IES Institute of Education Sciences

APPENDIXES
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Regional Educational Laboratory Central
At Marzano Research

The Impact of Career and Technical Education on Postsecondary Outcomes in Nebraska and South Dakota

See https://go.usa.gov/xHn39 for the full report.

Appendix A. Study background

As the demand for quality career and technical education (CTE) grows, research is needed to support state and local education agency decisionmaking on CTE programs and program improvement. Most of the literature examining secondary and postsecondary outcomes of CTE participation is composed of descriptive rather than causal studies (Dougherty, 2016). Moreover, many existing studies investigated CTE or vocational education during an earlier era when the programmatic, societal, and economic factors differed from those of today (Dougherty, 2016, 2018; Plank et al., 2008). There is also a dearth of studies examining longer-term outcomes of CTE participation.

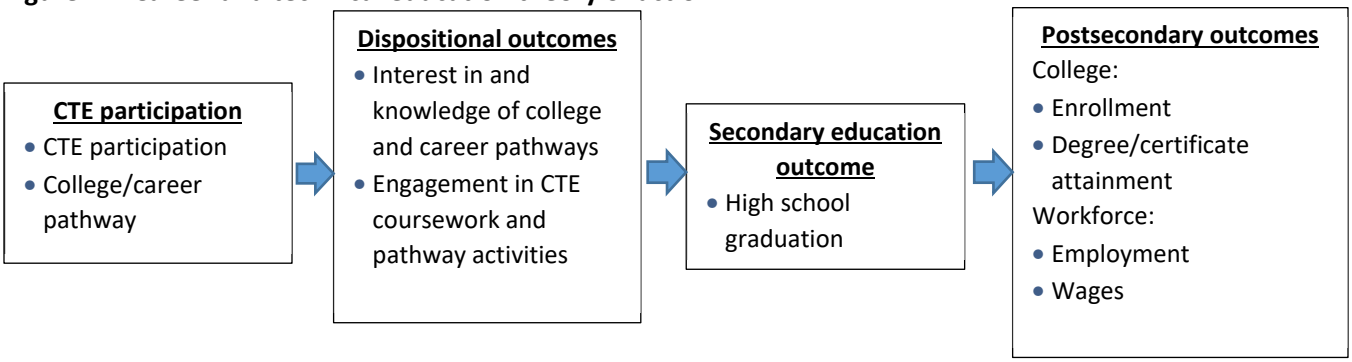
In general, descriptive and correlational studies examining outcomes for students who participate in CTE programs have shown promising results. CTE participation has been associated, to various degrees, with decreased dropout rates as well as increased high school attendance, college enrollment, and employment (Dougherty, 2016, 2018; Lee et al., 2016). Some of the limited number of causal studies have shown positive impacts of CTE participation on a range of secondary and early postsecondary and career outcomes, including high school graduation rates, college credits earned in high school, postsecondary enrollment, and employment rates (Castellano et al., 2014; Dougherty, 2016; Plank et al., 2008).

However, not all research supports claims of CTE effectiveness. Some studies have found that increased CTE participation was associated with lower rates of postsecondary degree attainment (Hudson & Boivin, 2016) or had no impact on workforce participation (Dalton, 2015). The limited number of causal studies, along with the mixed findings, suggested a need for more causal research to provide education leaders with the evidence they need to inform decisionmaking on CTE policies and practice, given the heightened interest in CTE. Additionally, it is important to examine CTE in a variety of contexts because the effects of CTE participation may differ across these contexts due to differences in implementation, state support, and economic conditions.

In 2018 state education agency leaders in four states approached the Regional Educational Laboratory (REL) Central for support to meet their need for valid, up-to-date information to inform decisionmaking on CTE policies, programming, and participation. As the work progressed, two states were unable to participate in the subsequent study. The final study used data from only Nebraska and South Dakota. The REL Central and the leaders grounded

the work in the theory of action presented below (figure A1). This theory of action posits that CTE participation will increase students' interest and engagement in CTE coursework and activities as they pursue identified career pathways (Reider et al., 2016). The increased interest and engagement of students will lead to positive secondary education and postsecondary college and workforce outcomes by providing students with the necessary knowledge, skills, and motivation to pursue their career pathways. This theory of action is adapted from the Perkins IV logic model (U.S. Department of Education, 2013) and the Science, Technology, Engineering, and Math Workforce Development logic model (Reider et al., 2016). The listed outcomes in the theory of action are drawn from the required performance indicators in the Perkins IV logic model.

Figure A1. Career and technical education theory of action



CTE is career and technical education.
Source: Adapted from U.S. Department of Education (2013) and Reider et al. (2016).

To support the partners in this work, the study team first collaborated with the participating state education agencies, state departments of higher education, and state departments of workforce development/labor to identify data available to measure the impact that CTE participation had on high school graduation as well as on postsecondary education and workforce outcomes. The leaders were particularly interested in examining the impact that CTE participation had on high school graduation, postsecondary enrollment, degree or certificate attainment, employment, and wages. Discussions focused on gathering existing, relevant data dictionaries from the participating agencies; identifying existing data-sharing agreements between agencies and departments; and determining how data-sharing agreements could be expanded outside the state education agencies to measure the impact that CTE participation had on postsecondary outcomes.

Once data dictionaries were gathered, the study team used Common Education Data Standards (CEDS; https://ceds.ed.gov/) tools to map available data. Using the CEDS tools allowed the team to identify the available data at each state agency and create a common vocabulary of variables to facilitate conversations across agencies and states.

After identifying relevant data and developing a common vocabulary, the study team facilitated discussions with the partners to draft a research plan. The plan included research questions of interest to each state and across states that could be addressed using existing data. During this process the study team and partners determined that the infrastructure to link education data to workforce data was not currently available. Consequently, the subsequent study examined only postsecondary education outcomes, but not workforce outcomes, two years after and five years after students' expected high school graduation year.

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Appendix B. Methods

This appendix describes the variables used in the study as well as the study sample and methodology. The study was designed to meet What Works Clearinghouse (2020) group design standards with reservations and to align with the What Works Clearinghouse (2016) *Review Protocol for Studies of Interventions to Support the Transition to College*.

Data sources

Table B1 provides an overview of the variables used to address the research questions and is followed by additional details about the variables.

Table B1. Overview of study variables

Data	Variable
Independent variables	• Student CTE concentrator status • Career cluster of CTE concentration
Study covariates	• State code • Expected four-year high school graduation year (student graduation cohort) • Gender • Race/ethnicity • English learner status (grade 8) • Eligibility for the national school lunch program (grade 8) • Special education status (grade 8) • State math assessment scores (grade 8) • State reading assessment scores (grade 8) • Urban-centric locale of high school district • Percentage of district students eligible for the national school lunch program • Number of career clusters addressed by a district's CTE programming

Outcome variables	• Four-year high school graduation status
	• Postsecondary enrollment status (two years and five years after students' expected high school graduation year)
	• Postsecondary award type (two years and five years after students' expected high school graduation year)
	  ○ Attaining any type of postsecondary award
	  ○ Attaining a professional certificate, diploma, or associate's degree
	  ○ Attaining a bachelor's degree or higher

Secondary outcome variables	• Full-time postsecondary enrollment (two years and five years after students' expected high school graduation year) • Enrollment in a two-year postsecondary institution (two years and five years after students' expected high school graduation year) • Enrollment in a four-year postsecondary institution (two years and five years after students' expected high school graduation year)

CTE is career and technical education.
Source: Authors' compilation.

Independent variables. CTE concentrator status was the primary independent variable in the study. Perkins IV defines a CTE concentrator as a "secondary student who has earned three or more credits in a single CTE program area (e.g., health care or business services), or two credits in a single CTE program area, but only in those program

areas where two-credit sequences at the secondary level are recognized by the state and/or its local eligible recipients" (U.S. Department of Education, 2015, p. 58). The Nebraska Department of Education uses the first option, whereas the South Dakota Department of Education uses the second, to define a CTE concentrator. To address these different definitions and other unmeasured differences between Nebraska and South Dakota, the study team's analyses include a binary indicator of state. All students in the study were classified as either being a CTE concentrator or a non-CTE concentrator.

Both the Nebraska Department of Education and the South Dakota Department of Education use the National Career Cluster Framework (U.S. Department of Education, n.d.) to organize their CTE programming. Each CTE concentrator is designated as having concentrated in one of the following 16 career clusters:

- Agriculture, food, and natural resources.
- Architecture and construction.
- Arts, audio/visual, and communications.
- Business, management, and administration.
- Education and training.
- Finance.
- Government and public administration.
- Health science.
- Hospitality and tourism.
- Human services.
- Information technology.
- Law, public safety, corrections, and security.
- Manufacturing.
- Marketing.
- Science, technology, engineering, and mathematics.
- Transportation, distribution, and logistics.
- Multiple clusters.

However, there were differences between the two states. Two career clusters were available only to students in Nebraska: government and public administration; and law, public safety, corrections, and security. Although students may concentrate in more than one career cluster, the data provided by the Nebraska Department of Education indicated only the first cluster each student concentrated in. The data provided by the South Dakota Department of Education indicated all the career clusters each student concentrated in. South Dakota students who concentrated in multiple clusters were coded as concentrating in multiple clusters and were not included in the descriptive analyses to address research question 2. Data for CTE concentrators in multiple clusters are in appendix E. Table E10 in appendix E shows that approximately 43 percent of the South Dakota CTE concentrator analytic sample used to examine two-year outcomes concentrated in multiple clusters.

