup>

**Portability:** the value of the credential outside the context of the credential issuing body, for example, among employers in other industries or professions, in educational systems, and/or in other contexts locally, nationally, and, as appropriate, internationally.

**Stackability:** the connections among credentials that allow them to “be accumulated incrementally over time to demonstrate attainment of broader, more complex, and/or more specialized knowledge and skills.”<sup>9</sup>

## PORTABILITY

The value of certifications in the labor market depends on their relevance to employer needs and their reliability in assessing relevant competencies. Establishing the value relationship and connections among credentials entails matching the competencies represented by one credential with the competencies represented by another credential. However, establishing the connections for certifications to degrees and certificates is often more difficult to do because competencies

---

8 Everhart et al., *Quality Dimensions for Connected Credentials* (2016).

9 Ibid.

associated with these other credentials are often less well-articulated. Clearly articulated competencies underlying quality certifications makes it possible to compare the articulated competencies of other credentials and more easily find their connections. These connections can also help certification holders better portray a more complete picture of obtained competencies to assist in hiring, promotion, and pay increases, and can help meet the prerequisites for other certification exams and/or to be awarded credit applicable toward earning another credential.

## **STACKABILITY**

Some pathways allow for stacking of certifications within a hierarchy or sequence of certifications, each with progressively higher competency requirements in a single profession, allowing people to progress with increased skill and experience either through specialization or broadening the scope of practice in their occupation or related field. For example, PMI offers a sequence of certifications beginning with the CAPM, which is for individuals new to project management, followed by Project Management Professional for the skilled practitioner, and going to specialized certifications such as the Agile Hybrid Project Pro or the Portfolio Management Professional for the senior-level practitioner. These certifications are also portable in that they can connect in pathways with other certifications applicable in a wide range of jobs outside their immediate occupation or in other industries.

Other pathways stack certifications in non-sequential or non-hierarchical ways in the same or other fields. For example, the Manufacturing Skill Standards Council's (MSSC) production, logistics, and forklift technician certifications complement each other, but do not need to be earned in a particular order. EC-Council also highlights career paths for individuals who want to pursue specialized careers in IT. For instance, to become a licensed security consultant, individuals could earn the Certified Penetration Tester (CPENT) or Licensed Penetration Tester (LPT master). Individuals who want to become a trainer can apply to be a Certified EC-Council Instructor (CEI). Those interested in becoming a multi-domain expert can choose from a variety of certifications including the Computer Hacking Forensics Investigator (CHFI), Certified Application Security Engineer (CASE), or other specialized certifications.

While some career pathways can be satisfied within the suite of certifications offered by one certification body, other pathways cut across certification bodies and even occupational fields. For example, CompTIA's vendor-neutral certifications can be combined with vendor-specific certifications like those offered by Cisco, AWS, Google, Red Hat, SAS, Oracle, VMWare, or Microsoft. People could also pair the PMI certifications with IT or cybersecurity certifications to demonstrate the ability to manage complex IT projects.

## INTEGRATING CERTIFICATIONS AND EDUCATIONAL PROGRAMS OF STUDY

Certifications interact with learning systems and educational programs of study in a number of important ways:

- » fulfilling the educational and work experience prerequisites required to sit for some certifications;
- » creating partnerships with or creating approved networks of a variety of education and training providers, such as universities, community colleges, high schools, apprenticeship programs, and/or boot camps, to help people prepare to take an initial certification exam and meet continuing learning requirements associated with renewing a certification;<sup>10</sup> and
- » sharing information on exam content and blueprints with educational providers and/or institutions to promote the awarding of appropriate educational credit for the competencies represented by the certification and/or aligning/embedding certification competencies with educational program curricula.

Beyond the connections between certifications and educational programs of study established through prerequisites and preparation for certification exams, many educational institutions and certification bodies are increasingly interested in finding ways to align or embed certifications in academic programs of study, which may make programs more relevant to employers' needs. Although notable examples of embedded certifications exist at the university level,<sup>13</sup> currently, this practice is more prevalent at the community college level, especially in workforce-oriented programs, which may or may not be credit-bearing.

