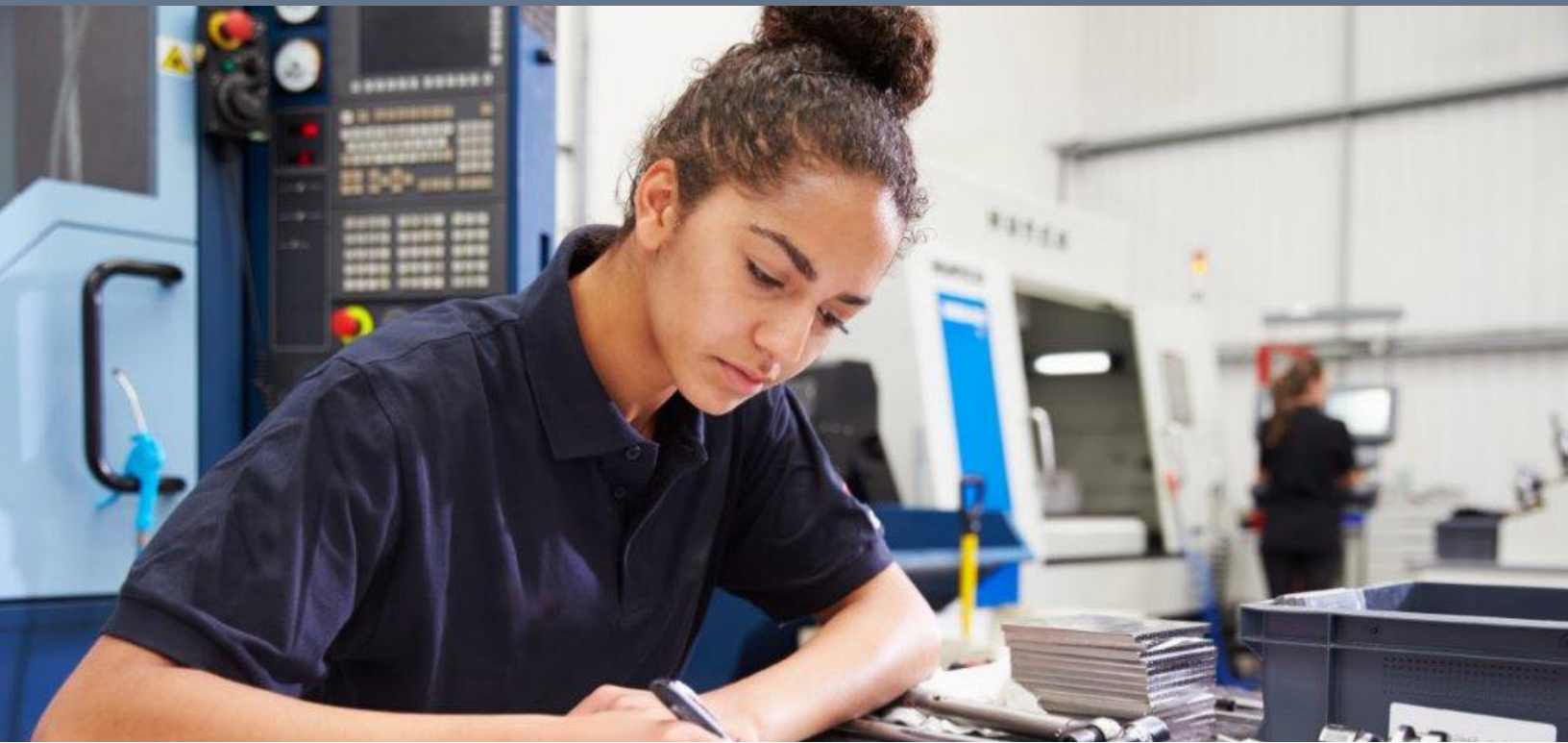


Where Credentials Meet the Market

State Case Studies on the Effect of High School Industry Credentials on Educational and Labor Market Outcomes

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Credentials Matter is a partnership between ExcelinEd and Burning Glass Technologies. This ongoing, comprehensive research project seeks to understand the industry credential landscape in the United States and provide actionable data analysis and resources for states and the public.



Launched by former Florida Governor Jeb Bush in 2008, the Foundation for Excellence in Education (ExcelinEd) supports state leaders in transforming education to unlock lifelong opportunity and success for each and every child. From policy development to implementation, ExcelinEd brings deep expertise and experience to customize education solutions for each state's unique needs. Focused on educational quality, innovation, and opportunity, ExcelinEd's agenda is increasing student learning, advancing equity, and readying graduates for college and career. Learn more at [ExcelinEd.org](https://www.ExcelinEd.org).



Burning Glass Technologies delivers job market analytics that empower employers, workers, and educators to make data-driven decisions. The company's artificial intelligence technology analyzes hundreds of millions of job postings and real-life career transitions to provide insight into workforce demand patterns. This real-time strategic intelligence offers crucial insights, such as which jobs are most in demand, the specific skills employers need, and the career directions that offer the highest potential for workers. For more information, visit burning-glass.com.



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Executive Summary

States should graduate students from high school prepared for the challenges they will face in college and their careers. Many states are working toward this goal by improving the quality of career and technical education (CTE) programs, and have looked to industry-recognized credentials as one component of this improvement. However, there is limited research on education and labor market outcomes associated with earning an industry credential in high school. A new report from ExcelinEd and Burning Glass Technologies, *Where Credentials Meet the Market: State Case Studies on the Effect of High School Industry Credentials on Educational and Labor Market Outcomes*, addresses that gap.

Credentials Meet the Market builds on the foundation laid in [Credentials Matter: A National Landscape](#) to examine the impact of credential attainment on long-term student outcomes. This second report analyzes the credentials students earn in high school and their impact on students' secondary completion, postsecondary enrollment and completion, and wage earnings. It provides insights into the return on investment of earning a credential in **Florida, Indiana, and Kentucky**—three states that collect rich, student-level data that includes credential attainment at the student level.

Findings

Overall, the report finds that earning a credential is associated with positive outcomes related to high school completion, community college enrollment and completion, and wages.

Secondary Educational Outcomes

- Earning a credential is associated with an increase in the probability of graduating from high school on time in **Florida, Indiana, and Kentucky**. This effect is stronger for female CTE students as compared to male CTE students.

Postsecondary Educational Outcomes

- In **Florida**, earning a credential is associated with an increase in the probability of CTE students enrolling in and graduating from community college and enrolling in university. There is no effect in **Florida** of earning a credential on CTE students graduating from the university system.
- In **Kentucky**, for CTE students, earning a credential is associated with an increase in the probability of earning an associate's degree. The effect of earning a credential on earning a bachelor's degree is negative for CTE students.
- **Indiana** was not able to provide data to assess postsecondary educational outcomes.

Labor Market Outcomes

- In both states that provided wage data, **Indiana** and **Florida**, earning a credential is correlated with higher wages for workers who earn at least \$20,000 annually and are at least 24 years old. Of the three types of credentials earned in **Florida**, certifications, licenses, and software credentials, only certifications were associated with a wage increase.

Table 1: Effect of Earning an Industry Credential on Educational and Labor Market Outcomes

	Effect of Earning an Industry Credential on CTE Students		
	Florida	Indiana	Kentucky
Graduating from High School on Time	+	+	+
Enrolling in Community College	+	N/A	N/A
Graduating from Community College/Earning an Associate’s Degree, Conditional on Enrollment	+	N/A	+
Enrolling in University	+	N/A	N/A
Graduating from University/Earning a Bachelor’s Degree, Conditional on Enrollment	No Effect	N/A	-
Wages for Full-Time Workers after High School	+	+	N/A

Based on these findings, we have also identified five specific recommendations for states to consider as they design education-to-career pathways for students.

Recommendations for States

- 1.** Collaborate across education, business and industry, and workforce systems to develop clear definitions for industry credentials of value that are appropriate to CTE programs and pathways. (For a description of this cross-sector process, see [*Credentials Matter: A National Landscape*](#).)
- 2.** Collect and report data on industry credential attainment throughout secondary and postsecondary.
- 3.** Connect industry credential attainment data to longitudinal datasets that include secondary, postsecondary, and labor market outcomes. Publish periodic user-friendly reports to all relevant stakeholders, including parents and students.
- 4.** Assess the return on investment of industry credentials over time to guide decision making related to policy and CTE program offerings, alignment, and quality. States can assess the value of individual credentials internally by adapting the methodology used in this report.
- 5.** Once these credentials are identified, provide incentives through financial incentives and accountability metrics for the attainment of industry credentials associated with positive long-term education and labor market outcomes.



Research Questions, Data, and Methodology

This research answers the following questions:

1. How do the socioeconomic and demographic characteristics of CTE students who earn a credential differ from those who do not?
2. What are the effects of credential attainment on state educational and labor market outcomes for these students?

