From Learning to Teaching: The Role of High School CTE Programs in Shaping Nevada's Educators

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Abstract

To improve student performance, states like Nevada need to train, recruit, and retain high-quality educators. One pathway into teaching is the Career and Technical Education (CTE) programs in Early Childhood Education and Teaching and Learning that are available to students at participating high schools. Using longitudinal data from Nevada between 2016 and 2022, this study explores public high school students' CTE program completion and certification and subsequent enrollment in Nevada System of Higher Education (NSHE) institutions, as well as their course-taking and programs of study. The aim was to uncover whether participation in an education-related CTE program in high school leads to eventual study or employment in the teaching profession. Findings provide insights into the extent to which high school CTE programs in education can be leveraged to strengthen and diversify the teacher pipeline in the state.

From Learning to Teaching: The Role of High School CTE Programs in Shaping Nevada's Educators

To improve student performance, states like Nevada need to train, recruit, and retain high-quality educators (Darling-Hammond, 2000; Harris & Sass, 2011). As news agencies across the state have reported, districts across Nevada are plagued with significant teacher shortages (Davis, 2023; DeLancey, 2022). Teacher shortages have been attributed to the declining popularity of education as a career and the subsequent decrease in enrollment in teacher preparation programs (Grose, 2023; National Center for Education Statistics, 2023). Moreover, the problem has only worsened since the Covid-19 pandemic (Nguyen et al., 2022; Davis, 2023).

One pathway into teaching is the Career and Technical Education (CTE) programs in Early Childhood Education and Teaching and Learning that are available to students at participating high schools. CTE programs aim to equip students with knowledge and skills to pursue postsecondary education and career opportunities in their chosen fields after high school graduation.

This project investigated the efficacy of current efforts to develop the Nevada teacher pipeline through high school programming. Specifically, the study aimed to understand whether CTE education programs induce high school students to pursue education careers in Nevada. Using longitudinal data from the Nevada P-20 to Workforce Research Data System (NPWR) between 2016 and 2022, this study explored public high school students' CTE program participation and subsequent enrollment, course-taking, and programs of study (i.e., majors) in Nevada System of Higher Education (NSHE) institutions. The goal was to uncover whether participation in an education-related CTE program in high school leads to the preparation for a

career in the teaching profession. Findings provide insights into the extent to which high school CTE programs in education can be leveraged to strengthen the teacher pipeline in Nevada.

Research Questions

To investigate the impact of high school CTE programs in education on students' higher education and workforce outcomes, this study addressed the following two research questions:

1. Which high school students are participating in CTE programs in education?

2. Does participation in a CTE program in education during high school predict postsecondary enrollment and study in education courses?

CTE Key Terms

There are several different ways that a student can choose to participate in a CTE program. In this study, the focus was on students who progress beyond a single course, as this suggests that the student may have a particular interest in the program in which s/he is participating and is leveraging the CTE program for career exploration. The differing levels of participation are defined as follows:

- **Concentrator:** a student who takes two or more courses in a designated CTE program area.

- **Completer:** a student who completes the required coursework sequence in a CTE program area.

- **Certificate Earner:** a student who completed the required coursework sequence and passed the end-of-program assessments measuring skill attainment in a CTE program area.

Earning a certificate provides the most benefits of CTE participation, as it enables a student to obtain college credit, postsecondary degree or certificate, apprenticeship, and/or employment.

Background and Study Motivation

Prior research has shown that participation in CTE is linked to positive outcomes for students, both during high school and if they enroll in higher education. Some successes include:

- In high school, CTE course-taking is associated with a decreased likelihood of dropping out and an increased likelihood of on-time graduation (Gottfried & Plasman, 2018).

- Student participation in STEM (science, technology, engineering, and mathematics) CTE programs is associated with an increased likelihood that the student will subsequently declare a college major in a STEM field (Gottfried et al., 2016).

- Students who participate in CTE dual enrollment programs in high school report feeling more prepared for the transition to college and greater confidence and satisfaction with their choices about college and careers (Lekes et al., 2007).

- Among community college students, high school CTE graduates are likelier to earn associate's degrees or certificates than those who did not participate in CTE programs.

