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APPENDIXES
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Regional Educational Laboratory Midwest
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Indiana and Minnesota Students Who Focused on Career and Technical Education in High School: Who Are They, and What Are Their College and Employment Outcomes?

See https://go.usa.gov/xHu8d for the full report.

Appendix A. Typology of career types in Indiana and Minnesota

Whereas Minnesota and some other states organize distinct career pathways into broader career clusters and then career fields, Indiana organizes career pathways into career clusters. The organization for clusters and pathways for Indiana is provided in table A1. The typology of careers for Minnesota is provided in table A2.

Table A1. Indiana's grouping of career pathways into career clusters

Career cluster	Career pathway
Agriculture	Agribusiness
	Animal science
	Food science
	Horticulture and landscape
	Natural resources
	Plants and soils
Architecture and construction	Architecture
	Building and facilities management
	Building and facility maintenance
	Commercial and residential facilities management
	Construction
	Electrical
	Heavy equipment
	Heating, ventilation, and air conditioning
	Mechanical
Arts, AV technology, and communications	Commercial photography
	Fashion, textiles, and design
	Interactive media
	Radio/television
	Visual communication

Career cluster	Career pathway
Business and marketing	Accounting and finance
	Entrepreneurship and management, business management focus
	Entrepreneurship and management, entrepreneur focus
	Marketing management, hospitality and tourism
	Marketing management, marketing
	Marketing management, sports and entertainment
Education and training	Early childhood
	Education careers
Health science	Biomedical
	Biotechnology
	Comprehensive health science and/or emerging careers
	Dental
	Dietetics and nutrition science
	Health career specialties
	Health science careers—pharmacy
	Health science careers—physical therapy
	Nursing
	Veterinary
Hospitality and human services	Cosmetology
	Culinary arts
	Hospitality management
	Human and social services
Information technology	Computer science
	Networking
	Personal computer support/Information technology support
	Programming
Manufacturing and logistics	Advanced manufacturing
	Electronics
	Engineering
	Logistics and supply chain management
	Machine technology
	Machine tool
	Welding
Public safety	Criminal justice
	Emergency medical technician/paramedic
	Fire and rescue
Science, technology, engineering, and math	Engineering
Transportation and logistics	Automotive collision
	Automotive technology
	Aviation flight and operations
	Aviation maintenance
	Diesel services technology
	Recreation and mobile equipment
	Tractor trailer operations

Source: Authors' compilation based on information from Indiana Governor's Workforce Cabinet (2020).

Table A2. Minnesota's grouping of career pathways into career clusters and career fields

Career field	Career cluster	Career pathway
Agriculture, food, and natural resources	Agriculture, food, and natural resources	Agribusiness systems
		Animal systems
		Environmental service systems
		Food products and processing systems
		Natural resources systems
		Plant systems
		Power, structural, and technical systems
Arts, communications, and information systems	Arts, audio/video technology, and communications	Audio/video technology and film
		Journalism and broadcasting
		Performing arts
		Printing technology
		Telecommunications
		Visual arts
	Information technology	Information support and services
		Network systems
		Programming and software development
		Web and digital communications
Business, management, and administration	Business, management, and administration	Administrative support
		Business information management
		General management
		Human resources management
		Operations management
	Finance	Accounting
		Banking services
		Business finance
		Insurance
		Securities and investment
	Hospitality and tourism	Lodging
		Recreation, amusements, and attractions
		Restaurants and food/beverage services
		Travel and tourism
	Marketing	Marketing communications
		Marketing management
		Marketing research
		Merchandising
		Professional sales
Engineering, manufacturing, and technology	Architecture and construction	Construction
		Design/pre-construction
		Maintenance/operations
	Manufacturing	Production
		Manufacturing production process development

Career field	Career cluster	Career pathway
		Maintenance, installation, and repair
		Quality assurance
		Logistics and inventory control
		Health, safety, and environmental assurance
	Science, technology, engineering, and math	Engineering and technology
		Science and math
	Transportation, distribution, and logistics	Facility and mobile equipment maintenance
		Health, safety, and environmental management
		Logistics planning and management services
		Sales and services
		Transportation operations
		Transportation systems/infrastructure planning, management, and regulation
		Warehousing and distribution center operations
Health science and technology	Health science	Biotechnology research and development
		Diagnostic services
		Support services
		Health informatics
		Therapeutic services
Human services	Law, public safety, corrections, and security	Correction services
		Emergency and fire management services
		Law enforcement services
		Legal services
		Security and protective services
	Human services	Consumer services
		Counseling and mental health services
		Early childhood development and services
		Family and community services
		Personal care services
	Government and public administration	Revenue and taxation
		Foreign service
		Governance
		National security
		Planning
		Public management and administration
		Regulation
	Education and training	Administration and administrative support
		Professional support services
		Teaching/training

Source: Authors' compilation based on information from Minnesota State Colleges and Universities (2017).

References

Indiana Governor's Workforce Cabinet. (2020). *Indiana career and technical education pathways*. Retrieved March 24, 2021, from https://www.in.gov/gwc/2437.htm.

Minnesota State Colleges and Universities. (2017). *Minnesota career fields, clusters & pathways.* https://www.minnstate.edu/system/cte/consortium_resources/documents/POS_Framework-2017-Final-8x11.pdf.

Appendix B. Methodology

This study used data collected by the state education agencies in Indiana and Minnesota, by the higher education agency in each state, and by the workforce development agency in each state. Although these data are collected by different agencies in each state, the data for each state are all part of a single longitudinal data system that is managed by one agency in the state (the Indiana Management Performance Hub and the Minnesota Office of Higher Education). The agency that administers each state's longitudinal data system also helps combine data across agencies using common identifiers.

The study team obtained data for Indiana students who graduated from a public high school between 2013/14 and 2017/18 and for Minnesota students who graduated between 2012/13 and 2017/18 (table B1). The data included demographic characteristics, grade 8 standardized achievement test scores, codes for courses completed during grades 9–12, characteristics of the high school attended, information about college experiences, and employment information.

Table B1. Milestone years for the high school graduate cohorts included in this study

Cohort	High school graduation year	Grade 8 test scores from year	First year after graduation	Four-year college completion	Five years post–high school graduation
2012/13[a]	2013	2008/09	2013/14	2016/17	2017/18
2013/14	2014	2009/10	2014/15	2017/18	2018/19
2014/15	2015	2010/11	2015/16	2018/19	—
2015/16	2016	2011/12	2016/17	—	—
2016/17	2017	2012/13	2017/18	—	—
2017/18	2018	2013/14	2018/19	—	—

— is not available.
a. Included in the Minnesota analyses only.
Source: Authors' compilation.

Data elements

The data from Indiana and Minnesota consisted of several sets of variables: graduate characteristics, high school characteristics, postsecondary education outcomes, and workforce outcomes. Student-level data for Indiana are collected by three state agencies: the Indiana Commission for Higher Education, the Indiana Department of Education, and the Indiana Department of Workforce Development. Student-level data for Minnesota are collected by three state agencies: the Minnesota Department of Education, the Minnesota Department of Employment and Economic Development, and the Minnesota Office of Higher Education. For both states the National Student Clearinghouse provides postsecondary data on high school graduates who enrolled in a private college or an out-of-state college through contracts with the Indiana Commission for Higher Education and the Minnesota Office of Higher Education. School-level data for both states are from the Common Core of Data (National Center for Education Statistics, 2021) or were calculated by the study team using student-level data.

In Indiana, data on postsecondary education outcomes beyond college enrollment are limited to high school graduates who attended an in-state public college or university. In Minnesota, data on college credit accumulation are limited to high school graduates who attended an in-state public college or university. In both states, data on workforce outcomes are limited to high school graduates who remained in the state. In addition, high school graduates who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government) are not included in each state's employment records. Because it was not possible to distinguish those graduates from unemployed high school graduates, they were

treated as unemployed with zero earnings in the analysis.[1] Table B2 defines each data element for Indiana and Minnesota and provides information on the source of the data element for each state.

Table B2. Summary of variables used in analyses

Variable	Data source	Description
Graduate background characteristics		
Concentrator[a]	IDOE, MDE	Concentrator versus similar sampler or nonparticipant
Explorer[a]	IDOE, MDE	Explorer versus similar sampler or nonparticipant
Cohort	IDOE, MDE	High school graduation year
Gender	IDOE, MDE	Male or female
Race/ethnicity	IDOE, MDE	American Indian/Alaskan Native, Asian, Black, Native Hawaiian/Pacific Islander, White, more than one race, or Hispanic (any race)
Socioeconomic status	IDOE, MDE	Whether a student was eligible for the national school lunch program in any school year in grades 9–12
English learner student status	IDOE, MDE	Whether a student was classified as an English learner in any school year in grades 9–12
Special education status	IDOE, MDE	Whether a student was classified as receiving special education services in any school year in grades 9–12
Proficient in math	IDOE, MDE	For Indiana, students whose status on the grade 8 Indiana Statewide Testing for Educational Progress—Plus math assessment was Pass or Pass+ were classified as proficient; students whose status was Did Not Pass were classified as not proficient. For Minnesota, students whose achievement level on the grade 8 Minnesota Comprehensive Assessment series II or III math was Meets standards or Exceeds standards were classified as proficient; students whose achievement level was Does not meet standards or Partially meets standards were classified as not proficient.
Proficient in English language arts (Indiana)/reading (Minnesota)	IDOE, MDE	For Indiana, students whose status on the grade 8 Indiana Statewide Testing for Educational Progress—Plus English language arts assessment was Pass or Pass+ were classified as proficient; students whose status was Did Not Pass were classified as not proficient. For Minnesota, students whose achievement level on the grade 8 Minnesota Comprehensive Assessment series II or III reading was Meets standards or Exceeds standards were classified as proficient; students whose achievement level was Does not meet standards or Partially meets standards were classified as not proficient.
Courses completed	IDOE, MDE	Course codes for the courses students completed in each of grades 9–12
High school characteristics		
School size	CCD	Number of students enrolled in grades 9–12
School percentage racial/ethnic minority	CCD	Percentage of students in the school from a racial/ethnic minority group
School percentage eligible for the national school lunch program	CCD	Percentage of students in the school who ever were eligible for the national school lunch program in grades 9–12

[1] According to data published by the Minnesota Office of Higher Education, 72 percent of the class of 2010 college graduates were employed in Minnesota at any time (worked in any one of the four quarters) during the second year after graduation (https://www.ohe.state.mn.us/mPg.cfm?pageID=2119). No comparable information is available for Indiana.

Variable	Data source	Description
School percentage English learner students	CCD	Percentage of students in the school who ever were classified as an English learner student in grades 9–12
School percentage receiving special education services	CCD	Percentage of students in the school who ever received special education services in grades 9–12
School percentage proficient in math	IDOE, MDE	Percentage of students who were classified as proficient in math based on their grade 8 standardized test scores
School percentage proficient in reading	IDOE, MDE	Percentage of students who were classified as proficient in English language arts (Indiana) or reading (Minnesota) based on their grade 8 standardized test scores
School locale	CCD	Whether a high school is located in an urban, suburban, town, or rural area
College enrollment[b]	ICHE, MOHE, NSC	Whether a high school graduate enrolled in any college following high school graduation versus did not enroll in college
Enrolled in a two-year college[b]	ICHE, MOHE, NSC	Whether a high school graduate enrolled in a two-year college versus did not enroll in a two-year college
Enrolled in a four-year college[b]	ICHE, MOHE, NSC	Whether a high school graduate enrolled in a four-year college or university versus did not enroll in a four-year college or university
College credits earned[c]	ICHE, MOHE	The number of college credits that a high school graduate earned in a specific year. High school graduates who have no college enrollment records were coded as having zero college credits.
College degree attained[d]	ICHE, MOHE, NSC	Whether a high school graduate attained no postsecondary certificate or degree, a professional certificate, an associate's degree, or a bachelor's degree
Employment status in each year after high school graduation[e]	IDWD, MDEED	Whether high school graduates earned at least $1 during a calendar year[f]
Annual earnings[e]	IDWD, MDEED	The sum of wages earned during the four quarters of a calendar year

CCD is the National Center for Education Statistics' Common Core of Data; ICHE is the Indiana Commission for Higher Education; IDOE is the Indiana Department of Education; IDWD is the Indiana Department of Workforce Development; MDE is the Minnesota Department of Education; MDEED is the Minnesota Department of Employment and Economic Development; MOHE is the Minnesota Office of Higher Education; NSC is the National Student Clearinghouse.

a. Course codes from each state were used to identify whether courses carry career and technical education credit. Each state also maintains a course-to-career cluster crosswalk file, which allowed the study team to determine the number of courses taken in each career field. The career fields and career clusters vary for each state.

b. Data were based on each state's administrative records and NSC records and were therefore available for graduates attending in-state public colleges and graduates attending private colleges and out-of-state colleges.

c. In both states data were limited to graduates attending in-state public colleges based on the state's administrative records.

d. In Indiana, data were limited to graduates attending in-state public colleges based on the state's administrative records; in Minnesota, data were available for graduates attending in-state public colleges and graduates attending private colleges and out-of-state colleges based on the state's administrative records and NSC records.

e. In both states employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in the analyses. Earnings for graduates designated as unemployed are $0. Earnings were standardized to 2013 dollar values based on the Consumer Price Index for All Urban Consumers, Midwest Region.

f. State workforce agencies in Indiana and Minnesota have found their indicators for employment and full-time equivalence to be less than reliable because employers are not required to provide those data. However, employers are required to provide each state with the wages that employees earn each quarter.

Source: Authors' compilation.

Sample definitions

Both Indiana and Minnesota provided data for the universe of students that make up the high school graduating cohorts, making sampling within cohorts unnecessary. For research questions 1 and 2 the study team analyzed

data for the Indiana graduating classes of 2013/14–2017/18 and the Minnesota graduating classes of 2012/13–2017/18. Partners at the Indiana Commission for Higher Education and members of the Midwest Career Readiness Research Alliance considered these cohorts to have been exposed to current career and technical education programming. The study team requested data from the 2009/10 academic year (when members of the graduating class of 2012/13 were in grade 8) through 2018/19 (when members of the graduating class of 2017/18 were one year post–high school graduation; table B3).

Table B3. Years of data requested to address research questions 1–4

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
2012/13 graduates	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12	Enroll Credits C, A, BA E & E	Enroll Credits C, A, BA E & E	Enroll Credits C, A, BA E & E	Enroll Credits C, A, BA E & E	Enroll Credits C, A, BA E & E	Enroll Credits C, A, BA E & E
2013/14 graduates		Grade 8	Grade 9	Grade 10	Grade 11	Grade 12	Enroll Credits C, A, BA E & E	Enroll Credits C, A, BA E & E	Enroll Credits C, A, BA E & E	Enroll Credits C, A, BA E & E	Enroll Credits C, A, BA E & E
2014/15 graduates			Grade 8	Grade 9	Grade 10	Grade 11	Grade 12	Enroll Credits C, A, BA E & E	Enroll Credits C, A, BA E & E	Enroll Credits C, A, BA E & E	Enroll Credits C, A, BA E & E
2015/16 graduates				Grade 8	Grade 9	Grade 10	Grade 11	Grade 12	Enroll Credits C or A E & E	Enroll Credits C or A E & E	Enroll Credits C or A E & E
2016/17 graduates					Grade 8	Grade 9	Grade 10	Grade 11	Grade 12	Enroll Credits C E & E	Enroll Credits C E & E
2017/18 graduates						Grade 8	Grade 9	Grade 10	Grade 11	Grade 12	Enroll Credits C E & E

A is attainment of associate's degree; BA is attainment of a bachelor's degree; C is attainment of certificate; Credits is college credits earned; E & E is employment and earnings; Enroll is enrollment in college.
Note: For each cohort of graduates, the study team obtained graduates' grade 8 test scores and career and technical education course enrollment and completion data for grades 9–12.
Source: Authors' compilation.

The study team used the cohorts of high school students who graduated between 2012/13 and 2017/18 to address research questions 3 and 4 as well. The choice was based on two considerations. First, the cohorts had to be recent enough to have been exposed to current career and technical education programming in each state. Second, the team wanted to include at least one cohort for whom sufficient time had elapsed since high school to allow for both graduation from a four-year college and attainment of steady employment. The number of high school graduates whose data were included in analyses varied by research question and outcome (tables B3 and B4). The following cohorts were included in the analyses for different outcomes for research question 3:

- Enrollment in any college, enrollment in a two-year college, enrollment in a four-year college, credits earned within one year of high school graduation, and attainment of a certificate: Five cohorts from Indiana (2013/14–2017/18) and six cohorts from Minnesota (2012/13–2017/18).

- Credits earned within three years of high school graduation, attainment of an associate's degree, and attainment of an associate or a bachelor's degree: Cohorts with at least three years of data after high school graduation, including the 2013/14–2015/16 cohorts in Indiana and the 2012/13–2015/16 cohorts in Minnesota.
- Attaining a bachelor's degree: Cohorts with at least four years of data after high school graduation, including the 2013/14–2014/15 cohorts in Indiana and the 2012/13–2014/15 cohorts in Minnesota. Only one cohort (2012/13 in Minnesota) had six years of data after high school graduation, which aligns with the U.S. Department of Education's six-year on-time graduation benchmark; therefore, the results for bachelor's degree completion should be interpreted with caution.

For research question 4 the sample size decreased from year to year because the number of cohorts that could be used in the analysis decreased each year (see table B4). For example, the analyses of employment rates and annual earnings in the first year after high school graduation included five cohorts from Indiana (2013/14–2017/18) and six cohorts from Minnesota (2012/13–2017/18), while the analyses of employment rates and annual earnings in the fifth year after high school graduation included only one cohort from Indiana (2013/14) and two cohorts from Minnesota (2012/13 and 2013/14).

To examine whether high school graduates who completed career and technical education courses have better college and employment outcomes, the study team constructed three groups of high school graduates: a sample of graduates who were career and technical education concentrators, graduates who were explorers, and graduates who were samplers and nonparticipants. The study team then compared outcomes between the concentrators and similar samplers and nonparticipants and between the explorers and similar samplers and nonparticipants. The study team used a propensity score matching procedure to identify groups of samplers and nonparticipants who had similar individual characteristics and prior academic achievement and attended the same school with the same cohort as concentrators or explorers. More details about the matching process are provided later in this appendix.

Table B4. Number of high school students who graduated from a public school between 2012/13 and 2017/18 and are included in the analyses for research questions 1–4, by state

Research question and outcome	Indiana		Minnesota	
Research questions 1 and 2				
All graduates	333,280		350,191	
Research question 3	**Career and technical education group**	**Matched comparison group**	**Career and technical education group**	**Matched comparison group**
Enrollment in any college, two-year colleges, and four-year colleges				
Concentrators vs. comparison	67,545	67,545	85,889	85,889
Explorers vs. comparison	26,090	26,090	32,405	32,405
Credit accumulation—first year[a]				
Concentrators vs. comparison	67,545	67,545	85,889	85,889
Explorers vs. comparison	26,090	26,090	32,405	32,405
Credit accumulation—first three years[a]				
Concentrators vs. comparison	36,813	36,813	57,063	57,063
Explorers vs. comparison	15,251	15,251	21,681	21,681
College completion—attaining a certificate[a]				
Concentrators vs. comparison	67,545	67,545	85,889	85,889
Explorers vs. comparison	26,090	26,090	32,405	32,405
College completion—attaining an associate's degree[a]				
Concentrators vs. comparison	36,813	36,813	57,063	57,063
Explorers vs. comparison	15,251	15,251	21,681	21,681

Research question and outcome	Indiana		Minnesota	
College completion—attaining an associate's or bachelor's degree[a]				
Concentrators vs. comparison	36,813	36,813	57,063	57,063
Explorers vs. comparison	15,251	15,251	21,681	21,681
College completion—attaining a bachelor's degree[a]				
Concentrators vs. comparison	22,469	22,469	42,538	42,538
Explorers vs. comparison	9,701	9,701	16,385	16,385
Research question 4	**Career and technical education group**	**Matched comparison group**	**Career and technical education group**	**Matched comparison group**
Employment in year 1[b]				
Concentrators vs. comparison	67,545	67,545	85,889	85,889
Explorers vs. comparison	26,090	26,090	32,405	32,405
Employment in year 2[b]				
Concentrators vs. comparison	53,346	53,346	71,363	71,363
Explorers vs. comparison	21,222	21,222	27,037	27,037
Employment in year 3[b]				
Concentrators vs. comparison	36,813	36,813	57,063	57,063
Explorers vs. comparison	15,251	15,251	21,681	21,681
Employment in year 4[b]				
Concentrators vs. comparison	22,469	22,469	42,538	42,538
Explorers vs. comparison	9,701	9,701	16,385	16,385
Employment in year 5[b]				
Concentrators vs. comparison	10,339	10,339	27,719	27,719
Explorers vs. comparison	4,610	4,610	10,911	10,911
Earnings in year 1[b]				
Concentrators vs. comparison	67,545	67,545	85,889	85,889
Explorers vs. comparison	26,090	26,090	32,405	32,405
Earnings in year 2[b]				
Concentrators vs. comparison	53,346	53,346	71,363	71,363
Explorers vs. comparison	21,222	21,222	27,037	27,037
Earnings in year 3[b]				
Concentrators vs. comparison	36,813	36,813	57,063	57,063
Explorers vs. comparison	15,251	15,251	21,681	21,681
Earnings in year 4[b]				
Concentrators vs. comparison	22,469	22,469	42,538	42,538
Explorers vs. comparison	9,701	9,701	16,385	16,385
Earnings in year 5[b]				
Concentrators vs. comparison	10,339	10,339	27,719	27,719
Explorers vs. comparison	4,610	4,610	10,911	10,911

a. In Indiana, data were limited to high school graduates who enrolled in in-state public colleges or universities. In Minnesota, data were available for all high school graduates.

b. In both states, employment and earnings information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed when examining these outcomes.