ExcelinEd and Burning Glass used data from longitudinal data systems maintained by each state to answer these questions. The data available for each state can be seen in the table opposite:

Methodology

To measure the association between earning a credential in high school and secondary, postsecondary, and labor market outcomes, ExcelinEd and Burning Glass ran regression analyses separately in each of the three states. The analyses controlled for a range of other variables in each state, including gender, race/ethnicity, low-income status, and academic performance. The analyses considered all credentials earned by high school students in these states as part of a CTE program. These credentials are distinct from educational degree attainment and include certifications and licenses, as well as software credentials and assessments. Researchers focused the analyses on the universe of CTE students in these states.



Table 2: Data Availability from Each State

	Florida	Indiana	Kentucky
Population	Cohort of graduating students	CTE students	All students
Years of data available:	2009-2018	2013-2018	2013-2017
Number of students in dataset:	271,165	519,336	377,433

Controls available:

Gender	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Race/Ethnicity	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Low-Income status	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Academic performance (GPA)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Outcomes Available:

Probability of graduating high school on time	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Wages for working individuals no longer in school	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Probability of enrolling in community college	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Probability of graduating from community college, conditional on enrollment	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Probability of earning an Associate’s degree	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Probability of enrolling in university system	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Probability of graduating from university system, conditional on enrollment	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Probability of earning a Bachelor’s degree	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

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PART 1

Motivation & Research Questions

Education professionals and policymakers agree that students should leave high school prepared for the challenges they will face in the labor market and during their postsecondary education. One of the primary ways students in high school are prepared for career success is through career and technical education (CTE) programs, which in aggregate currently enroll over 8 million secondary students. High school students can choose to sample CTE courses or to follow a sequential CTE career pathway that functions as a major of study. CTE programs have been linked to greater earnings, higher rates of secondary school completion, and greater rates of post-secondary enrollment.¹

The labor market is changing, with increasing demand for postsecondary credentials and the need for entry-level job seekers to possess more complex skill sets.² States have responded to this change by modeling CTE programs around the skills students will need for success. States are looking to industry-recognized credentials as a component of this CTE strategy. Industry-recognized credentials are awarded by third parties to certify competency in a skill or set of skills that are relevant to an occupation. In the best-case scenario, industry-recognized credentials strengthen the ability of students to signal their preparedness to both employers and universities and add a measure of accountability to CTE programs. However, sparse research exists that assesses the benefit of earning a credential for CTE students. Such research is difficult to conduct because some states do not collect data on credential attainment in high school, and because state data systems often do not connect person-level data from secondary and postsecondary education to data on labor market performance.

In this report, ExcelinEd and Burning Glass Technologies partner with three states that do have robust data collection practices: Florida, Kentucky, and Indiana. Analysis of rich longitudinal student-level data from these three states enables two novel research questions:

- How do the demographic and socioeconomic characteristics of CTE students who earn a credential differ from those who do not?
- What are the effects of credential attainment on educational and labor market outcomes?

The outcomes we explore are:

- wages for full-time workers after high school;
- probability of graduating secondary school on time;
- probability of enrollment in community college;
- probability of community college completion given enrollment;
- probability of earning an Associate's degree;
- probability of graduating from a four-year university;
- probability of earning a Bachelor's degree.

1 *Career Academies: Long-term impacts on labor market outcomes, educational attainment, and transitions to adulthood* (Kemple and Willner, 2008); *The Effect of Career and Technical Education on Human Capital Accumulation: Causal Evidence from Massachusetts* (Dougherty, 2018); *High School Career and Technical Education Participation and Initial College Enrollment: Evidence from Arkansas* (Dougherty, 2016);

2 *Recovery: Job Growth and Education Requirements Through 2020* (Carnevale, Smith, and Strohi, 2014)






Scope of Research

The policies, CTE programs, and credentials offered and earned differ significantly across each state. For example, in Florida the majority of credentials earned are software credentials such as Microsoft Office Specialist or Adobe Photoshop Expert, whereas in Kentucky and Indiana, the majority of students earn certifications, such as Automotive Service Excellence certifications and AWS Certified Welder certifications. Therefore, the analyses in this report aim to shed light on the value of credentials earned in each state's particular context, but not to invite state-to-state comparison.

This report considers as a credential all credentials earned as part of a high school CTE program. These credentials are distinct from educational degree attainment and include certifications and licenses, as well as software credentials and assessments. See Table 3 for a description and typology of the credentials available to these students.³

3 For a full description of credential typology, see *Credentials Matter Report 1: A National Landscape of High School Student Credential Attainment Compared to Workforce Demand* (ExcelinEd and Burning Glass Technologies, 2019)

Table 3: Credential Types

Type	Purpose	Credential Examples	Occupation Examples
 License	<p>Mandated by law for workers to gain permission to practice in specific occupations and must be renewed periodically. Requirements vary by state and/or by licensing agency.</p>	<ul style="list-style-type: none"> • Commercial Driver’s License (CDL) • EMT/Paramedic License • Licensed Cosmetologist 	<ul style="list-style-type: none"> • Truck Driver • Emergency Responder • Hair Stylist/Barber/Cosmetologist
 Certification	<p>Signal an individual has acquired a set of abilities and, in some cases, allows them to perform a specific job. Certifications are not a legal requirement, but may open doors to entry-level jobs or help seasoned workers advance up the career ladder in their field.</p>	<ul style="list-style-type: none"> • Automotive Service Excellence Certification • AWS Certified Welder CompTIA Network+ 	<ul style="list-style-type: none"> • Auto Mechanic • Welder • Computer Network Administrator
 Software	<p>Demonstrate competence of a specific software. This includes productivity software and job-specific applications such as graphic or computer-aided design.</p>	<ul style="list-style-type: none"> • Adobe Certified Expert • Microsoft Office Specialist • QuickBooks Certified User 	<ul style="list-style-type: none"> • Graphic Designer • Administrative Assistant • Accounting Technician
 General Career Readiness	<p>Measures foundational workplace skills including basic reading, math, financial and digital literacy, workplace safety, and basic life support or first aid.</p>	<ul style="list-style-type: none"> • WISE Financial Literacy Certification • Basic First Aid • OSHA 10-Hour - General • National Career Readiness Certificate 	<p>These types of skills are applicable across virtually all occupations.</p>
 CTE Assessment	<p>Measures the skill attainment of students who have completed a program course sequence or CTE pathway.</p>	<ul style="list-style-type: none"> • PLTW Principles of Engineering • NOCTI - Carpentry • Precision Exams Health Science • AAFCS Pre-PAC Education Fundamentals 	<p>These assessments test the student’s mastery of state standards and are not necessarily aligned with or approved by an industry body or used in hiring or advancement decisions. Some states include CTE Assessments, in addition to other types of industry credentials, within their CTE accountability and reporting systems.</p>

Research Stakes

This report explores the educational and labor market outcomes associated with credential attainment by CTE students in high school. There are various mechanisms through which earning a credential may yield positive returns in these areas. A credential may signal a student's competence to postsecondary institutions, or the rigor associated with earning a credential and a student's pride in successful completion may reinforce their career interest in that program area. Credentials may also lead to labor market outcomes such as higher wages, given the ability of the credential to signal either general competence or subject-matter expertise.

The report also examines whether credential attainment interacts with other student-level characteristics to augment or reduce the effect of earning a credential. The report looks specifically at whether there are differential effects of credential attainment by gender and by socioeconomic status. The presence of differential effects may inform the audience to whom states promote credential attainment, the expectations that states have for credential attainment, and how states position credentials within their broader CTE strategy.

More generally, this report aims to provide a methodology that states, credential providers, and industry organizations can use to assess the value of the credentials that they offer and support. All states collect and manage data related to the academic preferences, academic performance, and demographic and socioeconomic characteristics of students in secondary school. Some states also collect data on student outcomes following secondary school, including how students progress through postsecondary education and how they perform in the labor market, and fewer states collect data on credential attainment in high school. This report employs a methodology that states with robust data collection practices can use to analyze the value of credentialing as a whole, as well as to explore the value of individual credentials. This approach enables the organizations supporting credential attainment to do so in a way that leads to the best outcomes for credential earners.

Organization of Report

This report is structured as follows:

- **Part 2** provides a review of the current literature available on CTE students and the outcomes associated with credential attainment.
- **Part 3** describes the analytical approach, data availability, and methodology.
- **Part 4** provides descriptive summary statistics for the population of CTE students who earn credentials compared to the population of CTE students who do not earn credentials.
- **Part 5** measures the effect of credential attainment for CTE students on the labor market and educational outcomes outlined above.
- **Part 6** discusses these results by contextualizing the findings and suggesting policy implications.
- **Part 7** summarizes the report and concludes.

PART 2

Literature Review

Scarcity of Research

Due likely in large part to data limitations, few contemporary studies have evaluated the effect of industry-recognized credentials on educational or labor market outcomes. Castellano, Stone, and Stringfield (2005) sought to use the attainment of industry-recognized credentials as a metric for school accountability but found that few high schools in 2002 were collecting data on credential attainment. The researchers recommended that schools improve record keeping, including collecting data on credential attainment.⁴ However, over a decade later, a report by New America found that even among postsecondary institutions, where credentials are more established, 43% of schools do not receive the results of credentialing exams.⁵ With respect to data on credential attainment in high school, a report by ExcelinEd and Burning Glass in 2019 found that only half of states collect such data.⁶ The data limitations encountered by researchers nearly 15 years ago persist today.