However, these studies and other prior work have not specifically probed the role of CTE participation in education-focused programs and their impact on students' postsecondary pursuits. This study aimed to understand this relationship.

Data and Methods

This study used a quantitative research design. A combination of descriptive statistics and linear probability models described and predicted the relationship between high school education CTE concentration and postsecondary study of education.

Data

  Student data to answer both research questions came from the Nevada P-20 to Workforce Research Data System (NPWR). For the first research question, which asked which students are participating in education CTE programs in high school, a repeated cross-section dataset was constructed from the 2016 to 2021 school years consisting of Nevada public and charter high school graduates who concentrated in at least one CTE program. These data were merged with publicly available school-level information from the National Center for Education Statistics (NCES). Student-level information included in the dataset were demographic information, test scores, students' chosen CTE program(s), and attainment within their program(s) of choice. The dataset consisted of 69,284 unique observations.

  For the second research question, which asked whether participation in education CTE programs in high school predicted postsecondary enrollment and study in education courses, a panel dataset was constructed using student data, as well as data high school, district, and postsecondary institution data from (NCES). The panel consists of student-by-school term observations of Nevada high school CTE concentrators who subsequently enrolled in a Nevada System of Higher Education (NSHE) institution between Fall 2016 and Fall 2022. The panel contained 207,340 student-by-term observations.

Data Analysis

  Two approaches were used to analyze the data. First, descriptive statistics were used to compare the characteristics of students participating in education CTE programs with students participating in other types of CTE programs. Second, linear probability models (LPMs) were used to estimate the likelihood of a student participating in an education CTE program in high

school (Research Question 1) or studying education at an NSHE institution (Research Question 2) based on the demographics of the student and the high school and postsecondary institution the student attended. An LPM is a binary regression model that predicts the probability of observing the outcome variable based on the independent variables in the model.

For the first research question, the fully specified LPM employed was:

$$(1)\ Pr(Education = 1)_{ist} = \beta_0 + \beta_1 Race_{ist} + \beta_2 Gender_{ist} + \beta_3 Race * Gender_{ist} +$$
$$\theta SS_{st} + \delta_s + (\lambda_s \tau_t) + \varepsilon_{ist}$$

where i, s, and t index individuals, schools, and school years, respectively. *Education* represents the probability that a student participates in an education CTE program in high school. The model controls for a student's race, gender, and an interaction between the student's race and gender. It also includes a school fixed effect to control for unobserved characteristics about the student's high school and a school-by-time fixed effect to control for unobserved characteristics about the school in a given year. The parameters of interest are β_1, β_2, and β_3, which represent the marginal increases in the probability of participating in an education CTE program based on the student's race, gender, and an interaction between the student's race and gender.

For the second research question, the fully specified LPM employed was:

$$(1)\ Pr(Postsecondary = 1)_{ist} = \beta_0 + \gamma Secondary_{ist} + \beta_1 Race_{ist} + \beta_2 Gender_{ist} +$$
$$\beta_3 Race * Gender_{ist} + \theta SS_{st} + \delta_s + (\lambda_s \tau_t) + \varepsilon_{ist}$$

where i, s, and t index individuals, schools, and school years, respectively. *Postsecondary* represents the probability that a student studies education in an NSHE institution and *Secondary* represents the extent to which a student progressed through a high school education CTE program (i.e., concentration, completion, or certification). The model also controls for a student's

race, gender, and an interaction between the student's race and gender. It also includes a school fixed effect to control for unobserved characteristics about the NSHE school in which a student enrolls and a school-by-time fixed effect to control for unobserved characteristics about the institution in a given year. The parameter of interest is γ, which represents the marginal increase in the probability of postsecondary study in education based on high school education CTE participation.

Results

The results below are presented for each research question using both descriptive statistics and LPMs. The aim of these analyses is to gain a formative understanding of how well CTE programs in education in Nevada may contribute to developing the state's teacher pipeline in light of the persistent problem of teacher shortages and declining interest in education as a profession.

Research Question 1: Which high school students are participating in CTE programs in education?