Study covariates. Covariates used in the study included students' expected four-year high school graduation year (graduation cohort), student demographics (gender, race/ethnicity, grade 8 English learner status, grade 8 special education status, grade 8 eligibility for the national school lunch program), students' grade 8 state assessment

scores in math and reading, district locale (for example, town or city), percentage of district students eligible for the national school lunch program, number of career clusters addressed by a district's CTE programming, and a binary state indicator. The urban-centric locale of a district indicates where a district lies along a continuum from rurality to urbanicity. This is a 12 point ordinal variable that ranges from 1 (representing rural: remote) to 12 (representing city: large). Race/ethnicity was represented as a series of dummy variables for American Indian, Asian, Black, Hispanic, and Native Hawaiian/Pacific Islander or multiracial (combined into a single group because of small sample sizes), with White as the referent group. Grade 8 state assessment scores were standardized so that they could be aggregated across states. For the impact analyses, graduation cohort was converted into a series of dummy-coded variables to represent each cohort, with the 2012/13 cohort serving as the referent group.

Outcome variables. The primary outcome variables examined in the study included students' four-year high school graduation status, postsecondary enrollment status (two years and five years after students' expected high school graduation year), and postsecondary award type attained (two years and five years after students' expected high school graduation year). Postsecondary enrollment included part- and full-time enrollment as well as enrollment in any kind of postsecondary education, including a professional certificate program, a degree-granting program, or a two-year or four-year institution. Postsecondary award type was used to develop three outcome variables. First, the data were used to categorize students as having attained any kind of postsecondary award within two years of and within five years of their expected high school graduation year. For five-year postsecondary outcomes these data were also used to categorize the highest type of postsecondary award attained within five years of students' expected high school graduation year. Students who attained a postsecondary award were categorized as either having either attained a professional certificate, diploma, or associate's degree or having attained a bachelor's degree or higher. Students who attained a professional certificate, diploma, or associate's degree were grouped together because the study dataset did not allow the study team to accurately distinguish among these awards. The Nebraska Department of Education and the South Dakota Department of Education obtained postsecondary enrollment status, completion status, and award type through the National Student Clearinghouse.

Secondary outcome variables. Secondary outcome variables examined in the study included full-time postsecondary enrollment, enrollment in a two-year postsecondary institution, and enrollment in a four-year postsecondary institution. The effect of being a CTE concentrator on each of the variables was examined two years and five years after students' expected high school graduation year.

Sample

The study sample was drawn from all students in Nebraska and South Dakota whose expected four-year high school graduation year was between 2012/13 and 2016/17. A subsample used to examine five-year postsecondary outcomes was drawn from students in the 2012/13 and 2013/14 graduating cohorts. Students were included in the sample only if they completed the regular grade 8 state math and reading assessments, were accountable to an identified public school and district, and had all data necessary to conduct the propensity score matching described below. Students were excluded from the sample if they took an alternative grade 8 state assessment, were homeschooled, or attended an alternative, juvenile justice, private, or charter school.

Missing data. Prior to constructing the analytic student sample used to address the study research questions, the study team examined the extent of students' missing outcome and baseline data. Because all outcome data other than high school graduation status were gathered from the National Student Clearinghouse, there were very few missing data. The National Student Clearinghouse (https://www.studentclearinghouse.org/) provides an affirmative indication of student postsecondary enrollment and completion. Any nonaffirmative indicator is coded as a lack of postsecondary enrollment or completion, which essentially results in zero missing data. Nebraska and South Dakota students who attend for-profit postsecondary institutions do not have an affirmative enrollment or completion indicator because these institutions are not covered by the National Student Clearinghouse. This

approach has the possibility of attenuating the study impact estimates and resulting in conservative effect size estimates.

One area of missing data was students designated as having earned a postsecondary award but missing information on the type of award earned. The National Center for Education Evaluation and Regional Assistance (2019) recommends conducting a nonresponse bias analysis if more than 15 percent of a study sample has missing outcome data. This analysis is conducted to determine whether students with missing outcome data and students without missing outcome data differ systematically from one another and to statistically control for these differences if necessary. Examination of the rates of missing postsecondary award type showed that 0.5 percent of the total analytic sample had missing award type information two years after students' expected high school graduation year and that 3.4 percent of the total analytic sample had missing award type information five years after their expected high school graduation year. About 8.6 percent of students who were designated as having earned a postsecondary award within two years of their expected high school graduation year and about 8.9 percent of students who were designated as having earned a postsecondary award within five years of their expected high school graduation year had missing award type information. Because the number of students with missing award type information fell below the 15 percent specified in National Center for Education Evaluation and Regional Assistance (2019) guidelines and did not require a nonresponse bias analysis, the study team constructed the analytic sample using only students who had complete outcome data.

Additionally, students were included in the analytic sample only if they had complete baseline data. Less than 2 percent of the original student sample had missing grade 8 demographic and academic achievement data. Students with any missing baseline data were excluded from the propensity score matching process described below and were thus not included in the analytic sample.

Propensity score matching. In developing the analytic sample, the study team's primary concern was to account for selection bias and meet the What Works Clearinghouse (2020) requirement for quasi-experimental designs to establish the baseline equivalence of the treatment and comparison groups. Prior studies have shown that male students, White students, students from low-income households (that is, students eligible for the national school lunch program), and students with disabilities are overrepresented in CTE (Dougherty, 2016). The What Works Clearinghouse (2016) review protocol for supporting the transition to college states that if baseline data on the outcome variable (for example, postsecondary enrollment) are not available, baseline equivalence can be established using preintervention academic achievement (for example, state math and reading achievement scores) and socioeconomic status (for example, eligibility for the national school lunch program). Because CTE coursework primarily becomes available in high school, grade 8 is considered to be the preintervention/baseline year.

The study team used propensity score matching to establish the treatment and comparison samples. This approach creates an analytic sample of students who had an equal probability of receiving the treatment based on their baseline characteristics but who are in different study groups, providing for more accurate and less biased estimates of program impacts (Rosenbaum & Ruben, 1983). To match students, the study team used a logistic regression model with the following matching variables: gender; race/ethnicity (binary variables for American Indian, Asian, Black, Hispanic, and Native Hawaiian/Pacific Islander or multiracial); grade 8 eligibility for the national school lunch program; grade 8 special education status; grade 8 state assessment scores for math and reading; district locale; and percentage of district students eligible for the national school lunch program. The resulting propensity scores were used to match treatment and comparison students 1-to-1 with no replacements, using the nearest neighbor method. The matching was stratified by state (Nebraska or South Dakota) and student graduation cohort (2012/13, 2013/14, 2014/15, 2015/16, or 2016/17).

The demographic composition and baseline characteristics of the full student sample used in the analyses of high school graduation and two-year postsecondary outcomes prior to matching, the full sample after matching (which

contained the matched comparison and treatment groups), and the comparison and treatment groups after matching are in table B2. The comparison and treatment groups included students across the five student graduation cohorts and were used to examine the impact of being a CTE concentrator on high school graduation and two-year postsecondary outcomes.

Table B2. Characteristics of students in the samples and groups used in the analyses of high school graduation and two-year postsecondary outcomes

Characteristic	Prematch sample (*N* = 130,631)	Matched sample (*N* = 112,764)	Comparison group (*N* = 56,382)	Treatment group (*N* = 56,382)
Male	51.1	51.2	50.0	52.4
American Indian	3.4	3.5	4.0	2.9
Asian	1.7	1.5	1.5	1.5
Black	4.8	4.9	5.1	4.8
Hispanic	11.7	11.6	12.6	10.6
Multiracial	2.6	2.6	2.6	2.5
Native Hawaiian/Pacific Islander	0.1	0.1	0.1	0.1
White	75.8	75.9	74.1	77.7
Special education student	12.6	12.0	12.6	11.4
Eligible for the national school lunch program	38.2	38.4	40.2	36.6
English learner student	2.8	2.6	3.1	2.1
Urban-centric locale of district[a]	6.5	6.2	6.4	6.1
Number of career clusters offered by district	8.3 (4.3)	8.3 (4.4)	8.0 (4.3)	8.6 (4.4)
Percentage of students eligible for the national school lunch program at district level	42.1 (18.7)	42.7 (18.7)	43.6 (18.6)	41.8 (18.7)
Grade 8 math achievement score (*z*-score)	0.03 (0.99)	0.06 (0.97)	0.05 (1.01)	0.06 (0.92)
Grade 8 reading achievement score (*z*-score)	0.03 (0.99)	0.04 (0.98)	0.03 (1.02)	0.04 (0.94)

Note: Unless otherwise noted, numbers are raw percentages. Numbers in parentheses are standard deviations.
a. On a 12 point ordinal scale ranging from 1 (representing rural: remote) to 12 (representing city: large).
Source: Authors' analysis of data provided by the Nebraska Department of Education and the South Dakota Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

The demographic composition and baseline characteristics of the full student sample used in the analyses of five-year postsecondary outcomes prior to matching, the full sample after matching (which contained the matched comparison and treatment groups), and the comparison and treatment groups after matching are in table B3. The comparison and treatment groups included students across the two student graduation cohorts that were used to examine the impact of being a CTE concentrator on five-year postsecondary outcomes.