In some programs, attainment of certifications that are aligned or embedded within degree programs count for credit towards that degree and/or add job-specific competencies to a degree transcript. A number of certification bodies have also sought recognition of their certifications for credit toward an educational credential through the American Council on Education's (ACE) "Learning Evaluations" program, which evaluates formal military and workplace learning programs and some types of non-formal training and courses, and makes recommendations for the amount of academic credit that should be awarded for each. It is estimated that about 450 colleges and universities follow ACE's recommendations.<sup>14</sup> For example, the CEH certification and four others from EC-Council have been evaluated and determined to count for three credits towards a related degree. Similarly, a number of Microsoft's certifications have been reviewed and approved for college credit through this program.

---

10 Author's note: those certification bodies that adhere to quality standards need to maintain a "firewall" between their examination and any training provided in order to assure the integrity of the examination and assessment functions.

11 For more information about the EC-Council Academia Partnership program, see: <https://www.eccouncil.org/academia/>.

12 For more information about the CompTIA Academic Partner Program, see: <https://partners.comptia.org/become-a-partner/academic-partner>.

13 Zanville et al., *Report on Phase I Study: Embedding Industry and Professional Certifications within Higher Education* (2017).

14 For more information about ACE's Learning Evaluations, see: <https://www.acenet.edu/Programs-Services/Pages/Credit-Transcripts/Credit-Transcripts.aspx>.

## EXAMPLES OF CERTIFICATION-UNIVERSITY CONNECTIONS

**EC-Council** offers a variety of training and exam preparation materials that range from in-person classes delivered through hundreds of training centers authorized to teach EC-Council courses around the world; in person and online courses delivered through partner academic institutions to benefit students enrolled in a college or university degree programs; live online instructor-led training courses; an asynchronous, self-study environment delivered in streaming video format; mobile learning; a subscription-based learning platform; a pen-test platform; cyber range; hacking challenge; and textbooks. Its “Academia Partnership,” which is free for any accredited academic institution, provides cost-effective, authorized learning resources for enrolled students to prepare for EC-Council exams and ultimately their careers after graduation. In turn, students have the opportunity to achieve industry-recognized certifications and compete in free cyber competitions as they complete their degree programs.<sup>15</sup>

**CompTIA** has a free “Academic Partner Program” for secondary schools (including career, vocational, or technical centers), colleges and universities, not-for-profit organizations that provide technology instruction, U.S. government funded educational agencies in other countries, Job Corps centers, and correctional facilities to provide tools and resources for recruiting, training, certifying, and upgrading the skills of students in IT.<sup>16</sup> It is designed to help schools and other partners promote certification and enhance student career opportunities. Additional benefits include: discounts on exams and CompTIA learning resources; online certification testing and ease of tracking student results; instructional resources such as information on certification exam objectives, CompTIA-approved learning materials, a certification roadmap, CompTIA-hosted webinars, and classroom resources such as case studies, videos, and more; and access to the IT community through events, conferences, and the CompTIA instructor network community. CompTIA also engages in extensive recruitment efforts through social media, participation in conferences, direct employer contact, and a training perspective. Though it is free to join, a partner must purchase content or exam vouchers annually to remain in the program.

---

15 For more information about the EC-Council Academia Partnership program, see: <https://www.eccouncil.org/academia/>.

16 For more information about the CompTIA Academic Partner Program, see: <https://partners.comptia.org/become-a-partner/academic-partner>.

**Microsoft** has developed an extensive system to help people learn about and prepare for taking their various certification exams, with a worldwide network of more than 1,000 partner learning providers with Microsoft Certified Trainers (MCTs). In addition to instructor-led courses, the Microsoft website provides free online training, extensive learning materials that include visual depictions of learning paths that are made up of modules with related units (such as videos, labs, and articles). They also provide free online learning tools such as the “Microsoft Learn Sandbox,” where students use Microsoft tools to create virtual machines to practice what they are learning. In addition, Microsoft has partnered with Credly to provide certification holders with downloadable badges, which are digital representations of an individual’s achievements, competencies, and transcripts related to their certification, and serve to inform and provide verifiable information about the holder’s accomplishments. Microsoft also offers discounted pricing for exams for academic institutions, and allows companies to consolidate the purchasing, budgeting, and tracking of Microsoft training and certification products with other Microsoft technology purchases.