The first table shown below presents a high-level summary of the differences by the numbers in enrollment and availability between all CTE programs offered in Nevada and the two education-specific CTE programs.

Table 1

Nevada High School CTE and Education CTE Programs by the Numbers

All Nevada CTE Programs	Education CTE Programs
• **69,284** graduates concentrated in at least one CTE program between 2016 and 2021. • **16** school districts and the State Public Charter School Authority (SPCSA) offered CTE. • **158** public and charter high schools offered at least one CTE program. • **64.50%** of CTE concentrators completed at least one CTE program. • **31.19%** of CTE concentrators earned at least one certificate.	• **3.50%** of graduates concentrated in an education CTE program. • **7** school districts and the SPCSA offered education CTE programs. • **74** public and charter high schools offered at least one education CTE program. • **66.49%** of education CTE concentrators completed their program. • **38.05%** of education CTE concentrators earned a certificate.

As Table 1 shows, far fewer school districts—specifically Clark, Elko, Humboldt, Lincoln, Lyon, Nye, and Washoe—offered education CTE programs compared to the overall districts offering CTE programs. Slightly less than half of all schools with CTE programs offered education CTE programs. The data above does suggest that students who do participate in education CTE programs do persist in these programs at higher rates than their peers in other programs, with almost 2% more education CTE concentrators completing their programs and 7% more education CTE concentrators earning certificates than all CTE programs combined.

In Table 2, shown below, the individual, student-level demographics of CTE concentrators are compared.

Table 2

Demographics of High School CTE Concentrators in Nevada

	All Nevada CTE Programs	**Education CTE Programs**
% Female	46.92%	88.40%
% Free or Reduced Lunch	65.98%	80.52%
Average ACT Score	18.35	16.87

As Table 2 shows, far more students in education CTE programs are female, and far more are eligible to receive free or reduced-price lunch, which is a commonly used indicator of poverty. Additionally, the average ACT score, which ranges from 2 to 36, among students in education ACT programs is nearly 1.5 points lower than for students in all Nevada CTE programs.

The racial and ethnic composition between concentrators in education CTE programs and all CTE programs also differs, as shown in Figure 1. Demographics in CTE programs are consistent with enrollment in K-12 public schools in Nevada overall. However, when compared with the demographics of all CTE programs, education CTE concentrators are about have higher proportions of Black or African American students and Hispanic or Latino students, as well as fewer Asian students.