Table B3. Characteristics of students in the samples and groups used in the analyses of five-year postsecondary outcomes

Characteristic	Prematch sample (*N* = 51,028)	Matched sample (*N* = 42,398)	Comparison group (*N* = 21,199)	Treatment group (*N* = 21,199)
Male	50.8	54.0	51.8	56.1
American Indian	3.5	3.4	4.0	2.7
Asian	1.5	1.1	1.1	1.1
Black	4.9	4.7	4.8	4.7
Hispanic	10.8	10.0	10.9	9.2
Multiracial	2.4	2.2	2.3	2.1
Native Hawaiian/Pacific Islander	0.1	0.1	0.1	0.1
White	76.9	78.5	76.9	80.1
Special education student	12.2	10.9	11.0	10.7
Eligible for the national school lunch program	34.4	33.2	34.5	31.9
English learner student	3.1	2.7	3.2	2.2
Urban-centric locale of district[a]	6.5	5.9	6.0	5.8
Number of career clusters offered by district	8.0 (4.4)	7.8 (4.5)	7.5 (4.5)	8.2 (4.4)
Percentage of students eligible for the national school lunch program at district level	42.3 (0.2)	42.6 (0.2)	43.7 (0.2)	41.5 (0.2)
Grade 8 math achievement score (*z*-score)	0.03 (0.99)	0.10 (0.90)	0.10 (0.93)	0.11 (0.88)
Grade 8 reading achievement score (*z*-score)	0.03 (0.99)	0.04 (0.96)	0.05 (0.98)	0.03 (0.93)

Note: Unless otherwise noted, numbers are raw percentages. Numbers in parentheses are standard deviations.
a. On a 12 point ordinal scale ranging from 1 (representing rural: remote) to 12 (representing city: large).
Source: Authors' analysis of data provided by the Nebraska Department of Education and the South Dakota Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Baseline equivalence. To assess the effectiveness of the matching and meet What Works Clearinghouse (2020) standards, the study team examined the baseline equivalence of the treatment and comparison groups on the variables outlined in the What Works Clearinghouse (2016) study review protocol. These variables included students' grade 8 state assessment scores in math and reading and grade 8 eligibility for the national school lunch program. Baseline equivalence was assessed separately for the two-year outcome analytic sample (2012/13–2016/17 student graduation cohorts) and the five-year outcome analytic sample (2012/13 and 2013/14 student graduation cohorts). Hedges' *g* was used to assess the baseline equivalence for math and reading achievement, while Cox's index was used to assess the baseline equivalence for eligibility for the national school lunch program. Although baseline equivalence was established for both of the samples on the required variables (table B4), the variables were included in the impact analyses to statistically adjust for the existing difference. Because there was greater than a 0.05 standard deviation difference on eligibility for the national school lunch program for both of the study samples, the What Works Clearinghouse (2020) requires that statistical adjustment be used for these variables in the impact analyses.

Table B4. Baseline equivalence results

Baseline measure	Matched sample
Two-year sample (*N* = 112,764)	
Math achievement	0.02[a]
Reading achievement	0.01[a]
Eligibility for the national school lunch program	0.09[b]
Five-year sample (*N* = 42,398)	
Math achievement	0.02[a]
Reading achievement	−0.02[a]
Eligibility for the national school lunch program	0.07[b]

a. Hedges' *g* effect size.
b. Cox's index effect size.
Source: Authors' analysis of data from the Nebraska Department of Education and the South Dakota Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

Data analysis

This section describes the analytic approach used to address research questions 1 and 2.

Research question 1: What is the impact of being a CTE concentrator on high school graduation, two-year and five-year postsecondary enrollment and completion, and type of postsecondary award attained? To address research question 1, the study team conducted a series of logistic regressions. These analyses determined whether the proportion of treatment and comparison students who achieved a dichotomous outcome (for example, enrolling in a postsecondary institution) were significantly different from one another. Separate analyses were conducted on each of the following outcomes variables:

- Four-year high school graduation status.
- Postsecondary enrollment status (two years and five years after students' expected high school graduation year).
- Attaining any kind of postsecondary award (two years and five years after students' expected high school graduation year).
- Attaining a professional certificate, diploma, or associate's degree (five years after students' expected high school graduation year).
- Attaining a bachelor's degree or higher (five years after students' expected high school graduation year).

For each analysis, CTE concentrator status was entered as the treatment variable. Covariates in the analyses included dummy codes for students' expected four-year high school graduation year, demographic variables (gender, race/ethnicity, grade 8 English learner status, grade 8 special education status, grade 8 eligibility for the national school lunch program), students' grade 8 state assessment scores in math and reading, rurality/locale of district, percentage of district students eligible for the national school lunch program, number of career clusters addressed by a district's CTE programming, and a dummy code for state. Impacts on having attained a bachelor's degree or higher were not examined at two years after students' expected high school graduation year because very few students earned a bachelor's degree within two years.

The study team conducted secondary analyses, using the same analytic approach as above, on the following additional outcome variables:

- Full-time postsecondary enrollment (two years and five years after students' expected high school graduation year).

- Enrollment in a two-year postsecondary institution (two years and five years after students' expected high school graduation year).
- Enrollment in a four-year postsecondary institution (two years and five years after students' expected high school graduation year).

Additional analyses examined the impact of being a CTE concentrator on high school graduation and two-year outcomes, using the analytic sample that had five-year outcome data, the 2011/12 and 2012/13 student graduation cohorts. Comparison of the two-year outcomes for the full study sample and the smaller five-year outcome sample indicates the extent to which the five-year outcomes might generalize to the larger group. Similar results across these two groups would increase the generalizability of findings.

Research question 2: How do high school graduation and two-year and five-year postsecondary outcomes vary by career cluster? The study team used descriptive statistics to examine research question 2. The analysis examined the percentage and number of students in each career cluster who achieved each of the study outcomes.

Finally, the study team conducted secondary analyses to address the research questions separately for the Nebraska and South Dakota student samples.

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Appendix C. Detailed analysis results

This appendix provides additional detail on the study findings. Outcomes from the impact analyses are presented as odds ratios, marginal effects, and Cox's index effect sizes. Odds ratios are interpreted as the change in odds of achieving a certain outcome by being a career and technical education (CTE) concentrator. For example, an odds ratio of 2.0 for postsecondary enrollment indicates that the odds of enrolling in a postsecondary institution for CTE concentrators are twice the odds for non-CTE concentrators. Marginal effects represent the percentage difference in an outcome variable associated with a one-unit change in a given predictor, keeping other covariates constant, and evaluated at the mean of all covariates. For instance, a marginal effect of 0.10 in the postsecondary enrollment logistic regression indicates that the average CTE concentrator has a 10 percentage point greater likelihood of enrolling in a postsecondary institution than a non-CTE concentrator does, after all covariates are controlled for. Finally, Cox's index effect sizes represent the magnitude of the difference between two groups, or the effect size, on a certain outcome in standard deviation units. Effect sizes are generally considered to be small if they are .20–.49, medium if they are .50–.79, and large if they are .80 or above (Cohen, 1969). However, Kraft (2019) suggests that, for education interventions, effect sizes of .05–.20 be considered medium and effect sizes above .20 be considered large, particularly when examining impacts on students' academic achievement.

Education outcomes

The descriptive statistics of the study outcome variables for the full sample, the matched sample, the comparison group, and the treatment group are in tables C1 and C2. The descriptive statistics are presented separately for the two-year analytic sample and the five-year analytic sample. Two-year descriptive statistics for the five-year analytic sample are in table C3.

Table C1. Percentage of students in the two-year sample achieving each education outcome, by sample and group

Outcome	Prematch sample (*N* = 130,631)	Matched sample (*N* = 112,764)	Comparison group (*N* = 56,382)	Treatment group (*N* = 56,382)
Primary outcomes				
High school graduation	91.0	91.6	85.3	98.0
	(28.6)	(27.7)	(35.4)	(14.2)
Postsecondary enrollment	69.1	69.4	64.6	74.1
	(46.2)	(46.1)	(47.8)	(43.8)
Attaining any type of postsecondary award	4.5	4.4	2.9	6.0
	(20.8)	(20.6)	(16.9)	(23.7)
Secondary outcomes				
Full-time enrollment	60.6	60.9	56.6	65.2
	(48.9)	(48.8)	(49.6)	(47.6)
Enrollment in a two-year institution	31.6	31.5	26.6	36.4
	(46.5)	(46.4)	(44.2)	(48.1)
Enrollment in a four-year institution	46.7	47.2	46.4	48.1
	(49.9)	(49.9)	(49.9)	(50.0)

Note: Numbers are raw percentages. Numbers in parentheses are standard deviations.
Source: Authors' analysis of data provided by the Nebraska Department of Education and the South Dakota Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

Table C2. Percentage of students in the five-year sample achieving each education outcome, by sample and group

Outcome	Prematch sample (*N* = 51,028)	Matched sample (*N* = 42,398)	Comparison group (*N* = 21,199)	Treatment group (*N* = 21,199)
Primary outcomes				
Postsecondary enrollment	72.3	73.4	69.7	77.1
	(44.7)	(44.2)	(46.0)	(42.0)
Attaining any type of postsecondary award	35.6	37.2	36.0	38.3
	(47.9)	(48.3)	(48.0)	(48.6)
Attaining up to an associate's degree	8.2	8.9	6.4	11.3
	(27.4)	(28.4)	(24.5)	(31.7)
Attaining a bachelor's degree or higher	27.5	28.3	29.6	27.0
	(44.6)	(45.0)	(45.6)	(44.4)
Secondary outcomes				
Full-time enrollment	63.3	64.7	61.3	68.0
	(48.2)	(47.8)	(48.7)	(46.7)
Enrollment in a two-year institution	39.1	39.2	34.1	44.2
	(48.8)	(48.8)	(47.4)	(49.7)
Enrollment in a four-year institution	51.7	52.8	53.0	52.5
	(50.0)	(49.9)	(49.9)	(49.9)

Note: Numbers are raw percentages. Numbers in parentheses are standard deviations.
Source: Authors' analysis of data provided by the Nebraska Department of Education and the South Dakota Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Table C3. Percentage of students in the five-year sample achieving each two-year education outcome, by sample and group

Outcome	Prematch sample (*N* = 51,028)	Matched sample (*N* = 42,398)	Comparison group (*N* = 21,199)	Treatment group (*N* = 21,199)
Primary outcomes				
High school graduation	91.0	90.7	85.5	97.9
	(28.6)	(29.0)	(35.2)	(14.5)
Postsecondary enrollment	69.1	68.6	65.2	73.4
	(46.2)	(46.4)	(47.6)	(44.2)
Attaining any type of postsecondary award	4.5	3.0	1.8	4.8
	(20.8)	(17.2)	(13.3)	(21.3)
Secondary outcomes				
Full-time enrollment	60.6	59.8	56.4	64.4
	(48.9)	(49.0)	(49.6)	(47.9)
Enrollment in a two-year institution	31.6	31.0	27.4	35.8
	(46.5)	(46.2)	(44.6)	(48.0)
Enrollment in a four-year institution	46.7	47.0	46.4	47.7
	(49.9)	(49.9)	(49.9)	(49.9)

Note: Numbers are raw percentages. Numbers in parentheses are standard deviations.
Source: Authors' analysis of data provided by the Nebraska Department of Education and the South Dakota Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Impact analysis results

The results of analyses examining the impact of being a CTE concentrator on high school graduation and two-year outcomes are in table C4, and the results of analyses examining the impact on five-year outcomes are in table C5.