Note: Comparison group is nonparticipants and samplers. Sample sizes correspond to analyses with maximum number of cohorts. Some analyses, such as those for year 5 outcomes, were based on fewer cohorts and had smaller sample sizes. More information on sample sizes for each analysis is available in appendixes C and D.

Source: Authors' analysis of data provided by the Indiana Management Performance Hub and the Minnesota Statewide Longitudinal Education Data System.

Data preparation

The study team conducted the analyses following a three-step process. First, the study team recoded data, calculated the number of career and technical education courses that high school graduates completed, and assigned graduates to one of four categories of career and technical education participation based on their state's definitions: concentrator, explorer, sampler, or nonparticipant. Second, the study team created matched samples of concentrators and comparison graduates (samplers and nonparticipants) and explorers and comparison graduates. Third, the study team executed the analytic strategy using each state's data.

The first step in the analysis involved translating the data codes from the two states into a common form. For example, Indiana uses two codes representing whether students are eligible for the national school lunch program (0 = ineligible, 1 = eligible). Minnesota uses six codes to indicate students' eligibility for the national school lunch program (0 = not eligible but has access, 1 = eligible for reduced-price meals and has access, 2 = eligible for free meals and has access, 3 = not eligible, does not have access, 4 = eligible for reduced-price meals but does not have access, 5 = eligible for free meals but does not have access). The Minnesota codes were consolidated to 0 for not eligible (consisting of Minnesota codes 0 and 3) and 1 for eligible (consisting of Minnesota codes of 1, 2, 4, and 5).

This step also involved converting student and high school characteristics that were continuous variables (for example, achievement score on math and reading tests, percentage of students in schools who were eligible for the national school lunch program) into categories based on quartiles of the distribution for that characteristic for their state. These continuous-to-quartile conversions were applied to the following data elements:

- School size.
- Percentage of students in the school who are from a racial/ethnic minority group.
- Percentage of students in the school who ever were eligible for the national school lunch program in grades 9–12.
- Percentage of students in the school who ever were classified as an English learner student in grades 9–12.
- Percentage of students in the school who ever received special education services in grades 9–12.
- Percentage of students in the school who scored proficient on grade 8 math and reading tests.

The categorical versions of these variables were used only to address research question 1. When examining the effects of being a career and technical education concentrator or explorer using regression models, the study team used the continuous versions of these student- and school-level characteristics as covariates. For the regression models the focus was on the associations between graduates' participation in career and technical education (that is, as a concentrator or explorer versus a sampler or nonparticipant) and student outcomes, rather than the associations between the background characteristics of graduates and their high schools and outcomes.

Course codes for career and technical education courses that high school graduates completed were used to calculate the number of career and technical education courses graduates took and to assign graduates to one of four categories based on their state's definitions: concentrator, explorer, sampler, or nonparticipant. These categories resonated with the study's stakeholders; for example, states are familiar with the first category because they are required to submit reports to the U.S. Department of Education on career and technical education course takers who are either *participants* or *concentrators*. Prior to the Strengthening Career and Technical Education for the 21st Century Act of 2018, states had flexibility to define *concentrator* as a student who took two or three career and technical education courses in a single program (Carl D. Perkins Career and Technical Education Improvement Act, 2006). Indeed, Indiana adopted the latter definition (three yearlong courses or six semester-long course credits) and Minnesota the former definition (two yearlong courses, each involving of about 120 hours of instruction). However, the recently amended version of the law, which took effect on July 1, 2019, provides a

common definition that all states must use in their accountability reporting. The recent legislation defines a concentrator as a student who has completed two or more yearlong courses in a single program or program area (Strengthening Career and Technical Education for the 21st Century Act, 2018).

The study team adopted definitions of *concentrator* that were in use by the state as of spring 2020. Indiana defines *concentrators* as students who earn four or more semester credits in courses in a single career pathway.[2] Minnesota defines *concentrators* as students who complete 150 hours of instruction in career and technical education courses in a single career field.

The definition of *explorer* is similar to that of *concentrator*, except that explorers did not have to have the requisite number of credits or instructional hours in a single pathway or career field. That is, for Indiana, *explorers* were defined as graduates who completed four or more semester credits in career and technical education courses (excluding the "Preparing for College and Careers" course and the introductory course) in multiple career pathways but fewer than four credits in a single pathway. In Minnesota, *explorers* were defined as graduates who completed 150 or more instructional hours in career and technical education courses but fewer than 150 hours in a single career field.

Samplers were defined as graduates who attained more than zero semester credits or instructional hours in career and technical education courses but fewer than the number of credits or instructional hours necessary for the concentrator or explorer category. In Indiana, *samplers* were defined as graduates who attained more than zero but fewer than four credits in career and technical education courses. In Minnesota, *samplers* were defined as graduates who completed between 1 and 150 instructional hours in career and technical education courses.

Finally, for both states, nonparticipants were defined as graduates who completed no credits or instructional hours in career and technical education courses.

Analytic methods and models

Research questions were addressed by examining descriptive statistics (research questions 1 and 2) and by conducting regression analyses with robust errors (research questions 3 and 4). Analyses of research questions 1 and 2 were based on the universe of cases in the high school graduation cohorts in each state. Inferential tests (that is, statistical tests that allow researchers to infer population differences given differences observed in a sample) were not necessary because population values were directly observable. However, not using inferential tests made it necessary to establish some benchmark for determining whether an effect or difference between groups was meaningful. Research questions 1 and 2 were addressed by calculating descriptive statistics and examining differences between groups of graduates against stakeholder-derived benchmarks for what constitutes a meaningful difference. Research questions 3 and 4 required a statistical modeling approach to control for graduate- and school-related characteristics.

The study team asked partnering stakeholders (representatives of the Indiana Commission for Higher Education, Indiana Department of Education, and Governor's Workforce Cabinet and members of the Midwest Career Readiness Research Alliance) what magnitude of group difference would suggest an issue needing consideration. The stakeholders agreed that a 5 percentage point difference in population values would be meaningful. For parameters resulting from regression models, the study team identified statistical associations as those with parameter estimates with *p*-values of less than .05.

Method for addressing research questions 1 and 2. To examine associations between graduates' characteristics and career and technical education participation (research question 1), the study team cross-tabulated each of

[2] These four credits exclude the course titled "Preparing for College and Careers" and the introductory course for each pathway. The credits for these courses were counted toward Indiana's previous definition of concentrator, which required students to complete six credits in a single pathway.

the graduate characteristics with the categories of participation in career and technical education courses (concentrator, explorer, sampler, and nonparticipant) and then converted the frequencies in each cell to percentages. An association was indicated if group differences met or exceeded 5 percentage points. To examine associations between high school characteristics and graduates' career and technical education participation category (research question 2), the study team converted each high school characteristic into quartiles based on the distribution of schools for each state and calculated the percentage of graduates who fell into each of the four course-taking categories (concentrator, explorer, sampler, and nonparticipant) and whether they attended a high school in the highest or lowest quartile of that school characteristic. The study team compared the percentages of concentrators in the highest quartile schools and the lowest quartile schools. Associations between high school characteristics and percentages of concentrators were determined using the 5 percentage point threshold.

Method for addressing research question 3. To examine the effect of taking and completing career and technical education courses in high school on high school graduates' college enrollment, credit accumulation, and degree attainment, the study team compared college enrollment, credits earned, and college graduation outcomes between matched groups of graduates who were career and technical education concentrators and graduates who were samplers and nonparticipants and between matched groups of graduates who were career and technical education explorers and samplers and nonparticipants. The study team conducted propensity score matching separately for each comparison (that is, for concentrators versus samplers and nonparticipants and for explorers versus samplers and nonparticipants). The matching was based on graduates' demographic characteristics (gender, race/ethnicity, eligibility for the national school lunch program, special education status, and English learner status) as well as their grade 8 scores on state standardized tests in math and reading. The study team estimated propensity scores using a two-level (students nested within high schools) logistic regression model in which the outcome variable was a dichotomous variable set to 1 for concentrators (or explorers) and 0 for samplers and nonparticipants and the independent variables were baseline student characteristics. Matching was done separately for each cohort of graduates.

With θ_{ij} as the odds of student *i* in high school *j* attaining the outcome (being a concentrator or being an explorer), the two-level model takes the following general form:

Level-1 model (high school graduates):

$$log(\theta_{ij}) = \beta_{0j} + \sum_{k=1}^{k} \beta_{kj} S_{kij}$$

where β_{0j} is the intercept for school *j*, S_{kij} is the *k*th student characteristic for student *i* in high school *j*, and β_{kj} is a set of coefficients that represent the association between each student characteristic and the log odds of attaining the outcome.

Level-2 model (high school):

$$\beta_{0j} = \gamma_{00} + u_{oj}$$

$$\beta_{kj} = \gamma_{k0}.$$

The estimated propensity scores were used to match graduates. The study team used nearest-neighbor matching within a 1:1 matching ratio; that is, each high school graduate who was a career and technical education concentrator (or explorer) was matched with a graduate from the same school who was a sampler or a nonparticipant. Because the pool of samplers and nonparticipants was relatively small in Minnesota compared with the pool of concentrators, matching was done with replacement (in both states) to maximize the match rate and to create better balance. The matches were based on graduates with the closest propensity scores (within a caliper of 0.20 standard deviation). After matching concentrators with samplers and nonparticipants with the

closest propensity scores, the study team assessed whether the two matched groups of graduates were balanced on prior achievement (grade 8 math and reading scores) and eligibility for the national school lunch program, using a threshold of 0.25 standard deviation for standardized differences.[3] The matching process was iterated by using a tighter caliper until the two groups of graduates were balanced on those characteristics. The study team applied the same iterative process when matching explorers with similar samplers and nonparticipants. The study team found matches for 89 percent of concentrators and 91 percent of explorers in Indiana and for 62 percent of concentrators and 71 percent of explorers in Minnesota. Career and technical education explorers or concentrators who were not matched with a comparison student were excluded from the analysis.

To estimate the effects of career and technical education participation, the study team used regression models with robust standard errors that accounted for students clustered in schools to estimate the difference in outcomes between the matched groups of concentrators and comparison graduates and the matched groups of explorers and comparison graduates (Abadie et al., 2017; Abadie & Speiss, 2021). The analytic model assessed the effect of graduates' being a career and technical education concentrator or explorer on the outcome while controlling for associations with other student- and school-level covariates and accounting for clustering of students. For analyses examining dichotomous outcomes (for example, enrollment in college, attainment of a certificate or degree), the primary models were logistic regression models with robust standard error estimates. For models examining graduates' accumulation of college credits, the primary model was a standard regression model (that is, a model with a continuous outcome) with robust standard error estimates.

Models examining graduates' college enrollment outcomes and graduation outcomes (dichotomous outcomes) were logistic regression models with this logit link:

$$\eta_{ij} = log\left(\frac{u_{ij}}{1-u_{ij}}\right) [i, j \text{ in same cluster}]$$

where η_{ij} is the log odds of attaining the outcome (for example, graduating) for student *i* in high school *j* and u_{ij} is the probability of attaining the outcome (for example, graduating) for student *i* in high school *j*.

Models examining numbers of credits earned were standard regression models (that is, used with continuous outcome variables). The general equation for all models with continuous outcome variables was:

$$\eta_{ij} = \beta_{0j} + \theta_{0j} C_{ij} + \sum_{p=1}^{P} \beta_{pj} a_{pij} + \sum_{q=1}^{Q} \beta_{iq} X_{0q} [i, j \text{ in same cluster}]$$

where $i = 1, \ldots, I$ graduates from school j, $j = 1, \ldots, J$ high schools, η_{ij} is the outcome for graduate *i* from high school *j*, β_{0j} is the intercept for school *j*, C_{ij} is the indicator for whether graduate *i* in school *j* was a career and technical education concentrator or not (or whether the student was a career and technical education explorer or not), a_{pij} is the *p*th student characteristic for student *i* in high school *j* (see table B2), and X_{0q} is the *q*th characteristic for high school *j*, $q = 1, \ldots, Q$.

Method for addressing research question 4. To examine the effect of taking and completing career and technical education courses in high school on high school graduates' employment and earnings, the study team conducted two sets of analyses. One set of analyses examined whether graduates were employed in each year following high school graduation (a dichotomous outcome), and another examined graduates' annual earnings.

The study team examined the potential impact of participating in career and technical education on employment and earnings by comparing the outcomes between a sample of high school graduates who were career and

[3] The What Works Clearinghouse Supporting Postsecondary Success Review Protocol specifies that when a pretest measure or close proxy is not available, a quasi-experimental study must demonstrate baseline equivalence of the intervention and comparison groups for the analytic sample on both a baseline academic achievement measure and a baseline measure of student socioeconomic status (What Works Clearinghouse, 2019).

technical education concentrators and a matched comparison group of samplers and nonparticipants and between a sample of graduates who were career and technical education explorers and a matched comparison group of samplers and nonparticipants. The analyses used the same matched samples and the same types of regression models as those used for addressing research question 3. In addition, the study team conducted supplemental analyses exploring whether the effects of career and technical education participation on employment and earnings differed for graduates who were enrolled in colleges and graduates who were not enrolled in colleges. This was done by including a variable indicating whether the graduate was currently enrolled in college in each year an outcome was examined and an interaction term of this variable with the treatment variable (C_{ij}). All other covariates that were used in the main analysis also were included in the models for the supplemental analyses. The results of the supplemental analyses are summarized in appendix E.

Interpretation of regression results. The standard interpretation of a coefficient in a regression analysis is that a one unit change in the independent variable results in the respective regression coefficient change in the expected value of the outcome while all the other predictors are held constant. When the outcome is transformed using a logit link function, such interpretation becomes less intuitive and could be difficult to understand. To help readers interpret the regression estimates, the study team used the regression results to calculate the adjusted probability of attaining an outcome (for binary outcomes) or the adjusted mean (for continuous outcomes) for each of the groups being compared (for example, for concentrators and for matched samplers and nonparticipants), while holding other covariates in the model at their overall sample means (not by group). The group differences in the adjusted probabilities or in the adjusted means can be interpreted as estimated effects of being a career and technical education concentrator compared with similar samplers and nonparticipants. The group differences are provided in the main report.

Sensitivity analysis for research questions 3 and 4. The study team conducted a sensitivity analysis that compared the differences in college and labor market outcomes between concentrators and matched nonparticipants and between explorers and matched nonparticipants. The matching and analysis methods were the same as those used in the main analysis, except that the comparison pool included only nonparticipants (samplers were not included). The size of the matched sample was 117,868 graduates for Indiana (about 83 percent of the matched sample for the main analysis in the state) and 95,542 graduates for Minnesota (about 43 percent of the matched sample for the main analysis in the state). The estimated effects from the sensitivity analysis were largely consistent with those from the main analysis and therefore are not included in the report.

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Appendix C. Detailed findings on Indiana high school graduates

This appendix contains detailed findings on Indiana high school graduates. Tables in this appendix include the following:

- Tables C1–C3 contain percentages of graduates classified as each type of career and technical education participant (that is, concentrator, explorer, sampler, or nonparticipant) by student characteristic (table C1), school characteristic (table C2), and whether they enrolled in college, earned college credits, attained a certificate or degree, or were employed (table C3). Table C3 also contains average earnings for each type of career and technical education participant.
- Tables C4 and C5 show demographic similarities between matched groups of concentrators and similar samplers and nonparticipants (table C4) and between matched groups of explorers and samplers and similar nonparticipants (table C5).
- Tables C6–C11 show results of regression models comparing concentrators and similar samplers and nonparticipants.
    - Results for college enrollments within one year of high school graduation are presented in table C6, and college enrollments at any time after graduation are presented in table C7.
    - Results for postsecondary credits earned, certificate attainment, and degree attainment are presented in tables C8 and C9.
    - Results for employment outcomes are presented in table C10, and results for earnings outcomes are presented in table C11.
- Tables C12–C17 show results of regression models comparing explorers and similar samplers and nonparticipants.
    - Results for college enrollments within one year of high school graduation are presented in table C12, and college enrollments at any time after graduation are presented in table C13.
    - Results for postsecondary credits earned, certificate attainment, and degree attainment are presented in tables C14 and C15.
    - Results for employment outcomes are presented in table C16, and results for earnings outcomes are presented in table C17.

Table C1. Percentage of Indiana high school graduates in each career and technical education participant category, by graduate characteristic, 2013/14–2017/18 cohorts

Graduate characteristic	Concentrators	Explorers	Samplers	Nonparticipants
Statewide total	**21**	**8**	**48**	**22**
Graduating cohort				
2013/14	15	7	51	27
2014/15	18	7	51	23
2015/16	22	8	48	22
2016/17	25	9	46	21
2017/18	28	9	46	18
Difference, 2017/18–2012/13 (percentage points)	*12[a]*	*3*	*–6[a]*	*–9[a]*
Gender				
Female	18	7	52	23
Male	24	9	45	22
Difference (percentage points)	*–6[a]*	*–2*	*6[a]*	*2*
Race/ethnicity				
American Indian/Alaska Native	21	9	50	20
Asian	9	4	47	39
Black	18	7	47	29
Native Hawaiian/Pacific Islander	14	8	46	32
More than one race	18	7	51	24
White	22	9	48	21
Hispanic (any race)	19	7	50	24
Black–White difference (percentage points)	*–4*	*–2*	*–1*	*8[a]*
Eligible for the national school lunch program				
Eligible	23	8	49	20
Not eligible	21	8	48	23
Difference (percentage points)	*–2*	*0*	*–1*	*3*
English learner student status				
English learner student	18	6	49	27
Not English learner student	22	8	48	22
Difference (percentage points)	*4*	*2*	*–1*	*–5[a]*
Special education status				
Received special education services	28	9	46	17
Did not receive special education services	21	8	49	22
Difference (percentage points)	*–7[a]*	*–1*	*3*	*5[a]*
Proficiency in math				
Proficient	20	8	49	23
Not proficient	24	8	49	19
Difference (percentage points)	*4*	*0*	*0*	*–4*
Proficiency in English language arts				
Proficient	18	7	50	25
Not proficient	28	9	47	17
Difference (percentage points)	*10[a]*	*2*	*–3*	*–8[a]*

Note: *N* = 333,280 graduates. Concentrators attained six or more semester credits in career and technical education courses in the same career pathway. Explorers attained six or more semester credits in career and technical education courses in multiple pathways but fewer than six credits in a single pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses. Percentages may not sum to 100 because of rounding.

a. Meaningful difference (that is, a group difference of at least 5 percentage points).

Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Table C2. Percentage of Indiana high school graduates in each career and technical education participant category, by high school characteristic, 2012/13–2017/18 cohorts

High school characteristic	Concentrators	Explorers	Samplers	Nonparticipants
Statewide total	**21**	**8**	**48**	**22**
High school enrollment				
Smallest high schools (quartile 1)	5	2	22	71
Mid-sized high schools (quartiles 2 and 3)	22	9	43	26
Largest high schools (quartile 4)	21	8	52	20
Large school–small school difference (percentage points)	*16[a]*	*6[a]*	*30[a]*	*–51[a]*
Percentage of students who are from a racial/ethnic minority				
Schools with the smallest percentages (quartile 1)	29	12	48	11
Schools with mid-level percentages (quartiles 2 and 3)	20	8	49	23
Schools with the largest percentages (quartile 4)	19	5	47	29
Difference highest quartile–lowest quartile (percentage points)	*–10[a]*	*–7[a]*	*–1*	*18[a]*
Percentage of students eligible for the national school lunch program				
Schools with the smallest percentages of eligible students (quartile 1)	15	7	49	30
Schools with mid-level percentages of eligible students (quartiles 2 and 3)	25	9	48	18
Schools with the largest percentages of eligible students (quartile 4)	21	7	49	23
Difference highest quartile–lowest quartile (percentage points)	*6[a]*	*0*	*0*	*–7[a]*
Percentage of students who are English learner students				
Schools with the smallest percentages of English learner students (quartile 1)	26	11	46	17
Schools with mid-level percentages of English learner students (quartiles 2 and 3)	22	8	47	22
Schools with the largest percentages of English learner students (quartile 4)	19	7	50	24
Difference highest quartile–lowest quartile (percentage points)	*–7[a]*	*–4*	*4*	*7[a]*
Percentage of students who receive special education services				
Schools with the smallest percentages of students receiving services (quartile 1)	7	8	22	69
Schools with mid-level percentages of students receiving services (quartiles 2 and 3)	21	8	53	18
Schools with the largest percentages of students receiving services (quartile 4)	30	9	45	15
Difference highest quartile–lowest quartile (percentage points)	*23[a]*	*7[a]*	*23[a]*	*–54[a]*
Percentage of students who are proficient in math				
Schools with the smallest percentages of proficient students (quartile 1)	12	4	41	43
Schools with mid-level percentages of proficient students (quartiles 2 and 3)	26	9	49	17
Schools with the largest percentages of proficient students (quartile 4)	16	7	49	27
Difference highest quartile–lowest quartile (percentage points)	*4*	*3*	*8[a]*	*–16[a]*

High school characteristic	Concentrators	Explorers	Samplers	Nonparticipants
Percentage of students who are proficient in English language arts				
Schools with the smallest percentages of proficient students (quartile 1)	12	4	38	45
Schools with mid-level percentages of proficient students (quartiles 2 and 3)	25	8	49	18
Schools with the largest percentages of proficient students (quartile 4)	18	8	49	26
Difference highest quartile–lowest quartile (percentage points)	*6[a]*	*4*	*11[a]*	*–19[a]*
School locale				
Urban	19	6	48	27
Suburban	16	7	58	19
Town	32	13	47	9
Rural	27	10	51	11
Difference urban–rural (percentage points)	*8[a]*	*4[a]*	*3*	*–16[a]*

Note: *N* = 333,280 graduates. Concentrators attained six or more semester credits in career and technical education courses in the same career pathway. Explorers attained six or more semester credits in career and technical education courses in multiple pathways but fewer than six credits in a single pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses. Percentages may not sum to 100 because of rounding.
a. Meaningful difference (that is, a group difference of at least 5 percentage points).
Source: Authors' analyses of data provided by the Indiana Management Performance Hub.

Table C3. Percentage of Indiana high school graduates who attained each postsecondary and employment outcome, by career and technical education participant category, 2013/14–2017/18 cohorts

Outcome	Population size	Concentrators	Explorers	Samplers	Nonparticipants
College enrollment					
Enrolled in any college within one year	333,280	50[a]	56[a]	59[a]	64
Ever enrolled in any college	333,280	55[a]	61[a]	66[a]	71
Enrolled in a two-year college within one year	333,280	16[a]	15[a]	13	10
Ever enrolled in a two-year college	333,280	21[a]	20[a]	18	15
Enrolled in a four-year college within one year	333,280	34[a]	41[a]	46[a]	54
Ever enrolled in a four-year college	333,280	35[a]	42[a]	49[a]	57
Credits earned—high school graduates who ever enrolled in any college					
Credits earned within one year	228,192	16	17	17	16
Credits earned within three years	147,267	45	45	46	44
Credential attainment—high school graduates who ever enrolled in any college					
Attained a certificate (for cohorts with one to five years of postgraduation data)	228,192	6	5	5	3
Attained an associate's degree (for cohorts with three to five years of postgraduation data)	147,267	8[a]	6	5	3
Attained a bachelor's degree (for cohorts with four to five years of postgraduation data)	98,538	18[a]	23[a]	26	28
Credential attainment—high school graduates who ever enrolled in a two-year college					
Attained a certificate (for cohorts with one to five years of postgraduation data)	63,500	14	13	13	11
Attained an associate's degree (for cohorts with three to five years of postgraduation data)	41,862	18[a]	16[a]	13	11
Attained a bachelor's degree (for cohorts with four to five years of postgraduation data)	28,493	3	4	4	4

Outcome	Population size	Concentrators	Explorers	Samplers	Nonparticipants
Credential attainment—high school graduates who ever enrolled in a four-year college					
Attained a bachelor's degree (for cohorts with four to five years of postgraduation data)	72,039	28[a]	32	34	34
Employment					
Employed in year 1—not currently enrolled in college	194,372	39[a]	37[a]	37[a]	32
Employed in year 1—currently enrolled in college	161,643	37	37	37	34
Employed in year 2—not currently enrolled in college	161,538	41[a]	39[a]	38[a]	32
Employed in year 2—currently enrolled in college	136,837	44[a]	42	43	39
Employed in year 3—not currently enrolled in college	122,031	45[a]	43[a]	40[a]	33
Employed in year 3—currently enrolled in college	101,894	49[a]	47[a]	46	42
Employed in year 4—not currently enrolled in college	84,426	48[a]	47[a]	43[a]	35
Employed in year 4—currently enrolled in college	64,994	52[a]	50[a]	48	44
Employed in year 5—not currently enrolled in college	51,749	50[a]	48[a]	44[a]	38
Employed in year 5—currently enrolled in college	23,221	51	51	50	49
Earnings					
Earnings in year 1—not currently enrolled in college	71,063	12,154.75[a]	10,285.50[a]	8,621.06[a]	7,207.11
Earnings in year 1—currently enrolled in college	59,118	8,118.44[a]	7,127.72[a]	6,380.10[a]	5,504.87
Earnings in year 2—not currently enrolled in college	60,721	16,735.47[a]	13,997.76[a]	11,975.36[a]	10,025.45
Earnings in year 2—currently enrolled in college	57,798	12,338.24[a]	10,711.31[a]	9,670.32[a]	8,423.87
Earnings in year 3—not currently enrolled in college	48,515	20,590.58[a]	17,390.80[a]	14,663.17[a]	12,298.77
Earnings in year 3—currently enrolled in college	46,106	15,300.82[a]	13,857.35[a]	12,218.75[a]	10,799.50
Earnings in year 4—not currently enrolled in college	35,638	24,069.00[a]	20,682.66[a]	17,423.58[a]	14,906.36
Earnings in year 4—currently enrolled in college	31,112	18,273.72[a]	17,108.22[a]	14,707.38[a]	13,162.05
Earnings in year 5—not currently enrolled in college	22,456	28,502.38[a]	24,734.68[a]	23,250.39[a]	21,547.21
Earnings in year 5—currently enrolled in college	11,734	23,050.46[a]	22,666.95[a]	19,988.64[a]	18,547.66

Note: Concentrators attained six or more semester credits in career and technical education courses in the same career pathway. Explorers attained six or more semester credits in career and technical education courses in multiple pathways but fewer than six credits in a single pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses.

a. Meaningful difference from nonparticipants (that is, a group difference of at least 5 percentage points or, for annual earnings, at least 5 percent of nonparticipants' earnings).

Source: Authors' analyses of data provided by the Indiana Management Performance Hub.

Table C4. Demographic characteristics of Indiana career and technical education concentrators and samplers and nonparticipants before and after the propensity score matching procedure, 2013/14–2017/18 cohorts

	All graduates			Graduates included in matching			Matched graduates			Matched graduates included in analysis		
Characteristic	Concentrators (N = 75,557[a])	Samplers and nonparticipants (N = 251,920[b])	Standardized difference	Concentrators (n = 72,620[c])	Samplers and nonparticipants (n = 230,272[c])	Standardized difference	Concentrators (n = 67,545[c])	Samplers and nonparticipants (n = 67,545[c])	Standardized difference	Concentrators (n = 67,545[c])	Samplers and nonparticipants (n = 67,545[d])	Standardized difference
Female	0.435	0.536	0.247	0.437	0.539	0.246	0.448	0.444	0.011	0.448	0.444	0.011
White	0.799	0.739	0.207	0.802	0.753	0.173	0.800	0.801	0.004	0.800	0.801	0.004
Eligible for the national school lunch program	0.278	0.254	0.076	0.274	0.248	0.083	0.267	0.263	0.010	0.267	0.263	0.010
English learner students	0.064	0.082	0.161	0.063	0.075	0.108	0.065	0.062	0.032	0.065	0.062	0.032
Received special education services	0.125	0.083	0.280	0.112	0.076	0.260	0.088	0.079	0.076	0.088	0.079	0.076
Proficient in math	0.749	0.816	0.242	0.749	0.816	0.242	0.779	0.781	0.006	0.779	0.781	0.006
Proficient in English language arts	0.828	0.845	0.076	0.828	0.845	0.076	0.846	0.853	0.031	0.846	0.853	0.031

Note: Concentrators attained six or more semester credits in career and technical education courses in the same career pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses.

a. The sample size for proficient in math and proficient in English language arts is 72,620 due to missing data on these characteristics. This is 96 percent of all concentrators.

b. The sample size for proficient in math and proficient in English language arts is 230,272 due to missing data on these characteristics. This is 91 percent of all samplers and nonparticipants.

c. Graduates who had missing data on the proficiency variables were not included in the matching. There were no missing data on other graduate characteristics variables.

d. Represents the sample size for the analysis of all college enrollment outcomes. See table B2 in appendix B for the sample size for the analysis of each outcome.

Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Table C5. Demographic characteristics of Indiana career and technical education explorers and samplers and nonparticipants before and after the propensity score matching procedure, 2013/14–2017/18 cohorts

	All graduates			Graduates included in matching			Matched graduates			Matched graduates included in analysis		
Characteristic	Explorers (N = 28,538[a])	Samplers and nonparticipants (N = 251,920[b])	Standardized difference	Explorers (n = 27,569[c])	Samplers and nonparticipants (n = 230,272[c])	Standardized difference	Explorers (n = 26,090[c])	Samplers and nonparticipants (n = 26,090[c])	Standardized difference	Explorers (n = 26,090[d])	Samplers and nonparticipants (n = 26,090[d])	Standardized difference
Female	0.457	0.536	0.193	0.459	0.539	0.193	0.463	0.463	0.001	0.463	0.463	0.001
White	0.805	0.739	0.230	0.808	0.753	0.196	0.814	0.814	0.002	0.814	0.814	0.002
Eligible for the national school lunch program	0.260	0.254	0.020	0.257	0.248	0.029	0.243	0.242	0.006	0.243	0.242	0.006
English learner students	0.057	0.082	0.235	0.056	0.075	0.184	0.050	0.050	0.000	0.050	0.050	0.000
Received special education services	0.100	0.083	0.124	0.091	0.076	0.117	0.077	0.068	0.088	0.077	0.068	0.088
Proficient in math	0.792	0.816	0.093	0.792	0.816	0.093	0.811	0.811	0.002	0.811	0.811	0.002
Proficient in English language arts	0.844	0.845	0.004	0.844	0.845	0.004	0.850	0.862	0.059	0.850	0.862	0.059

Note: Explorers attained six or more semester credits in career and technical education courses in multiple pathways but fewer than six credits in a single pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses.

a. The sample size for proficient in math and proficient in English language arts is 27,569 due to missing data on these characteristics. This is 97 percent of all explorers.

b. The sample size for proficient in math and proficient in English language arts is 230,272 due to missing data on these characteristics. This is 91 percent of all nonparticipants.

c. Graduates who had missing data on the proficiency variables were not included in the matching. There were no missing data on other graduate characteristics variables.

d. Represents the sample size for the analysis of all college enrollment outcomes. See table B2 in appendix B for the sample size for the analysis for each outcome.

Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Table C6. Results from logistic regression models predicting enrollment in any type of college, enrollment in a two-year college, and enrollment in a four-year college within one year of high school graduation for Indiana career and technical education concentrators and similar samplers and nonparticipants, 2013/14–2017/18 cohorts

	Enrolled in any type of college within one year (*n* = 135,090)		Enrolled in a two-year college within one year (*n* = 135,090)		Enrolled in a four-year college within one year (*n* = 135,090)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Concentrator	–0.189***	0.035	0.344***	0.037	–0.392***	0.043
2014/15 cohort	0.032	0.045	–0.107	0.056	0.106	0.054
2015/16 cohort	0.042	0.045	–0.112*	0.056	0.116*	0.055
2016/17 cohort	0.008	0.049	–0.212***	0.060	0.132*	0.054
2017/18 cohort	–0.305***	0.044	–0.036	0.055	–0.308***	0.054
Female	0.420***	0.031	0.161***	0.034	0.372***	0.035
White	–0.189***	0.041	–0.178***	0.046	–0.112*	0.046
Eligible for the national school lunch program	–0.442***	0.032	0.114***	0.031	–0.580***	0.036
English learner student	–0.025	0.059	0.156*	0.065	–0.114	0.068
Received special education services	–0.253***	0.033	0.247***	0.044	–0.625***	0.046
Proficient in math	0.566***	0.030	–0.141***	0.035	0.948***	0.040
Proficient in English language arts	0.688***	0.028	–0.328***	0.037	1.079***	0.035
School characteristics						
School size	0.000*	0.000	0.000*	0.000	0.000	0.000
Percentage racial/ethnic minority	0.812***	0.209	–0.078	0.254	0.917**	0.275
Percentage eligible for the national school lunch program	–0.791*	0.330	0.519	0.386	–1.165**	0.381
Percentage English learner students	–0.123	0.383	–1.323**	0.446	0.602	0.448
Percentage that received special education services	1.567	0.841	3.091**	1.043	–0.051	1.022
Percentage proficient in math	0.179	0.548	0.661	0.569	–0.325	0.573
Percentage proficient in English language arts	4.005***	1.010	0.051	1.256	4.155***	1.170
No locale designation[a] vs. urban	–0.221	0.241	0.110	0.199	–0.443*	0.201
Suburban vs. urban	–0.017	0.066	–0.101	0.079	0.034	0.082
Town vs. urban	–0.033	0.072	–0.192	0.112	0.065	0.092
Rural vs. urban	0.016	0.073	–0.036	0.105	0.036	0.095
Constant	–1.036***	0.219	–1.865***	0.289	–2.060***	0.249
	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error
Concentrators	0.518	0.005	0.161	0.003	0.360	0.005
Samplers and nonparticipants	0.561	0.007	0.120	0.004	0.442	0.008

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

Note: Concentrators attained six or more semester credits in career and technical education courses in the same career pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses. The reference group for cohort terms is the 2013/14 cohort. Coefficient estimates are log odds ratios.

a. Includes schools with a locale code of "N/A."

Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Table C7. Results from logistic regression models predicting enrollment in any type of college, enrollment in a two-year college, and enrollment in a four-year college within the first five years after high school graduation for Indiana career and technical education concentrators and similar samplers and nonparticipants, 2013/14–2017/18 cohorts

	Enrolled in any type of college in any year (*n* = 135,090)		Enrolled in a two-year college in any year (*n* = 135,090)		Enrolled in a four-year college in any year (*n* = 135,090)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Concentrator	–0.267***	0.034	0.242***	0.035	–0.437***	0.042
2014/15 cohort	0.008	0.046	–0.141**	0.053	0.118*	0.055
2015/16 cohort	–0.008	0.047	–0.174***	0.050	0.116*	0.055
2016/17 cohort	–0.103*	0.050	–0.339***	0.057	0.124*	0.053
2017/18 cohort	–0.487***	0.044	–0.329***	0.058	–0.317***	0.053
Female	0.540***	0.030	0.225***	0.032	0.432***	0.034
White	–0.296***	0.039	–0.184***	0.042	–0.199***	0.045
Eligible for the national school lunch program	–0.431***	0.026	0.119***	0.034	–0.564***	0.034
English learner student	–0.022	0.056	0.158**	0.053	–0.143*	0.070
Received special education services	–0.250***	0.030	0.211***	0.040	–0.633***	0.046
Proficient in math	0.570***	0.029	–0.144***	0.032	0.976***	0.039
Proficient in English language arts	0.719***	0.028	–0.290***	0.034	1.122***	0.035
School characteristics						
School size	0.000**	0.000	0.000*	0.000	0.000	0.000
Percentage racial/ethnic minority	0.864***	0.202	–0.049	0.238	0.923**	0.279
Percentage eligible for the national school lunch program	–0.618*	0.314	0.703	0.385	–1.102**	0.377
Percentage English learner student	–0.415	0.404	–1.677***	0.456	0.694	0.465
Percentage that received special education services	1.496*	0.714	2.159*	1.052	–0.019	0.964
Percentage proficient in math	0.359	0.533	0.513	0.548	–0.174	0.558
Percentage proficient in English language arts	4.289***	0.909	0.176	1.260	4.168***	1.122
No locale designation[a] vs. urban	–0.341	0.204	0.054	0.184	–0.495*	0.201
Suburban vs. urban	–0.048	0.065	–0.138	0.080	0.035	0.083
Town vs. urban	–0.088	0.072	–0.191	0.110	0.040	0.096
Rural vs. urban	–0.037	0.070	–0.083	0.105	0.009	0.098
Constant	–0.706**	0.212	–1.322***	0.276	–1.994***	0.253
	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error
Concentrators	0.569	0.005	0.205	0.004	0.376	0.006
Samplers and nonparticipants	0.627	0.007	0.169	0.005	0.468	0.007

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

Note: Concentrators attained six or more semester credits in career and technical education courses in the same career pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses. The reference group for cohort terms is the 2013/14 cohort. Coefficient estimates are log odds ratios.

a. Includes schools with a locale code of "N/A."

Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Table C8. Results from regression models predicting credits earned within one year of high school graduation, credits earned within three years of high school graduation, and certificate attainment for Indiana career and technical education concentrators and similar samplers and nonparticipants, 2013/14–2017/18 cohorts

	Credits earned within one year of high school graduation (*n* = 135,090)		Credits earned within three years of high school graduation (*n* = 73,626[a])		Attained a certificate (*n* = 135,090)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Concentrator	–1.052***	0.208	–1.170	0.839	0.061	0.081
2014/15 cohort	–0.188	0.320	1.150	1.027	0.007	0.087
2015/16 cohort	–0.252	0.286	2.487**	0.944	0.011	0.104
2016/17 cohort	–0.763*	0.303	na	na	–0.189	0.117
2017/18 cohort	0.239	0.330	na	na	–0.602***	0.167
Female	2.237***	0.173	5.658***	0.746	0.070	0.074
White	–0.222	0.209	–0.164	0.769	0.191*	0.083
Eligible for the national school lunch program	–2.748***	0.172	–10.978***	0.604	–0.361***	0.069
English learner student	1.715***	0.329	5.377***	1.206	0.671***	0.111
Received special education services	–1.304***	0.158	–5.053***	0.613	0.202**	0.076
Proficient in math	3.042***	0.130	11.772***	0.491	0.453***	0.072
Proficient in English language arts	4.555***	0.163	16.243***	0.554	0.409***	0.072
School characteristics						
School size	0.000	0.000	0.000	0.001	0.000	0.000
Percentage racial/ethnic minority	3.494**	1.266	11.140*	4.336	–0.760	0.521
Percentage eligible for the national school lunch program	–3.800	2.132	–8.794	7.117	1.040	0.748
Percentage English learner student	–4.167	2.296	–12.095	7.799	–1.082	1.068
Percentage that received special education services	9.762	6.109	38.162	20.498	1.271	1.852
Percentage proficient in math	5.299	4.014	5.534	11.467	–1.396	1.476
Percentage proficient in English language arts	16.077*	6.408	75.935***	20.229	2.088	2.493
No locale designation[b] vs. urban	–0.788	1.277	–3.840	3.803	–0.084	0.418
Suburban vs. urban	–0.042	0.446	–0.286	1.401	–0.096	0.173
Town vs. urban	–0.367	0.541	0.846	1.836	0.012	0.198
Rural vs. urban	0.329	0.543	2.710	1.818	–0.031	0.158
Constant	2.198	1.376	–0.808	4.661	–3.945***	0.485
	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error
Concentrators	9.837	0.132	33.115	0.496	0.042	0.002
Samplers and nonparticipants	10.889	0.200	34.286	0.717	0.040	0.004

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

na is not applicable.

Note: Concentrators attained six or more semester credits in career and technical education courses in the same career pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses. Certificate attainment rates are based on all years of data available for each cohort of high school graduates. The reference group for cohort terms is the 2013/14 cohort. Linear regression was used for the credits earned models. Logistic regression was used for the certificate attainment model, so coefficient estimates for this model are log odds ratios.

a. Limited to cohorts with at least three years of data post–high school graduation.

b. Includes schools with a locale code of "N/A."

Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Table C9. Results from logistic regression models predicting attainment of an associate's degree, attainment of an associate's or bachelor's degree, and attainment of a bachelor's degree for Indiana career and technical education concentrators and similar samplers and nonparticipants, 2013/14–2017/18 cohorts

	Attained an associate's degree (n = 73,626[a])		Attained an associate's or bachelor's degree (n = 73,626[a])		Attained a bachelor's degree (n = 44,938[b])	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Concentrator	0.476***	0.096	–0.150*	0.063	–0.465***	0.082
2014/15 cohort	–0.181*	0.090	–0.362***	0.071	–0.397***	0.086
2015/16 cohort	–0.540***	0.084	–1.896***	0.102	na	na
Female	0.151	0.079	0.256***	0.056	0.243**	0.075
White	0.216*	0.090	0.006	0.074	–0.076	0.096
Eligible for the national school lunch program	–0.427***	0.088	–0.678***	0.061	–0.773***	0.073
English learner student	0.641***	0.120	0.335**	0.107	0.194	0.140
Received special education services	0.178*	0.087	–0.382***	0.077	–0.917***	0.137
Proficient in math	0.460***	0.086	0.774***	0.061	0.969***	0.101
Proficient in English language arts	0.196*	0.079	0.871***	0.057	1.378***	0.099
School characteristics						
School size	0.000	0.000	0.000	0.000	0.000	0.000
Percentage racial/ethnic minority	0.097	0.564	0.340	0.364	0.726	0.427
Percentage eligible for the national school lunch program	0.001	0.719	–0.837	0.595	–1.345	0.727
Percentage English learner student	–2.542**	0.939	–0.962	0.571	–0.013	0.715
Percentage that received special education services	1.330	2.010	3.541*	1.464	4.447*	1.980
Percentage proficient in math	0.076	1.203	–0.012	0.990	–0.309	1.030
Percentage proficient in English language arts	–1.142	2.280	4.261**	1.521	7.202***	1.727
No locale designation[c] vs. urban	0.318	0.347	–0.590	0.320	–1.797***	0.469
Suburban vs. urban	0.041	0.157	0.029	0.105	–0.048	0.149
Town vs. urban	0.109	0.249	0.021	0.133	–0.026	0.145
Rural vs. urban	0.385	0.210	0.106	0.125	–0.049	0.154
Constant	–3.768	0.579	–3.175***	0.401	–4.210	0.476
	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error
Concentrators	0.053	0.002	0.120	0.003	0.112	0.004
Samplers and nonparticipants	0.033	0.003	0.135	0.006	0.162	0.008

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

na is not applicable.

Note: Concentrators attained six or more semester credits in career and technical education courses in the same career pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses. Certificate and degree attainment rates are based on all years of data available for each cohort of high school graduates. The reference group for cohort terms is the 2013/14 cohort. Coefficient estimates are log odds ratios.

a. Limited to graduates in the 2013/14–2015/16 cohorts.

b. Limited to graduates in the 2013/14 and 2014/15 cohorts.

c. Includes schools with a locale code of "N/A."

Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Table C10. Results from logistic regression models predicting employment within the first five years after high school graduation for Indiana career and technical education concentrators and similar samplers and nonparticipants, 2013/14–2017/18 cohorts

	Employment during year 1 after high school graduation (*n* = 135,090)		Employment during year 2 after high school graduation (*n* = 106,692)		Employment during year 3 after high school graduation (*n* = 73,626)		Employment during year 4 after high school graduation (*n* = 44,938)		Employment during year 5 after high school graduation (*n* = 20,678)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics										
Concentrator	0.178***	0.031	0.153***	0.032	0.165***	0.035	0.197***	0.041	0.128*	0.059
2014/15 cohort	–0.276***	0.046	–0.312***	0.044	–0.290***	0.045	–0.284***	0.042	na	na
2015/16 cohort	–0.661***	0.041	–0.694***	0.040	–0.671***	0.041	na	na	na	na
2016/17 cohort	–1.141***	0.050	–1.156	0.049	na	na	na	na	na	na
2017/18 cohort	–1.932	0.058	na	na	na	na	na	na	na	na
Female	0.192***	0.030	0.202***	0.034	0.120**	0.036	0.042	0.043	–0.036	0.062
White	–0.067	0.037	–0.083	0.042	–0.098	0.053	–0.131*	0.055	–0.181	0.097
Eligible for the national school lunch program	0.191***	0.026	0.190***	0.029	0.180***	0.033	0.179***	0.045	0.232***	0.060
English learner student	–0.369***	0.059	–0.382***	0.064	–0.317***	0.071	–0.294***	0.082	–0.247	0.127
Received special education services	–0.180***	0.029	–0.169***	0.030	–0.139***	0.038	–0.055	0.046	–0.057	0.069
Proficient in math	–0.045	0.027	–0.063*	0.030	–0.080*	0.033	–0.055	0.038	–0.037	0.059
Proficient in English language arts	–0.131***	0.025	–0.132***	0.028	–0.122***	0.030	–0.169***	0.037	–0.086	0.053
School characteristics										
School size	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Percentage racial/ethnic minority	–0.518**	0.194	–0.464*	0.187	–0.471*	0.188	–0.319	0.210	–0.502	0.265
Percentage eligible for the national school lunch program	0.068	0.299	0.125	0.277	0.240	0.304	0.389	0.368	0.896	0.470
Percentage English learner students	1.290**	0.419	1.074**	0.389	0.996**	0.360	1.139**	0.396	1.504**	0.510
Percentage that received special education services	0.257	0.939	0.231	0.886	0.312	0.975	–0.312	0.957	0.152	1.526
Percentage proficient in math	0.503	0.526	0.585	0.479	0.247	0.504	–0.208	0.545	0.420	0.758
Percentage proficient in English language arts	–0.929	1.013	–1.014	0.938	–0.639	0.990	0.604	1.168	1.329	1.496
No locale designation[a] vs. urban	0.114	0.156	0.176	0.159	0.111	0.171	–0.018	0.181	–0.155	0.178
Suburban vs. urban	–0.094	0.080	–0.059	0.073	–0.077	0.077	–0.022	0.087	–0.284**	0.100
Town vs. urban	–0.045	0.097	0.020	0.087	0.040	0.089	0.094	0.097	–0.060	0.126
Rural vs. urban	–0.059	0.110	–0.038	0.101	–0.023	0.105	0.006	0.101	–0.128	0.130
Constant	0.359	0.229	0.271	0.217	0.195	0.224	0.055	0.277	–0.280	0.315

	Employment during year 1 after high school graduation (*n* = 135,090)		Employment during year 2 after high school graduation (*n* = 106,692)		Employment during year 3 after high school graduation (*n* = 73,626)		Employment during year 4 after high school graduation (*n* = 44,938)		Employment during year 5 after high school graduation (*n* = 20,678)	
	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error
Concentrators	0.367	0.004	0.419	0.004	0.464	0.005	0.497	0.005	0.509	0.007
Samplers and nonparticipants	0.326	0.007	0.382	0.008	0.423	0.008	0.448	0.010	0.477	0.013

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

na is not applicable.

Note: Concentrators attained six or more semester credits in career and technical education courses in the same career pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses. The sample size decreased from year to year because the number of cohorts that could be used in the analysis decreased each year. The reference group for cohort terms is the 2013/14 cohort. Coefficient estimates are log odds ratios. Employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses.

a. Includes schools with a locale code of "N/A."

Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Table C11. Results from regression models predicting annual earnings within the first five years after high school graduation for Indiana career and technical education concentrators and similar samplers and nonparticipants, 2013/14–2017/18 cohorts

	Annual earnings during year 1 after high school graduation (*n* = 135,090)		Annual earnings during year 2 after high school graduation (*n* = 106,692)		Annual earnings during year 3 after high school graduation (*n* = 73,626)		Annual earnings during year 4 after high school graduation (*n* = 44,938)		Annual earnings during year 5 after high school graduation (*n* = 20,678)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics										
Concentrator	1,141.65***	85.62	1,726.23***	133.00	2,244.36***	191.20	3,068.22***	250.59	2,630.66***	527.02
2014/15 cohort	–99.14	136.89	–483.76*	196.44	–879.01***	240.13	–1,044.79***	258.10	na	na
2015/16 cohort	–721.98***	143.07	–1,654.38***	174.40	–2,298.62***	215.26	na	na	na	na
2016/17 cohort	–1,796.46***	114.73	–2,911.78	171.54	na	na	na	na	na	na
2017/18 cohort	–3,023.50	117.53	na	na	na	na	na	na	na	na
Female	–666.33***	81.37	–1,134.17***	145.94	–2,305.62***	212.93	–3,418.32***	288.09	–4,853.92***	524.37
White	193.21	107.27	72.89	177.10	136.14	263.90	148.05	346.01	–54.46	713.32
Eligible for the national school lunch program	539.25***	78.23	751.24***	117.97	787.54***	167.53	832.80**	276.33	317.18	466.55
English learner student	26.69	167.43	–150.84	257.91	190.68	414.72	688.50	545.19	260.19	918.79
Received special education services	–421.28***	92.97	–616.31***	150.63	–847.17***	227.63	–694.01*	313.45	–1,630.55**	554.36
Proficient in math	–93.09	88.66	–68.36	138.94	–14.02	176.67	–85.88	247.78	1,056.65**	401.32
Proficient in English language arts	–912.36***	94.53	–1,317.79***	141.98	–1,677.38***	200.91	–2,019.59***	282.50	–1,273.29**	482.86
School characteristics										
School size	–0.04	0.08	–0.02	0.11	–0.11	0.16	–0.19	0.21	–0.25	0.31
Percentage racial/ethnic minority	–2,845.33***	490.79	–4,053.15***	693.21	–4,487.68***	966.52	–4,427.46**	1,277.55	–2,036.59	2,184.66
Percentage eligible for the national school lunch program	–16.34	884.44	277.49	1,329.98	–1,072.95	1,895.51	–100.36	2,564.68	873.35	4,007.36
Percentage English learner students	6,137.25***	1,202.86	8,641.39***	1,765.36	11,012.27***	1,984.96	11,283.63***	2,692.95	11,992.50**	4,055.31
Percentage that received special education services	–700.09	2,612.80	–2,400.20	3,797.42	–2,984.40	5,464.30	–3,058.62	6,503.07	3,770.52	12,999.92
Percentage proficient in math	1,037.41	1,270.86	2,749.77	1,956.72	3,558.48	3,082.32	5,066.26	4,400.11	14,103.57*	6,922.67
Percentage proficient in English language arts	–7,742.71**	2,874.53	–13,752.81**	4,286.25	–20,225.91***	6,475.90	–18,235.34*	8,036.92	–3,962.65	13,385.17
No locale designation[a] vs. urban	161.33	439.91	582.72	736.57	–21.07	1,018.29	–1,293.43	940.25	–2,726.79	1,977.78
Suburban vs. urban	–147.66	212.59	–81.03	315.04	–388.36	461.92	–869.18	547.35	–2,570.03**	958.16
Town vs. urban	–169.44	217.53	202.98	315.58	–15.17	467.65	–124.95	551.98	459.44	1,065.22
Rural vs. urban	–177.17	247.99	–40.16	367.55	–341.26	523.10	–401.41	598.54	–424.32	1,082.34
Constant	6,061.69	606.34	8,852.75***	911.48	12,370.38	1,318.78	13,378.88	1,863.25	11,137.89***	2,980.46

	Annual earnings during year 1 after high school graduation (*n* = 135,090)		Annual earnings during year 2 after high school graduation (*n* = 106,692)		Annual earnings during year 3 after high school graduation (*n* = 73,626)		Annual earnings during year 4 after high school graduation (*n* = 44,938)		Annual earnings during year 5 after high school graduation (*n* = 20,678)	
	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error
Concentrators	3,954.59	63.00	6,212.01	93.87	8,474.30	131.68	10,776.39	172.88	13,693.46	265.10
Samplers and nonparticipants	2,812.94	79.48	4,485.78	123.68	6,229.94	178.58	7,708.17	230.55	11,062.80	462.75

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

na is not applicable.

Note: Concentrators attained six or more semester credits in career and technical education courses in the same career pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses. The sample size decreased from year to year because the number of cohorts that could be used in the analysis decreased each year. The reference group for cohort terms is the 2013/14 cohort. Employment information was not available for high school graduates who were employed outside the state, who were self–employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses. Earnings for graduates designated as unemployed are $0. Annual earnings were converted to 2013 dollar values using inflation calculations based on the Consumer Price Index for All Urban Consumers, Midwest Region.

a. Includes schools with a locale code of "N/A."

Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Table C12. Results from logistic regression models predicting enrollment in any type of college, enrollment in a two-year college, and enrollment in a four-year college within one year of high school graduation for Indiana career and technical education explorers and similar samplers and nonparticipants, 2013/14–2017/18 cohorts

	Enrolled in any type of college within one year (*n* = 52,180)		Enrolled in a two-year college within one year (*n* = 52,180)		Enrolled in a four-year college within one year (*n* = 52,180)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Explorer	–0.028	0.041	0.304***	0.042	–0.180***	0.046
2014/15 cohort	0.059	0.058	–0.170*	0.069	0.156*	0.065
2015/16 cohort	0.058	0.052	–0.191*	0.074	0.165**	0.061
2016/17 cohort	–0.020	0.056	–0.253**	0.078	0.115*	0.058
2017/18 cohort	–0.326***	0.058	0.020	0.076	–0.337***	0.064
Female	0.351***	0.046	0.101*	0.044	0.310***	0.046
White	–0.198***	0.050	–0.205***	0.058	–0.103	0.057
Eligible for the national school lunch program	–0.500***	0.035	0.219***	0.040	–0.679***	0.042
English learner student	–0.134	0.076	0.073	0.094	–0.183*	0.091
Received special education services	–0.281***	0.046	0.216***	0.057	–0.639***	0.054
Proficient in math	0.635***	0.043	–0.280***	0.051	1.067***	0.053
Proficient in English language arts	0.684***	0.037	–0.322***	0.053	1.038***	0.044
School characteristics						
School size	0.000	0.000	0.000	0.000	0.000	0.000
Percentage racial/ethnic minority	0.866***	0.224	0.076	0.277	0.899***	0.258
Percentage eligible for the national school lunch program	–0.498	0.390	–0.228	0.476	–0.477	0.389
Percentage English learner students	–0.778	0.429	–1.290*	0.574	–0.180	0.448
Percentage that received special education services	0.219	0.994	3.156*	1.337	–1.456	1.136
Percentage proficient in math	0.123	0.652	0.755	0.761	–0.432	0.572
Percentage proficient in English language arts	3.231**	1.186	–1.847	1.516	4.069**	1.216
No locale designation[a] vs. urban	–0.574	0.303	–0.147	0.300	–0.788**	0.299
Suburban vs. urban	0.081	0.083	–0.039	0.103	0.110	0.086
Town vs. urban	0.013	0.083	–0.241*	0.118	0.135	0.085
Rural vs. urban	0.126	0.086	0.061	0.120	0.100	0.096
Constant	–0.975**	0.293	–1.412***	0.355	–2.164***	0.289
	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error
Explorers	0.574	0.005	0.149	0.004	0.428	0.006
Samplers and nonparticipants	0.580	0.009	0.115	0.004	0.466	0.009

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

Note: Explorers attained six or more semester credits in career and technical education courses in multiple pathways but fewer than six credits in a single pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses. The reference group for cohort terms is the 2013/14 cohort.

a. Includes schools with a locale code of "N/A."

Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Table C13. Results from logistic regression models predicting enrollment in any type of college, enrollment in a two-year college, and enrollment in a four-year college within the first five years after high school graduation for Indiana career and technical education explorers and similar samplers and nonparticipants, 2012/13–2017/18 cohorts

	Enrolled in any type of college in any year (*n* = 52,180)		Enrolled in a two-year college in any year (*n* = 52,180)		Enrolled in a four-year college in any year (*n* = 52,180)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Explorer	–0.081*	0.040	0.220***	0.039	–0.222***	0.043
2014/15 cohort	0.031	0.057	–0.176*	0.071	0.166*	0.065
2015/16 cohort	–0.006	0.052	–0.289***	0.070	0.178**	0.060
2016/17 cohort	–0.108	0.059	–0.354***	0.070	0.132*	0.058
2017/18 cohort	–0.470***	0.057	–0.251**	0.074	–0.317***	0.065
Female	0.456***	0.043	0.173***	0.040	0.348***	0.043
White	–0.274***	0.051	–0.164**	0.053	–0.158**	0.059
Eligible for the national school lunch program	–0.496***	0.033	0.211***	0.042	–0.675***	0.041
English learner student	–0.054	0.071	0.151	0.082	–0.162	0.091
Received special education services	–0.295***	0.048	0.156**	0.053	–0.638***	0.054
Proficient in math	0.625***	0.044	–0.276***	0.043	1.097***	0.053
Proficient in English language arts	0.707***	0.035	–0.305***	0.049	1.072***	0.045
School characteristics						
School size	0.000	0.000	0.000	0.000	0.000	0.000
Percentage racial/ethnic minority	0.931***	0.226	0.110	0.267	0.873**	0.269
Percentage eligible for the national school lunch program	–0.393	0.384	0.008	0.467	–0.416	0.372
Percentage English learner students	–1.287**	0.445	–1.703**	0.526	–0.241	0.472
Percentage that received special education services	0.504	0.936	2.689*	1.256	–1.525	1.107
Percentage proficient in math	–0.030	0.652	0.238	0.675	–0.500	0.592
Percentage proficient in English language arts	3.859**	1.191	–1.070	1.488	4.292***	1.215
No locale designation[a] vs. urban	–0.489	0.342	–0.069	0.278	–0.759*	0.323
Suburban vs. urban	0.048	0.081	–0.088	0.105	0.108	0.084
Town vs. urban	–0.029	0.087	–0.192	0.122	0.099	0.088
Rural vs. urban	0.097	0.084	0.014	0.124	0.074	0.097
Constant	–0.685*	0.297	–0.988**	0.334	–2.094***	0.299
	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error
Explorers	0.627	0.005	0.194	0.004	0.445	0.006
Samplers and nonparticipants	0.644	0.008	0.162	0.005	0.493	0.008

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

Note: Explorers attained six or more semester credits in career and technical education courses in multiple pathways but fewer than six credits in a single pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses. The reference group for cohort terms is the 2013/14 cohort. Coefficient estimates are log odds ratios.

a. Includes schools with a locale code of "N/A."

Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Table C14. Results from regression models predicting credits earned within one year of high school graduation, credits earned within three years of high school graduation, and certificate attainment for Indiana career and technical education explorers and similar samplers and nonparticipants, 2013/14–2017/18 cohorts

	Credits earned within one year of high school graduation (n = 52,180)		Credits earned within three years of high school graduation (n = 30,502[a])		Attained a certificate (n = 52,180)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Explorer	–0.441	0.268	–2.815**	0.942	–0.023	0.090
2014/15 cohort	–0.098	0.397	1.369	1.190	–0.209	0.125
2015/16 cohort	–0.294	0.333	2.572*	1.165	–0.190	0.146
2016/17 cohort	–1.134**	0.376	na	na	–0.226	0.158
2017/18 cohort	0.221	0.353	na	na	–0.628**	0.190
Female	2.015***	0.258	5.483***	1.178	0.226*	0.090
White	–0.170	0.275	2.121*	1.058	0.259*	0.110
Eligible for the national school lunch program	–3.169***	0.236	–12.296***	0.832	–0.411***	0.087
English learner student	1.543***	0.431	3.778*	1.696	0.691***	0.151
Received special education services	–1.623***	0.253	–6.205***	0.918	0.097	0.110
Proficient in math	3.586***	0.209	13.677***	0.779	0.245*	0.107
Proficient in English language arts	4.626***	0.184	16.937***	0.768	0.473***	0.103
School characteristics						
School size	0.000	0.000	0.000	0.001	0.000	0.000
Percentage racial/ethnic minority	4.014**	1.266	12.042**	4.321	–1.391*	0.656
Percentage eligible for the national school lunch program	–3.051	2.481	5.040	11.287	0.622	0.943
Percentage English learner students	–7.816**	2.358	–24.501*	10.963	–0.590	1.420
Percentage that received special education services	5.763	6.030	–6.259	28.762	3.206	2.257
Percentage proficient in math	0.165	4.233	14.490	15.724	–1.164	1.480
Percentage proficient in English language arts	16.225*	7.047	58.692*	27.703	–0.413	3.009
No locale designation[b] vs. urban	–4.051*	1.599	–7.374	5.214	0.124	0.705
Suburban vs. urban	0.247	0.426	–0.685	1.845	–0.088	0.220
Town vs. urban	–0.169	0.563	–0.193	2.459	–0.009	0.236
Rural vs. urban	0.776	0.543	1.891	2.371	0.011	0.209
Constant	2.832	1.615	–1.377	6.229	–3.762***	0.655
	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error
Explorers	10.904	0.126	34.288	0.543	0.038	0.002
Samplers and nonparticipants	11.345	0.247	37.102	0.881	0.039	0.004

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

na is not applicable.

Note: Explorers attained six or more semester credits in career and technical education courses in multiple pathways but fewer than six credits in a single pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses. Certificate attainment rates are based on all years of data available for each cohort of high school graduates. Data represent graduates who enrolled in an Indiana public college. The reference group for cohort terms is the 2013/14 cohort. Linear regression was used for the credits earned models. Logistic regression was used for the certificate attainment model, so coefficient estimates for this model are log odds ratios.

a. Limited to cohorts with at least three years of data post–high school graduation.

b. Includes schools with a locale code of "N/A."

Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Table C15. Results from logistic regression models predicting attainment of an associate's degree, an associate's or bachelor's degree, or a bachelor's degree for Indiana career and technical education explorers and similar samplers and nonparticipants, 2013/14–2017/18 cohorts

	Attained an associate's degree (n = 30,502[a])		Attained an associate's or bachelor's degree (n = 30,502[a])		Attained a bachelor's degree (n = 19,402[b])	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Explorer	0.371**	0.119	–0.059	0.065	–0.193*	0.083
2014/15 cohort	–0.233*	0.105	–0.343***	0.078	–0.360***	0.096
2015/16 cohort	–0.728***	0.116	–2.157***	0.123	na	na
Female	0.311**	0.106	0.318***	0.074	0.245**	0.091
White	–0.022	0.173	0.159	0.086	0.227*	0.098
Eligible for the national school lunch program	–0.541***	0.119	–0.760***	0.079	–0.790***	0.089
English learner student	0.602*	0.299	0.256	0.162	0.113	0.206
Received special education services	0.404**	0.134	–0.449***	0.112	–1.193***	0.162
Proficient in math	0.241	0.124	0.888***	0.093	1.254***	0.135
Proficient in English language arts	0.509***	0.123	0.964***	0.090	1.177***	0.146
School characteristics						
School size	0.000	0.000	0.000	0.000	0.000	0.000
Percentage racial/ethnic minority	–0.818	0.707	–0.012	0.345	0.592	0.408
Percentage eligible for the national school lunch program	–0.031	0.936	0.028	0.671	–0.409	0.789
Percentage English learner students	–1.004	1.566	–1.021	0.703	–0.806	0.792
Percentage that received special education services	2.483	2.608	1.281	1.701	1.757	2.092
Percentage proficient in math	0.621	1.369	0.252	1.045	–0.568	1.143
Percentage proficient in English language arts	–3.204	3.427	2.747	1.795	5.206*	2.086
No locale designation[b] vs. urban	1.063	0.685	0.168	0.539	–1.022	0.720
Suburban vs. urban	0.172	0.228	0.092	0.118	0.056	0.137
Town vs. urban	–0.005	0.243	–0.022	0.130	0.029	0.152
Rural vs. urban	0.366	0.239	0.139	0.127	0.090	0.154
Constant	–3.681***	0.744	–3.453***	0.418	–4.449***	0.504
	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error
Explorers	0.044	0.002	0.139	0.004	0.150	0.004
Samplers and nonparticipants	0.031	0.003	0.146	0.007	0.174	0.010

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.
na is not applicable.
Note: Explorers attained six or more semester credits in career and technical education courses in multiple pathways but fewer than six credits in a single pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses. The reference group for cohort terms is the 2013/14 cohort. Coefficient estimates are log odds ratios.
a. The analyses of attainment of associate's degree and attainment of an associate's or bachelor's degree were limited to the 2013/14–2015/16 cohorts.
b. The analysis of attainment of a bachelor's degree was limited to graduates from the 2013/14 and 2014/15 cohorts.
c. Includes schools with a locale code of "N/A."
Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Table C16. Results from logistic regression models predicting employment within the first five years after high school graduation for Indiana career and technical education explorers and similar samplers and nonparticipants, 2013/14–2017/18 cohorts

Predictor/covariate	Employment during year 1 after high school graduation (*n* = 52,180)		Employment during year 2 after high school graduation (*n* = 42,444)		Employment during year 3 after high school graduation (*n* = 30,502)		Employment during year 4 after high school graduation (*n* = 19,402)		Employment during year 5 after high school graduation (*n* = 9,220)	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics										
Explorer	0.063	0.041	0.053	0.042	0.059	0.045	0.114*	0.053	0.029	0.074
2014/15 cohort	–0.254***	0.059	–0.305***	0.055	–0.292***	0.059	–0.290***	0.055	na	na
2015/16 cohort	–0.687***	0.052	–0.731***	0.050	–0.729***	0.057	na	na	na	na
2016/17 cohort	–1.153***	0.054	–1.200	0.056	na	na	na	na	na	na
2017/18 cohort	–1.988	0.069	na	na	na	na	na	na	na	na
Female	0.130**	0.039	0.113**	0.039	0.065	0.045	–0.020	0.054	–0.090	0.083
White	–0.033	0.061	–0.059	0.066	–0.069	0.067	–0.041	0.075	–0.035	0.129
Eligible for the national school lunch program	0.190***	0.040	0.201***	0.045	0.176***	0.051	0.208**	0.061	0.273***	0.071
English learner student	–0.329***	0.092	–0.322***	0.085	–0.281**	0.084	–0.228**	0.087	–0.248	0.153
Received special education services	–0.156***	0.044	–0.116**	0.045	–0.061	0.049	0.001	0.060	0.035	0.093
Proficient in math	–0.063	0.036	–0.050	0.038	–0.091*	0.045	–0.073	0.057	0.076	0.079
Proficient in English language arts	–0.113**	0.035	–0.127**	0.037	–0.113**	0.042	–0.186**	0.055	–0.159*	0.071
School characteristics										
School size	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Percentage racial/ethnic minority	–0.687**	0.240	–0.528*	0.241	–0.589*	0.229	–0.127	0.284	–0.292	0.358
Percentage eligible for the national school lunch program	–0.856**	0.324	–0.627*	0.304	–0.368	0.282	–0.207	0.400	–0.627	0.635
Percentage English learner students	2.243***	0.415	1.823***	0.442	1.534***	0.412	1.237*	0.536	1.032	0.526
Percentage that received special education services	0.365	0.935	0.171	0.880	0.260	0.883	–0.068	1.054	0.531	1.713
Percentage proficient in math	0.671	0.560	0.776	0.570	0.444	0.534	0.420	0.614	0.522	0.770
Percentage proficient in English language arts	–3.236**	1.028	–2.905**	1.045	–2.357*	0.982	–1.254	1.364	–2.643	1.537
No locale designation[a] vs. urban	–0.028	0.191	–0.034	0.213	–0.007	0.225	–0.003	0.240	0.268	0.336
Suburban vs. urban	–0.130	0.087	–0.094	0.086	–0.081	0.082	–0.028	0.119	–0.178	0.111
Town vs. urban	–0.104	0.098	–0.057	0.088	0.011	0.084	0.096	0.113	–0.025	0.138
Rural vs. urban	–0.217*	0.103	–0.179	0.096	–0.097	0.096	–0.034	0.113	–0.117	0.142
Constant	0.913	0.236	0.780**	0.233	0.623	0.233	0.332	0.328	0.386	0.377

Predictor/covariate	Employment during year 1 after high school graduation (*n* = 52,180)		Employment during year 2 after high school graduation (*n* = 42,444)		Employment during year 3 after high school graduation (*n* = 30,502)		Employment during year 4 after high school graduation (*n* = 19,402)		Employment during year 5 after high school graduation (*n* = 9,220)	
	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error
Explorers	0.352	0.005	0.405	0.005	0.446	0.005	0.480	0.006	0.493	0.008
Samplers and nonparticipants	0.338	0.009	0.392	0.009	0.431	0.010	0.452	0.012	0.485	0.016

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.
na is not applicable.
Note: Explorers attained six or more semester credits in career and technical education courses in multiple pathways but fewer than six credits in a single pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses. The sample size decreased from year to year because the number of cohorts that could be used in the analysis decreased each year. The reference group for cohort terms is the 2013/14 cohort. Coefficient estimates are log odds ratios. Employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses.
a. Includes schools with a locale code of "N/A."
Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Table C17. Results from regression models predicting annual earnings within the first five years after high school graduation for Indiana career and technical education explorers and similar samplers and nonparticipants, 2013/14–2017/18 cohorts

	Annual earnings during year 1 after high school graduation (*n* = 52,180)		Annual earnings during year 2 after high school graduation (*n* = 42,444)		Annual earnings during year 3 after high school graduation (*n* = 30,502)		Annual earnings during year 4 after high school graduation (*n* = 19,402)		Annual earnings during year 5 after high school graduation (*n* = 9,220)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics										
Explorer	321.98**	114.96	438.35*	186.14	655.36**	235.59	1,456.53***	320.03	552.46	659.25
2014/15 cohort	–102.98	186.62	–373.00	242.95	–500.06	297.75	–740.64*	310.42	na	na
2015/16 cohort	–750.34***	169.66	–1,723.07***	204.66	–2,198.89***	247.13	na	na	na	na
2016/17 cohort	–1,641.59***	145.10	–2,809.52	208.94	na	na	na	na	na	na
2017/18 cohort	–2,755.48	167.64	na	na	na	na	na	na	na	na
Female	–616.77***	104.50	–1,165.70***	159.68	–2,167.24***	245.77	–3,037.95***	373.11	–4,365.77***	635.49
White	382.32**	139.01	262.06	241.89	260.79	302.02	569.66	345.05	1,116.15	785.27
Eligible for the national school lunch program	517.64***	109.65	851.77***	163.48	894.62***	250.13	1,045.76**	368.53	791.29	589.20
English learner student	438.84	268.98	188.27	409.67	529.89	588.08	1,117.11	650.91	33.90	1,204.69
Received special education services	–479.03***	133.60	–553.12**	202.58	–459.36	285.00	–948.56*	401.94	–1,339.87	712.20
Proficient in math	–239.54*	116.47	–260.54	167.74	–333.09	240.16	–627.58	327.16	661.21	590.66
Proficient in English language arts	–1,010.90***	123.56	–1,528.96***	188.66	–1,787.84***	284.59	–2,013.29***	351.62	–1,294.82*	640.85
School characteristics										
School size	–0.09	0.07	–0.07	0.10	–0.16	0.15	–0.31	0.22	–0.10	0.42
Percentage racial/ethnic minority	–2,895.50***	640.02	–3,812.54***	876.14	–4,472.60***	1,271.96	–2,496.34	1,645.68	–989.25	2,655.65
Percentage eligible for the national school lunch program	–1,483.71	831.97	–1,927.72	1,139.26	–1,286.99	1,650.68	–1,467.18	2,294.24	–7,422.13	4,871.94
Percentage English learner students	8,694.09***	1,435.37	11,727.82***	1,918.22	12,267.23***	2,612.40	11,480.44**	4,154.01	11,335.58*	5,359.34
Percentage that received special education services	1,715.45	2,590.11	–267.48	3,744.46	–3,886.05	4,977.42	–791.14	6,490.23	6,069.91	13,236.08
Percentage proficient in math	1,451.04	1,446.89	2,262.07	2,110.08	3,278.07	3,160.52	3,261.42	4,346.09	9,681.85	7,293.27
Percentage proficient in English language arts	–9,744.63***	2,655.39	–15,914.20***	3,874.73	–20,120.38**	5,819.94	–16,032.32*	7,939.50	–20,755.33	14,227.09
No locale designation[a] vs. urban	–1,316.82**	472.13	–478.10	1,374.93	326.68	1,523.91	–1,634.64	1,662.43	65.64	3,458.44
Suburban vs. urban	–165.89	248.21	18.60	311.78	–6.90	442.71	–83.83	595.35	–1,160.55	1,223.01
Town vs. urban	–243.67	295.68	195.56	338.07	432.97	467.41	858.98	611.13	943.80	1,254.10
Rural vs. urban	–609.90*	304.06	–341.05	357.14	–246.19	490.80	304.13	617.76	–407.31	1,323.63
Constant	6,518.59	635.04	9,830.18***	854.64	12,546.73	1,302.98	12,809.24	1,984.08	14,974.12***	3,588.18

	Annual earnings during year 1 after high school graduation (*n* = 52,180)		Annual earnings during year 2 after high school graduation (*n* = 42,444)		Annual earnings during year 3 after high school graduation (*n* = 30,502)		Annual earnings during year 4 after high school graduation (*n* = 19,402)		Annual earnings during year 5 after high school graduation (*n* = 9,220)	
	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error
Explorers	3,230.49	68.38	5,063.19	99.60	7,007.41	132.97	9,195.47	191.34	11,893.46	275.88
Samplers and nonparticipants	2,908.50	98.00	4,624.83	151.04	6,352.05	203.55	7,738.93	265.42	11,341.00	563.70

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

na is not applicable.

Note: Explorers attained six or more semester credits in career and technical education courses in multiple pathways but fewer than six credits in a single pathway. Samplers attained more than zero but fewer than six semester credits in career and technical education courses. Nonparticipants did not attain any credits in career and technical education courses. The sample size decreased from year to year because the number of cohorts that could be used in the analysis decreased each year. The reference group for cohort terms is the 2013/14 cohort. Employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses. Earnings for graduates designated as unemployed are $0. Annual earnings were converted to 2013 dollar values using inflation calculations based on the Consumer Price Index for All Urban Consumers, Midwest Region.

a. Includes schools with a locale code of "N/A."

Source: Authors' analysis of data provided by Indiana Management Performance Hub.

Appendix D. Detailed findings on Minnesota high school graduates

This appendix contains detailed findings on Minnesota high school graduates. Tables in this appendix include the following:

- Tables D1–D3 contain percentages of graduates classified as each type of career and technical education participant (that is, concentrator, explorer, sampler, or nonparticipant) by student characteristic (table D1), school characteristic (table D2), and whether they enrolled in college, earned college credits, attained a certificate or degree, or were employed (table D3). Table D3 also contains average earnings for each type of career and technical education participant.
- Tables D4 and D5 show demographic similarities between matched groups of concentrators and similar samplers and nonparticipants (table D4) and between matched groups of explorers and similar samplers and nonparticipants (table D5).
- Tables D6–D11 show results of regression models comparing concentrators and similar samplers and nonparticipants.
    - Results for college enrollments within one year of high school graduation are presented in table D6, and college enrollments at any time after graduation are presented in table D7.
    - Results for postsecondary credits earned, certificate attainment, and degree attainment are presented in tables D8 and D9.
    - Results for employment outcomes are in table D10, and results for earnings outcomes are presented in table D11.
- Tables D12–D17 show results of regression models comparing explorers and similar samplers and nonparticipants.
    - Results for college enrollments within one year of high school graduation are presented in table D12, and college enrollments at any time after graduation are presented in table D13.
    - Results for postsecondary credits earned, certificate attainment, and degree attainment are presented in tables D14 and D15.
    - Results for employment outcomes are in table D16, and results for earnings outcomes are presented in table D17.

Table D1. Percentage of Minnesota high school graduates in each career and technical education participant category, by graduate characteristic, 2012/13–2017/18 cohorts

Graduate characteristic	Concentrators	Explorers	Samplers	Nonparticipants
Statewide total	44	15	24	17
Graduating cohort				
2012/13	44	15	24	17
2013/14	44	15	24	17
2014/15	44	15	24	18
2015/16	43	14	25	17
2016/17	44	15	25	17
2017/18	43	14	24	18
Difference, 2017/18–2012/13 (percentage points)	*–1*	*–1*	*0*	*1*
Gender				
Female	39	14	27	20
Male	48	15	22	15
Difference (percentage points)	*–9[a]*	*–1*	*5[a]*	*5[a]*
Race/ethnicity				
American Indian/Alaska Native	42	13	24	21
Asian/Pacific Islander	33	18	30	19
Black	34	17	28	21
Hispanic (any race)	41	16	26	17
White	46	14	23	17
Black–White difference (percentage points)	*–12[a]*	*3*	*5[a]*	*4*
Eligible for the national school lunch program				
Eligible	44	16	24	16
Not eligible	44	14	25	18
Difference (percentage points)	*0*	*–2*	*1*	*2*
English learner status				
English learner student	32	20	30	18
Not English learner student	44	14	24	17
Difference (percentage points)	*12[a]*	*–6*	*–6*	*–1*
Special education status				
Received special education services	49	15	20	16
Did not receive special education services	43	15	25	18
Difference (percentage points)	*–6[a]*	*0*	*5*	*2*
Proficiency in math				
Proficient	23	24	33	20
Not proficient	15	16	32	37
Difference (percentage points)	*–8[a]*	*–8[a]*	*–1*	*17[a]*
Proficiency in reading				
Proficient	41	14	26	18
Not proficient	52	16	20	12
Difference (percentage points)	*11[a]*	*2*	*–6[a]*	*–6[a]*

Note: *N* = 350,191 graduates. Concentrators completed at least 150 hours of instruction in career and technical education courses in the same career field. Explorers completed at least 150 hours of instruction in career and technical education courses in multiple career fields but fewer than 150 hours in a single field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses.

a. Meaningful difference (that is, a group difference of at least 5 percentage points).

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D2. Percentage of Minnesota high school graduates in each career and technical education participant category, by school characteristics, 2012/13–2017/18 cohorts

High school characteristic	Concentrators	Explorers	Samplers	Nonparticipants
Statewide total	**44**	**15**	**24**	**17**
High school enrollment				
Smallest high schools (quartile 1)	43	16	23	18
Mid-sized high schools (quartiles 2 and 3)	43	13	22	22
Largest high schools (quartile 4)	44	15	25	16
Large school–small school difference (percentage points)	*1*	*–1*	*2*	*–2*
Percentage of students who are from a racial/ethnic minority group				
Schools with the smallest percentages (quartile 1)	55	13	19	13
Schools with mid-level percentages (quartiles 2 and 3)	43	14	24	18
Schools with the largest percentages (quartile 4)	31	18	30	21
Highest–smallest difference (percentage points)	*–24*[a]	*5*[a]	*11*[a]	*8*[a]
Percentage of students eligible for the national school lunch program				
Schools with the smallest percentages of eligible students (quartile 1)	46	14	23	18
Schools with mid-level percentages of eligible students (quartiles 2 and 3)	44	15	25	16
Schools with the largest percentages of eligible students (quartile 4)	34	18	28	20
Difference largest–smallest (percentage points)	*–12*[a]	*4*	*5*[a]	*2*
Percentage of students who are English learner students				
Schools with the smallest percentages of English learner students (quartile 1)	46	12	23	20
Schools with mid-level percentages of English learner students (quartiles 2 and 3)	46	14	23	16
Schools with the largest percentages of English learner students (quartile 4)	38	17	27	17
Difference largest–smallest (percentage points)	*–8*[a]	*5*[a]	*4*	*–3*
Percentage of students who receive special education services				
Schools with the smallest percentages of students receiving services (quartile 1)	45	14	24	17
Schools with mid-level percentages of students receiving services (quartiles 2 and 3)	44	15	25	17
Schools with the largest percentages of students receiving services (quartile 4)	31	15	25	29
Difference largest–smallest (percentage points)	*–14*[a]	*1*	*1*	*12*[a]
Percentage of students who are proficient in math				
Schools with the smallest percentages of proficient students (quartile 1)	17	16	33	35
Schools with mid-level percentages of proficient students (quartiles 2 and 3)	24	24	31	21
Schools with the largest percentages of proficient students (quartile 4)	16	23	37	24
Difference largest–smallest (percentage points)	*–1*	*7*[a]	*4*	*–11*[a]

High school characteristic	Concentrators	Explorers	Samplers	Nonparticipants
Percentage of students who are proficient in reading				
Schools with the smallest percentages of proficient students (quartile 1)	35	15	25	25
Schools with mid-level percentages of proficient students (quartiles 2 and 3)	44	16	24	16
Schools with the largest percentages of proficient students (quartile 4)	46	14	24	16
Difference largest–smallest (percentage points)	*11*[a]	*–1*	*–1*	*–9*[a]
School locale				
Urban	32	15	30	23
Suburban	40	15	25	20
Town	51	15	21	13
Rural	54	13	21	12
Difference urban–rural (percentage points)	*–22*[a]	*2*	*9*[a]	*11*[a]

Note: *N* = 350,191 graduates. Concentrators completed at least 150 hours of instruction in career and technical education courses in the same career field. Explorers completed at least 150 hours of instruction in career and technical education courses in multiple career fields but fewer than 150 hours in a single field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses.
a. Meaningful difference (that is, a group difference of at least 5 percentage points).
Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D3. Percentage of Minnesota high school graduates who attained each postsecondary and employment outcome, by career and technical education participant category, 2012/13–2017/18 cohorts

Outcome	Population size	Concentrators	Explorers	Samplers	Nonparticipants
College enrollment					
Enrolled in any college within one year	350,191	63[a]	65	69	68
Ever enrolled in any college	350,191	78	80	84	81
Enrolled in a two-year college within one year	350,191	26[a]	23[a]	19	17
Ever enrolled in a two-year college	350,191	48[a]	47	45	43
Enrolled in a four-year college within one year	350,191	36[a]	41[a]	50	51
Ever enrolled in a four-year college	350,191	48[a]	53[a]	62	62
Credits earned—high school graduates who ever enrolled in any college					
Credits earned within one year	253,789	17	17	18	19
Credits earned within three years	171,227	42	43	47	49
Credential attainment—high school graduates who ever enrolled in any college					
Attained a certificate (for cohorts with one to six years of postgraduation data)	253,789	8	6	5	4
Attained an associate's degree (for cohorts with three to six years of postgraduation data)	171,227	12	10	10	10
Attained a bachelor's degree (for cohorts with four to six years of postgraduation data)	129,851	22	26	33	36
Credential attainment—high school graduates who ever enrolled in a two-year college					
Attained a certificate (for cohorts with one to six years of postgraduation data)	158,067	10	8	6	6
Attained an associate's degree (for cohorts with three to six years of postgraduation data)	106,549	16	14	16	17
Attained a bachelor's degree (for cohorts with four to six years of postgraduation data)	80,155	13	16	22	24

Outcome	Population size	Concentrators	Explorers	Samplers	Nonparticipants
Credential attainment—high school graduates who ever enrolled in a four-year college					
Attained a bachelor's degree (for cohorts with four to six years of postgraduation data)	82,767	37	40	44	47
Employment					
Employed in year 1—not currently enrolled in college	179,745	77	75	72	65
Employed in year 1—currently enrolled in college	170,446	88	86	85	83
Employed in year 2—not currently enrolled in college	157,992	75	74	70	64
Employed in year 2—currently enrolled in college	132,274	90	89	88	87
Employed in year 3—not currently enrolled in college	136,874	72	70	65	59
Employed in year 3—currently enrolled in college	94,982	90	89	88	87
Employed in year 4—not currently enrolled in college	110,229	71	67	62	57
Employed in year 4—currently enrolled in college	63,617	89	88	87	87
Employed in year 5—not currently enrolled in college	91,061	72	70	66	63
Employed in year 5—currently enrolled in college	24,744	88	87	87	86
Earnings					
Earnings in year 1—not currently enrolled in college	131,697	8,623.80	7,670.00	6,510.00	6,052.30
Earnings in year 1—currently enrolled in college	146,551	6,460.50	5,936.00	5,401.00	5,164.80
Earnings in year 2—not currently enrolled in college	113,673	12,250.30	10,842.00	9,588.00	8,725.80
Earnings in year 2—currently enrolled in college	117,369	8,743.50	8,028.30	7,457.30	7,161.90
Earnings in year 3—not currently enrolled in college	93,187	15,606.80	13,612.90	12,250.10	11,452.30
Earnings in year 3—currently enrolled in college	84,254	10,127.70	9,456.00	8,838.10	8,292.70
Earnings in year 4—not currently enrolled in college	72,511	17,969.80	15,904.50	15,005.50	14,053.40
Earnings in year 4—currently enrolled in college	55,930	11,254.70	10,800.80	10,061.80	9,571.20
Earnings in year 5—not currently enrolled in college	62,545	20,323.30	18,748.00	18,675.30	18,048.90
Earnings in year 5—currently enrolled in college	21,645	13,317.30	12,589.00	12,316.50	11,978.40

Note: Concentrators completed at least 150 hours of instruction in career and technical education courses in the same career field. Explorers completed at least 150 hours of instruction in career and technical education courses in multiple career fields but fewer than 150 hours in a single field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses.

a. Meaningful difference from nonparticipants (that is, a group difference of at least 5 percentage points or, for annual earnings, at least 5 percent of nonparticipants' earnings).