Figure 1

Race and Ethnicity of High School CTE Concentrators in Nevada

Chart legend: ■ All Nevada CTE Programs   ■ Education CTE Programs

Category	All Nevada CTE Programs	Education CTE Programs
AmerIndian or Native AK	0.85	0.21
Asian	7.93	2.48
Black or African-American	8.15	13.21
Hawaiian or Pacific Islander	1.31	1.11
Hispanic or Latino	41.9	51.84
Two or more races	5.24	3.67
White	34.61	27.49
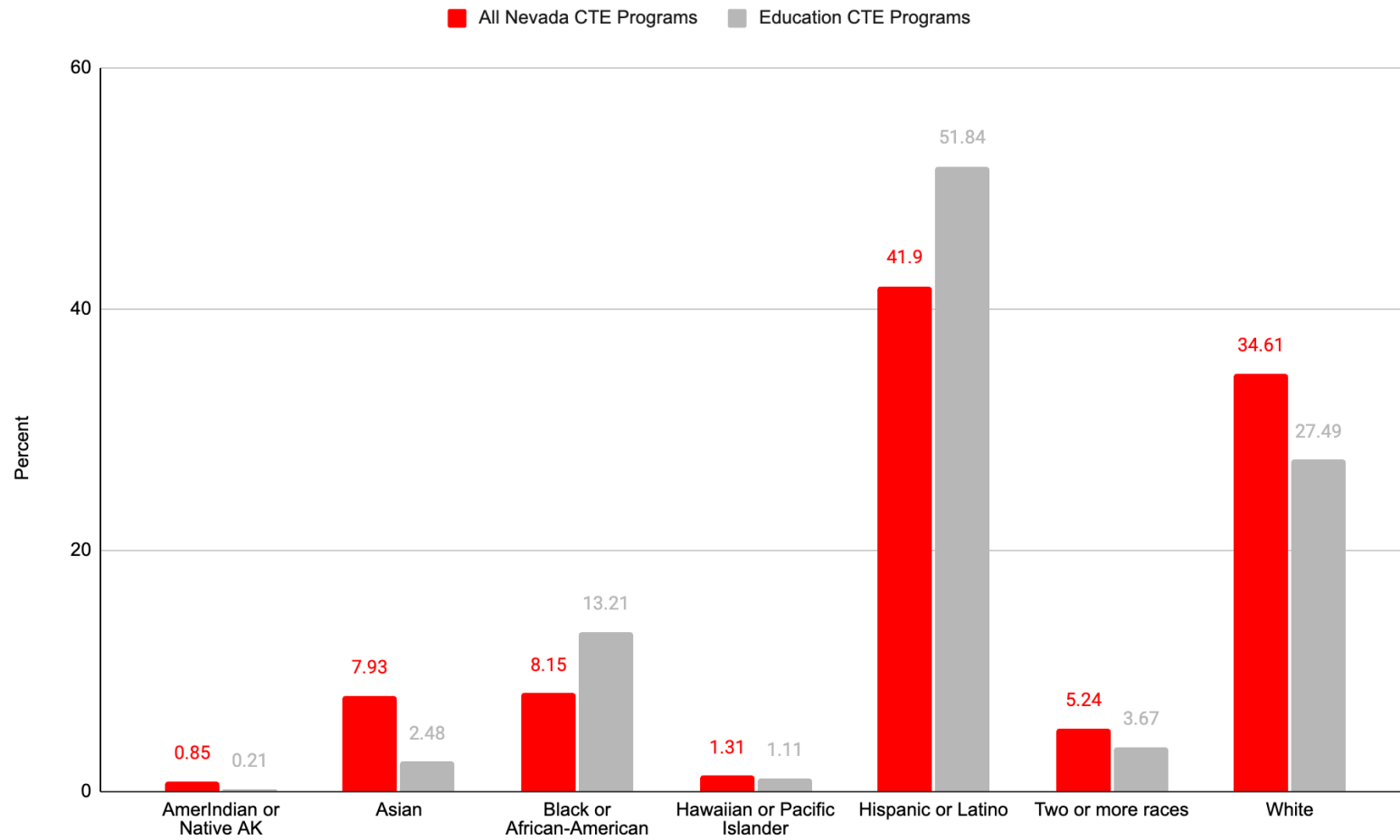
The LPM can further analyze the characteristics of students who concentrate in CTE programs by using them to predict the likelihood of concentrating in an education CTE program. In Table 3 below, the key findings from the LPM are used to estimate the probability of concentration in an education CTE program. (See Appendix A for the full results.) Each column of the table represents the regression estimation for the various levels of progression a student could make through CTE programs, beginning with concentration and ending with earning a certificate.

Table 3

Predicted Characteristics of High School Education CTE Students

	(1) Concentrate	(2) Complete	(3) Certificate
Male	-0.054*** (0.012)	-0.030*** (0.007)	-0.021*** (0.006)
Asian	-0.027** (0.009)	-0.021* (0.009)	-0.017* (0.007)
AmerIndian /AK Nat.	-0.043*** (0.012)	-0.023** (0.007)	-0.014* (0.006)
ACT Composite Score	-0.002*** (0.000)	-0.001** (0.000)	0.000* (0.000)

Note. Standard errors are in parentheses. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

As the table shows, male, Asian, or American Indian/Alaska Native students are *less likely* to concentrate, complete, or earn a certificate in an education CTE program. Conversely, students *more likely* to concentrate, complete, or earn a certificate in an education CTE program

scored lower on the ACT.

Research Question 2: Does participation in a CTE program in education during high school predict postsecondary enrollment and study in education courses?

Turning to the second research question, the first table, Table 4 presents the high-level comparisons between all high school CTE graduates who matriculated into NSHE institutions and education concentrators who did the same.