Table C4. Results of impact analysis on high school graduation and two-year outcomes

Outcome	Odds ratio	Marginal effects	*p*-value	Cox's index
Primary outcomes				
High school graduation	9.83***	0.07***	.00	1.39
	(.335)	(.001)		
Postsecondary enrollment	1.67***	0.10***	.00	0.31
	(.025)	(.003)		
Attaining any type of postsecondary award	1.96***	0.02***	.00	0.41
	(.062)	(.001)		
Secondary outcomes				
Full-time enrollment	1.53***	0.10***	.00	0.26
	(.022)	(.003)		
Enrollment in a two-year institution	1.63***	0.10***	.00	0.30
	(.022)	(.003)		
Enrollment in four-year institution	1.09***	0.02***	.00	0.05
	(.016)	(.004)		

*** Significant at $p < .001$.
Note: Numbers in parentheses are standard errors.
Source: Authors' analysis of data provided by the Nebraska Department of Education and the South Dakota Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

Table C5. Results of impact analysis on five-year outcomes

Outcome	Odds ratio	Marginal effects	*p*-value	Cox's index
Primary outcomes				
Postsecondary enrollment	1.57***	0.08***	.00	0.27
	(.039)	(.004)		
Attaining any type of postsecondary award	1.17***	0.03***	.00	0.09
	(.027)	(.005)		
Attaining up to an associate's degree	1.77***	0.04***	.00	0.35
	(.065)	(.002)		
Attaining a bachelor's degree or higher	0.91***	−0.01***	.00	−0.06
	(.023)	(.004)		
Secondary outcomes				
Full-time enrollment	1.43***	0.08***	.00	0.22
	(.033)	(.005)		
Enrollment in a two-year institution	1.56***	0.10***	.00	0.27
	(.033)	(.005)		
Enrollment in a four-year institution	1.01	0.00	.76	0.00
	(.023)	(.006)		

*** Significant at $p < .001$.
Note: Numbers in parentheses are standard errors.
Source: Authors' analysis of data provided by the Nebraska Department of Education and the South Dakota Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Results of two-year impact analysis with five-year student sample

The results of analyses examining the impact of being a CTE concentrator on high school graduation and two-year outcomes, using the analytic sample used to examine five-year outcomes, are in table C6. A comparison of these data to those in table C4 shows similar results.

Table C6. Results of impact analysis on two-year outcomes, using the five-year student sample

Study outcome	Odds ratio	Marginal effects	*p*-value	Cox's index
Primary outcomes				
High school graduation	8.93*** (.495)	0.06*** (.002)	.00	1.33
Postsecondary enrollment	1.53*** (.037)	0.08*** (.005)	.00	0.26
Attaining any type of postsecondary award	1.92*** (.115)	0.01*** (.001)	.00	0.40
Secondary outcomes				
Full-time enrollment	1.41*** (.032)	0.08*** (.005)	.00	0.21
Enrollment in a two-year institution	1.60*** (.035)	0.10*** (.005)	.00	0.29
Enrollment in a four-year institution	1.00 (.023)	0.00 (.006)	.96	0.00

*** Significant at $p < .001$.
Note: Numbers in parentheses are standard errors.
Source: Authors' analysis of data provided by the Nebraska Department of Education and the South Dakota Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Education outcomes by career and technical education career cluster

The numbers and percentages of CTE concentrators who concentrated in each career cluster are in table C7.

Table C7. Number and percentage of career and technical education concentrators in the two-year sample who concentrated in each career cluster

Career cluster	Number	Percent	Career cluster	Number	Percent
Agriculture, food, and natural resources	8,257	14.6	Human services	8,702	15.4
Architecture and construction	5,125	9.1	Information technology	2,681	4.8
Arts, audio/visual, and communication	1,781	3.2	Law, public safety, corrections, and security[a]	306	0.5
Business, management, and administration	6,616	11.7	Manufacturing	2,938	5.2
Education and training	717	1.3	Marketing	1,419	2.5
Finance	2,457	4.4	Science, technology, engineering, and mathematics	1,289	2.3
Government and public administration[a]	200	0.4	Transportation, distribution, and logistics	977	1.7
Health sciences	4,081	7.2	Multiple clusters[b]	6,867	12.2
Hospitality and tourism	1,969	3.5			

a. Sample included only students in Nebraska. No South Dakota students were CTE concentrators in this cluster.
b. Sample included only students in South Dakota. The Nebraska Department of Education does not classify students as having concentrated in multiple career clusters. For Nebraska students who concentrated in multiple career clusters, the department reported only the first career cluster the students concentrated in.
Source: Authors' analysis of data provided by the Nebraska Department of Education and the South Dakota Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

High school graduation and postsecondary outcomes assessed two years and five years after students' expected high school graduation year, disaggregated by career cluster, are in tables C8 and C9.

Table C8. High school graduation and two-year postsecondary outcomes, by career cluster

Group or career cluster	Primary outcomes			Secondary outcomes		
	High school graduation	Postsecondary enrollment	Attaining any type of postsecondary award	Full-time enrollment	Enrollment in two-year institution	Enrollment in four-year institution
Comparison group (56,382)	85.3	64.6	2.9	56.6	26.6	46.4
Treatment group (56,382)	98.0	74.1	6.0	65.2	36.4	48.1
Agriculture, food, and natural resources (8,257)	97.6	76.0	10.3	69.8	40.9	46.7
Architecture and construction (5,125)	98.2	67.8	7.8	58.7	37.7	37.6
Arts, audio/visual, and communication (1,781)	98.9	79.8	2.8	71.8	34.1	58.1
Business, management, and administration (6,616)	98.6	79.3	3.3	69.9	34.9	56.1
Education and training (717)	99.7	84.1	1.4	73.9	37.4	62.1
Finance (2,457)	99.9	86.2	4.0	77.3	38.2	63.0
Government and public administration (200)[a]	100.0	84.5	1.0	78.0	26.0	72.0
Health sciences (4,081)	99.2	84.5	3.0	75.2	39.1	60.9
Hospitality and tourism (1,969)	97.8	63.6	1.9	49.7	38.5	32.5
Human services (8,702)	98.2	71.6	2.4	59.1	38.6	43.9
Information technology (2,681)	98.3	75.4	3.3	64.8	35.3	50.2
Law, public safety, corrections, and security (306)[a]	96.7	73.5	1.3	60.2	38.2	48.0
Manufacturing (2,938)	98.3	61.4	8.4	51.8	41.3	25.8
Marketing (1,419)	99.4	85.1	2.0	78.6	33.8	69.8
Science, technology, engineering, and mathematics (1,289)	96.6	77.4	3.8	70.5	24.7	62.5
Transportation, distribution, and logistics (977)	94.1	51.3	11.5	40.6	39.9	15.4
Multiple clusters (6,867)[b]	95.7	70.1	12.0	65.0	27.0	48.2

Note: Numbers are raw percentages. Numbers in parentheses are the sample size for each group or career cluster.
a. Sample included only students in Nebraska. No South Dakota students were CTE concentrators in this cluster.
b. Sample included only students in South Dakota. The Nebraska Department of Education does not classify students as having concentrated in multiple career clusters. For Nebraska students who concentrated in multiple career clusters, the department reported only the first career cluster the students concentrated in.
Source: Authors' analysis of data provided by the Nebraska Department of Education and the South Dakota Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

Table C9. Five-year postsecondary outcomes, by career cluster

Group or career cluster	Primary outcomes				Secondary outcomes		
	Post-secondary enrollment	Attaining any type of postsecondary award	Attaining up to an associate's degree	Attaining a bachelor's degree or higher	Full-time enrollment	Enrollment in two-year institution	Enrollment in four-year institution
Comparison group (21,199)	69.7	36.0	6.4	29.6	61.3	34.1	53.0
Treatment group (21,199)	77.1	38.3	11.3	27.0	68.0	44.2	52.5
Agriculture, food, and natural resources (3,345)	76.7	45.5	15.6	29.9	70.8	44.5	51.9

Group or career cluster	Primary outcomes				Secondary outcomes		
	Post-secondary enrollment	Attaining any type of postsecondary award	Attaining up to an associate's degree	Attaining a bachelor's degree or higher	Full-time enrollment	Enrollment in two-year institution	Enrollment in four-year institution
Architecture and construction (2,219)	72.2	31.9	11.0	20.9	62.0	43.7	45.0
Arts, audio/visual, and communication (818)	83.9	42.5	6.7	35.8	75.6	45.5	63.3
Business, management, and administration (2,432)	83.8	42.1	7.9	34.3	73.7	45.0	62.9
Education and training (238)	87.0	40.8	5.5	35.3	78.6	46.6	66.8
Finance (781)	88.3	51.7	6.8	44.9	81.2	45.2	71.1
Government and public administration (128)[a]	87.5	57.0	1.6	55.5	80.5	30.5	77.3
Health sciences (1,287)	89.0	46.4	8.9	37.5	79.3	50.7	67.4
Hospitality and tourism (747)	73.8	22.2	7.6	14.6	59.3	48.5	40.0
Human services (2,879)	72.8	30.9	8.6	22.3	60.9	46.0	46.0
Information technology (1,231)	77.9	32.1	7.2	24.9	66.5	43.5	53.7
Law, public safety, corrections, and security (142)[a]	76.8	26.8	4.9	21.8	66.2	52.1	51.4
Manufacturing (1,104)	66.0	24.7	11.7	13.0	54.9	46.5	31.8
Marketing (573)	90.2	49.7	3.8	45.9	82.4	46.8	78.0
Science, technology, engineering, and mathematics (470)	80.2	32.8	6.8	26.0	71.9	37.7	65.7
Transportation, distribution, and logistics (432)	57.4	25.2	16.9	8.3	45.6	46.5	19.2
Multiple clusters (2,373)[b]	72.1	43.6	23.1	20.5	67.2	35.1	47.0

Note: Numbers are raw percentages. Number in parentheses represent the sample size for each group or career cluster.
a. Sample included only students in Nebraska. No South Dakota students were CTE concentrators in this cluster.
b. Sample included only students in South Dakota. The Nebraska Department of Education does not classify students as having concentrated in multiple career clusters. For Nebraska students who concentrated in multiple career clusters, the department reported only the first career cluster the students concentrated in.
Source: Authors' analysis of data provided by the Nebraska Department of Education and the South Dakota Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

References

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Appendix D. Nebraska analyses

This appendix presents the descriptive findings and the results of the impact analyses using only the sample of students from Nebraska.