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D4. Demographic characteristics of Minnesota career and technical education concentrators and samplers and nonparticipants before and after the propensity score matching procedure, 2012/13–2017/18 cohorts

	All graduates			Graduates included in matching			Matched graduates			Matched graduates included in analysis		
Characteristic	Concentrators (N = 152,789[a])	Samplers and nonparticipants (N = 146,331[b])	Standardized difference	Concentrators (n = 134,256[c])	Samplers and nonparticipants (N = 120,031[c])	Standardized difference	Concentrators (n = 94,656)	Samplers and nonparticipants (n = 94,656)	Standardized difference	Concentrators (n = 85,889[d])	Samplers and nonparticipants (n = 85,889[d])	Standardized difference
Female	0.448	0.561	–0.23	0.448	0.574	–0.25	0.483	0.471	0.03	0.488	0.473	0.03
White	0.805	0.737	0.16	0.825	0.778	0.12	0.837	0.842	–0.02	0.841	0.847	–0.02
Eligible for the national school lunch program	0.369	0.351	0.04	0.350	0.315	0.07	0.282	0.279	0.01	0.268	0.264	0.01
English learner students	0.044	0.068	–0.11	0.031	0.038	–0.04	0.029	0.027	0.01	0.027	0.026	0.01
Received special education services	0.150	0.117	0.10	0.116	0.090	0.08	0.066	0.060	0.02	0.060	0.053	0.03
Proficient in math	0.624	0.750	–0.27	0.632	0.760	–0.28	0.673	0.681	–0.02	0.687	0.696	–0.02
Proficient in reading	0.578	0.701	–0.26	0.582	0.705	–0.26	0.724	0.730	–0.01	0.733	0.741	–0.02

Note: Concentrators completed at least 150 hours of instruction in career and technical education courses in the same career field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses.

a. The sample size is 135,568 for proficient in math and 136,567 for proficient in reading due to missing data on these characteristics. This is 89 percent of all concentrators for both subjects.

b. The sample size is 120,884 for proficient in math and 122,161 for proficient in reading due to missing data on these characteristics. This is 83 percent of all samplers and nonparticipants for both subjects.

c. Graduates who had missing data on any of the graduate characteristics variables were not included in the matching.

d. Represents the sample size for the analysis of college enrollment outcomes. The sample size for each group was smaller than that of the matched sample because matched graduates with missing data on any of the school covariates were excluded from the analysis. See table B2 in appendix B for the sample size for the analysis of each outcome.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D5. Demographic characteristics of Minnesota career and technical education explorers and samplers and nonparticipants before and after the propensity score matching procedure, 2012/13–2017/18 cohorts

	All graduates			Graduates included in matching			Matched graduates			Matched graduates included in analysis		
Characteristic	Explorers (*N* = 51,071[a])	Samplers and nonparticipants (*N* = 146,331[b])	Standardized difference	Explorers (*n* = 43,687[c])	Samplers and nonparticipants (*n* = 120,031[c])	Standardized difference	Explorers (*n* = 36,132)	Samplers and nonparticipants (*n* = 36,132)	Standardized difference	Explorers (*n* = 32,405[d])	Samplers and nonparticipants (*n* = 32,405[d])	Standardized difference
Female	0.477	0.561	–0.17	0.482	0.574	–0.19	0.492	0.489	0.01	0.493	0.488	0.01
White	0.728	0.737	–0.02	0.761	0.778	–0.04	0.777	0.781	–0.01	0.788	0.791	–0.01
Eligible for the national school lunch program	0.404	0.351	0.11	0.374	0.315	0.12	0.332	0.332	0.00	0.311	0.311	0.00
English learner students	0.082	0.068	0.05	0.054	0.038	0.08	0.049	0.046	0.01	0.044	0.042	0.01
Received special education services	0.139	0.117	0.07	0.114	0.090	0.08	0.093	0.074	0.07	0.085	0.066	0.07
Proficient in math	0.654	0.750	–0.21	0.664	0.760	–0.22	0.663	0.665	0.00	0.685	0.688	–0.01
Proficient in reading	0.609	0.701	–0.20	0.613	0.705	–0.20	0.712	0.712	0.00	0.729	0.730	0.00

Note: Explorers completed at least 150 hours of instruction in career and technical education courses in multiple career fields but fewer than 150 hours in a single field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses.

a. The sample size is 44,101 for proficient in math and 44,645 for proficient in reading due to missing data on these characteristics. This is 86 percent of all explorers for math and 87 percent for reading.

b. The sample size is 120,884 for proficient in math and 122,161 for proficient in reading due to missing data on these characteristics. This is 83 percent of all samplers and nonparticipants for both subjects.

c. Graduates who had missing data on any of the graduate characteristics variables were not included in the matching.

d. Represents the sample size for the analysis of all college enrollment outcomes. The sample size for each group was smaller than that of the matched sample because matched graduates with missing data on any of the school covariates were excluded from the analysis. See table B2 in appendix B for the sample size for the analysis for each outcome.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D6. Results from logistic regression models predicting enrollment in any type of college, enrollment in a two-year college, and enrollment in a four-year college within one year of high school graduation for Minnesota career and technical education concentrators and similar samplers and nonparticipants, 2012/13–2017/18 cohorts

	Enrolled in any type of college within one year (*n* = 171,778)		Enrolled in a two-year college within one year (*n* = 171,778)		Enrolled in a four-year college within one year (*n* = 171,778)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Concentrator	–0.401***	0.039	0.435***	0.039	–0.676***	0.043
2013/14 cohort	0.069	0.054	0.084	0.069	0.000	0.060
2014/15 cohort	0.144*	0.067	0.064	0.058	0.096	0.066
2015/16 cohort	0.186**	0.069	0.143*	0.064	0.069	0.066
2016/17 cohort	0.342***	0.063	0.005	0.059	0.301***	0.061
2017/18 cohort	0.480***	0.067	0.081	0.062	0.355***	0.060
Female	0.336***	0.035	–0.089**	0.029	0.318***	0.034
White	–0.262***	0.048	–0.253***	0.039	0.010	0.052
Eligible for the national school lunch program	–0.641***	0.032	0.273***	0.031	–0.810***	0.038
English learner student	0.078	0.059	0.164*	0.080	–0.173	0.090
Received special education services	–0.711***	0.045	–0.128*	0.051	–0.939***	0.051
Proficient in math	0.553***	0.030	–0.645***	0.035	1.001***	0.031
Proficient in reading	0.385***	0.036	–0.457***	0.034	0.749***	0.038
School characteristics						
School size	0.000	0.000	0.000	0.000	0.000	0.000
Percentage racial/ethnic minority	0.653	0.355	–1.279***	0.348	1.435***	0.345
Percentage eligible for the national school lunch program	–0.022	0.391	2.118***	0.449	–1.590***	0.436
Percentage English learner students	1.507*	0.654	–0.040	0.685	2.459***	0.620
Percentage that received special education services	–1.313	0.912	–2.730*	1.062	0.735	0.977
Percentage proficient in English language arts	0.009**	0.003	0.003	0.003	0.008**	0.003
Percentage proficient in math	0.009**	0.003	0.000	0.003	0.009**	0.003
Suburban vs. urban	–0.024	0.092	0.270*	0.111	–0.153	0.116
Town vs. urban	0.072	0.113	0.232	0.136	–0.040	0.135
Rural vs. urban	0.113	0.112	0.214	0.137	0.007	0.135
Constant	–0.446	0.332	–1.080**	0.362	–1.869***	0.342
	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error
Concentrators	0.731	0.004	0.232	0.005	0.448	0.006
Samplers and nonparticipants	0.803	0.007	0.164	0.007	0.614	0.010

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

Note: Concentrators completed at least 150 hours of instruction in career and technical education courses in the same career field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses. The reference group for cohort terms is the 2012/13 cohort. Coefficient estimates are log odds ratios.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D7. Results from logistic regression models predicting enrollment in any type of college, enrollment in a two-year college, and enrollment in a four-year college within the first six years after high school graduation for Minnesota career and technical education concentrators and similar samplers and nonparticipants, 2012/13–2017/18 cohorts

	Enrolled in any type of college any year (*n* = 171,778)		Enrolled in a two-year college in any year (*n* = 171,778)		Enrolled in a four-year college in any year (*n* = 171,778)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Concentrator	–0.546***	0.052	0.159***	0.038	–0.782***	0.044
2013/14 cohort	0.006	0.059	0.160**	0.058	–0.003	0.070
2014/15 cohort	–0.104	0.089	0.099	0.064	0.074	0.069
2015/16 cohort	–0.219**	0.069	0.130*	0.065	–0.136*	0.066
2016/17 cohort	–0.096	0.066	0.193*	0.089	0.029	0.069
2017/18 cohort	–0.302***	0.070	0.164	0.096	–0.091	0.065
Female	0.715***	0.036	0.190***	0.031	0.520***	0.032
White	–0.337***	0.054	–0.299***	0.039	–0.075	0.051
Eligible for the national school lunch program	–0.787***	0.041	0.131***	0.033	–0.838***	0.033
English learner student	0.014	0.082	0.264**	0.101	–0.196**	0.071
Received special education services	–0.879***	0.044	–0.222***	0.053	–1.015***	0.053
Proficient in math	0.885***	0.036	–0.209***	0.044	1.078***	0.031
Proficient in reading	0.597***	0.039	–0.085*	0.037	0.813***	0.032
School characteristics						
School size	0.000	0.000	0.000	0.000	0.000	0.000
Percentage racial/ethnic minority	0.755*	0.334	–2.076***	0.551	1.245**	0.361
Percentage eligible for the national school lunch program	0.295	0.418	3.388***	0.686	–1.507**	0.442
Percentage English learner students	1.362*	0.669	–0.892	0.980	2.555***	0.637
Percentage that received special education services	–0.497	0.805	–4.009*	1.587	0.096	1.007
Percentage proficient in English language arts	0.010**	0.003	0.004	0.004	0.003	0.003
Percentage proficient in math	0.016***	0.003	–0.002	0.004	0.013***	0.003
Suburban vs. urban	0.110	0.105	0.356*	0.155	–0.043	0.121
Town vs. urban	0.224	0.121	0.352	0.217	0.096	0.144
Rural vs. urban	0.282*	0.130	0.347	0.225	0.169	0.144
Constant	0.060	0.331	–0.326	0.527	–0.963**	0.360
	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error
Concentrators	0.893	0.003	0.486	0.010	0.597	0.007
Samplers and nonparticipants	0.935	0.004	0.447	0.014	0.764	0.009

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

Note: Concentrators completed at least 150 hours of instruction in career and technical education courses in the same career field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses. The reference group for cohort terms is the 2012/13 cohort. Coefficient estimates are log odds ratios.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D8. Results from regression models predicting credits earned within one year of high school graduation, credits earned within three years of high school graduation, and certificate attainment for Minnesota career and technical education concentrators and similar samplers and nonparticipants, 2012/13–2017/18 cohorts

	Credits earned within one year of high school graduation (*n* = 171,778)		Credits earned within three years of high school graduation (*n* = 114,126[a])		Attained a certificate (*n* = 171,778)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Concentrator	–1.393***	0.183	–4.312***	0.563	0.662***	0.075
2013/14 cohort	–0.042	0.221	7.678***	0.629	–0.294**	0.091
2014/15 cohort	0.711**	0.260	16.020***	0.973	–0.667***	0.083
2015/16 cohort	8.709***	0.560	16.112***	1.063	–0.651***	0.104
2016/17 cohort	7.520***	0.338	na	na	–1.486***	0.125
2017/18 cohort	0.785**	0.284	na	na	–2.136***	0.213
Female	1.073***	0.238	4.149***	0.639	0.351***	0.064
White	–1.373***	0.171	–3.797***	0.724	0.273***	0.070
Eligible for the national school lunch program	–1.285***	0.138	–5.193***	0.571	–0.045	0.060
English learner student	–1.211***	0.342	–0.858	1.474	0.225	0.128
Received special education services	–2.161***	0.214	–7.476***	0.570	–0.046	0.093
Proficient in math	2.223***	0.164	6.249***	0.583	–0.420***	0.059
Proficient in reading	1.450***	0.147	6.587***	0.545	–0.278***	0.052
School characteristics						
School size	0.000	0.000	0.001	0.001	0.000***	0.000
Percentage racial/ethnic minority	–4.220**	1.415	–13.043**	4.634	–1.945***	0.484
Percentage eligible for the national school lunch program	6.409***	1.515	12.674**	4.774	1.163*	0.477
Percentage English learner students	7.273*	3.556	30.387**	10.636	2.741**	0.935
Percentage that received special education services	–2.989	4.174	–1.588	12.883	–0.984	1.066
Percentage proficient in English language arts	0.019	0.014	0.054	0.043	–0.002	0.004
Percentage proficient in math	0.024	0.014	0.076*	0.038	–0.004	0.004
Suburban vs. urban	0.365	0.485	1.314	1.267	0.131	0.191
Town vs. urban	1.038	0.559	1.328	1.767	0.060	0.251
Rural vs. urban	0.651	0.583	0.870	1.847	0.101	0.255
Constant	2.414	1.344	5.396	4.617	–2.127***	0.495
	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error
Concentrators	9.495	0.097	28.531	0.283	0.037	0.002
Samplers and nonparticipants	10.889	0.189	32.843	0.569	0.020	0.002

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

na is not applicable.

Note: Concentrators completed at least 150 hours of instruction in career and technical education courses in the same career field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses. Certificate attainment rates are based on all years of data available for each cohort of high school graduates. The reference group for cohort terms is the 2012/13 cohort. Linear regression was used for the credits earned models. Logistic regression was used for the certificate attainment model, so coefficient estimates for this model are log odds ratios.

a. Limited to graduates in the 2012/13–2015/16 cohorts.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D9. Results from regression models predicting attainment of an associate's degree, attainment of an associate's or bachelor's degree, and attainment of a bachelor's degree for Minnesota career and technical education concentrators and similar samplers and nonparticipants, 2012/13–2017/18 cohorts

	Attained an associate's degree (n = 114,126[a])		Attained an associate's or a bachelor's degree (n = 114,126[a])		Attained a bachelor's degree (n = 85,076[b])	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Concentrator	0.141*	0.059	–0.441***	0.043	–0.730***	0.053
2013/14 cohort	–0.133	0.085	–0.354***	0.050	–0.343***	0.070
2014/15 cohort	–0.380***	0.096	–1.879***	0.106	–2.334***	0.137
2015/16 cohort	–0.748***	0.111	–3.091***	0.138	na	na
Female	0.287***	0.062	0.479***	0.052	0.558***	0.064
White	–0.132*	0.065	0.045	0.060	0.148*	0.072
Eligible for the national school lunch program	–0.038	0.061	–0.652***	0.049	–0.895***	0.061
English learner student	0.015	0.187	0.101	0.152	–0.037	0.223
Received special education services	–0.365***	0.103	–0.818***	0.085	–1.071***	0.107
Proficient in math	–0.150**	0.055	0.612***	0.043	0.978***	0.058
Proficient in reading	0.082	0.065	0.620***	0.053	0.897***	0.075
School characteristics						
School size	0.000	0.000	0.000	0.000	0.000	0.000
Percentage racial/ethnic minority	–2.286***	0.452	–0.513	0.387	0.771	0.449
Percentage eligible for the national school lunch program	3.240***	0.520	0.806	0.454	–0.869	0.535
Percentage English learner students	0.164	1.024	0.947	0.942	1.689	1.133
Percentage that received special education services	–1.265	1.210	1.405	1.166	1.810	1.345
Percentage proficient in English language arts	–0.001	0.005	0.012**	0.004	0.014**	0.005
Percentage proficient in math	0.004	0.004	0.007	0.004	0.007	0.005
Suburban vs. urban	0.273	0.148	–0.063	0.087	–0.149	0.093
Town vs. urban	0.520**	0.168	0.177	0.129	0.131	0.134
Rural vs. urban	0.563**	0.175	0.210	0.133	0.118	0.139
Constant	–2.894	0.434	–2.178***	0.345	–3.105	0.435
	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error
Concentrators	0.082	0.003	0.187	0.005	0.159	0.005
Samplers and nonparticipants	0.072	0.004	0.263	0.009	0.281	0.010

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

na is not applicable.