Table 4

NSHE Matriculation of Nevada High School CTE Concentrators

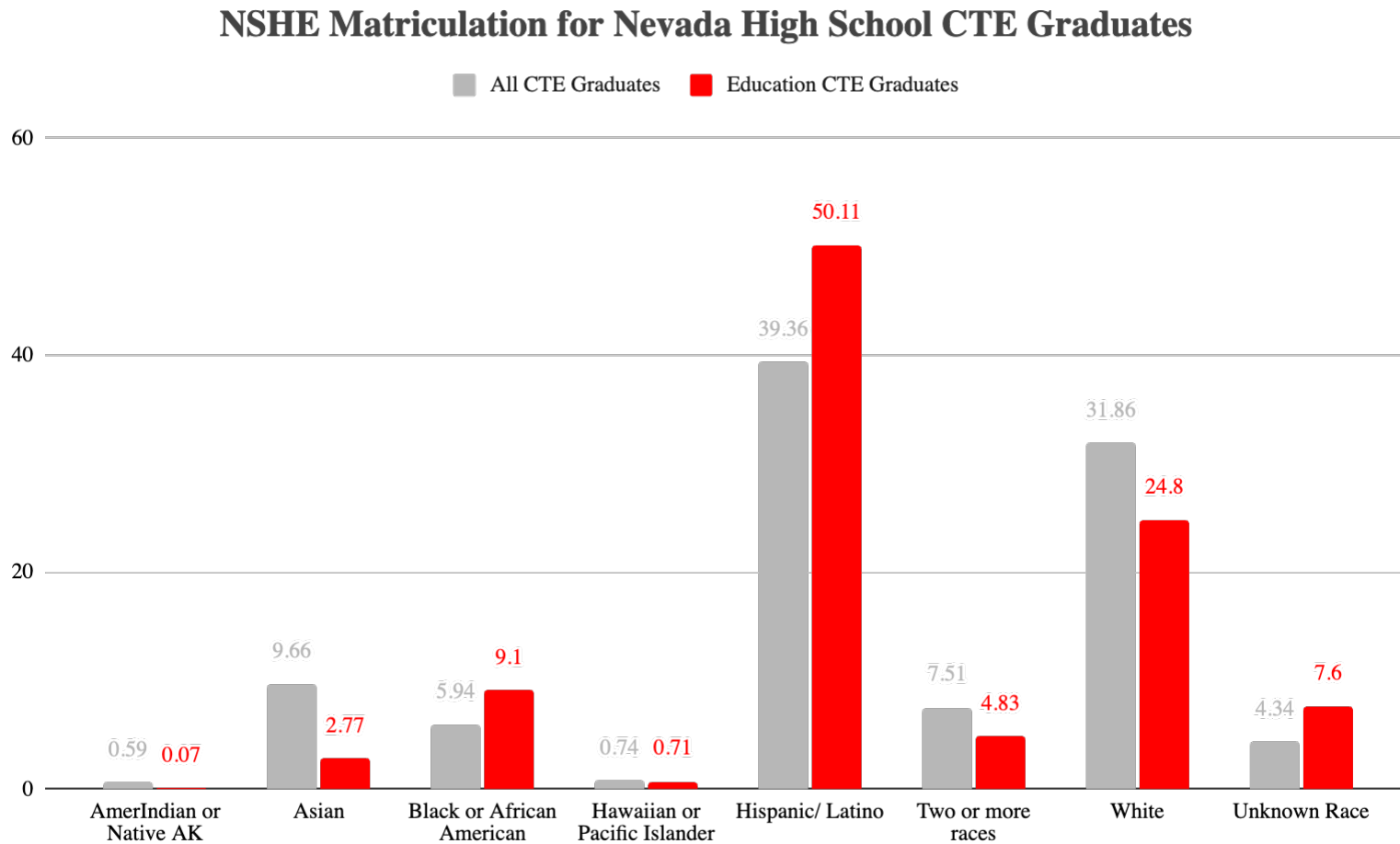| All Nevada CTE Programs	Education CTE Programs
56.74% of all CTE graduates in Nevada enrolled in an NSHE institution. **38.67%** of all CTE graduates in NSHE enrolled in a four-year institution. **8.13%** of all CTE graduates took at least one course in an education-related program area. **3.83%** of all CTE graduates declared a major in education at some point while enrolled in NSHE. **4.78%** of all CTE graduate degree-earners had majored in an education field.	**61.33%** of education CTE concentrators enrolled in NSHE after graduation. **42.68%** of education CTE concentrators in NSHE enrolled in a four-year institution. **36.92%** of education CTE concentrators took at least one course in an education-related program area. **22.13%** of education CTE concentrators declared a major in education at some point while enrolled in NSHE. **22.67%** of education CTE concentrators who earned a degree majored in an education field.