While the data limitations persist, the credential landscape has changed significantly since researchers began studying the effects of earning a credential. Much of this change has been driven by the increased adoption of new CTE programs that emphasize college and career readiness and the development of new credentials to support these programs. This report's unique contribution is its assessment of the returns to credential attainment in high school, and the analyses within use data that reflects the present CTE and credential landscape.

Research into the effects of credential attainment in high school is also scarce because all previous studies have examined the effects of credentials earned in community college or as a part of supplementary workforce development programs. These credentials often require a high school diploma or equivalent or additional years of work experience to earn. Thus, the students and credentials studied by previous research differ substantially from the students and credentials studied in this report. Further, as discussed previously, this report takes a relatively broad view of credentials, and does not purposefully exclude anything that was considered to be a credential by the state providing data. Previous research may have included or excluded credentials based on internal research definitions. For these reasons, much of the existing literature on the effects of credential attainment is not directly comparable to the research carried out in this report. However, surveying that literature provides a sense of the types of outcomes that may be expected from credential attainment in high school.

Survey of Research into Postsecondary Credentials

Researchers have been interested in the effects of postsecondary credentials on labor market outcomes for over two decades. Kerckhoff and Bell (1998) carry out one of the first studies of postsecondary credentials earned in community college and technical institutions using data from the National Center for Education Statistics. The researchers find that licenses and certifications lead to similar wages as Associate of the Arts (A.A.) degrees. The researchers call for heightened attention on such credentials.⁷ In the decades since, researchers have found a variety of positive results for credentials that take at least a year of postsecondary education to earn:

- Jacobson and Mokher (2009) use administrative data from Florida to measure the student-level effects of credential attainment on wages and postsecondary persistence. Florida maintains the largest

4 *Earning Industry-Recognized Credentials in High School: Exploring Research and Policy Issues* (Castellano, Stone, and Stringfield, 2005)

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

6 *Credentials Matter Report 1: A National Landscape of High School Student Credential Attainment Compared to Workforce Demand* (ExcelinEd and Burning Glass Technologies, 2019)

7 *Hidden Capital: Vocational Credentials and Attainment in the United States* (Kerckhoff and Bell, 1998)

and most complete set of data for this type of analysis. The state keeps student-level records for demographic data, attendance and enrollment in secondary and postsecondary institutions, transcripts at the secondary and postsecondary level, and credential attainment. The researchers follow a cohort of over 144,000 students who were in ninth grade in 1996. They find a positive effect on earnings for students who earn credentials in community college: credential earners have a median salary that is approximately \$8,000 greater than students who terminated their postsecondary education without a credential or degree. Further, this earnings gap increases when the researchers control for high school preparation and performance, and low-performing high school students are found to be less likely to transfer from two-year programs into four-year programs and earn the approximately \$18,000 premium associated with a Bachelor's degree. These findings suggest that credentials could be a particularly good option for low-performing high school students.⁸

- Jepsen, Troske, & Coomes (2014) also study the effects of credential attainment in community college. The researchers use administrative data from the Kentucky Community and Technical College System, which includes student-level data on demographics, course selection, and academic performance. The researchers differentiate between short-term credentials and long-term credentials using the number of credits required for each. Long-term credentials often take more than a year to complete, whereas short term credentials can be completed in less than a year. The researchers find positive effects of long-term credentials on earnings: long-term credentials are associated with wage premiums of \$1,900 for women and \$1,300 for men. The researchers find that short-term credentials have no effect on earnings. This research suggests that high school students who are able to earn long-term credentials in high school as part of a well-structured career pathway may enjoy similar earnings premiums.⁹
- Dadgar and Weiss (2012) use longitudinal data from college transcripts and unemployment insurance records for students who entered a Washington State community college between 2001 and 2002. The researchers, like Jepsen et al. above, find that credentials that take at least a year to earn lead to wage premiums whereas credentials that can be earned in less than a year generally do not. The researchers add that the increased earnings for these credentials are driven by credentials in health-related fields and in transportation for men.¹⁰

Research to date has focused on credential attainment in community college, however high schools are increasingly prioritizing attainment of industry-recognized credentials. As noted in *Credentials Matter Report 1*, 24 states currently use credential attainment as an indicator of college and career readiness under their ESSA accountability plan, and 13 states have developed financial incentives to reward the attainment of credentials in high school. Some states include industry credentials as part of graduation pathways or distinction. The investment in credentialing at the high school level emphasizes that research into credential attainment needs to include the credentials students earn in secondary school. As CTE programs articulate career pathways that include both secondary and postsecondary education systems, well-linked and accessible administrative data will be an important tool to assess the value of career and technical education and of industry-recognized credentials.

8 *Pathways to Boosting the Earnings of Low-Income Students by Increasing Their Educational Attainment* (Jacobson and Mokher, 2009)

9 *The Labor-Market Returns to Community College Degrees, Diplomas, and Certificates* (Jepsen, Troske, Coomes, 2014)

10 *Labor Market Returns to Sub-Baccalaureate Credentials: How Much Does a Community College Degree or Certificate Pay?* (Dadgar and Weiss, 2012)

Extension of Research on CTE

In addition to extending the research on credential attainment in community college to credential attainment in high school, this report also expands on the research into the educational and labor market outcomes of CTE programs. This report studies how well industry-recognized credentials build on the best practices of CTE programs uncovered by previous research.

- Kriesman and Stange (2016) find that students who participate in upper-level CTE courses earn wage premiums per year of additional study in their career pathway. This finding suggests that labor market rewards increase in levels of expertise. If credential attainment also represents subject-level mastery, similar gains should be expected for those who earn them.¹¹
- Dougherty (2016) finds that participation in CTE programs boosts a student's probability of enrollment in two-year degree programs, and Dougherty (2018) finds that participation in CTE programs boosts a student's probability of on-time graduation from high school. If CTE programs achieve this effect on postsecondary enrollment and high school persistence, credential attainment by CTE students may bolster these educational outcomes.¹²

This paper builds on the existing literature by carrying out the first examination of the effect of credential attainment on educational and labor market outcomes for high school CTE students. This paper also reports on the characteristics of credential earners compared to the full CTE population, including demographic characteristics, socioeconomic status, and average Grade Point Average (GPA). States can use this approach to assess the value of the credentials earned as a part of CTE programs.

11 *Vocational and Career Tech Education in American High Schools: The Value of Depth Over Breadth* (Kriesman and Stange, 2016)

12 *The Effect of Career and Technical Education on Human Capital Accumulation: Causal Evidence from Massachusetts* (Dougherty, 2018); *High School Career and Technical Education Participation and Initial College Enrollment: Evidence from Arkansas* (Dougherty, 2016)

PART 3

Data & Methodology

Data Availability

The data required for these analyses come from state longitudinal data systems, which link K-12, postsecondary, and wage record data in each state at the student level. Florida, Indiana, and Kentucky are three of the relatively few states that not only link these data systems but also include information on credential attainment in their longitudinal systems. The analyses performed were contingent upon available state data.

- The Florida Department of Education provided data on high school graduation, community college enrollment, community college completion, university enrollment, university completion, and wages following school. The postsecondary data came from a data system for community colleges and a data system for public, four-year universities. The Florida Department of Education also provided data that allowed for student-level controls on academic performance, socioeconomic status, gender, and race/ethnicity.
- The Indiana Department of Education provided data on high school graduation and wages following school, as well as data to control for gender, race/ethnicity, and socioeconomic status. The Indiana Department of Education was not able to provide data to control for academic performance.
- The Kentucky Center for Statistics provided data on high school graduation, associate degree completion, and bachelor's degree completion, as well as data to control for student gender, race/ethnicity, and academic performance. The Kentucky Center for Statistics did not provide data to control for socioeconomic status.

Table 4: Available Data for Each State

	Florida	Indiana	Kentucky
Population	Cohort of graduating students	CTE students	All students
Years of data available:	2009-2018	2013-2018	2013-2017
Number of students in dataset:	271,165	519,336	377,433

Controls available:

Gender	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Race/Ethnicity	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Low-Income status	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Academic performance (GPA)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Outcomes Available:

Probability of graduating high school on time	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Wages for working individuals no longer in school	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Probability of enrolling in community college	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Probability of graduating from community college, conditional on enrollment	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Probability of earning an Associate’s degree	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Probability of enrolling in university system	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Probability of graduating from university system, conditional on enrollment	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Probability of earning a Bachelor’s degree	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Methodology

This research uses a series of regression analyses to isolate the effects of credential attainment on secondary completion, postsecondary enrollment and completion, and wage earnings for CTE students in three states: Florida, Indiana, and Kentucky. The method of identifying CTE students was different for each state, as were the outcome and control variables. Therefore, individual regression models were specified for each outcome in each state.

CTE Student Definition

In establishing the universe of CTE students in each state, this research takes into consideration the data availability and approach to CTE programs in each state.