Note: Concentrators completed at least 150 hours of instruction in career and technical education courses in the same career field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses. The reference group for cohort terms is the 2012/13 cohort. Coefficient estimates are log odds ratios.

a. Limited to graduates in the 2012/13–2015/16 cohorts.

b. Limited to graduates from the 2012/13–2014/15 cohorts.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D10. Results from logistic regression models predicting employment within the first five years after high school graduation for Minnesota career and technical education concentrators and similar samplers and nonparticipants, 2012/13–2017/18 cohorts

	Employment during year 1 after high school graduation (*n* = 171,778)		Employment during year 2 after high school graduation (*n* = 142,726)		Employment during year 3 after high school graduation (*n* = 114,126)		Employment during year 4 after high school graduation (*n* = 85,076)		Employment during year 5 after high school graduation (*n* = 55,438)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics										
Concentrator	1.144**	0.054	0.153**	0.056	0.225***	0.053	0.209**	0.061	0.218*	0.099
2013/14 cohort	0.873	0.087	0.005	0.078	–0.108	0.080	–0.113	0.071	–0.307***	0.068
2014/15 cohort	0.968	0.112	0.028	0.081	–0.019	0.070	–0.269**	0.090	na	na
2015/16 cohort	0.878	0.085	–0.074	0.080	–0.413***	0.078	na	na	na	na
2016/17 cohort	1.034	0.085	–0.297	0.070	na	na	na	na	na	na
2017/18 cohort	0.628	0.046	na	na	na	na	na	na	na	na
Female	1.193***	0.056	0.198***	0.042	0.159**	0.052	0.105*	0.051	0.106	0.075
White	1.410***	0.096	0.307***	0.058	0.188**	0.056	0.058	0.050	–0.023	0.070
Eligible for the national school lunch program	1.091*	0.044	0.098*	0.043	0.187***	0.045	0.161**	0.050	0.197**	0.065
English learner student	0.652***	0.052	–0.537***	0.084	–0.541***	0.130	–0.316*	0.154	–0.540***	0.134
Received special education services	0.688***	0.035	–0.394***	0.051	–0.211**	0.063	–0.115	0.074	–0.126	0.080
Proficient in math	0.937	0.040	–0.052	0.044	–0.142**	0.053	–0.206***	0.054	–0.242***	0.054
Proficient in reading	0.940	0.037	–0.155***	0.043	–0.243***	0.052	–0.122*	0.054	–0.136*	0.065
School characteristics										
School size	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Percentage racial/ethnic minority	0.712	0.291	0.374	0.400	–0.041	0.409	–0.553	0.449	–0.736	0.552
Percentage eligible for the national school lunch program	1.097	0.481	–0.029	0.449	0.446	0.471	0.782	0.532	0.641	0.630
Percentage English learner students	1.298	0.893	0.350	0.868	–0.036	0.908	0.244	0.816	1.711	1.380
Percentage that received special education services	3.500	3.280	1.155	1.074	1.328	1.234	–0.037	1.188	0.210	1.390
Percentage proficient in English language arts	0.995	0.003	0.000	0.003	0.004	0.004	–0.006	0.005	–0.001	0.005
Percentage proficient in math	0.998	0.003	0.000	0.004	–0.005	0.004	0.003	0.005	0.000	0.005
Suburban vs. urban	1.229*	0.126	0.232	0.144	0.190	0.135	0.317*	0.130	0.557**	0.193
Town vs. urban	1.486**	0.182	0.362*	0.146	0.320*	0.135	0.310	0.159	0.443**	0.162
Rural vs. urban	1.451**	0.183	0.321*	0.151	0.188	0.139	0.190	0.153	0.368*	0.178
Constant	4.036	1.494	0.985**	0.365	0.806	0.399	1.141**	0.420	1.001	0.517

Predictor/covariate	Employment during year 1 after high school graduation (*n* = 171,778)		Employment during year 2 after high school graduation (*n* = 142,726)		Employment during year 3 after high school graduation (*n* = 114,126)		Employment during year 4 after high school graduation (*n* = 85,076)		Employment during year 5 after high school graduation (*n* = 55,438)	
	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error
Concentrators	0.841	0.004	0.840	0.004	0.807	0.004	0.781	0.005	0.772	0.007
Samplers and nonparticipants	0.823	0.007	0.819	0.008	0.769	0.010	0.743	0.012	0.731	0.017

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.
na is not applicable.
Note: Concentrators completed at least 150 hours of instruction in career and technical education courses in the same career field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses. The reference group for cohort terms is the 2012/13 cohort. The sample size decreased from year to year because the number of cohorts that could be used in the analysis decreased each year. Coefficient estimates are log odds ratios. Employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses.
Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D11. Results from regression models predicting annual earnings within the first five year after high school graduation for Minnesota career and technical education concentrators and similar samplers and nonparticipants, 2012/13–2017/18 cohorts

	Annual earnings during year 1 after high school graduation (*n* = 171,778)		Annual earnings during year 2 after high school graduation (*n* = 142,726)		Annual earnings during year 3 after high school graduation (*n* = 114,126)		Annual earnings during year 4 after high school graduation (*n* = 85,076)		Annual earnings during year 5 after high school graduation (*n* = 55,438)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics										
Concentrator	1,351.75***	88.62	1,817.06***	144.97	2,409.53***	182.48	2,323.98***	263.34	1,536.42**	475.55
2013/14 cohort	74.56	128.59	316.46	171.94	277.30	239.53	48.55	312.69	–9,467.21***	387.99
2014/15 cohort	476.30***	130.39	660.73***	186.61	248.31	228.61	–5,954.55***	318.61	na	na
2015/16 cohort	760.85***	159.24	791.99***	211.70	–4,333.81***	235.97	na	na	na	na
2016/17 cohort	965.90***	154.06	–3,199.09	208.28	na	na	na	na	na	na
2017/18 cohort	–2,050.30	159.43	na	na	na	na	na	na	na	na
Female	–692.54***	92.84	–884.88***	131.98	–1,266.83***	202.22	–1,467.74***	250.42	–1,272.76**	440.24
White	623.47***	127.46	939.77***	222.12	827.01**	253.14	472.34	378.02	317.31	566.83
Eligible for the national school lunch program	1,452.39***	87.97	1,800.53***	126.79	1,787.07***	163.45	1,269.08***	260.76	–733.85*	338.94
English learner student	–340.62	244.34	–449.34	377.34	–759.35	509.82	–520.08	579.07	–1,705.56*	770.59
Received special education services	–110.68	137.10	–317.98	199.72	–401.03	247.15	–675.37*	291.36	–1,776.84***	356.96
Proficient in math	–954.06***	77.81	–1,215.32***	119.83	–1,514.24***	156.31	–1,377.71***	177.12	–38.17	282.93
Proficient in reading	–1,113.01***	81.73	–1,468.85***	130.83	–1,938.93***	198.02	–1,693.85***	250.34	–338.84	360.40
School characteristics										
School size	0.03	0.14	0.11	0.24	0.20	0.27	0.30	0.34	0.62	0.43
Percentage racial/ethnic minority	–3,917.56***	794.66	–4,576.72***	1,205.54	–5,768.13***	1,425.43	–6,316.60**	1,915.23	–1,696.44	2,546.50
Percentage eligible for the national school lunch program	2,585.50*	933.37	4,106.80***	1,344.98	5,932.52**	1,870.20	5,718.22*	2,471.82	–38.06	2,887.82
Percentage English learner students	–1,117.52	1,464.95	–686.23	2,201.08	–161.76	2,737.67	2,171.27	3,755.50	9,414.42	5,912.75
Percentage that received special education services	1,671.21	2,008.04	–2,680.60	2,912.54	–5,449.55	4,003.09	–3,414.93	5,108.93	1,348.43	6,514.38
Percentage proficient in English language arts	–20.08***	5.82	–24.32*	9.56	–33.20*	13.09	–42.53*	19.40	–23.32	34.21
Percentage proficient in math	–21.93***	5.51	–24.29***	8.45	–24.20*	11.02	–15.94	18.28	–4.00	27.96
Suburban vs. urban	408.74	240.24	992.01*	389.63	1,407.32**	415.67	2,310.64***	540.59	3,205.14***	761.16
Town vs. urban	561.06*	261.89	1,217.13***	389.45	1,775.41***	447.27	2,656.61***	576.17	4,161.82***	791.80
Rural vs. urban	192.10	256.93	639.90	370.74	1,184.22**	442.86	1,748.61**	625.83	3,961.68***	911.60
Constant	7,244.20	708.25	9,788.76***	1,051.63	12,574.63	1,440.56	14,526.07	2,014.55	16,265.74***	2,569.54

Predictor/covariate	Annual earnings during year 1 after high school graduation (*n* = 171,778)		Annual earnings during year 2 after high school graduation (*n* = 142,726)		Annual earnings during year 3 after high school graduation (*n* = 114,126)		Annual earnings during year 4 after high school graduation (*n* = 85,076)		Annual earnings during year 5 after high school graduation (*n* = 55,438)	
	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error
Concentrators	5,651.31	71.27	8,136.69	107.14	9,847.55	128.28	11,204.86	157.19	14,261.10	169.12
Samplers and nonparticipants	4,299.56	82.39	6,319.63	139.50	7,438.02	171.39	8,880.88	255.26	12,724.68	428.83

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

na is not applicable.

Note: Concentrators completed at least 150 hours of instruction in career and technical education courses in the same career field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses. The reference group for cohort terms is the 2012/13 cohort. The sample size decreased from year to year because the number of cohorts that could be used in the analysis decreased each year. Employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses. Earnings for graduates designated as unemployed are $0. Annual earnings were converted to 2013 dollar values using inflation calculations based on the Consumer Price Index for All Urban Consumers, Midwest Region.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D12. Results from logistic regression models predicting enrollment in any type of college, enrollment in a two-year college, and enrollment in a four-year college within one year of high school graduation for Minnesota career and technical education explorers and similar samplers and nonparticipants, 2012/13–2017/18 cohorts

	Enrolled in any type of college within one year (*n* = 64,810)		Enrolled in a two-year college within one year (*n* = 64,810)		Enrolled in a four-year college within one year (*n* = 64,810)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Explorer	–0.234***	0.037	0.264***	0.037	–0.391***	0.039
2013/14 cohort	–0.013	0.066	0.083	0.063	–0.052	0.062
2014/15 cohort	0.113	0.081	0.135	0.070	0.038	0.076
2015/16 cohort	0.189*	0.083	0.231**	0.072	0.015	0.075
2016/17 cohort	0.270**	0.079	0.054	0.066	0.219**	0.073
2017/18 cohort	0.485***	0.089	0.133	0.069	0.346***	0.074
Female	0.318***	0.035	–0.111**	0.036	0.322***	0.035
White	–0.308***	0.046	–0.299***	0.053	–0.011	0.049
Eligible for the national school lunch program	–0.594***	0.034	0.345***	0.041	–0.801***	0.036
English learner student	0.121	0.071	0.098	0.092	–0.030	0.108
Received special education services	–0.696***	0.050	–0.046	0.060	–0.980***	0.065
Proficient in math	0.542***	0.035	–0.681***	0.044	0.993***	0.035
Proficient in reading	0.421***	0.043	–0.436***	0.039	0.767***	0.040
School characteristics						
School size	0.000	0.000	0.000	0.000	0.000	0.000
Percentage racial/ethnic minority	0.897*	0.374	–1.110**	0.374	1.467***	0.321
Percentage eligible for the national school lunch program	–0.090	0.439	1.889***	0.413	–1.309**	0.414
Percentage English learner students	0.915	0.750	–0.599	0.653	2.119***	0.555
Percentage that received special education services	–1.594	0.832	–3.368***	0.858	0.765	0.910
Percentage proficient in English language arts	0.006	0.003	0.005	0.003	0.004	0.003
Percentage proficient in math	0.014***	0.003	–0.001	0.003	0.014***	0.003
Suburban vs. urban	–0.001	0.076	0.057	0.109	–0.009	0.091
Town vs. urban	0.198	0.106	–0.001	0.149	0.231	0.132
Rural vs. urban	0.239	0.126	–0.071	0.145	0.291*	0.136
Constant	–0.504	0.351	–0.874*	0.355	–2.116***	0.320
	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error
Explorers	0.747	0.004	0.205	0.006	0.493	0.007
Samplers and nonparticipants	0.789	0.007	0.166	0.006	0.590	0.009

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

Note: Explorers completed at least 150 hours of instruction in career and technical education courses in multiple career fields but fewer than 150 hours in a single field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses. The reference group for cohort terms is the 2012/13 cohort. The sample size decreased from year to year because the number of cohorts that could be used in the analysis decreased each year. Coefficient estimates are log odds ratios.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D13. Results from logistic regression models predicting enrollment in any type of college, enrollment in a two-year college, and enrollment in a four-year college within six years after high school graduation for Minnesota career and technical education explorers and similar samplers and nonparticipants, 2012/13–2017/18 cohorts

	Enrolled in any type of college in any year (*n* = 64,810)		Enrolled in a two-year college in any year (*n* = 64,810)		Enrolled in a four-year college in any year (*n* = 64,810)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Explorer	–0.293***	0.041	0.100**	0.031	–0.429***	0.040
2013/14 cohort	0.097	0.081	0.223***	0.055	–0.042	0.073
2014/15 cohort	–0.023	0.093	0.167**	0.063	0.000	0.077
2015/16 cohort	–0.135	0.097	0.198**	0.074	–0.209*	0.085
2016/17 cohort	–0.100	0.092	0.285**	0.092	–0.057	0.078
2017/18 cohort	–0.235*	0.093	0.199*	0.098	–0.073	0.088
Female	0.703***	0.045	0.163***	0.031	0.549***	0.039
White	–0.436***	0.064	–0.359***	0.037	–0.051	0.058
Eligible for the national school lunch program	–0.745***	0.046	0.162***	0.037	–0.841***	0.034
English learner student	0.061	0.102	0.161	0.103	–0.009	0.082
Received special education services	–0.963***	0.061	–0.199**	0.060	–1.077***	0.059
Proficient in math	0.900***	0.042	–0.265***	0.043	1.135***	0.034
Proficient in reading	0.618***	0.044	–0.066	0.037	0.800***	0.037
School characteristics						
School size	0.000	0.000	0.000	0.000	0.000	0.000
Percentage racial/ethnic minority	1.126**	0.364	–1.892***	0.530	1.044**	0.392
Percentage eligible for the national school lunch program	0.207	0.502	3.311***	0.674	–1.192*	0.466
Percentage English learner students	0.687	0.824	–1.127	0.775	2.811***	0.624
Percentage that received special education services	0.363	0.871	–4.736**	1.445	0.763	0.965
Percentage proficient in English language arts	0.009*	0.003	0.006	0.004	0.001	0.003
Percentage proficient in math	0.022***	0.003	–0.003	0.004	0.018***	0.003
Suburban vs. urban	0.136	0.084	0.217	0.129	0.128	0.108
Town vs. urban	0.390**	0.114	0.231	0.201	0.332*	0.162
Rural vs. urban	0.444**	0.128	0.184	0.197	0.400*	0.169
Constant	–0.403	0.363	–0.143	0.519	–1.430***	0.385
	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error
Explorers	0.908	0.003	0.468	0.010	0.652	0.007
Samplers and nonparticipants	0.929	0.003	0.443	0.012	0.742	0.009

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

Note: Explorers completed at least 150 hours of instruction in career and technical education courses in multiple career fields but fewer than 150 hours in a single field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses. The reference group for cohort terms is the 2012/13 cohort. Coefficient estimates are log odds ratios.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D14. Results from regression models predicting credits earned within one year of high school graduation, credits earned within three years of high school graduation, and certificate attainment for Minnesota career and technical education explorers and similar samplers and nonparticipants, 2012/13–2017/18

	Credits earned within one year of high school graduation (*n* = 64,810)		Credits earned within three years of high school graduation (*n* = 43,362[a])		Attained a certificate (*n* = 64,810)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Explorer	–1.055***	0.174	–3.142***	0.608	0.324**	0.096
2014 cohort	–0.034	0.264	8.353***	0.765	–0.179	0.125
2015 cohort	0.593	0.320	16.030***	0.952	–0.676***	0.127
2016 cohort	8.390***	0.521	15.968***	1.086	–0.746***	0.129
2017 cohort	7.419***	0.368	na	na	–1.401***	0.185
2018 cohort	0.527	0.293	na	na	–1.880***	0.245
Female	1.146***	0.212	4.305***	0.623	0.600***	0.088
White	–1.415***	0.188	–3.502***	0.647	0.198*	0.099
Eligible for the national school lunch program	–1.006***	0.165	–4.152***	0.556	0.053	0.073
English learner student	–0.870**	0.326	–1.058	1.843	0.543**	0.185
Received special education services	–2.183***	0.198	–7.742***	0.601	0.031	0.116
Proficient in math	2.300***	0.195	6.254***	0.669	–0.446***	0.087
Proficient in reading	1.697***	0.192	7.598***	0.588	–0.321***	0.078
School characteristics						
School size	0.000	0.000	0.001	0.001	0.000**	0.000
Percentage racial/ethnic minority	–3.183*	1.523	–9.228*	4.344	–1.133	0.588
Percentage eligible for the national school lunch program	5.548***	1.562	14.483**	5.155	0.767	0.604
Percentage English learner students	6.617	3.434	22.461*	10.029	1.998	1.020
Percentage that received special education services	–5.445	3.712	–9.441	11.847	–1.701	1.483
Percentage proficient in English language arts	0.010	0.016	0.013	0.049	0.003	0.006
Percentage proficient in math	0.040*	0.016	0.137**	0.045	0.000	0.005
Suburban vs. urban	0.327	0.464	0.797	1.316	0.129	0.131
Town vs. urban	1.227*	0.531	2.799	1.655	0.207	0.186
Rural vs. urban	0.957	0.538	2.116	1.617	0.241	0.186
Constant	1.812	1.458	1.809	4.696	–2.683***	0.555
	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error
Explorers	9.561	0.109	29.038	0.354	0.031	0.002
Samplers and nonparticipants	10.616	0.189	32.180	0.631	0.022	0.002

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

na is not applicable.

Note: Explorers completed at least 150 hours of instruction in career and technical education courses in multiple career fields but fewer than 150 hours in a single field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses. Certificate attainment rates are based on all years of data available for each cohort of high school graduates. Data represent graduates who enrolled in a Minnesota public college. The reference group for cohort terms is the 2012/13 cohort. Linear regression was used for the credits earned models. Logistic regression was used for the certificate attainment model, so coefficient estimates for this model are log odds ratios.

a. The analysis of credits earned within three years was restricted to graduates in the 2012/13–2015/16 cohorts.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D15. Results from logistic regression models predicting attainment of an associate's degree, an associate's or bachelor's degree, or a bachelor's degree for Minnesota career and technical education explorers and similar samplers and nonparticipants, 2012/13–2017/18 cohorts

	Attained an associate's degree (n = 43,362[a])		Attained an associate's or bachelor's degree (n = 43,362[a])		Attained a bachelor's degree (n = 32,770[b])	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics						
Explorer	0.060	0.059	–0.289	0.048	–0.450***	0.059
2013/14 cohort	0.013	0.091	–0.381	0.058	–0.413***	0.071
2014/15 cohort	–0.282**	0.101	–1.985**	0.102	–2.424***	0.120
2015/16 cohort	–0.575***	0.113	–3.138***	0.124	na	na
Female	0.325***	0.066	0.605***	0.053	0.657***	0.067
White	–0.142	0.091	–0.003	0.083	0.083	0.099
Eligible for the national school lunch program	–0.022	0.074	–0.697	0.057	–0.923***	0.065
English learner student	0.153	0.186	0.198	0.168	–0.004	0.287
Received special education services	–0.415***	0.118	–0.900***	0.085	–1.154***	0.117
Proficient in math	–0.160*	0.072	0.629*	0.056	0.982***	0.070
Proficient in reading	0.010	0.082	0.584	0.068	0.861***	0.080
School characteristics						
School size	0.000	0.000	0.000	0.000	0.000	0.000
Percentage racial/ethnic minority	–2.790***	0.450	–0.933***	0.396	0.536	0.424
Percentage eligible for the national school lunch program	3.426***	0.562	1.153***	0.518	–0.557	0.563
Percentage English learner students	0.767	0.844	1.030	0.929	1.134	0.979
Percentage that received special education services	–1.733	1.068	0.390	1.059	0.631	1.383
Percentage proficient in English language arts	0.003	0.005	0.011	0.004	0.008	0.005
Percentage proficient in math	0.007	0.004	0.009	0.004	0.009	0.005
Suburban vs. urban	0.077	0.132	–0.137	0.088	–0.174	0.106
Town vs. urban	0.249	0.183	0.179	0.131	0.249	0.135
Rural vs. urban	0.296	0.188	0.214	0.122	0.256	0.133
Constant	–3.048***	0.449	–2.079***	0.392	–2.741***	0.482
	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error
Explorers	0.074	0.003	0.194	0.005	0.180	0.006
Samplers and nonparticipants	0.070	0.004	0.244	0.009	0.256	0.010

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

na is not applicable.