Demographic composition of the Nebraska sample

The demographic composition and baseline characteristics of the full Nebraska student sample used in the analyses of high school graduation and two-year postsecondary outcomes prior to matching, the full sample after matching (which contained the matched comparison and treatment groups), and the comparison and treatment groups after matching are in table D1. The comparison and treatment groups included students across the five student graduation cohorts and were used to examine the impact of being a career and technical education (CTE) concentrator on high school graduation and two-year postsecondary outcomes.

Table D1. Characteristics of Nebraska students in the samples and groups used in the analyses of high school graduation and two-year postsecondary outcomes

Characteristic	Prematch sample (*N* = 94,118)	Matched sample (*N* = 80,876)	Comparison group (*N* = 40,438)	Treatment group (*N* = 40,438)
Male	51.1	52.1	51.7	52.5
American Indian	1.2	1.1	1.3	0.8
Asian	1.8	1.6	1.5	1.6
Black	6.0	6.3	6.3	6.3
Hispanic	15.1	15.0	16.2	13.9
Multiracial	3.1	3.0	3.1	3.0
Native Hawaiian/Pacific Islander	0.1	0.1	0.1	0.1
White	72.7	73.0	71.6	74.3
Special education student	13.7	12.8	13.8	11.9
Eligible for the national school lunch program	41.4	41.4	43.6	39.3
English learner student	3.1	2.9	3.3	2.4
Urban-centric locale of district[a]	7.3	6.9	6.8	7.0
Number of career clusters offered by district	8.8 (4.6)	8.8 (4.6)	8.3 (4.7)	9.4 (4.5)
Percentage of students eligible for the national school lunch program at district level	43.5 (19.1)	44.2 (19.0)	44.8 (18.9)	43.5 (19.1)
Grade 8 math assessment score (*z*-score)	0.03 (0.99)	0.05 (0.95)	0.03 (0.98)	0.08 (0.92)
Grade 8 reading assessment score (*z*-score)	0.03 (0.99)	0.02 (0.98)	0.00 (1.01)	0.05 (0.94)

CTE is career and technical education.
Note: Unless otherwise noted, numbers are raw percentages. Numbers in parentheses are standard deviations.
a. On a 12 point ordinal scale ranging from 1 (representing rural: remote) to 12 (representing city: large).
Source: Authors' analysis of data provided by the Nebraska Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

The demographic composition and baseline characteristics of the full Nebraska student sample used in the analyses of five-year postsecondary outcomes prior to matching, the full sample after matching (which included the matched comparison and treatment groups), and the comparison and treatment groups after matching are in table D2. The comparison and treatment groups included students across the two student graduation cohorts that were used to examine the impact of being a CTE concentrator on five-year postsecondary outcomes.

Table D2. Characteristics of Nebraska students in the samples and groups used in the analyses of five-year postsecondary outcomes

Characteristic	Prematch sample (*N* = 36,540)	Matched sample (*N* = 29,390)	Comparison group (*N* = 14,695)	Treatment group (*N* = 14,695)
Male	50.7	54.4	53.7	55.1
American Indian	1.2	0.9	1.0	0.8
Asian	1.7	1.2	1.1	1.3
Black	6.2	6.5	6.5	6.5
Hispanic	14.2	13.7	14.7	12.6
Multiracial	3.0	2.7	2.9	2.6
Native Hawaiian/Pacific Islander	0.1	0.1	0.1	0.1
White	73.7	74.9	73.7	76.1
Special education student	13.4	11.4	11.8	10.9
Eligible for the national school lunch program	39.7	38.1	39.8	36.4
English learner student	3.6	3.2	3.7	2.7
Urban-centric locale of district[a]	7.3	6.7	6.6	6.9
Number of career clusters offered by district	8.6 (4.7)	8.6 (4.8)	8.0 (4.9)	9.2 (4.6)
Percentage of students eligible for the national school lunch program at district level	43.7 (19.1)	44.7 (18.9)	45.7 (18.2)	43.7 (19.5)
Grade 8 math achievement score (*z*-score)	0.03 (0.97)	0.14 (0.87)	0.11 (0.88)	0.17 (0.87)
Grade 8 reading achievement score (*z*-score)	0.03 (0.99)	0.05 (0.95)	0.04 (0.97)	0.06 (0.93)

CTE is career and technical education.
Note: Unless otherwise noted, numbers are raw percentages. Numbers in parentheses are standard deviations.
a. On a 12 point ordinal scale ranging from 1 (representing rural: remote) to 12 (representing city: large).
Source: Authors' analysis of data provided by the Nebraska Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Baseline equivalence was established for the Nebraska sample (table D3). Although baseline equivalence was established, the baseline variables were included in the impact analyses to statistically adjust for existing group differences.

Table D3. Baseline equivalence results

Baseline measure	Nebraska sample
Two-year sample (*N* = 80,876)	
Math achievement	0.05[a]
Reading achievement	0.04[a]
Eligibility for the national school lunch program	0.11[b]
Five-year sample (*N* = 29,390)	
Math achievement	0.07[a]
Reading achievement	0.02[a]
Eligibility for the national school lunch program	0.09[b]

a. Hedges' *g* effect size.
b. Cox's index effect size.
Source: Authors' analysis of data from the Nebraska Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

Education outcomes for the Nebraska sample

The descriptive statistics of the study outcome variables for Nebraska's full sample, the matched sample, the comparison group, and the treatment group are in tables D4–D6.

Table D4. Percentage of Nebraska students in the two-year sample achieving each education outcome, by sample and group

Outcome	Prematch sample (*N* = 94,118)	Matched sample (*N* = 80,876)	Comparison group (*N* = 40,438)	Treatment group (*N* = 40,438)
Primary outcomes				
High school graduation	91.3	92.3	85.4	99.2
	(28.1)	(26.6)	(35.3)	(8.8)
Postsecondary enrollment	69.5	70.1	64.5	75.6
	(46.0)	(45.8)	(47.8)	(43.0)
Attaining any type of postsecondary award	3.2	3.5	2.7	4.2
	(17.7)	(18.3)	(16.2)	(20.1)
Secondary outcomes				
Full-time enrollment	59.7	60.2	55.3	65.2
	(49.1)	(48.9)	(49.7)	(47.6)
Enrollment in a two-year institution	36.1	36.5	32.0	41.0
	(48.0)	(48.1)	(46.6)	(49.2)
Enrollment in a four-year institution	44.4	44.8	42.6	46.9
	(49.7)	(49.7)	(49.4)	(49.9)

Note: Numbers are raw percentages. Number in parentheses are standard deviations.
Source: Authors' analysis of data provided by the Nebraska Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

Table D5. Percentage of Nebraska students in the five-year sample achieving each education outcome, by sample and group

Outcome	Prematch sample (*N* = 36,540)	Matched sample (*N* = 29,390)	Comparison group (*N* = 14,695)	Treatment group (*N* = 14,695)
Primary outcomes				
Postsecondary enrollment	72.9	74.4	70.1	78.7
	(44.4)	(43.6)	(45.8)	(40.9)
Attaining any type of postsecondary award	33.3	35.0	34.3	35.6
	(47.1)	(47.7)	(47.5)	(47.9)
Attaining up to an associate's degree	6.3	6.7	5.7	7.8
	(24.3)	(25.1)	(23.2)	(26.8)
Attaining a bachelor's degree or higher	27.0	28.2	28.6	27.8
	(44.4)	(45.0)	(45.2)	(44.8)
Secondary outcomes				
Full-time enrollment	62.4	64.1	60.3	67.8
	(48.4)	(48.0)	(48.9)	(46.7)
Enrollment in a two-year institution	45.0	45.4	41.2	49.7
	(49.8)	(49.8)	(49.2)	(50.0)
Enrollment in a four-year institution	49.7	51.3	50.0	52.6
	(50.0)	(50.0)	(50.0)	(49.9)

Note: Numbers are raw percentages. Number in parentheses are standard deviations.
Source: Authors' analysis of data provided by the Nebraska Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Table D6. Percentage of Nebraska students in the five-year sample achieving each two-year education outcome by sample and group

Outcome	Prematch sample (*N* = 36,540)	Matched sample (*N* = 29,390)	Comparison group (*N* = 14,695)	Treatment group (*N* = 14,695)
Primary outcomes				
High school graduation	90.9 (28.7)	92.9 (25.6)	86.6 (34.0)	99.3 (8.5)
Postsecondary enrollment	69.0 (46.2)	70.5 (45.6)	66.2 (47.3)	74.9 (43.4)
Attaining any type of postsecondary award	1.5 (12.2)	1.7 (12.9)	1.6 (12.4)	1.8 (13.4)
Secondary outcomes				
Full-time enrollment	58.8 (49.2)	60.4 (48.9)	56.6 (49.6)	64.3 (47.9)
Enrollment in a two-year institution	35.7 (47.9)	36.0 (48.0)	32.0 (46.7)	40.0 (49.0)
Enrollment in a four-year institution	44.5 (49.7)	46.1 (49.8)	44.9 (49.7)	47.3 (49.9)

Note: Numbers are raw percentages. Numbers in parentheses are standard deviations.
Source: Authors' analysis of data provided by the Nebraska Department of Education and the South Dakota Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Impact analysis results for the Nebraska sample

The results of analyses examining the impact of being a CTE concentrator on high school graduation and two-year outcomes in Nebraska are in table D7, and the results of analyses examining the impact on five-year outcomes in Nebraska are in table D8.