- Florida defines a CTE concentrator based on the number and type of CTE courses that a student takes.¹³ However, the data provided for this report had limited student transcript data. Instead of identifying CTE students using the state definition, a CTE student is defined such that the fraction of CTE students in the study corresponds to the fraction of CTE concentrators¹⁴ in the student body. Florida reports 16% of students are CTE concentrators. Therefore, a CTE student is defined as a student who takes enough CTE courses such that 16% of students are CTE students. Of the 271,165 students, 43,873 were classified as CTE students in Florida.
- For Indiana, the state provided data exclusively for CTE students, so this report includes all students in the analyses. This amounted to 519,361 CTE students in Indiana.
- For Kentucky, this report follows state guidelines for identifying CTE students by including only those who have qualified as preparatory within their career pathway rather than simply exploratory.¹⁵ Of the 377,433 students, 55,564 were classified as CTE students in Kentucky.

Model Specification

The treatment variable is credential attainment. This report relies on state definitions for industry-recognized credentials.¹⁶

This report also studies the effect of credential type on wage earnings in Florida. There are five credential types identified by previous research present in the data provided by states on industry credentials: licenses, certifications, software credentials, general career readiness credentials, and CTE assessments.¹⁷

The outcome and control variables differ by state, resulting in different regression specifications for each outcome in each state. In general, the regressions on secondary and postsecondary outcomes take the form of equation (1) below, and the regressions on wage earnings take the form of equation (2) below:

¹³ Review Perkins IV for the definitions of CTE concentrators in each state.

¹⁴ These statistics are available on the website accompanying *Credentials Matter Report 1*, which can be found here: [CredentialsMatter.org](https://www.credentialsmatter.org)

¹⁵ The exploratory versus preparatory variable was provided as part of the data provided by the Kentucky Center for Statistics.

¹⁶ See Appendix for definitions by state.

¹⁷ See Scope of Research above for definitions, examples, and related occupations for each of these credential types.

$$\ln\left(\frac{P_i}{1-P_i}\right) = B_0 + B_1 \text{Credential}_i + B_2 \text{Gender}_i + B_3 \text{LowIncome}_i + B_4 \text{Race}_i + B_5 \text{HighSchoolGPA}_i + \varepsilon_i \quad (1)$$

$$\ln(\text{Wages}_i) = B_0 + B_1 \text{Credential}_i + B_2 \text{Gender}_i + B_3 \text{LowIncome}_i + B_4 \text{Race}_i + B_5 \text{HighSchoolGPA}_i + \varepsilon_i \quad (2)$$

Where P is the probability of a positive secondary or postsecondary outcome for student i and $\ln(\text{Wages})$ is the log wages for student i .

Where possible, interaction terms are included between *Credential* and *Gender* and between *Credential* and *LowIncome*. When a data element is not available for a state, it is not included in the above regressions.

Due to the differences in data availability outlined above and the differences in the CTE and credentialing landscape between states detailed in the Appendix, this report does not recommend direct comparison of the effects of earning a credential between states. Further, in all cases except one, this report does not interpret the magnitude of the resulting coefficients on the treatment variable.¹⁸

Variable Definitions

The effect of earning a credential on wages is only assessed for the last recorded wages of individuals who were 24 years or older at the time of the observation. This subset was chosen as an approximation for individuals who are no longer in school and who are working full-time, in order to avoid comparisons between full-time workers and part-time workers or students.

The probability of on-time graduation is based on the probability of a student graduating late. A student is deemed late if that student graduated or would graduate at age 19 or greater based on their age at the time of the observation.

The variable indicating that a student is low-income is constructed using a student's eligibility for free or reduced lunch in Florida and using a status flag for economic disadvantage Indiana.

¹⁸ Interpreting the magnitude of coefficients in a logistic regression results in a description of the effect on the odds ratio or describes effects on conditional probabilities, neither of which concepts are intuitive. Because of this difficulty, where logistic regressions are used, this research reports on the sign of the coefficients, which indicates either a positive or negative association between earning a credential and the outcome variable. Linear regressions are used to assess the effect of credentialing on wages, and an interpretation on magnitude is provided only where student-level controls are robust enough to allow for such interpretation.

PART 4

Characteristics of Credential Earners

This section provides descriptive summary statistics for CTE students who earn credentials compared to the full CTE population. Where possible, for each state this section examines differences in the representation of women and people of color among CTE students compared to credential earners, differences in the representation of low-income students among CTE students compared to credential earners, and differences in GPA among CTE students compared to credential earners.

National Summary of CTE Students

Data on credential attainment is not collected in a systematic way across all states, but the U.S. Department of Education does collect data on the CTE student population. Nationally, 54% are men and 46% are women. CTE students are 16.4% black or African American and 23.8% are Hispanic/Latino.¹⁹ The overall secondary school student body is 15.3% black or African American and 22.6% Hispanic/Latino.²⁰

Table 5: Percentage of CTE Students by Gender Nationwide

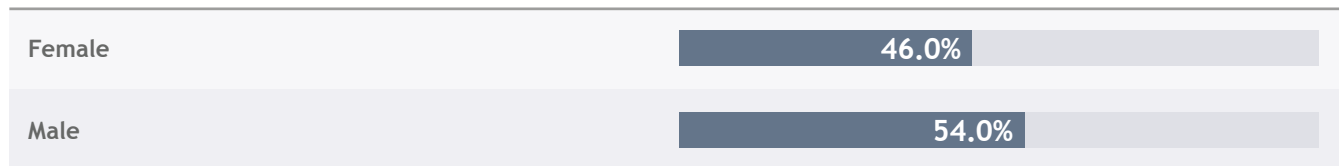
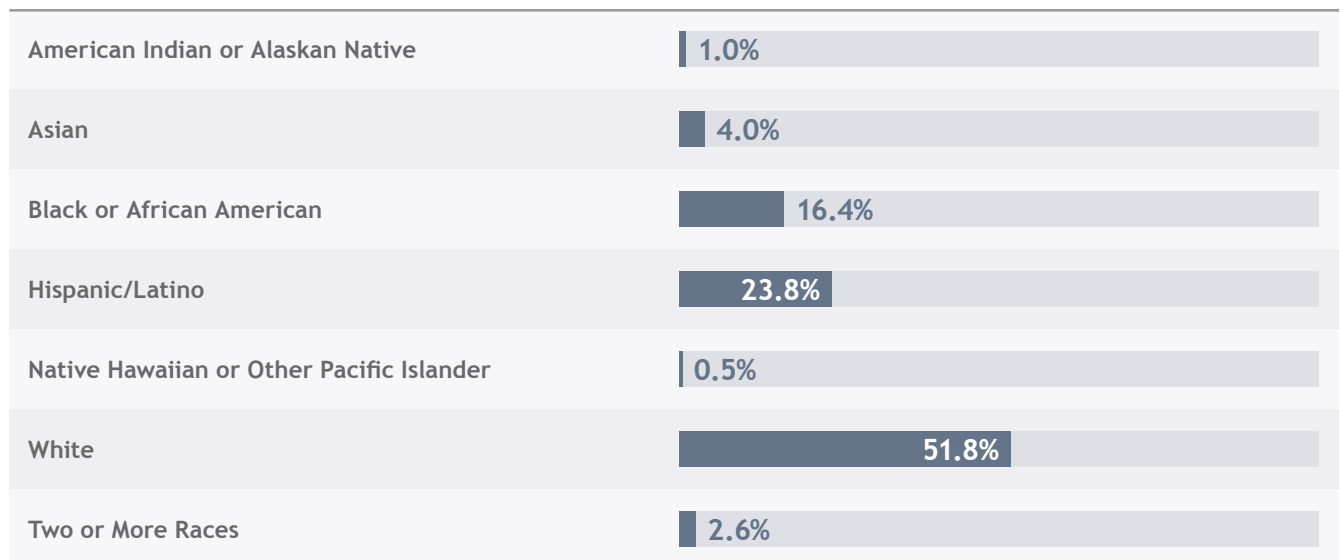


Table 6: Percentage of CTE Students by Race/Ethnicity Nationwide



¹⁹ Report to Congress on State Performance Program Year 2014-15 (U.S. Department of Education, 2018)

²⁰ 2013-2017 ACS 5-year Estimates, accessed through the American FactFinder web portal

Florida

In Florida, 22% of CTE students earn a credential. Among the characteristics examined in this paper, CTE students who earn a credential reflect the demographics of the overall CTE population with little deviation. In contrast to national statistics, in Florida women account for a greater fraction of the secondary CTE population than men. Similarly, women comprise a greater fraction of credential earners than men.

Table 7: Distribution of CTE Students and Credential Earners by Gender in Florida

	CTE Students	Credential Earners
Female	51.0%	50.1%
Male	49.0%	49.9%

The distribution of credential attainment by race and ethnicity also parallels the distribution of CTE participation by race and ethnicity. The majority of CTE students in Florida are non-white (50%), as are the majority of credential earners (52%). Non-white CTE students earn credentials at a slightly higher rate than white CTE students.