In addition, most states and colleges conduct an analysis of learning achieved outside of formal educational programs of study using their own prior learning assessment processes, but these processes are often underutilized because they are generally cumbersome for educators and may be unknown to students. The process of embedding certifications in credit-bearing educational programs is complicated because it can be difficult and time consuming to align the competencies assessed in certifications with the learning outcomes of the educational programs of study. Educators are not always aware of the detailed exam blueprints produced by certification bodies that could help determine program equivalencies and relationships that are available. These blueprints provide information about the percentage of questions on the exam that address each domain of knowledge, competencies, and tasks covered by the exam. Another problem that often emerges when aligning certifications with degree programs is that educational, program-level learning objectives are often



*Embedding Credentials in Degree Programs*

too broadly written to adequately match them to related competencies in certifications without conducting an analysis of course-level curricula.

While embedding certifications in educational programs of study may or may not involve the award of educational credit for the certifications, this practice can help create new credentialing and career pathways. Enabling an individual to earn a certification while pursuing a degree or at the end of a degree program, may broaden job or career opportunities that would not have been available with earning just a degree. Research also suggests that earning a short-term credential such as some certifications may increase completion and degree attainment rates.<sup>18</sup> It also may increase a student's chances for employment and work-based learning experiences during the academic year, and/or help students who start post-secondary education and drop-out or stop-out after their first or second year of a degree program find a job with livable wages.<sup>19</sup>



## STEPS, AND DISTANCE BETWEEN STEPS, IN CAREER AND CREDENTIAL PATHWAYS

For each career or credentialing pathway, the number of credentials (steps) and the distance between steps vary. For some occupations, the distance between certification steps in the pathway are tied to attainment of educational credentials (e.g., high school diploma, bachelor's degree,

---

17 For more information about the Microsoft Certified Trainers program, see: <https://docs.microsoft.com/en-us/learn/certifications/mct-certification>.

18 Giani and Fox, "Do stackable credentials reinforce stratification or promote upward mobility? An analysis of health professions pathways reform in a community college consortium" (2016).

19 Swift et al., *Embedding Certifications Into Bachelor's Degrees: Certification-Degree Pathways Project Framework* (2020).

graduate degree) and/or years of work experience. For example, there is a big gap between the steps needed in the pathway to become a Certified Pharmacy Technician (CPhT), which can be obtained with a high school diploma and completion of a Pharmacy Technician Certification Board-recognized education/training program or equivalent work experience, versus the pathway to becoming a pharmacist, which requires a doctoral degree, passing the Multistate Pharmacy Jurisprudence Examination®, and passing a licensure exam before being able to practice as a pharmacist. While requiring the certification seeker to obtain a higher-level degree or have substantially more work experience may be arguably justified in terms of protecting the public or reflecting employer hiring practices in different niches of the labor market, it may not constitute a viable career path for many. In contrast, several of the IT certification pathways outlined previously in the paper allow for more flexibility and therefore may increase the utility of these certifications as pathway mobility tools.

A number of certification bodies studied have tried to improve access to their related occupations by adding additional levels in their certification offerings. For instance, the Board for Global EHS Credentialing tried to simplify entry into the practice of evaluating, protecting, managing, and enhancing the health and safety of people and the environment by creating a new certification—the Certified Associate Industrial Hygienist (CAIH)—to enable those that were doing industrial hygiene-like work, but would otherwise be unable to qualify for the Certified Industrial Hygienist (CIH) certification, to still obtain a credential. The education, experience, and exam qualifications for the CAIH were similar to those for the CIH, except were less stringent and targeted to people who had less science education, or who were working in more multi-disciplinary roles. And, the CAIH exam itself was different from the CIH, with more emphasis on recognition and evaluation, and fewer questions on program management. However, because of low demand, the CAIH was discontinued in 2006.