Among all Nevada high school CTE concentrators, 39,312 enrolled in NSHE institutions at some point after graduating from high school, while the other 27, 972 did not. Those students either

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did not enroll in any postsecondary institution or higher education in another state. The 8.13% of students who took at least one course in an education-related program area while at an NSHE institution include students who took education seminar courses and some research courses. The 4.78% of students who earned a degree in education is derived from a small subset of slightly more than 6,000 students who earned a degree over the course of the postsecondary panel, which ran from fall term 2016 to fall term 2022.

Figure 2 shows the demographics of Nevada high school CTE concentrators who subsequently enrolled in NSHE institutions. Much like the demographic composition of the programs in high schools, there are higher proportions of Hispanic/Latino students and Black or African American students and lower proportions of Asian students coming out of the education CTE programs and enrolling in the NSHE institutions.

Figure 2

NSHE Matriculation for Nevada High School CTE Graduates

NSHE Matriculation for Nevada High School CTE Graduates

Legend: All CTE Graduates (gray), Education CTE Graduates (red)

Race	All CTE Graduates	Education CTE Graduates
AmerIndian or Native AK	0.59	0.07
Asian	9.66	2.77
Black or African American	5.94	9.1
Hawaiian or Pacific Islander	0.74	0.71
Hispanic/ Latino	39.36	50.11
Two or more races	7.51	4.83
White	31.86	24.8
Unknown Race	4.34	7.6

Next, the LPM is used to predict the likelihood of studying education based on a student's characteristics, as well as their prior participation in education CTE programs in education. In Table 5 shown on the next page, the key findings from the LPM used to estimate the probability that a high school CTE concentrator either took at least one course in an education-related program or declared a major in education at some point during their enrollment in NSHE. (See Appendix B for the full results).

Table 5

	(1)	(2)	(3)	(4)	(5)	(6)
	Predicted Characteristics of Postsecondary Students in Education					
	Took at least 1 course in Education	Declared Major in Education	Took at least 1 course in Education	Declared Major in Education	Took at least 1 course in Education	Declared Major in Education
HS Education CTE Concentrator	0.246923** (0.060)	0.193129*** (0.031)				
HS Education CTE Completer			0.309102** (0.064)	0.227022*** (0.029)		
HS Education CTE Certificate Earner					0.321850*** (0.051)	0.246881*** (0.023)
Male	-0.054080** (0.012)	-0.045839*** (0.004)	-0.056544** (0.012)	-0.048400*** (0.004)	-0.057722** (0.012)	-0.049045*** (0.004)
Asian	-0.049770*** (0.007)	-0.056125*** (0.006)	-0.050073*** (0.007)	-0.056936*** (0.006)	-0.050541*** (0.008)	-0.057113*** (0.006)
Black	-0.028044* (0.010)	-0.040928** (0.010)	-0.026011* (0.009)	-0.039349** (0.010)	-0.025281* (0.009)	-0.038562** (0.010)
Hispanic / Latino	-0.020386** (0.005)	-0.021739** (0.005)	-0.021551** (0.005)	-0.022779** (0.004)	-0.020771** (0.005)	-0.022129** (0.005)
American Indian or Alaska Native	-0.017816 (0.014)	-0.054094** (0.010)	-0.019430 (0.015)	-0.055785** (0.010)	-0.021584 (0.014)	-0.057148** (0.010)
Two or more races	-0.021561** (0.004)	-0.029628*** (0.005)	-0.022261** (0.004)	-0.030765*** (0.005)	-0.022779** (0.006)	-0.031077*** (0.005)
Native Hawaiian or Pacific Islander	-0.051364* (0.015)	-0.075341** (0.015)	-0.049755* (0.015)	-0.074446** (0.014)	-0.049567* (0.016)	-0.074627** (0.014)
N	207340	183792	207340	183792	207340	183792