Table 8: Distribution of CTE Students and Credential Earners by Race/Ethnicity in Florida

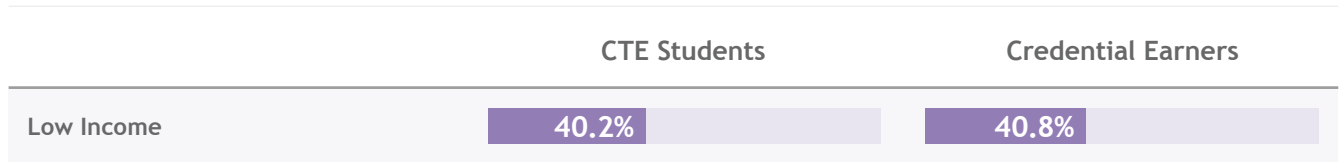
	CTE Students	Credential Earners
White	49.9%	48.4%
Black/African American	20.4%	21.4%
Hispanic/Latino	24.1%	24.1%
Asian	2.8%	3.0%
Other	2.8%	2.7%

Among CTE students, 40% are low-income. That figure increases slightly for credential earners, to 41%. These data show that both CTE students and credential earners have a B average. Credential earners have a slightly higher GPA on average than non-earners.

Table 9: Average GPA of CTE Students and Credential Earners in Florida

	CTE Students	Credential Earners
Average GPA	2.95	3.05

Table 10: Distribution of Low-Income CTE Students and Credential Earners in Florida



Indiana

In Indiana, 5% of CTE students earn a credential. A greater proportion of CTE students in Indiana are male; however, 54% of credential earners are women and 46% are men. Women earn credentials at a rate 17% higher than men.

Table 11: Distribution of CTE Students and Credential Earners by Gender in Indiana

	CTE Students	Credential Earners
Female	48.2%	53.9%
Male	51.8%	46.1%

White CTE students in Indiana earn credentials at a greater rate than both black and Hispanic/Latino CTE students. White CTE students earn a credential 28% more often than black CTE students and 13% more often than Hispanic/Latino CTE students.

Table 12: Distribution of CTE Students and Credential Earners by Race/Ethnicity in Indiana

	CTE Students	Credential Earners
White	79.1%	81.9%
Black/African American	10.9%	8.8%
Hispanic/Latino	9.4%	8.6%

Nearly half of CTE students in Indiana are low-income, and slightly more than half of credential earners are low-income.

Table 13: Distribution of Low-Income CTE Students and Credential Earners in Indiana

	CTE Students	Credential Earners
Low Income	49.9%	51.7%

Kentucky

In Kentucky, 35% of CTE students earn a credential. Among credential earners, 54% are men and 46% are women. Female CTE students earn credentials at a slightly higher rate than male CTE students.

Table 14: Distribution of CTE Students and Credential Earners by Gender in Kentucky

	CTE Students	Credential Earners
Female	45.6%	46.2%
Male	54.4%	53.8%

White CTE students in Kentucky earn credentials 25% more often than black CTE students, and white students account for 88% of CTE students and 89% of credential earners.

Table 15: Distribution of CTE Students and Credential Earners by Race/Ethnicity in Kentucky

	CTE Students	Credential Earners
White	87.8%	89.1%
Black/African American	7.4%	6.0%
Asian	1.0%	1.0%

There is practically no difference in the average GPA between the CTE students who earn a credential and those who do not.

Table 16: Distribution of CTE Students and Credential Earners by Other Characteristics in Kentucky

	CTE Students	Credential Earners
Average GPA	3.00	3.01

PART 5

Returns to Credentials: Education and Labor Market Outcomes

The effect of credentials on educational and labor market outcomes for CTE students are presented below for each state.

Florida

A summary of the analyses performed and the results found in Florida can be found in Table 17 below.

Table 17: Summary of Florida Results

Outcomes

Probability of graduating high school on time	+
Wages for working individuals no longer in school	+
Probability of enrolling in community college	+
Probability of graduating from community college, conditional on enrollment	+
Probability of enrolling in university system	+
Probability of graduating from university system, conditional on enrollment	No Effect

Controls

Gender	✓
Race/Ethnicity	✓
Low-Income status	✓
Academic performance (GPA)	✓

Years of data available	2009-2018
Number of students in dataset	271,165

As shown in Table 17, the Florida Department of Education collects an exhaustive set of data on student-level socio-demographic characteristics, course selection, and performance in secondary and postsecondary school, as well as student-level credential attainment. Florida connects these data with additional data collected on personal income during and following school. The collection and organization of these data enable research into the educational and labor market outcomes of earning a credential for CTE students.

Table 18 below shows the effect of earning a credential on the probability of graduating high school on time for CTE students and for all students, controlling for gender, low-income status, race/ethnicity, and GPA. The analysis revealed that earning a credential is associated with an increase in the probability of graduating from high school on time for all students and for CTE students. The effect is higher for female students compared to male students for all students and for CTE students. The effect is lower for low-income students compared to non-low-income students for all students and for CTE students.

Table 18: Florida - Probability of Graduating High School On Time

	(1) All Students	(2) All Students	(3) All Students	(4) CTE Only	(5) CTE Only	(6) CTE Only
Earned Credential	0.3084***			0.3479***		
Gender (Female = 1)	0.4140***		0.4140***	0.4385***		0.4383***
Low-Income	-0.5044***	-0.5043***		-0.3116***	-0.3119***	
Gender*Credential Earner						
Female, Earned Credential		0.3847***			0.3630***	
Female, No Credential		0.0972***			0.0707	
Male, No Credential		-0.3218***			-0.3863***	
Low-Income*Credential Earner						
Low-Income, Earned Credential			-0.4985***			-0.4892***
Low-Income, No Credential			-0.8097***			-0.7513***
Not Low-Income, No Credential			-0.3043***			-0.4829***
Race/Ethnicity						
Asian	-0.0923	-0.0924	-0.0923	-0.2718*	-0.2711*	-0.2731*
Black or African American	-0.5977***	-0.5974***	-0.5977***	-0.5190***	-0.5181***	-0.5179***
Hispanic/Latino	-0.1780***	-0.1779***	-0.1780***	-0.2239***	-0.2231***	-0.2232***
Other	0.0678	0.0679	0.0678	-0.0813	-0.0814	-0.0814
CTE Student	-0.5782***	-0.5782***	-0.5782***			
GPA	0.9617***	0.9619***	0.9617***	0.5197***	0.5210***	0.5186***
Intercept	0.6425***	0.9617***	0.9475***	1.0558***	1.4307***	1.5151***
Observations	271,165	271,165	271,165	43,873	43,873	43,873

Notes: A student is defined as graduating high school on time if the last time they were recorded they were not more than 1 year late. ‘Late’ is calculated based on the age of the student in each grade, with age 18 in grade 12 being 0 years late and age 18 in grade 11 being 1 year late. A CTE student is defined as a student who takes enough CTE courses such that 16% of students are CTE students, which is the rate of CTE concentrators in Florida.

Table 19 shows the effect on log wages of earning a credential for CTE students and all students, controlling for gender, race/ethnicity, and high school GPA. The analysis revealed a positive association between earning a credential and increased wages for individuals who were at least 24 years old. Earning a credential is associated with an increase in wages of approximately 4% for all students and approximately 5% for CTE students only. Further, the analysis yielded differential effects on wages by credential type. Three credential types are reported in the Florida data: certifications, licenses, and software.¹⁹ Only certifications were associated with a wage increase, of approximately 12%.

Table 19: Florida - Log Wages

	(1) All Students	(2) All Students	(3) CTE Only	(4) CTE Only
Earned Credential	0.0359***		0.0503***	
Earned Credential Type				
Certification		0.0767***		0.1193***
License		-0.0358		-0.1979
Software		0.0036		-0.0176
Gender (Female =1)	-0.0927***	-0.0949***	-0.2201***	-0.2255***
Low-Income	-0.0262***	-0.0266***	-0.0707***	-0.0715***
Race/Ethnicity				
Asian	-0.1491***	-0.1491***	-0.1688**	-0.1649**
Black or African American	-0.2356***	-0.2354***	-0.2560***	-0.2535***
Hispanic/Latino	-0.0042	-0.0039	0.0156	0.0186
Other	-0.0930***	-0.0926***	-0.0826*	-0.0799
CTE Student	0.0588***	0.0581***		
GPA	0.2051***	0.2050***	0.2215***	0.2207***
Intercept	9.2244***	9.2267***	9.3243***	9.3303***
Observations	116,470	116,470	21,473	21,473

Note: A CTE student is defined as a student who takes enough CTE courses such that 16% of students are CTE students, which is the rate of concentrators in Florida. Observations are limited to last wages earned when the student was at least 24 years old.

21 See *Credentials Matter Report 1* (ExcelinEd and Burning Glass Technologies, 2019) for a discussion of credential types.

Tables 20 and 21 relate to the Florida Community College System. Table 20 shows the effect of earning a credential on the probability of a CTE student enrolling in a Florida community college. Table 21 shows the effect of earning a credential on the probability of a CTE student completing community college, conditional on enrollment.

The analysis revealed that earning a credential is associated with an increase in both the probability of enrolling in a community college and the probability of completing community college following enrollment. The effect of earning a credential on the probability of enrollment in community college is higher for women than men and for those who were low-income. The effect of earning a credential in high school on the probability of graduating from community college, conditional on enrollment in community college, is also greater for CTE students who were not low-income, but there is no differential effect for gender.