The BACB is another example of a certification body that added another certification to its offerings—the RBT paraprofessional certification as previously mentioned—to provide individuals who have been working as technicians in the behavior analysis field an opportunity to obtain a credential to formally recognize their knowledge and skills. In addition, the RBT serves as an entry point for individuals interested in the behavior analysis profession.

## **NAVIGATIONAL AND OTHER SUPPORTS**

Differences among individual motivations and circumstances, employer needs, and the complex interplay of all of the variations among certifications and career pathways often make it difficult for individuals to navigate the credentialing marketplace. Several certification bodies studied offer navigational tools to help credential seekers understand how the certifications they provide fit into career paths, the value of the certification in the labor market, the costs, the prerequisites, the preparatory opportunities, and the exam options available. For example, the American Healthcare Information Management Association (AHIMA) provides a career map showing dozens of occupations in various parts of healthcare that use AHIMA certifications.<sup>20</sup> These include hospitals, office-based physician practices, nursing homes, home health agencies, mental health facilities, public health

---

20 For more information about the AHIMA career map, see: <https://my.ahima.org/careermap>

agencies, and organizations that use patient data or health information, such as pharmaceutical companies, law and insurance firms, and health product vendors.

Additionally, CompTIA developed an IT career planning tool that allows individuals to explore job roles and the relevant CompTIA certifications.<sup>21</sup> The tool describes five broad occupational categories: IT support specialist, IT networking specialist, cybersecurity specialist, software and web developers, and data specialists, for individuals to explore information about the related certifications and specific job roles that can be achieved, and is divided into experience level. Other information that is provided includes descriptions of the jobs, required skills, number of job postings, median annual salary, learning and training opportunities provided by CompTIA, and certifications offered by CompTIA and other issuers that align with the job role. Individuals can also download a customized career road map.

The federal government and states also provide information about certifications. The U.S. Department of Labor's CareerOneStop site offers their Certification Finder tool where individuals can search for certifications and their issuers, related occupations, and whether they are in demand in the labor market.<sup>22</sup>

## EXIT POINTS TO THE LABOR MARKET

Multiple exit points along the pathways indicate the kinds of jobs and the earnings that can be obtained with different credentials. These exit points are largely determined by employer hiring and promotion requirements, as well as other industry and occupational imperatives such as licensing requirements, which may differ from state to state. Ideally, exit points into the labor market can also serve as entrance points for access to continued learning and career advancement opportunities for people choosing to take the next step. Some certifications can even be used within a variety of jobs and may provide a greater variety of employment options than those certifications that are more specifically directed. Some can serve as a base credential within a hierarchy of credentials needed to advance in a career pathway, while other certifications may get the credential holder in the door for a good job in which an individual can then advance based on the individual's on-the-job performance and other work-related learning without additional credentials.

A recent Brookings Institution study illustrates very different mobility patterns for workers with different skill levels and demographic characteristics within and across occupations and economic sectors.<sup>23</sup> Unfortunately, data is needed on the impact attainment of different kinds of certifications has on the actual mobility patterns of people with different characteristics within and across different economic sectors.

---

21 For more information about the CompTIA career planning tool, see: <https://www.comptia.org/content/it-careers-path-roadmap>.

22 For more information about the CareerOneStop Certification Finder tool, see: <https://www.careeronestop.org/Toolkit/Training/find-certifications.aspx>.

23 Escobari et al., *Moving Up, Promoting Workers Economic Mobility Using Network Analysis* (2021).

# RECOMMENDATIONS

By bringing together academic preparation, successful clinical/performance, and validation by a third-party exam, certifications can potentially bridge divides in the current credentialing system that impedes economic mobility for individuals and negatively impacts employers' ability to find skilled workers. To realize this potential, more research and data collection is needed to better understand certification attainment, employer utilization patterns, employment and earnings outcomes, and career mobility patterns associated with different certifications. Systemic changes to the current credentialing and labor market systems is also urgently needed. The following recommendations address these challenges.