Table D7. Results of impact analysis on high school graduation and two-year outcomes in Nebraska

Outcome	Odds ratio	Marginal effects	*p*-value	Cox's index
Primary outcomes				
High school graduation	25.05*** (1.551)	0.06*** (.001)	.00	1.98
Postsecondary enrollment	1.81*** (.032)	0.11*** (.003)	.00	0.36
Attaining any type of postsecondary award	1.70*** (.071)	0.01*** (.001)	.00	0.32
Secondary outcomes				
Full-time enrollment	1.62*** (.027)	0.11*** (.004)	.00	0.29
Enrollment in a two-year institution	1.54*** (.023)	0.10*** (.004)	.00	0.26
Enrollment in a four-year institution	1.21*** (.021)	0.05*** (.004)	.00	0.12

*** Significant at $p < .001$.
Note: Numbers in parentheses are standard errors.
Source: Authors' analysis of data provided by the Nebraska Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

Table D8. Results of impact analysis on five-year outcomes in Nebraska

Outcome	Odds ratio	Marginal effects	*p*-value	Cox's index
Primary outcomes				
Postsecondary enrollment	1.66*** (.050)	0.09*** (.005)	.00	0.319
Attaining any type of postsecondary award	1.10*** (.031)	0.02*** (.006)	.00	0.06
Attaining up to an associate's degree	1.47*** (.071)	0.02*** (.003)	.00	0.23
Attaining a bachelor's degree or higher	0.97 (.030)	−0.01 (.005)	.25	−0.02
Secondary outcomes				
Full-time enrollment	1.45*** (.041)	0.08*** (.006)	.00	0.23
Enrollment in a two-year institution	1.43*** (.035)	0.09*** (.006)	.00	0.22
Enrollment in a four-year institution	1.11*** (.031)	0.03*** (.007)	.00	0.07

*** Significant at $p < .001$.
Note: Numbers in parentheses are standard errors.
Source: Authors' analysis of data provided by the Nebraska Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Results of two-year impact analysis with five-year Nebraska student sample

The results of analyses examining the impact of being a CTE concentrator on high school graduation and two-year outcomes in Nebraska, using the analytic sample used to examine five-year outcomes, are in table D9.

Table D9. Results of impact analysis on two-year outcomes, using the five-year Nebraska student sample

Outcome	Odds ratio	Marginal effects	*p*-value	Cox's index
Primary outcomes				
High school graduation	27.39*** (2.815)	0.06*** (.002)	.00	2.01
Postsecondary enrollment	1.61*** (.047)	0.09*** (.006)	.00	0.29
Attaining any type of postsecondary award	1.38*** (.131)	0.003***[a] (.001)	.00	0.20
Secondary outcomes				
Full-time enrollment	1.44*** (.040)	0.09*** (.006)	.00	0.22
Enrollment in a two-year institution	1.45*** (.037)	0.09*** (.006)	.00	0.23
Enrollment in a four-year institution	1.10*** (.031)	0.02*** (.007)	.00	0.06

*** Significant at $p \leq .001$.
a. Number goes to three decimal places to show the value of the significant finding.
Source: Authors' analysis of data provided by the Nebraska Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Education outcomes by career and technical education career cluster

The numbers and percentages of Nebraska CTE concentrators in each career cluster are in table D10.

Table D10. Number and percentage of career and technical education concentrators in the two-year sample in Nebraska who concentrated in each career cluster

Career cluster	Number	Percent	Career cluster	Number	Percent
Agriculture, food, and natural resources	5,931	14.7	Human services	7,379	18.3
Architecture and construction	4,252	10.5	Information technology	2,444	6.0
Arts, audio/visual, and communication	1,600	4.0	Law, public safety, corrections, and security	306	0.8
Business, management, and administration	5,062	12.5	Manufacturing	2,633	6.5
Education and training	714	1.8	Marketing	1,257	3.1
Finance	2,434	6.0	Science, technology, engineering, and mathematics	620	1.5
Government and public administration	200	0.5	Transportation, distribution, and logistics	591	1.5
Health sciences	3,345	8.3	Multiple clusters[a]	na	na
Hospitality and tourism	1,670	4.1			

na is not applicable.

a. The Nebraska Department of Education does not classify students as having concentrated in multiple clusters. For Nebraska students who concentrated in multiple career clusters, the department reported only the first cluster the students concentrated in.

Source: Authors' analysis of data provided by the Nebraska Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

High school graduation and postsecondary outcomes assessed two years and five years after Nebraska students' expected high school graduation year, disaggregated by career cluster, are in tables D11 and D12.

Table D11. High school graduation and two-year outcomes in Nebraska, by career cluster

	Primary outcomes			Secondary outcomes		
Group or career cluster	High school graduation	Postsecondary enrollment	Attaining any type of postsecondary award	Full-time enrollment	Enrollment in two-year institution	Enrollment in four-year institution
Comparison group (40,438)	85.4	64.5	2.7	55.3	32.0	42.6
Treatment group (40,438)	99.2	75.6	4.2	65.2	41.0	46.9
Agriculture, food, and natural resources (5,931)	99.3	77.6	8.8	70.6	45.4	46.0
Architecture and construction (4,252)	99.6	69.2	6.6	59.5	40.0	37.5
Arts, audio/visual, and communication (1,600)	99.7	80.6	2.3	72.8	35.8	58.3
Business, management, and administration (5,062)	99.3	79.8	3.0	69.2	40.4	53.1
Education and training (714)	99.7	84.3	1.4	74.1	37.5	62.2
Finance (2,434)	99.9	86.2	4.0	77.2	38.4	62.7
Government and public administration (200)	100.0	84.5	1.0	78.0	26.0	72.0
Health sciences (3,345)	99.4	83.9	2.5	73.5	43.2	57.7
Hospitality and tourism (1,670)	98.7	64.0	1.3	48.9	42.5	29.9
Human services (7,379)	98.9	71.9	1.9	58.4	41.5	42.1
Information technology (2,444)	98.9	75.0	3.2	63.9	37.5	48.3
Law, public safety, corrections, and security (306)	96.7	73.5	1.3	60.1	38.2	48.0
Manufacturing (2,633)	98.6	61.2	7.2	51.0	42.2	25.0
Marketing (1,257)	99.8	88.5	1.7	82.3	35.4	73.0

Group or career cluster	Primary outcomes			Secondary outcomes		
	High school graduation	Postsecondary enrollment	Attaining any type of postsecondary award	Full-time enrollment	Enrollment in two-year institution	Enrollment in four-year institution
Science, technology, engineering, and mathematics (620)	99.2	83.5	2.6	75.5	36.0	64.2
Transportation, distribution, and logistics (591)	98.3	57.4	8.5	41.1	47.9	14.2
Multiple clusters (na)[a]	na	na	na	na	na	na

na is not applicable.

Note: Numbers are raw percentages. Numbers in parentheses represent the sample size for each group or career cluster.

a. The Nebraska Department of Education does not classify students as having concentrated in multiple clusters. For Nebraska students who concentrated in multiple career clusters, the department reported only the first cluster the students concentrated in.

Source: Authors' analysis of data provided by the Nebraska Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

Table D12. Five-year outcomes in Nebraska, by career cluster

Group or career cluster	Primary outcomes				Secondary outcomes		
	Post-secondary enrollment	Attaining any type of postsecondary award	Attaining up to an associate's degree	Attaining a bachelor's degree or higher	Full-time enrollment	Enrollment in two-year institution	Enrollment in four-year institution
Comparison group (14,695)	70.1	34.3	5.7	28.6	60.3	41.2	50.0
Treatment group (14,695)	78.7	35.6	7.8	27.8	67.8	49.7	52.6
Agriculture, food, and natural resources (2,034)	78.2	44.3	11.6	32.7	71.1	50.6	53.4
Architecture and construction (1,795)	73.7	30.4	8.6	21.7	62.2	46.5	45.9
Arts, audio/visual, and communication (759)	84.6	43.5	6.3	37.2	76.4	47.6	63.5
Business, management, and administration (1,927)	83.7	39.6	6.3	33.3	72.3	49.8	60.9
Education and training (236)	87.3	40.7	5.5	35.2	78.8	47.0	66.9
Finance (781)	88.3	51.7	6.8	44.9	81.2	45.2	71.1
Government and public administration (128)	87.5	57.0	1.6	55.5	80.5	30.5	77.3
Health sciences (1,040)	88.6	41.9	7.4	34.5	78.0	56.9	64.4
Hospitality and tourism (624)	74.2	18.3	5.9	12.3	58.3	54.2	36.9
Human services (2,088)	72.4	25.7	6.6	19.1	58.1	52.3	40.9
Information technology (1,112)	77.4	30.8	7.1	23.7	65.5	46.2	51.8
Law, public safety, corrections, and security (142)	76.8	26.8	4.9	21.8	66.2	52.1	51.4
Manufacturing (970)	66.2	23.6	10.5	13.1	53.8	48.5	30.8

Group or career cluster	Primary outcomes				Secondary outcomes		
	Post-secondary enrollment	Attaining any type of postsecondary award	Attaining up to an associate's degree	Attaining a bachelor's degree or higher	Full-time enrollment	Enrollment in two-year institution	Enrollment in four-year institution
Marketing (520)	92.1	52.9	4.2	48.7	84.4	49.0	79.6
Science, technology, engineering, and mathematics (263)	86.7	34.2	4.9	29.3	78.3	48.3	68.4
Transportation, distribution, and logistics (276)	63.8	20.7	14.1	6.5	46.7	54.3	19.6
Multiple clusters (na)[a]	na	na	na	na	na	na	na

na is not applicable.