Table 20: Florida - Probability of Enrolling in Community College System

	(1) CTE Only	(2) CTE Only	(3) CTE Only
Earned Credential	0.1988***		
Gender (Female = 1)	0.3745***		0.3744***
Low-Income	-0.3287***	-0.3287***	
Gender*Credential Earner			
Female, Earned Credential		0.3955***	
Female, No Credential		0.1828***	
Male, No Credential		-0.1842***	
Low-Income*Credential Earner			
Low-Income, Earned Credential			-0.2642***
Low-Income, No Credential			-0.5068***
Not Low-Income, No Credential			-0.1550***
Race/Ethnicity			
Asian	0.9641***	0.9638***	0.9645**
Black or African American	0.4757***	0.4753***	0.4752***
Hispanic/Latino	0.7014***	0.7011***	0.7010***
Other	0.3106***	0.3106***	0.3109***
GPA	0.6370***	0.6366***	0.6374***
Intercept	-2.3883***	-2.1991***	-2.2226***
Observations	43,873	43,873	43,873

Note: A CTE student is defined as a student who takes enough CTE courses such that 16% of students are CTE students, which is the rate of concentrators in Florida.

Table 21: Florida - Probability of Graduating From Community College System

	(1) All Students	(2) All Students	(3) All Students	(4) CTE Only	(5) CTE Only	(6) CTE Only
Earned Credential	0.1397***			0.1900***		
Gender (Female = 1)	0.0087		0.0086	-0.1069***		-0.1070***
Low-Income	-0.0707***	-0.0707***		-0.1827***	-0.1824***	
Gender*Credential Earner						
Female, Earned Credential		0.0168			-0.0545	
Female, No Credential		-0.1275***			-0.2765***	
Male, No Credential		-0.1341***			-0.1458***	
Low-Income*Credential Earner						
Low-Income, Earned Credential			-0.0291			-0.1411**
Low-Income, No Credential			-0.2005***			-0.3632***
Not Low-Income, No Credential			-0.1188***			-0.1615***
Race/Ethnicity						
Asian	0.1797***	0.1797***	0.1797***	0.5634***	0.5612***	0.5646***
Black or African American	-0.2222***	-0.2223***	-0.2228***	-0.1082**	-0.1096**	-0.1089**
Hispanic/Latino	0.1933***	0.1932***	0.1932***	0.3732***	0.3720***	0.3731***
Other	0.0094	0.0094	0.0094	0.0040	0.0044	0.0039
CTE Student	-0.1618***	-0.1618***	-0.1618***			
GPA	0.8620***	0.8619***	0.8616***	1.4759***	1.4749***	1.4760***
Intercept	-2.9861***	-2.8506***	-2.8620***	-4.8823***	-4.7193***	-4.7119***
Observations	122,675	122,675	122,675	19,230	19,230	19,230

Note: A CTE student is defined as a student who takes enough CTE courses such that 16% of students are CTE students, which is the rate of concentrators in Florida.

The final pair of regressions assessed the effect of earning a credential on the probability of enrolling in and graduating from the State University System of Florida. Table 22 reports that earning a credential is positively associated with CTE students enrolling in the state university system, however table 23 shows that there is no effect of earning a credential on graduating from the state university system. The effect of the credential on enrollment in the state university system is stronger for non-low-income students.

Table 22: Florida - Probability of Enrolling in University System

	(1) All Students	(2) All Students	(3) All Students	(4) CTE Only	(5) CTE Only	(6) CTE Only
Earned Credential	0.0772***			0.3037***		
Gender (Female = 1)	0.0296***		0.0290***	0.0476		0.0472
Low-Income	-0.5351***	-0.5347***		-0.5597***	-0.5599***	
Gender*Credential Earner						
Female, Earned Credential		-0.0393*			-0.0143	
Female, No Credential		-0.0767***			-0.2778***	
Male, No Credential		-0.1227***			-0.3593***	
Low-Income*Credential Earner						
Low-Income, Earned Credential			-0.4353***			-0.5051***
Low-Income, No Credential			-0.5959***			-0.8568***
Not Low-Income, No Credential			-0.0350**			-0.2674***
Race/Ethnicity						
Asian	0.4554***	0.4555***	0.4553***	1.0060***	1.0073***	1.0064***
Black or African American	0.1963***	0.1975***	0.1952***	0.7112***	0.7130***	0.7106***
Hispanic/Latino	0.2991***	0.2994***	0.2987***	0.8234***	0.8246***	0.8228***
Other	0.0639**	0.0638**	0.0640**	0.2907**	0.2895**	0.2910**
GPA	1.9199***	1.9200***	1.9187***	1.9785***	1.9794***	1.9787***
Intercept	-6.7309***	-6.6182***	-6.6838***	-8.2359***	-7.8998***	-7.9556***
Observations	271,165	271,165	271,165	43,873	43,873	43,873

Note: A CTE student is defined as a student who takes enough CTE courses such that 16% of students are CTE students, which is the rate of concentrators in Florida.

Table 23: Florida - Probability of Graduating From University System

	(1) All Students	(2) All Students	(3) All Students	(4) CTE Only	(5) CTE Only	(6) CTE Only
Earned Credential	-0.2049***			-0.0775		
Gender (Female = 1)	0.2993***		0.2993***	0.2079***		0.2088***
Low-Income	-0.4543***	-0.4548***		-0.3918***	-0.3931***	
Gender*Credential Earner						
Female, Earned Credential		0.3661***			0.3119***	
Female, No Credential		0.5315***			0.3238***	
Male, No Credential		0.2492***			0.1794	
Low-Income*Credential Earner						
Low-Income, Earned Credential			-0.4491***			-0.4405***
Low-Income, No Credential			-0.2488***			-0.3168***
Not Low-Income, No Credential			0.2070***			0.0469
Race/Ethnicity						
Asian	0.0487	0.0488	0.0487	0.0291	0.0301	0.0287
Black or African American	-0.0690***	-0.0705***	-0.0691***	0.0064	0.0023	0.0091
Hispanic/Latino	-0.1801***	-0.1803***	-0.1801***	-0.0663	-0.0677	-0.0645
Other	-0.1885***	-0.1881***	-0.1885***	-0.4401*	-0.4308	-0.4406*
CTE Student	-0.4552***	-0.4567***	-0.4552***			
GPA	2.0162***	2.0158***	2.0161***	1.3894***	1.3896***	1.3896***
Intercept	-5.9166***	-6.1544***	-6.1230***	-4.5043***	-4.6436***	-4.5648***
Observations	75,984	75,984	75,984	4,064	4,064	4,064

Note: A CTE student is defined as a student who takes enough CTE courses such that 16% of students are CTE students, which is the rate of concentrators in Florida.

Indiana

A summary of the analyses conducted and the findings for Indiana can be found in Table 24 below.

Table 24: Summary of Indiana Results

Outcomes

Probability of graduating high school on time	+
Wages for working individuals no longer in school	+

Controls

Gender	✓
Race/Ethnicity	✓
Low-Income status	✓
Academic performance (GPA)	

Years of data available	2013-2018
Number of students in dataset	519,336

The Indiana Department of Education provided student-level data on the socio-demographic characteristics of CTE students and credential attainment of these students. Indiana links this data to additional datasets reflecting high school completion and wages.

The analysis of education and labor market outcomes of credential attainment on CTE students in Indiana yield the following conclusions. Table 25 reports that earning a credential is associated with an increase in the probability of graduating high school on time for CTE students. This effect is stronger for female students and students who are not low-income. Table 26 reports that earning a credential in high school is correlated with higher earnings for individuals 24 years old. Since the data provided by Indiana did not include information on GPA or other measures of academic performance, it is possible these findings are driven by such factors.

Table 25: Indiana - Probability of Graduating High School On Time

	(1) CTE Only	(2) CTE Only	(3) CTE Only
Earned Credential	0.2825***		
Gender (Female = 1)	0.4520***		0.4517***
Gender*Credential Earner			
Female, Earned Credential		0.6078***	
Female, No Credential		0.2335***	
Male, No Credential		-0.2121***	
Low-Income	-0.9741***	-0.9743***	
Low-Income*Credential Earner			
Low-Income, Earned Credential			-0.6845***
Low-Income, No Credential			-1.0581***
Not Low-Income, No Credential			-0.0721
Race/Ethnicity			
Asian	0.1572	0.1576	0.1558
Black or African American	-0.3060***	-0.3066***	-0.3056***
Hispanic/Latino	-0.0265	-0.0265	-0.0268
Other	-0.2828***	-0.2829***	-0.2816***
Intercept	3.1550***	3.3698***	3.2356***
Observations	519,361	519,361	519,361

Notes: A student is defined as graduating high school on time if the last time they were recorded they were not more than 1 year late. ‘Late’ is calculated based on the age of the student in each grade, with age 18 in grade 12 being 0 years late and age 18 in grade 11 being 1 year late. All students provided in Indiana data are CTE students.