## IMPROVE DATA COLLECTION

Despite their prevalence in the workforce, there is no complete, centralized source of data on the outcomes of certifications for job seekers, workers, or employers. While there have been isolated efforts to collect this data by states, as well as self-reported data from certification bodies and individuals, outcomes data are fragmented and incomplete. Certification bodies are often more focused on assuring the quality of their processes than measuring outcomes, and there have been little-to-no incentives or requirements from accreditors or other stakeholders to do so. However, as interest grows in increasing integration of certifications with educational programs of study and related career pathways, the scarcity of data on outcomes related to specific certifications is of utmost concern.<sup>24</sup>

Especially needed is disaggregated data collected on certification attainment patterns and the employment, earnings, and educational attainment outcomes associated with the certifications, including a focus on how outcomes differ by:

- » key influential factors, such as the race, gender, age, income, and geographic location of certification holders;
- » the affordability and accessibility of learning opportunities to help individuals prepare for the exams;
- » access to guidance and other needed supports; and
- » and the characteristics of the credentialing and career pathways themselves.

---

24 Prebil and McCarthy, *Building Better Degrees Using Industry Certifications: Lessons from the Field* (2018).

A partnership between the National Student Clearinghouse, the U.S. Census Bureau, the National Association of Manufacturers (NAM)/Manufacturing Institute (MI), and their manufacturing organization partners is demonstrating the feasibility of using data matching techniques to produce much needed aggregate-level data on the employment and earnings outcomes associated with the attainment of manufacturing certifications.<sup>25</sup> Preliminary data from 2005–2018, with the majority of the data from years 2010 and beyond, on two manufacturing certifications showed an immediate increase in wages and the year-over-year increase in wages after the attainment of the first certification.<sup>26</sup> Likewise, people age 18–25 saw an immediate upward wage trajectory for the five years after receiving a certification. Between age 26 and 45, wages were stagnant before earning a certification, then rose steadily for the five years after earning it. People older than 45 who earned a manufacturing certification were able to replace wages that they lost before they attained that credential. Moreover, these positive impacts on wages and employment for credential attainers held up when they were compared against a control group of workers who had similar characteristics to those studied in the pilot, but were not credentialed.

While that pilot project produced data on only two manufacturing certifications, the National Student Clearinghouse has partnered with Workcred on a Lumina Foundation-funded project involving more than 35 certification bodies to consider creating formal, contractual relationships with the Clearinghouse to begin building the database that is needed to improve understanding of the value of certifications, the labor market outcomes of individuals who hold them, and insights into successful career pathways into the workforce.<sup>27</sup> The linking of certification data with data on other educational credentials is so important to helping individuals, employers, and policymakers make more informed choices about certifications.

More nationally-representative survey data on certifications, like through larger surveys such as the Adult Training and Education Survey run through the National Household Education Surveys Program of the U.S. Department of Education’s National Center for Education Statistics,<sup>28</sup> and the National Science Foundation’s National Training, Education, and Workforce Survey,<sup>29</sup> could also help fill this gap in the understanding of certifications and their place within credentialing and career pathways.

---

25 For more information on the National Student Clearinghouse’s work with industry credentials, see: <https://www.studentclearinghouse.org/workforce/industry-credentials/>.

26 Brown and Carrick, “The Manufacturing Institute, National Student Clearinghouse, and Census Bureau’s Efforts to Link Administration Data on Certification” (2020).

27 For more information about Workcred’s data-linking project, see: <https://www.workcred.org/Our-Work/Demonstrate-Value-through-Linking-Data.aspx>.

28 For more information about the Adult Training and Education Survey program, see: <https://nces.ed.gov/nhes/ates.asp>.

29 For more information about the Training, Education, and Workforce Survey program, see: <https://www.nsf.gov/statistics/stw/skilled-technical-workforce.cfm#develop-a-new-survey-the-national-training-education-and-workforce-survey-ntews>.

Furthermore, research is needed to better understand the impact of prerequisites and education/work experience trade-offs on individual's decisions to pursue a certain certification, their success in passing the certification exam, and/or their ultimate performance on the job. More research also is needed on employer utilization of certifications and their impact on employers' ability to grow and diversify their workforces.