Note: Numbers are raw percentages. Numbers in parentheses represent the sample size for each group.

a. The Nebraska Department of Education does not classify students as having concentrated in multiple clusters. For Nebraska students who concentrated in multiple career clusters, the department reported only the first cluster the students concentrated in.

Source: Authors' analysis of data provided by the Nebraska Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Appendix E. South Dakota analyses

This appendix presents the descriptive findings and the results of the impact analyses using only the sample of students from South Dakota.

Demographic composition of the South Dakota sample

The demographic composition and baseline characteristics of the full South Dakota student sample used in the analyses of high school graduation and two-year postsecondary outcomes prior to matching, the full sample after matching (which contained the matched comparison and treatment groups), and the comparison and treatment groups after matching are in table E1. The comparison and treatment groups included students across the five student graduation cohorts and were used to examine the impact of being a career and technical education (CTE) concentrator on high school graduation and two-year outcomes.

Table E1. Characteristics of South Dakota students in the samples and groups used in the analyses of high school graduation and two-year postsecondary outcomes

Characteristic	Prematch sample (*N* = 36,513)	Matched sample (*N* = 31,888)	Comparison group (*N* = 15,944)	Treatment group (*N* = 15,944)
Male	51.1	48.9	45.4	52.3
American Indian	9.0	9.5	11.0	8.1
Asian	1.3	1.3	1.5	1.1
Black	1.7	1.5	2.0	1.0
Hispanic	2.8	2.9	3.5	2.2
Multiracial	1.4	1.5	1.5	1.4
Native Hawaiian/Pacific Islander	0.1	0.1	0.1	0.0
White	83.7	83.3	80.4	86.1
Special education student	9.6	9.7	9.5	9.9
Eligible for the national school lunch program	30.0	30.8	31.7	29.8
English learner student	2.0	2.0	2.7	1.3
Urban-centric locale of district[a]	4.6	4.6	5.3	3.9
Number of career clusters offered by district	6.9 (3.2)	7.0 (3.2)	7.3 (3.3)	6.7 (3.2)
Percentage of students eligible for the national school lunch program at district level	38.4 (16.9)	39.0 (17.3)	40.4 (17.4)	37.5 (17.1)
Grade 8 math assessment score (*z*-score)	0.04 (1.01)	0.06 (1.01)	0.09 (1.08)	0.03 (0.95)
Grade 8 reading assessment score (*z*-score)	0.03 (0.98)	0.06 (0.98)	0.10 (1.03)	0.03 (0.93)

CTE is career and technical education.
Note. Unless otherwise noted, numbers are raw percentages. Numbers in parentheses are standard deviations.
a. On a 12 point ordinal scale ranging from 1 (representing rural: remote) to 12 (representing city: large).
Source: Authors' analysis of data provided by the South Dakota Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

The demographic composition and baseline characteristics of the full South Dakota student sample used in the analyses of five-year postsecondary outcomes prior to matching, the full sample after matching (which contained the matched comparison and treatment groups), and the comparison and treatment groups after matching are in table E2. The comparison and treatment groups included students across the two student graduation cohorts that were used to examine the impact of being a CTE concentrator on five-year postsecondary outcomes.

Table E2. Characteristics of South Dakota students in the samples and groups used in the analyses of five-year postsecondary outcomes

Characteristic	Prematch sample (*N* = 14,488)	Matched sample (*N* = 13,008)	Comparison group (*N* = 6,504)	Treatment group (*N* = 6,504)
Male	51.2	53.0	47.7	58.3
American Indian	9.2	8.9	10.8	7.0
Asian	1.1	1.0	1.1	0.9
Black	1.6	0.7	0.9	0.5
Hispanic	2.3	1.8	2.2	1.5
Multiracial	1.0	1.0	1.1	1.0
Native Hawaiian/Pacific Islander	0.03	0.03	0.05	0.02
White	84.9	86.6	83.9	89.2
Special education student	9.3	9.8	9.4	10.2
Eligible for the national school lunch program	21.2	22.2	22.5	21.8
English learner student	1.8	1.7	2.1	1.2
Urban-centric locale of district[a]	4.5	3.9	4.5	3.3
Number of career clusters offered by district	6.4 (3.0)	6.1 (3.0)	6.3 (3.1)	5.9 (2.9)
Average percentage of students eligible for the national school lunch program at district level	38.6 (16.3)	38.0 (16.7)	39.3 (17.4)	36.7 (15.9)
Grade 8 math assessment score (*z*-score)	0.04 (0.98)	0.02 (0.96)	0.06 (1.04)	−0.02 (0.88)
Grade 8 reading assessment score (*z*-score)	0.04 (0.98)	0.02 (0.97)	0.07 (1.02)	−0.04 (0.92)

CTE is career and technical education.
Note: Unless otherwise noted, numbers are raw percentages. Numbers in parentheses are standard deviations.
a. On a 12 point ordinal scale ranging from 1 (representing rural: remote) to 12 (representing city: large).
Source: Authors' analysis of data provided by the South Dakota Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Baseline equivalence was established for the South Dakota sample (table E3). Although baseline equivalence was established, the baseline variables were included in the impact analyses to statistically adjust for existing group differences.

Table E3. Baseline equivalence results for the South Dakota sample

Baseline measure	South Dakota sample
Two-year sample (*N* = 31,888)	
Math achievement	−0.06[a]
Reading achievement	−0.08[a]
Eligibility for the national school lunch program	0.06[b]
Five-year sample (*N* = 13,008)	
Math achievement	−0.08[a]
Reading achievement	−0.12[a]
Eligibility for the national school lunch program	0.03[b]

a. Hedges' *g* effect size.
b. Cox's index effect size.
Source: Authors' analysis of data from the South Dakota Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

Education outcomes for the South Dakota sample

The descriptive statistics of the study outcome variables for South Dakota's full sample, the matched sample, the comparison group, and the treatment group are in tables E4–E6.

Table E4. Percentage of South Dakota students in the two-year sample achieving each education outcome, by sample and group

Outcome	Prematch sample (*N* = 36,513)	Matched sample (*N* = 31,888)	Comparison group (*N* = 15,944)	Treatment group (*N* = 15,944)
Primary outcomes				
High school graduation	90.2	89.9	85.0	94.8
	(29.7)	(30.2)	(35.7)	(22.3)
Postsecondary enrollment	68.0	67.7	64.9	70.5
	(46.6)	(46.8)	(47.7)	(45.6)
Attaining any type of postsecondary award	7.8	6.9	3.5	10.4
	(26.9)	(25.4)	(18.3)	(30.5)
Secondary outcomes				
Full-time enrollment	62.9	62.5	59.8	65.2
	(48.3)	(48.4)	(49.0)	(47.6)
Enrollment in a two-year institution	20.1	18.7	12.8	24.7
	(40.1)	(39.0)	(33.4)	(43.1)
Enrollment in a four-year institution	52.4	53.6	56.2	51.0
	(49.9)	(49.9)	(49.6)	(50.0)

Note: Numbers are raw percentages. Numbers in parentheses represent the sample size for each group.
Source: Authors' analysis of data provided by the South Dakota Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

Table E5. Percentage of South Dakota students in the five-year sample achieving each education outcome, by sample and group

Outcome	Prematch sample (*N* = 14,488)	Matched sample (*N* = 13,008)	Comparison group (*N* = 6,504)	Treatment group (*N* = 6,504)
Primary outcomes				
Postsecondary enrollment	70.9	71.1	68.7	73.4
	(45.4)	(45.3)	(46.4)	(44.2)
Attaining any type of postsecondary award	41.6	42.1	39.8	44.4
	(49.3)	(49.4)	(49.0)	(49.7)
Attaining up to an associate's degree	12.9	13.7	8.0	19.3
	(33.5)	(34.4)	(27.1)	(39.5)
Attaining a bachelor's degree or higher	28.8	28.4	31.8	25.1
	(45.3)	(45.1)	(46.6)	(43.3)
Secondary outcomes				
Full-time enrollment	65.6	66.0	63.6	68.4
	(47.5)	(47.4)	(48.1)	(46.5)
Enrollment in a two-year institution	24.2	25.0	18.2	31.8
	(42.8)	(43.3)	(38.6)	(46.6)
Enrollment in a four-year institution	56.6	56.1	59.9	52.2
	(49.6)	(49.6)	(49.0)	(50.0)

Note: Numbers are raw percentages. Numbers in parentheses represent the sample size for each group.
Source: Authors' analysis of data provided by the South Dakota Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Table E6. Percentage of South Dakota students in the five-year sample achieving each two-year education outcome, by sample and group

Outcome	Prematch sample (*N* = 51,028)	Matched sample (*N* = 42,398)	Comparison group (*N* = 21,199)	Treatment group (*N* = 21,199)
Primary outcomes				
High school graduation	90.1 (29.8)	90.5 (29.4)	86.1 (34.5)	94.8 (22.3)
Postsecondary enrollment	67.6 (46.8)	67.8 (46.7)	65.5 (47.5)	70.2 (45.7)
Attaining any type of postsecondary award	6.9 (25.4)	7.5 (26.3)	3.6 (18.7)	11.4 (31.8)
Secondary outcomes				
Full-time enrollment	62.3 (48.5)	62.6 (48.4)	60.3 (48.9)	64.9 (47.7)
Enrollment in a two-year institution	19.1 (39.3)	20.0 (40.0)	13.3 (33.9)	26.7 (44.2)
Enrollment in a four-year institution	53.3 (49.9)	52.7 (49.9)	56.5 (49.6)	48.8 (50.0)

Note: Numbers are raw percentages. Numbers in parentheses are standard deviations.
Source: Authors' analysis of data provided by the South Dakota Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Impact analysis results for the South Dakota sample

The results of analyses examining the impact of being a CTE concentrator on high school graduation and two-year outcomes in South Dakota are in table D7, and the results of analyses examining the impact on five-year outcomes in South Dakota are in table D8.