Table 26: Indiana - Log Wages

	(1) CTE Only
Earned Credential	0.3250***
Gender (Female =1)	-0.2089***
Low-Income	-0.1558***
Race/Ethnicity	
Asian	0.1963
Black or African American	-0.4095***
Hispanic/Latino	0.3361***
Other	-0.4187
Intercept	8.9982***
Observations	2,222

Notes: Observations are limited to the last wages a student earned when they were at least 24 years old. All students provided in Indiana data are CTE students.

Kentucky

A summary of the analyses conducted and effects found in Kentucky can be found below in Table 27.

Table 27: Summary of Kentucky Results

Outcomes

Probability of graduating high school on time	+
Probability of earning an Associate’s degree	+
Probability of earning a Bachelor’s degree	-

Controls

Gender	✓
Race/Ethnicity	✓
Low-Income status	
Academic performance (GPA)	✓

Years of data available	2013-2018
Number of students in dataset	519,336

The Kentucky Center for Statistics collects a rich set of student-level data on demographic characteristics, course selection, and academic performance in secondary school. Kentucky also collects data on the highest degree earned by students in the state.

Table 28 reports that earning a credential is associated with an increase in the probability of graduating high school on time for all students and for CTE students. This effect is higher for female students who earn a credential compared to male students who earn a credential.

Further, Table 29 shows that earning a credential is associated with an increase in the probability of earning an Associate’s degree for all students and for CTE students. This effect is stronger for female students in the population of all students but is not different for male and female students in the population of only CTE students.

Finally, Table 30 reports that earning a credential is negatively associated with the probability of earning a Bachelor’s degree. There is no differential effect by gender.

Table 28: Kentucky - Probability of Graduating High School On Time

	(1) All Students	(2) All Students	(3) CTE Only	(4) CTE Only
Earned Credential	0.4451***		0.0814*	
Gender (Male=1)	-0.3528***		-0.4966***	
Gender*Earned Credential				
Female, Earned Credential		0.6413***		0.6133***
Female, No Credential		-0.0098		0.4117***
Male, No Credential		-0.3470***		-0.0311
Race				
Asian	-0.8826***	-0.8815***	-0.7624***	-0.7590***
Black or African American	-0.3760***	-0.3769***	0.2746***	0.2734***
Native Hawaiian or Pacific Islander	-1.0111***	-1.0110***	-1.0255**	-1.0362**
Two or More Races	0.3328***	0.3315***	0.3378*	0.3365*
Other	-0.7651***	-0.7654***	-0.4538***	-0.4544***
CTE Student	0.4484***	0.4499***		
GPA	0.7492***	0.7491***	0.6312***	0.6310***
Intercept	0.8390***	0.8391***	1.7338***	1.2855***
Observations	377,433	377,433	55,564	55,564

Notes: A student is defined as graduating high school on time if the last time they were recorded they were not more than 1 year late. ‘Late’ is calculated based on the age of the student in each grade, with age 18 in grade 12 being 0 years late and age 18 in grade 11 being 1 year late.

Table 29: Kentucky - Probability of Earning an Associate’s Degree

	(1) All Students	(2) All Students	(3) CTE Only	(4) CTE Only
Earned Credential	0.6043***		0.2819***	
Gender (Male=1)	-0.1404***		0.1606***	
Gender*Earned Credential				
Female, Earned Credential		0.1745***		-0.1043
Female, No Credential		-0.4474***		-0.4317***
Male, No Credential		-0.5780***		-0.2337***
Race				
Asian	-0.9492***	-0.9487***	-0.6297*	-0.6282*
Black or African American	-0.8930***	-0.8937***	-1.3106***	-1.3116***
Native Hawaiian or Pacific Islander	-0.6005	-0.5999	-14.5459	-13.7416
Two or More Races	-0.4210***	-0.4211***	-0.7154***	-0.7154***
Other	-0.2275	-0.2276	-0.4723	-0.4730
CTE Student	0.6774***	0.6774***		
GPA	1.3540***	1.3537***	1.4697***	1.4685***
Intercept	-8.9305***	-8.4858***	-8.6385***	-8.2213***
Observations	377,433	377,433	55,564	55,564

Notes: CTE students are defined as those identified in the Kentucky data as preparatory within their career pathway, rather than simply exploratory. Significance levels: p < .1 * / p < .05 ** / p < .01 ***

Table 30: Kentucky - Probability of Earning a Bachelor’s Degree

	(1) All Students	(2) All Students	(3) CTE Only	(4) CTE Only
Earned Credential	-0.7225***		-0.8061***	
Gender (Male=1)	-0.1686***		-0.2222***	
Gender*Earned Credential				
Female, Earned Credential		0.1291		0.0148
Female, No Credential		0.8665***		0.8956***
Male, No Credential		0.6948***		0.6165***
Race				
Asian	-0.2578***	-0.2580***	-0.1117	-0.1136
Black or African American	0.0376	0.0377	0.0747	0.0747
Native Hawaiian or Pacific Islander	-0.5968	-0.5973	-16.7761	-0.5728
Two or More Races	0.0073	0.0073	-0.2988	-0.2990
Other	0.1730	0.1730	0.3697	0.3706
CTE Student	0.7811***	0.7811***		
GPA	2.8315***	2.8317***	3.3701***	3.3724***
Intercept	-14.0873***	-14.9535***	-15.2796***	-16.1630***
Observations	377,433	377,433	55,564	55,564

Notes: CTE students are defined as those identified in the Kentucky data as preparatory within their career pathway, rather than simply exploratory. Significance levels: p < .1 * / p < .05 ** / p < .01 ***

PART 6

Discussion of Results & Implications

Credential attainment is associated with a variety of positive educational and labor market outcomes. Across all three states studied, earning a credential was associated with an increase in the probability of graduating high school on time. Evidence from Florida indicates that CTE students who earn credentials are more likely to enroll in community college, and once enrolled more likely to graduate. Similar evidence from Kentucky shows that earning a credential in high school is associated with a greater likelihood of earning an Associate's degree. Finally, in Florida and Indiana, earning a credential in high school was associated with increased wages.

This section will unpack these effects in more detail.

Secondary Education Outcomes

Earning a credential was associated with an increase in the probability of graduating from high school on time in all three of the states studied. This effect was found for the population of CTE students as well as for the full student population. This effect would be expected if credential earners were found to have higher GPAs overall; however, among CTE students, the average GPA of credential earners was similar to that of non-earners, and the regression analysis controlled for student GPA.

One possible explanation for the positive association between credential attainment and on-time graduation from high school could be that students who are motivated to earn a credential are similarly motivated to complete high school. It could also be the case that earning a credential provides students momentum to continue and complete their education, or that earning a credential reinforces a student's interest in and desire to complete a career pathway. If the latter scenario is true, states could promote credential attainment as a strategy to increase the rate of on-time secondary school completion.

The effect of credential attainment on the likelihood of graduating on time was stronger for female CTE students. Women are underrepresented among CTE students in two of the three states studied and are underrepresented in CTE programs nationally. In Indiana and Kentucky, where women comprise a smaller fraction of CTE students, women also earn credentials at a higher rate than men. In Florida, men and women are represented more evenly among both CTE students and credential earners, and male and female CTE students earn credentials at similar rates. The higher rate of credential attainment among women in the two states where women are underrepresented in CTE suggests that states may increase credential attainment by attracting more women to CTE programs. The positive differential effect for women of earning a credential on graduating on time suggests that encouraging credential attainment among women in CTE may improve graduation rates.

In addition to differences in the rate of credential attainment by gender, this report also explored the rate of credential attainment by race and ethnicity. In Indiana and Kentucky, minority groups earn credentials at a lower rate than the white population. White students in these states earned credentials between 13% and 28% more often than black students and Hispanic/Latino students. This paper does not explore barriers to credential attainment based on race or ethnicity or differential effects of credential attainment based on race or ethnicity, but further research may investigate these questions.

Postsecondary Education Outcomes

Earning a credential was also positively associated with a variety of postsecondary outcomes. In Florida, credential attainment was positively associated with enrollment in community college. Like the effect on graduating on time, the effect on community college enrollment was stronger for women than men. For students enrolled in community college in Florida, credential attainment was also positively associated with graduating. In Kentucky, credential attainment was associated with an increased likelihood of earning an

Associate's degree. These findings suggest that credentials may be an important tool in connecting secondary and postsecondary education.

The positive effects of earning a credential on postsecondary outcomes were stronger for students who were not low-income. There does not appear to be socioeconomic disparity in access to credentials: in the two states that provided data on the economic status of students, similar fractions of credential earners and CTE students in each state were low-income. However, non-low-income students had greater differential effects for credential attainment on the probability of graduating high school on time, enrolling in community college, and completing community college after enrollment. The direction of this result was unexpected, and future research may look to validate this result by using different measures of socioeconomic status. States should also investigate why credentials may be more effective for more advantaged students, and they should explore ways to increase the effectiveness of credentials for low-income students. A possible explanation is that low-income and non-low-income students are earning different credentials. A report by the Education Strategy Group noted the cost of credentialing exams is occasionally borne by students.²⁰ If the credentials that drive the association between credential attainment and positive postsecondary outcomes have exam costs that low-income students cannot afford, states should aim to relieve students of those financial burdens. States should investigate whether there is income disparity at the level of individual credentials.