## **TRANSFORM AND BETTER ALIGN WORKFORCE AND EDUCATION CREDENTIALING AND SYSTEMS**

Beyond improved data and research, we need to implement policies and practices to bring together and improve workforce and education credentials so that they work better to support career mobility and lifelong learning needs of individuals, and better serve the needs of employers.

### **EMPLOYERS AND CERTIFICATION BODIES**

The goal of greater career mobility cannot be achieved without the sustained involvement of employers. Employers use credentials as signaling and sorting devices in the hiring process to help them predict how well applicants will meet their workplace performance expectations. They elevate the value for particular certifications by including them as preferred or required in job postings, requesting them from job candidates, or encouraging employees to obtain them.

Many employers use post-secondary credentials as the minimum hiring requirement, thereby excluding from consideration many job applicants who may be perfectly capable of performing required work simply because they lack a degree. Major employers and a small but increasing number of small- and medium-sized employers are experimenting with skills-based or competency-based hiring (such as direct assessment of skills) as an alternative to reliance on post-secondary credentials. They do this to expand the pool of eligible workers and because of dissatisfaction with at least some traditional degrees and other educational credentials. In addition, employers increasingly are using technology-driven, online postings and applicant tracking systems to sort and filter applicants based on data analytics. This means the knowledge, skills, and abilities represented by certifications and educational credentials need to be made discoverable in these systems. Most importantly, credentialing processes and products need to be aligned with emerging employer practices in ways that more equitably improve economic opportunity.<sup>30</sup>

Employers and certification bodies are in a unique position to serve as catalysts for the needed credentialing system transformation. Employers can advocate directly to policymakers and certification providers by providing examples of best practices that demonstrate the value of certifications to individuals and employers. Certification bodies can provide leadership since certifications are a competency-based credential and have established quality assurance standards that could be adapted for broader use. Yet, certification bodies and other credential providers will have to become more transparent in their processes and the outcomes related to the credentials

---

30 Connecting Credentials, "Applying Demand and Supply Signals: Work Group Report" (2017).

they provide. Further, just as employers are experimenting with skills-based hiring practices to expand the eligibility of job applicants, certification bodies should assess the actual utility of prerequisites and their impact on access to the certifications they provide.

## **EDUCATION AND WORKFORCE SYSTEMS**

Education and workforce systems also have key roles to play. Anecdotal evidence from career pathways initiatives suggests that because of life circumstances, it is often difficult for some people to attain an initial credential or move beyond initial attainment to earn additional one(s) that may help advance in a career. While progress is being made in implementing competency-based practices and integrating certifications in relevant educational programs of study, significantly more needs to be done to spur systemic reforms and create more aligned and flexible systems that make it easier to attain portable, high-quality credentials that work best for each person. Such reforms include changes in credit, transfer, quality assurance, and accountability policies as well as the provision of improved navigational, financial, and other supports to help people attain the credentials they need to advance. In addition, a better understanding of how various policy levers can be applied to promote larger integration of certifications and a greater commitment among credential providers, learners, employers, accreditors, and policymakers is needed in order to establish a more connected credentialing system to better serve the needs of the diverse U.S. workforce. Only then can the real potential of certifications be fully realized.



# BIBLIOGRAPHY

Albert, Kyle, Isabel Cardenas-Navia, Stephen Crawford, Karen Elzey, Janet Forte, Evelyn Ganzglass, Melissa Goldberg, Larry Good, and Roy Swift, *Recertification: A Distinguishing Feature of Certifications* (2022):

<https://share.ansi.org/wc/Shared%20Documents/Workcred-Reports/Understanding-Certifications-Study/Recertification-A-Distinguishing-Feature-of-Certifications.pdf>.

Brown, Vanessa, and Gardner Carrick, “The Manufacturing Institute, National Student Clearinghouse, and Census Bureau’s Efforts to Link Administration Data on Certification,” Non-degree Credential Research Network webinar (2020): <https://gwipp.gwu.edu/sites/g/files/zaxdzs2181/f/downloads/NCRN%20Presentation%20on%20IC%20and%20Census%20Bureau%20July2020%20FINAL%20%281%29.pdf>.