Note. Constant (1) 0.138827*** (0.014), (2) 0.078144*** (0.007), (3) 0.142588*** (0.014), (4) 0.082380*** (0.007), (5) 0.148653*** (0.018), (6) 0.085764*** (0.008). Standard errors in parentheses. ="* p<0.05 ** p<0.01 *** p<0.001"

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As indicated in Table 5, the probability that an education CTE student will declare a major in education while enrolled in NSHE increases in accordance with the student's progression in the education CTE program in high school. The probability of declaring a major in education is 1931% for concentrators, 22.70% for completers, and 24.69% for certificate earners. Similarly, although less important for potentially contributing to the teacher pipeline, the probability that an education CTE student will take at least one education course while enrolled at an NSHE institution.

Conversely, males and students of color are less likely to declare a major or take a course in education. Both relationships are negative and statistically significant across all six models.

Discussion and Policy Recommendations

The purpose of this study was to examine how Nevada's high school CTE programs may lessen issues associated with teacher shortages across the state. The findings from the study are twofold. First, the study identified the students most likely to participate in education CTE programs. Second, the study showed that participation in CTE programs in high school is associated with an increased likelihood of course-taking and majoring in education at NSHE institutions after graduation. Moreover, further progression through education CTE programs, from concentration to completion to certification -increases the likelihood of education studies in postsecondary settings.

The study has two main limitations. First, it is important to note that the LPMS in the study are not causal estimates of the relationships. Second, the postsecondary education outcomes are limited only to Nevada CTE concentrators enrolled in NSHE institutions. Nevada CTE students who enrolled elsewhere, CTE students from other states in NSHE institutions, and

non-CTE students may have very different outcomes than those presented here.

Researchers could address these issues in future studies. Additionally, Future research should explore the critical time points at which aspiring and current educators exit the pipeline. Future research could also investigate how postsecondary students who did not participate in education CTE programs arrive at a major in education.

Policy Recommendations

Having concluded this study, the author presents the following policy recommendations to for the state of Nevada to consider regarding its CTE programs and teacher workforce moving forward:

1. **Expand access and appeal of education CTE programs to attract a more diverse student population.** In identifying the characteristics of students who concentrate in education CTE programs and subsequently progress in education in NSHE institutions, the findings showed that this segment of the educator pipeline is predominantly composed of non-male and non-people of color (i.e., white women). A diverse state like Nevada should consider encouraging a more diverse population in education CTE programs, as this is one potential way to introduce more diversity to Nevada's educator workforce. Racial match is crucial for student outcomes (Chetty et al., 2014; Lindsay & Hart, 2017). Perhaps a diverse workforce may also help with shortage issues as well.

2. **Identify the critical points in time when aspiring and current educators leave the pipeline.** Uncovering when and why educators are leaving the pipeline to determine ways to prevent the revolving door of teacher exits (Ingersoll, 2003).

3. **Develop more incentives for NSHE education graduates to teach in Nevada.**

Encouraging NSHE graduates to remain in the state may be another way to reduce

shortage issues.

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Appendix A

Full Linear Probability Model Results for Equation 1

	Concentration in Education	Completion of an Education Program	Certificate in an Education Program
Male	-0.054*** (0.012)	-0.030*** (0.007)	-0.021*** (0.006)
Asian	-0.027** (0.009)	-0.021* (0.009)	-0.017* (0.007)
Black	0.029 (0.016)	0.011 (0.010)	-0.005 (0.005)
Hispanic/Latino	0.011 (0.007)	0.007 (0.005)	0.001 (0.003)
American Indian or Alaska Native	-0.043*** (0.012)	-0.023** (0.007)	-0.014* (0.006)
Two or more Races	-0.013 (0.009)	-0.011 (0.007)	-0.008 (0.006)
Native Hawaiian or Pacific Islander	-0.009 (0.017)	0.000 (0.013)	-0.009 (0.008)
Male x Asian	0.031*** (0.009)	0.020** (0.007)	0.015** (0.005)
Male x Black	-0.031 (0.024)	-0.013 (0.015)	0.004 (0.007)
Male x Hispanic/Latino	-0.014 (0.012)	-0.012 (0.009)	-0.004 (0.007)
Male x American Indian or AK Native	0.051*** (0.012)	0.031*** (0.008)	0.021*** (0.006)