The effects of earning a credential on postsecondary outcomes related to four-year universities or Bachelor's degree attainment for CTE students were mixed. In Florida, earning a credential was associated with an increase in the probability of enrolling in the state university system, but for the high school CTE students who went on to enroll in the university system there was no effect on the probability of graduating from the university system. In Kentucky, earning a credential was associated with a decrease in the probability of earning a Bachelor's degree. Because these analyses controlled for high school GPA, a possible explanation of the negative association between earning a credential in high school and earning a Bachelor's degree is that the GPA of credential earners and non-earners does not adequately reflect the academic preparation of these two groups for a four-year degree. Future research may control for curricular rigor in addition to GPA or include other measures of preparedness for a four-year degree program. Another possible explanation for the negative association between credential attainment and Bachelor's degree attainment is that the opportunity cost of each additional year of education is higher for credential earners than non-earners. In this scenario, states should consider policies like paid internships, co-ops, or work-study programs that would mitigate such opportunity costs.

Labor Market Outcomes

In addition to academic outcomes, this paper also studied the effect of earning a credential on wages. Earning a credential was associated with an increase in wages for individuals who were at least 24 years old. The positive effect of credential attainment on wages was robust to controls on academic performance in high school where those data were available. This finding and the above findings related to postsecondary degree attainment suggest that credential attainment in high school could be particularly beneficial to students who will not enroll in a Bachelor's degree program.

The positive effect on wages in Florida only applied to certifications. Software credentials and licenses did not show statistically significant effects on wages. This result suggests that certifications may be more valuable in the labor market than software credentials and the licenses that can be earned in high school. This is similar to the results found in *Credentials Matter: A National Landscape*: while the licenses available

22 *Credential Currency: How States Can Identify and Promote Credentials of Value* (Education Strategy Group, 2018)

to students in secondary school are frequently in high demand, they often are associated with less-than-living-wage salaries. Similarly, students who do not earn a software credential are often just as likely to signal underlying software competencies or skills. Earning a certification seems to be the primary mechanism by which students are able to command a wage premium in Florida.

One limitation of this research is individuals in this analysis were at most 28 years old. Future research should consider a longer time horizon, and could expand on these analyses by controlling for educational attainment and years in the workforce. With sufficient sample sizes, it would also be possible to look at wage premiums for individual credentials rather than credentials as a whole. These additional analyses could be carried out by states to identify how the wage premiums for credentials earned in high school extend over time, and which credentials provide the most significant returns.

Recommendations for States

Based on these findings, we have identified five specific recommendations for states to consider as they design education-to-career pathways for students.

1. Collaborate across education, business and industry, and workforce systems to develop clear definitions for industry-recognized credentials of value that are appropriate to CTE programs and pathways. (For a description of this cross-sector process, see [Credentials Matter: A National Landscape](#).)
2. Collect and report data on industry credential attainment throughout secondary and postsecondary.
3. Connect industry credential attainment data to longitudinal datasets that include secondary, postsecondary, and labor market outcomes. Publish periodic user-friendly reports to all relevant stakeholders, including parents and students.
4. Assess the return on investment of industry credentials over time to guide decision making related to policy and CTE program offerings, alignment, and quality. States can assess the value of individual credentials internally by adapting the methodology used in this report.
5. Once these credentials are identified, provide incentives through financial incentives and accountability metrics for the attainment of industry credentials associated with positive long-term education and labor market outcomes.

PART 7

Conclusion

This report is the first longitudinal assessment of the effects of earning an industry-recognized credential on a variety of educational and labor market outcomes for high school CTE students. The report calculated these effects using detailed student-level administrative data from three states with robust data collection practices: Florida, Indiana, and Kentucky. The analysis yielded a positive association between CTE students earning a credential in high school and on-time graduation from high school, enrollment in community college, completion of community college, and attainment of an Associate's degree. The analysis also found a positive association between CTE students earning a credential in high school and enrollment in four-year degree programs. However, the report found either no effect or a negative effect on the probability of graduating from those programs. Finally, the research showed a positive effect of earning a credential on wages. Certifications in particular, as opposed to software credentials or licenses, were associated with higher wages in Florida.

This report builds on the work done in [Credentialed Matter: A National Landscape](#) that explored the labor market demand for individual credentials by state. This report validates the assumption in the previous report that earning a credential can lead to a variety of positive outcomes for an individual student, at least in Florida, Indiana, and Kentucky.

States, academics, and researchers can expand on the research carried out in this report. A similar approach could be used to study the effect of earning a credential on additional educational or labor market outcomes, such as academic performance during postsecondary education, the probability of being employed, the duration of job seeking, or the likelihood of a credential earner working in an industry related to that credential. Also, just as this report analyzed the effect of credential types on wages, and a similar approach could be used to assess the value of individual credentials on educational and labor market outcomes. States could fold such an analysis into their validation of industry-recognized credentials.

Educators, policymakers, and state officials who are invested in preparing high school students for success in postsecondary study and the workforce should view this analysis as a step forward in the assessment of industry-recognized credentials as a tool to achieve those goals. In states where detailed person-level data is collected for students during their secondary and postsecondary education and into the workforce, researchers can build on the approach taken in this paper to further assess the value of industry-recognized credentials. In states where such data is not collected, governments can seek to develop such policies and practices. This report can also serve to inform efforts to improve CTE pathways and outcomes, of which industry credentials represent an important part.

APPENDIX

State Definitions of Credentials

Florida

Florida passed the Career and Professional Education Act (CAPE) in 2007, with the goal of providing a statewide planning partnership between the business and education communities. This act included an objective directly related to credentials: “to provide rigorous and relevant career-themed courses that articulate to postsecondary-level coursework and lead to industry certification.”²¹ The definition of industry certification in Florida is:

Industry certification as used in this section is a voluntary process through which students are assessed by an independent, third-party certifying entity using predetermined standards for knowledge, skills, and competencies, resulting in the award of a credential that is nationally recognized and must be at least one of the following:

- (a) Within an industry that addresses a critical local or statewide economic need;
- (b) Linked to an occupation that is included in the workforce system’s targeted occupation list; or
- (c) Linked to an occupation that is identified as emerging.²²

The state of Florida maintains the CAPE Industry Certification Funding List, a list of fundable industry certifications adopted by the state. This list is divided into three types of Certificates: CAPE Digital Tool Certificates, CAPE Industry Certifications, and CAPE Acceleration Industry Certifications. In order to add a certification to the list, the state workforce development board, CareerSource Florida, conducts an annual submission process to identify and review new certifications.

When a student earns a certification on the CAPE Industry Certification Funding List, the school district receives credit, and bonuses are awarded to classroom teachers who provided direct instruction toward the attainment of the certification. Districts report attempted or earned industry certifications for review

Indiana

The Indiana State Board of Education (SBOE) defines industry-recognized credentials as developed or supported by business and industry to verify student mastery of technical skills competences in an occupational area that aligns with Indiana’s economic sectors and is approved by the DWD.²³ The credentials on the official List of Industry Recognized Credentials are evaluated to determine:

1. Does this meet SBOE rule language as well as nationally understood definitions of industry certifications?

²³ *Technical Assistance Paper: Career and Professional Education (CAPE) Act* (Florida Department of Education, 2018)

²⁴ *Ibid.*

²⁵ *Memorandum: Methodology to determine industry-recognized credentials for the purpose of school accountability grades* (Indiana Department of Workforce Development, 2019)

2. Does this credential meet minimum demand requirements determined using job predictions data? The minimum requirement is 200 jobs available, which are connected to the successful completion of the certification, over the next 10 years.
3. Does this credential meet minimum wage requirements determined using the twenty-fifth percentile of all wages for all occupations in Indiana in 2014?²⁴

For each CTE course, Indiana provides a variable supplemental amount based on the wage and demand associated with an occupation. The state also provides performance incentives based on a district's number of CTE concentrators, dual credit earners and industry certifications earned.²⁵

Kentucky

The process used to determine which industry certifications are recommended for the valid industry credential list in Kentucky was established by KRS 158.6455.

Kentucky builds its valid industry credential list based on the following process:

1. The Kentucky Center for Education and Workforce Statistics (KCEWS) works with information on job and demand data for the region provided by local workforce investment boards (WIBs).
2. Local WIBs work with local economic development organizations and businesses to compile a list of industry-recognized credentials ranked by demand.
3. The list is reviewed by multiple business and industry groups.
4. The list is approved by and presented to the Kentucky Workforce Innovation Board (KWIB) Business and Education Alignment Committee.
5. The Kentucky Department of Education works with the KWIB to edit and refine the list to ensure all credentials are practical, relevant, and align with career pathways.²⁶

²⁶ Ibid.

²⁷ *Putting Career and Technical Education to Work for Students: A Playbook for State Policymakers* (ExcelinEd, 2019)

²⁸ See the Kentucky Department of Education website for Accountability and CTE:
<https://education.ky.gov/CTE/Pages/CTE-St-Acc.aspx>

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