Table E7. Results of impact analysis on high school graduation and two-year outcomes in South Dakota

Outcome	Odds ratio	Marginal effects	*p*-value	Cox's index
Primary outcomes				
High school graduation	3.51*** (.167)	0.06*** (.002)	.00	0.76
Postsecondary enrollment	1.29*** (.037)	0.05*** (.006)	.00	0.15
Attaining any type of postsecondary award	2.51*** (.130)	0.04*** (.002)	.00	0.56
Secondary outcomes				
Full-time enrollment	1.25*** (.035)	0.05*** (.006)	.00	0.13
Enrollment in a two-year institution	1.94*** (.061)	0.09*** (.004)	.00	0.40
Enrollment in a four-year institution	0.81*** (.022)	−0.05*** (.007)	.00	−0.13

*** Significant at $p < .001$.
Source: Authors' analysis of data provided by the South Dakota Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

Table E8. Results of impact analysis on five-year outcomes in South Dakota

Outcome	Odds ratio	Marginal effects	*p*-value	Cox's index
Primary outcomes				
Postsecondary enrollment	1.31***	0.05***	.00	0.16
	(.060)	(.008)		
Attaining any type of postsecondary award	1.22***	0.05***	.00	0.12
	(.051)	(.010)		
Attaining up to an associate's degree	2.14***	0.08***	.00	0.46
	(.125)	(.006)		
Attaining a bachelor's degree or higher	0.79***	−0.04***	.00	−0.15
	(.037)	(.007)		
Secondary outcomes				
Full-time enrollment	1.27***	0.05***	.00	0.14
	(.056)	(.009)		
Enrollment in a two-year institution	1.82***	0.11***	.00	0.36
	(.080)	(.008)		
Enrollment in a four-year institution	0.79***	−0.06***	.00	−0.14
	(.034)	(.011)		

*** Significant at $p < .001$.

Source: Authors' analysis of data provided by the South Dakota Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Results of two-year impact analysis with the five-year South Dakota student sample

The results of analyses examining the impact of being a CTE concentrator on high school graduation and two-year outcomes in South Dakota, using the analytic sample used to examine five-year outcomes, are in table E9.

Table E9. Results of impact analysis on two-year outcomes, using the five-year South Dakota student sample

Outcome	Odds ratio	Marginal effects	*p*-value	Cox's index
Primary outcomes				
High school graduation	3.00***	0.05***	.00	0.67
	(.224)	(.004)		
Postsecondary enrollment	1.27***	0.05***	.00	0.14
	(.057)	(.009)		
Attaining any type of postsecondary award[a]	2.37***	0.04***	.00	0.52
	(.191)	(.004)		
Secondary outcomes				
Full-time enrollment	1.22***	0.04***	.00	0.12
	(.053)	(.010)		
Enrollment in a two-year institution	1.96***	0.10***	.00	0.41
	(.095)	(.007)		
Enrollment in a four-year institution	0.78***	−0.06***	.00	−0.15
	(.034)	(.011)		

*** Significant at $p < .001$.

a. The covariate for Black was removed from the analysis due to not being present in one of the study groups.

Source: Authors' analysis of data provided by the South Dakota Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.

Education outcomes by career and technical education career cluster

The numbers and percentages of South Dakota students in each career cluster are in table E10.

Table E10. Number and percentage of career and technical education concentrators in the two-year sample in South Dakota who concentrated in each career cluster

Career cluster	Number	Percent	Career cluster	Number	Percent
Agriculture, food, and natural resources	2,326	14.6	Human services	1,323	8.3
Architecture and construction	873	5.5	Information technology	237	1.5
Arts, audio/visual, and communication	181	1.1	Law, public safety, corrections, and security	na	na
Business, management, and administration	1,554	9.8	Manufacturing	305	1.9
Education and training	3	0.02	Marketing	162	1.0
Finance	23	0.1	Science, technology, engineering, and mathematics	669	4.2
Government and public administration	na	na	Transportation, distribution, and logistics	386	2.4
Health sciences	736	4.6	Multiple clusters	6,867	43.1
Hospitality and tourism	299	1.9			

na is not applicable because no South Dakota students concentrated in this career cluster.
Source: Authors' analysis of data provided by the South Dakota Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

High school graduation and postsecondary outcomes assessed two years and five years after South Dakota students' expected high school graduation year, disaggregated by career cluster, are in tables E11 and E12.

Table E11. High school graduation and two-year outcomes in South Dakota, by career cluster

	Primary outcomes			Secondary outcomes		
Group or career cluster	High school graduation	Postsecondary enrollment	Attaining any type of postsecondary award	Full-time enrollment	Enrollment in two-year institution	Enrollment in four-year institution
Comparison group (15,944)	85.0	64.9	3.5	59.8	12.8	56.2
Treatment group (15,944)	94.8	70.5	10.4	65.2	24.7	51.0
Agriculture, food, and natural resources (2,326)	93.3	71.8	14.3	67.6	29.3	48.4
Architecture and construction (873)	91.5	61.2	13.5	54.6	26.3	38.5
Arts, audio/visual, and communication (181)	91.7	72.4	7.2	63.5	19.9	56.4
Business, management, and administration (1,554)	96.4	77.6	4.5	72.0	17.1	65.8
Education and training (3)	100.0	33.3	0.0	33.3	0.0	33.3
Finance (23)	100.0	91.3	4.3	91.3	13.0	87.0
Government and public administration (na)	na	na	na	na	na	na
Health sciences (736)	98.5	87.0	5.4	82.5	20.7	75.1
Hospitality and tourism (299)	92.6	61.5	5.7	54.2	16.7	46.5
Human services (1,323)	93.9	69.5	5.4	63.0	22.2	53.9
Information technology (237)	92.4	79.7	3.8	74.7	12.2	70.5
Law, public safety, corrections, and security (na)	na	na	na	na	na	na
Manufacturing (305)	95.4	63.0	19.0	58.7	33.8	32.8

Group or career cluster	Primary outcomes			Secondary outcomes		
	High school graduation	Postsecondary enrollment	Attaining any type of postsecondary award	Full-time enrollment	Enrollment in two-year institution	Enrollment in four-year institution
Marketing (162)	96.9	59.3	4.3	50.0	21.0	45.1
Science, technology, engineering, and mathematics (669)	94.2	71.7	4.9	65.9	14.2	60.8
Transportation, distribution, and logistics (386)	87.6	42.0	16.1	39.9	27.7	17.1
Multiple clusters (6,867)	95.7	70.1	12.0	65.0	27.0	48.2

na is not applicable because no South Dakota students concentrated in this career cluster.
Note: Numbers are raw percentages. Numbers in parentheses represent the sample size for each group.
Source: Authors' analysis of data provided by the South Dakota Department of Education for students whose expected high school graduation year was between 2012/13 and 2016/17.

Table E12. Five-year outcomes in South Dakota, by career cluster

Group or career cluster	Primary outcomes				Secondary outcomes		
	Post-secondary enrollment	Attaining any type of postsecondary award	Attaining up to an associate's degree	Attaining a bachelor's degree or higher	Full-time enrollment	Enrollment in two-year institution	Enrollment in four-year institution
Comparison group (6,504)	68.7	39.8	8.0	31.8	63.6	18.2	59.9
Treatment group (6,504)	73.4	44.4	19.3	25.1	68.4	31.8	52.2
Agriculture, food, and natural resources (1,311)	74.3	47.4	21.8	25.6	70.3	35.2	49.6
Architecture and construction (424)	65.8	38.2	21.0	17.2	60.8	31.6	41.3
Arts, audio/visual, and communication (59)	74.6	30.5	11.9	18.6	64.4	18.6	61.0
Business, management, and administration (505)	84.4	51.7	13.9	37.8	79.0	26.5	70.5
Education and training (2)	50.0	50.0	0.0	50.0	50.0	0.0	50.0
Finance (na)	na	na	na	na	na	na	na
Government and public administration (na)	na	na	na	na	na	na	na
Health sciences (247)	90.7	65.2	15.0	50.2	85.0	24.7	79.8
Hospitality and tourism (123)	71.5	42.3	16.3	26.0	64.2	19.5	56.1
Human services (791)	74.0	44.9	14.0	30.8	68.0	29.5	59.4
Information technology (119)	82.4	44.5	8.4	36.1	76.5	17.6	71.4
Law, public safety, corrections, and security (na)	na	na	na	na	na	na	na
Manufacturing (134)	64.9	32.8	20.1	12.7	62.7	32.1	38.8

Group or career cluster	Primary outcomes				Secondary outcomes		
	Post-secondary enrollment	Attaining any type of postsecondary award	Attaining up to an associate's degree	Attaining a bachelor's degree or higher	Full-time enrollment	Enrollment in two-year institution	Enrollment in four-year institution
Marketing (53)	71.7	18.9	0.0	18.9	62.3	24.5	62.3
Science, technology, engineering, and mathematics (207)	72.0	30.9	9.2	21.7	63.8	24.2	62.3
Transportation, distribution, and logistics (156)	46.2	33.3	21.8	11.5	43.6	32.7	18.6
Multiple clusters (2,373)	72.1	43.6	23.1	20.5	67.2	35.1	47.0

na is not applicable because no South Dakota students in the five-year sample concentrated in this career cluster.
Note: Numbers are raw percentages. Numbers in parentheses represent the sample size for each group.
Source: Authors' analysis of data provided by the South Dakota Department of Education for students whose expected high school graduation year was 2012/13 or 2013/14.