Male x Two or more races	0.015 (0.010)	0.012 (0.007)	0.007 (0.005)
Male x Native Hawaiian or Pac. Isl.	0.003 (0.018)	-0.003 (0.013)	0.008 (0.008)
ACT Composite Score	-0.002*** (0.000)	-0.001** (0.000)	0.000* (0.000)
Whether the Student is FRL	0.004 (0.003)	0.004 (0.002)	0.005* (0.002)
Schoolwide % of Students who are FRL	-0.040*** (0.009)	-0.023*** (0.006)	-0.017*** (0.005)
Whether the School Receives Title I Money	-0.026*** (0.006)	-0.016*** (0.004)	-0.011** (0.003)
Schoolwide % of Students who are not white	0.084*** (0.019)	0.052*** (0.013)	0.038** (0.011)
School District is Urban	0.005** (0.002)	0.003** (0.001)	0.000 (0.001)

Note. N = 53,732. Constant (1) 0.037*** (0.010), (2) 0.014** (0.005), (3) -0.002 (0.003); Standard errors in parentheses.
* p<0.05, ** p<0.01, *** p<0.001

Appendix B

Full Linear Probability Model Results for Equation 2

Predicted Characteristics of Postsecondary Students in Education						
	(1)	(2)	(3)	(4)	(5)	(6)
	Took at least 1 course in Education	Declared Major in Education	Took at least 1 course in Education	Declared Major in Education	Took at least 1 course in Education	Declared Major in Education
HS Education CTE Concentrator	0.246923** (0.060)	0.193129*** (0.031)				
HS Education CTE Completer			0.309102** (0.064)	0.227022*** (0.029)		
HS Education CTE Certificate Earner					0.321850*** (0.051)	0.246881*** (0.023)
Male	-0.054080** (0.012)	-0.045839*** (0.004)	-0.056544** (0.012)	-0.048400*** (0.004)	-0.057722** (0.012)	-0.049045*** (0.004)
Asian	-0.049770*** (0.007)	-0.056125*** (0.006)	-0.050073*** (0.007)	-0.056936*** (0.006)	-0.050541*** (0.008)	-0.057113*** (0.006)
Black	-0.028044* (0.010)	-0.040928** (0.010)	-0.026011* (0.009)	-0.039349** (0.010)	-0.025281* (0.009)	-0.038562** (0.010)

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		-0.021739** (0.005)	-0.021551** (0.005)	-0.022779** (0.004)	-0.020771** (0.005)	-0.022129** (0.005)
Hispanic / Latino	-0.020386** (0.005)					
American Indian or Alaska Native	-0.017816 (0.014)	-0.054094** (0.010)	-0.019430 (0.015)	-0.055785** (0.010)	-0.021584 (0.014)	-0.057148** (0.010)
Two or more races	-0.021561** (0.004)	-0.029628*** (0.005)	-0.022261** (0.004)	-0.030765*** (0.005)	-0.022779** (0.006)	-0.031077*** (0.005)
Native Hawaiian or Pacific Islander	-0.051364* (0.015)	-0.075341** (0.015)	-0.049755* (0.015)	-0.074446** (0.014)	-0.049567* (0.016)	-0.074627** (0.014)
N	207340	183792	207340	183792	207340	183792

Note. Constant (1) 0.138827*** (0.014), (2) 0.078144*** (0.007), (3) 0.142588*** (0.014), (4) 0.082380*** (0.007), (5) 0.148653*** (0.018), (6) 0.085764*** (0.008). Standard errors in parentheses. ="* p<0.05 ** p<0.01 *** p<0.001"