Cardenas-Navia, Isabel, Karen Elzey, Janet Forte, Roy Swift, Kyle Albert, Stephen Crawford, Evelyn Ganzglass, Melissa Goldberg, and Larry Good, *Accreditation Standards: The Primary Source of Quality Assurance for Certifications* (2022): <https://share.ansi.org/wc/Shared%20Documents/Workcred-Reports/Understanding-Certifications-Study/Accreditation-Standards-The-Primary-Source-of-Quality-Assurance-for-Certifications.pdf>.

Crawford, Stephen, Kyle Albert, Isabel Cardenas-Navia, Karen Elzey, Janet Forte, Evelyn Ganzglass, Melissa Goldberg, Larry Good, and Roy Swift, *Certifications: The Ideal, Reality, and Potential* (2022): <https://share.ansi.org/wc/Shared%20Documents/Workcred-Reports/Understanding-Certifications-Study/Certifications-The-Ideal-Reality-and-Potential.pdf>.

The Center for Law and Social Policy, *Shared Vision, Strong Systems: The Alliance for Quality Career Pathways Framework Version 1.0* (2014): <https://www.clasp.org/sites/default/files/public/resources-and-publications/files/aqcp-framework-version-1-0/AQCP-Framework.pdf>.

Connecting Credentials, *Applying Demand and Supply Signals: Work Group Report* (2017): <https://skilledwork.org/wp-content/uploads/2021/11/Applying-Demand-and-Supply-Signals.pdf>.

Cunningham, Evan, “Professional Certifications and Occupational Licenses: Evidence from the Current Population Survey,” in *Monthly Labor Review*, U.S. Bureau of Labor Statistics (2019): <https://doi.org/10.21916/mlr.2019.15>.

Escobari, Marcela, Ian Seyal and Carlos Daboin Contreras, *Moving Up, Promoting Workers Economic Mobility Using Network Analysis*, Global Economy and Development at Brookings (2021): <https://www.brookings.edu/research/moving-up-promoting-workers-upward-mobility-in-a-time-of-change>.

Everhart, Deborah, Evelyn Ganzglass, Carla Casilli, Daniel Hickey, and Brandon Muramatsu, *Quality Dimensions for Connected Credentials*, The American Council on Education (2016): <https://www.acenet.edu/Documents/Quality-Dimensions-for-Connected-Credentials.pdf>.

Giani, Matthew, and Heather Lee Fox, "Do stackable credentials reinforce stratification or promote upward mobility? An analysis of health professions pathways reform in a community college consortium," in *Journal of Vocational Education & Training* (2016) 69:1, 100-122, DOI: 10.1080/13636820.2016.1238837.

Good, Larry, Evelyn Ganzglass, Stephen Crawford, Kyle Albert, Roy Swift, Karen Elzey, and Isabel Cardenas-Navia, *Understanding Certifications* (2020): <https://www.workcred.org/Documents/Understanding-Certifications-Report-Dec-2020.pdf>.

Lumina Foundation, "Connecting Credentials," accessed January 21, 2022: <https://connectingcredentials.org/>.

Prebil, Michael, and Mary Alice McCarthy, *Building Better Degrees Using Industry Certifications: Lessons from the Field*, Center on Education & Labor Education Policy (2018): <https://www.newamerica.org/education-policy/reports/building-better-degrees-using-industry-certifications>.

Swift, Roy, Karen Elzey, Isabel Cardenas-Navia, Robert Hansen, Julie Uranis, Sheila Martin, Shalin Jyotishi, Shari Garmise, and Andrea Rodriguez, *Embedding Certifications Into Bachelor's Degrees: Certification-Degree Pathways Project Framework* (2020): <https://www.workcred.org/Documents/Embedding-Certifications-Into-Bachelors-Degrees-Certification-Degree-Pathways-Project-Framework-Report-November-2020.pdf>.

Zanville, Holly, Kelly Porter, and Evelyn Ganzglass, *Report on Phase I Study: Embedding Industry and Professional Certifications within Higher Education* (2017): <https://www.luminafoundation.org/files/resources/report-on-phase-i-study-embedding-industry-professional-certifications-within-higher-education-january-2017.pdf>.