Note: Explorers completed at least 150 hours of instruction in career and technical education courses in multiple career fields but fewer than 150 hours in a single field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses. Data represent graduates who enrolled in a Minnesota public college. The reference group for cohort terms is the 2012/13 cohort. Coefficient estimates are log odds ratios.

a. Limited to graduates from the 2012/13–2015/16 cohorts.

b. Limited to graduates from the 2012/13–2014/15 cohorts.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D16. Results from logistic regression models predicting employment within the first five years after high school graduation for Minnesota career and technical education explorers and similar samplers and nonparticipants, 2012/13–2017/18 cohorts

	Employment during year 1 after high school graduation (*n* = 64,810)		Employment during year 2 after high school graduation (*n* = 54,074)		Employment during year 3 after high school graduation (*n* = 43,462)		Employment during year 4 after high school graduation (*n* = 32,770)		Employment during year 5 after high school graduation (*n* = 21,822)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics										
Explorer	0.044	0.045	0.085	0.047	0.128*	0.051	0.121	0.063	0.069	0.080
2013/14 cohort	0.016	0.088	0.064	0.087	–0.064	0.077	0.041	0.079	–0.129	0.070
2014/15 cohort	0.048	0.080	–0.026	0.088	–0.078	0.080	–0.294**	0.085	na	na
2015/16 cohort	0.021	0.079	0.014	0.077	–0.325***	0.078	na	na	na	na
2016/17 cohort	0.065	0.073	–0.337	0.074	na	na	na	na	na	na
2017/18 cohort	–0.423	0.084	na	na	na	na	na	na	na	na
Female	0.179***	0.041	0.181***	0.047	0.035	0.046	0.083	0.052	0.074	0.075
White	0.336***	0.057	0.285***	0.066	0.180**	0.059	0.063	0.061	0.051	0.069
Eligible for the national school lunch program	0.124*	0.048	0.095*	0.048	0.178***	0.048	0.223***	0.045	0.281***	0.062
English learner student	–0.542***	0.091	–0.595***	0.101	–0.455**	0.132	–0.245	0.132	–0.241	0.149
Received special education services	–0.477***	0.059	–0.345***	0.062	–0.199**	0.069	–0.009	0.079	0.009	0.089
Proficient in math	–0.089	0.049	–0.106*	0.047	–0.212***	0.053	–0.221***	0.052	–0.202**	0.065
Proficient in reading	–0.099	0.052	–0.106*	0.052	–0.147*	0.063	–0.052	0.060	–0.123	0.072
School characteristics										
School size	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Percentage racial/ethnic minority	–0.246	0.406	0.405	0.382	0.161	0.407	–0.403	0.493	–0.261	0.576
Percentage eligible for the national school lunch program	–0.104	0.442	–0.178	0.413	0.240	0.432	0.436	0.518	0.326	0.574
Percentage English learner students	0.893	0.685	0.532	0.740	–0.211	0.822	0.548	0.765	0.694	1.141
Percentage that received special education services	1.399	0.760	0.905	0.791	0.028	0.956	–1.123	1.004	–2.095	1.322
Percentage proficient in English language arts	0.001	0.003	0.002	0.003	–0.002	0.004	–0.008	0.005	–0.005	0.006
Percentage proficient in math	–0.005	0.003	–0.002	0.003	–0.001	0.004	0.002	0.004	0.005	0.005
Suburban vs. urban	0.039	0.094	0.079	0.115	0.048	0.112	0.211	0.135	0.269	0.180
Town vs. urban	0.262*	0.110	0.267*	0.121	0.213	0.119	0.188	0.138	0.119	0.188
Rural vs. urban	0.302**	0.108	0.320**	0.119	0.203	0.120	0.126	0.157	0.016	0.186
Constant	1.303	0.341	1.040**	0.333	1.311	0.370	1.487**	0.438	1.418*	0.573

Predictor/covariate	Employment during year 1 after high school graduation (*n* = 64,810)		Employment during year 2 after high school graduation (*n* = 54,074)		Employment during year 3 after high school graduation (*n* = 43,462)		Employment during year 4 after high school graduation (*n* = 32,770)		Employment during year 5 after high school graduation (*n* = 21,822)	
	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error	Predicted probability (adjusted)	Standard error
Explorers	0.831	0.004	0.832	0.004	0.797	0.005	0.768	0.006	0.757	0.007
Samplers and nonparticipants	0.825	0.006	0.820	0.007	0.776	0.008	0.745	0.011	0.744	0.015

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.
na is not applicable.
Note: Explorers completed at least 150 hours of instruction in career and technical education courses in multiple career fields but fewer than 150 hours in a single field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses. The reference group for cohort terms is the 2012/13 cohort. The sample size decreased from year to year because the number of cohorts that could be used in the analysis decreased each year. Coefficient estimates are log odds ratios. Employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses.
Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Table D17. Results from regression models predicting annual earnings within the first five years after high school graduation for Minnesota career and technical education explorers and similar samplers and nonparticipants, 2012/13–2017/18 cohorts

	Annual earnings during year 1 after high school graduation (*n* = 64,810)		Annual earnings during year 2 after high school graduation (*n* = 54,074)		Annual earnings during year 3 after high school graduation (*n* = 43,362)		Annual earnings during year 4 after high school graduation (*n* = 32,770)		Annual earnings during year 5 after high school graduation (*n* = 21,822)	
Predictor/covariate	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Graduate characteristics										
Explorer	746.85***	81.85	953.77***	142.09	1,118.77***	175.14	890.02**	280.83	–271.65	460.69
2013/14 cohort	215.30	143.95	548.22**	179.06	679.52*	287.82	412.96	322.76	–8,794.08***	437.45
2014/15 cohort	588.50***	156.87	817.29***	197.40	387.10	264.33	–5,620.67***	317.74	na	na
2015/16 cohort	759.09***	178.17	871.25***	207.48	–3,870.48***	248.03	na	na	na	na
2016/17 cohort	990.68***	164.32	–2,900.94	185.44	na	na	na	na	na	na
2017/18 cohort	–1,882.07	145.37	na	na	na	na	na	na	na	na
Female	–495.59***	92.44	–735.13***	127.87	–1,044.92***	189.51	–1,371.23***	280.83	–1,200.91*	473.40
White	620.44***	135.56	855.96***	214.55	347.02	265.41	389.63	342.08	698.53	458.03
Eligible for the national school lunch program	1,440.68***	97.83	1,851.90***	133.27	1,862.04***	191.49	1,701.43***	264.96	–42.63	396.80
English learner student	–1,131.92***	244.20	–1,205.62**	379.26	–1,061.51	582.26	–174.45	684.54	–776.04	728.97
Received special education services	–121.61	152.52	–56.42	220.88	192.29	319.12	–165.12	395.44	–1,981.80***	493.53
Proficient in math	–1,030.78***	87.96	–1,354.57***	139.58	–1,650.18***	189.80	–1,763.81***	248.26	142.98	350.01
Proficient in reading	–1,092.35***	101.10	–1,479.29***	162.13	–1,922.18***	240.47	–1,811.18***	298.18	–932.12**	356.63
School characteristics										
School size	–0.07	0.13	0.06	0.22	0.16	0.30	0.24	0.38	0.61	0.53
Percentage racial/ethnic minority	–3,156.44***	823.14	–4,177.68**	1,222.27	–5,039.89**	1,513.06	–6,266.44**	2,080.16	–2,631.51	3,294.60
Percentage eligible for the national school lunch program	1,301.97	958.94	2,797.80*	1,332.31	2,796.85	1,813.23	4,044.20	2,506.18	2,732.90	3,399.36
Percentage English learner students	689.84	1,572.24	1,519.44	2,164.83	2,599.45	2,864.01	5,196.33	3,767.86	9,172.47	5,491.41
Percentage that received special education services	3,495.50	1,927.35	–276.95	2,855.22	–3,153.15	3,601.62	–10,128.91*	4,918.39	–8,290.01	8,095.08
Percentage proficient in English language arts	–6.23	6.61	–5.90	10.02	–26.26	14.20	–39.14	21.06	–12.95	43.79
Percentage proficient in math	–27.40***	6.18	–28.25**	8.28	–25.86*	11.56	–12.65	17.50	22.25	34.39
Suburban vs. urban	–104.05	188.18	119.85	283.02	182.00	367.11	765.63	536.17	1,984.75*	812.78
Town vs. urban	–75.49	237.11	201.12	331.67	576.10	427.99	1,048.32	625.59	2,264.01*	977.15
Rural vs. urban	–349.31	242.49	–52.11	340.41	183.70	466.36	717.94	824.42	2,952.57*	1,192.32
Constant	7,095.24	645.09	9,577.55***	955.94	13,859.35	1,312.97	16,782.86	1,940.25	15,933.81***	3,157.92

Predictor/covariate	Annual earnings during year 1 after high school graduation (*n* = 64,810)		Annual earnings during year 2 after high school graduation (*n* = 54,074)		Annual earnings during year 3 after high school graduation (*n* = 43,362)		Annual earnings during year 4 after high school graduation (*n* = 32,770)		Annual earnings during year 5 after high school graduation (*n* = 21,822)	
	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error	Adjusted mean	Standard error
Explorers	5,089.26	69.11	7,375.74	105.24	8,807.28	129.95	10,105.40	165.02	12,996.93	195.33
Samplers and nonparticipants	4,342.42	75.05	6,421.98	133.66	7,688.50	176.29	9,215.38	279.69	13,268.58	458.62

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

na is not applicable.

Note: Explorers completed at least 150 hours of instruction in career and technical education courses in multiple career fields but fewer than 150 hours in a single field. Samplers completed more than 1 but fewer than 150 hours of instruction in career and technical education courses. Nonparticipants did not complete any hours of instruction in career and technical education courses. The reference group for cohort terms is the 2012/13 cohort. The sample size decreased from year to year because the number of cohorts that could be used in the analysis decreased each year. Employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses. Earnings for graduates designated as unemployed are $0. Annual earnings were converted to 2013 dollar values using inflation calculations based on the Consumer Price Index for All Urban Consumers, Midwest Region.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Appendix E. Other analyses

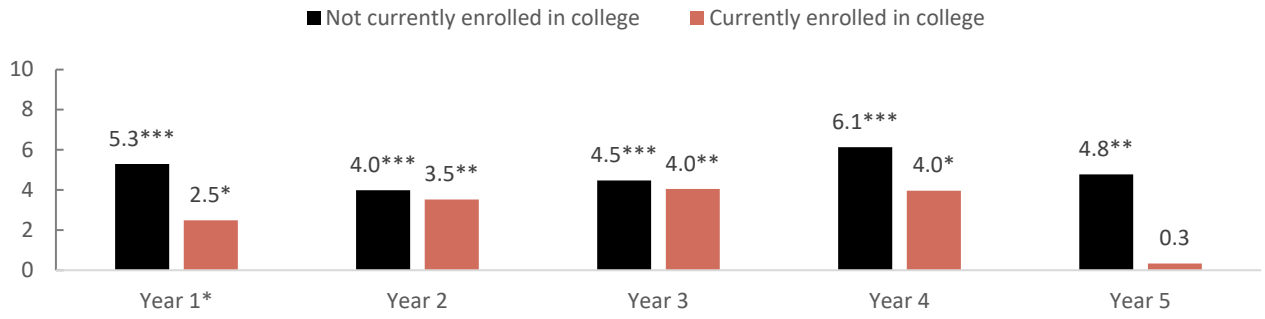
This appendix summarizes findings from the supplemental analyses that explored whether the gaps in employment rates and annual earnings between concentrators and similar samplers and nonparticipants and between explorers and similar samplers and nonparticipants differed by whether graduates were currently enrolled in college.

Findings for Indiana

Indiana concentrators had a higher employment rate than similar samplers and nonparticipants in the first four years after high school graduation, both among graduates who were enrolled in college and among graduates who were not enrolled in college (figure E1). Concentrators and similar samplers and nonparticipants who were enrolled in college had a similar employment rate in the fifth year after high school graduation. The gap in employment rates between concentrators and similar samplers and nonparticipants, however, did not differ by whether graduates were currently enrolled in college, except in the first year after high school graduation.

Figure E1. In the first year after high school graduation, the gap in employment rates between Indiana career and technical education concentrators and similar samplers and nonparticipants was larger among graduates not enrolled in college than among those enrolled in college, 2013/14–2017/18

Difference in employment rates between concentrators and similar samplers and nonparticipants (percentage points)



* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

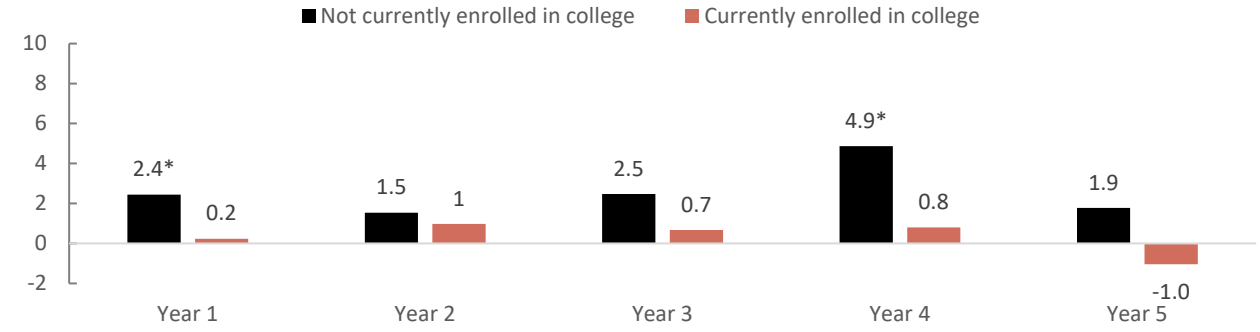
Note: n = 135,090 high school graduates for year 1, 106,692 for year 2, 73,626 for year 3, 44,938 for year 4, and 20,678 for year 5. The significance sign (*) on the "Year 1" horizontal axis label indicates that the gap that year between concentrators and matched samplers and nonparticipants differed by whether graduates were currently enrolled in college. A significance sign (*, **, or ***) on the label on top of a bar indicates that the difference that year between concentrators and matched samplers and nonparticipants in each subgroup (represented by each bar) was statistically significant. Employment rates are adjusted to account for prior demographic and academic characteristics of the graduates and their high schools. Positive differences in employment rates favor concentrators. Employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses.

Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Among Indiana graduates who were not enrolled in college, explorers had a higher employment rate than matched samplers and nonparticipants in the first and fourth years after high school graduation (figure E2). Among Indiana graduates who were enrolled in college, explorers and matched samplers and nonparticipants had a similar employment rate in the first five years after high school graduation. In the first five years after high school graduation, the gap in employment rates between explorers and similar samplers and nonparticipants did not differ by whether graduates were enrolled in college.

Figure E2. The gap in employment rates between Indiana career and technical education explorers and similar samplers and nonparticipants did not differ by whether graduates were currently enrolled in college, 2013/14–2017/18

Difference in employment rates between explorers and similar samplers and nonparticipants (percentage points)



* Significant at $p < .05$.

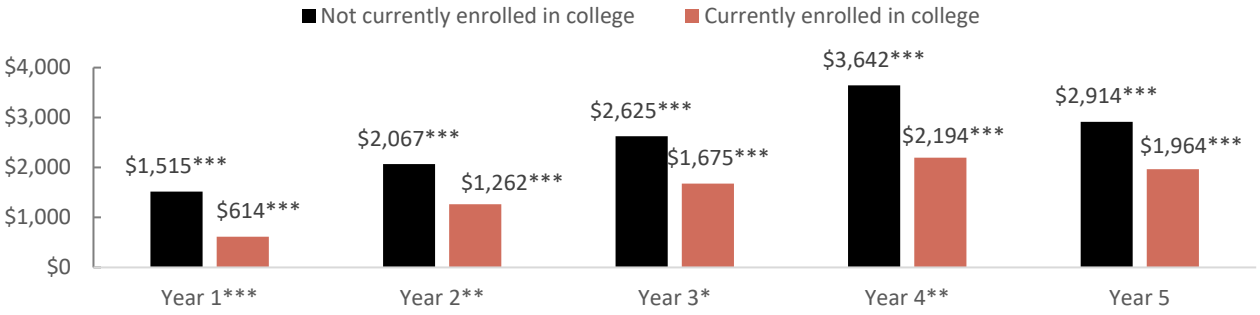
Note: n = 52,180 high school graduates for year 1, 42,444 for year 2, 30,502 for year 3, 19,402 for year 4, and 9,220 for year 5. None of the gaps between concentrators and matched samplers and nonparticipants in a given year significantly differed by whether graduates were currently enrolled in college. A significance sign (*) on the label on top of a bar indicates that the difference that year between concentrators and matched samplers and nonparticipants in each subgroup (represented by each bar) was statistically significant. Employment rates are adjusted to account for prior demographic and academic characteristics of the graduates and their high schools. Positive differences in employment rates favor explorers. Employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses.

Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Indiana concentrators had higher earnings than similar samplers and nonparticipants in the first five years after high school graduation, both among graduates who were enrolled in college and among graduates who were not enrolled in college (figure E3). In the first four years after high school graduation, the gap in earnings was larger among graduates not enrolled in college than among graduates enrolled in college.

Figure E3. In the first four years after high school graduation, the gap in annual earnings between Indiana career and technical education concentrators and similar samplers and nonparticipants was larger among graduates not enrolled in college than among graduates enrolled in college, 2013/14–2017/18

Difference in annual earnings between concentrators and similar samplers and nonparticipants ($)



* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

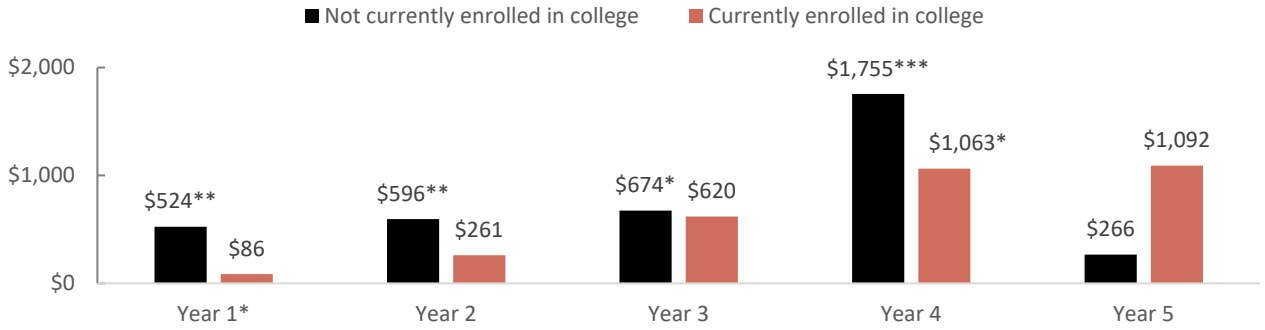
Note: n = 135,090 graduates for year 1, 106,692 for year 2, 73,626 for year 3, 44,938 for year 4, and 20,678 for year 5. A significance sign (*, **, or ***) on the horizontal axis label indicates that the gap that year between concentrators and matched samplers and nonparticipants differed by whether graduates were currently enrolled in college. A significance sign on the label on top of a bar indicates that the difference that year between concentrators and matched samplers and nonparticipants in each subgroup (represented by each bar) was statistically significant. Average annual earnings are adjusted to account for prior demographic and academic characteristics of the graduates and their high schools. Positive differences in earnings favor concentrators. Employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses. Earnings for graduates designated as unemployed are $0. Annual earnings were converted to 2013 dollar values using inflation calculations based on the Consumer Price Index for All Urban Consumers, Midwest Region.

Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Among Indiana graduates not enrolled in college, explorers had higher earnings than similar samplers and nonparticipants in the first four years after high school graduation (figure E4). Among Indiana graduates who were enrolled in college, explorers had higher earnings than similar samplers and nonparticipants only in the fourth year after high school. The gap in earnings between explorers and similar samplers and nonparticipants were larger among graduates not enrolled in college than among those enrolled in college in the first year after high school.

Figure E4. In the first year after high school graduation, the gap in annual earnings between Indiana career and technical education explorers and similar samplers and nonparticipants was larger among graduates not enrolled in college than among graduates enrolled in college, 2013/14–2017/18

Difference in annual earnings between explorers and similar samplers and nonparticipants ($)



* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

Note: n = 52,180 graduates for year 1, 42,444 for year 2, 30,502 for year 3, 19,402 for year 4, and 9,220 for year 5. The significance sign (*) on the "Year 1" horizontal axis label indicates that the gap that year between concentrators and matched samplers and nonparticipants differed by whether graduates were currently enrolled in college. A significance sign (*, **, or ***) on the label on top of a bar indicates that the difference that year between concentrators and matched samplers and nonparticipants in each subgroup (represented by each bar) was statistically significant. Average annual earnings are adjusted to account for prior demographic and academic characteristics of the graduates and their high schools. Positive differences in earnings favor explorers. Employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses. Earnings for graduates designated as unemployed are $0. Annual earnings were converted to 2013 dollar values using inflation calculations based on the Consumer Price Index for All Urban Consumers, Midwest Region.

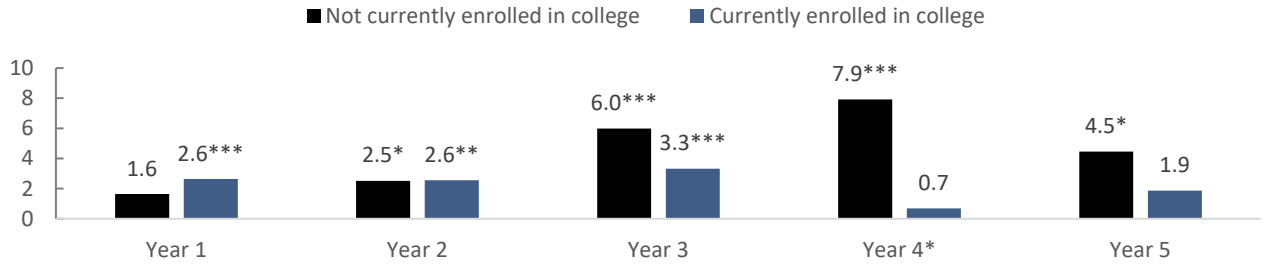
Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

Findings for Minnesota

Minnesota concentrators had a higher employment rate than similar samplers and nonparticipants in the second and third years after high school graduation, both among graduates who were enrolled in college and among graduates who were not enrolled in college (figure E5). Among graduates who were not enrolled in college, concentrators had a higher employment rate than similar samplers and nonparticipants in the fourth and fifth years after high school graduation. Among graduates who were enrolled in college, concentrators and similar samplers and nonparticipants had a similar employment rate in the fourth and fifth years after high school graduation. However, the gap in employment rates between concentrators and similar samplers and nonparticipants did not differ by whether graduates were currently enrolled in college, except in the fourth year after high school graduation.

Figure E5. In the fourth year after high school graduation the gap in employment rates between Minnesota career and technical education concentrators and similar samplers and nonparticipants was larger among graduates who were not enrolled in college than among graduates who were enrolled in college, 2012/13–2017/18

Difference in employment rates between concentrators and similar samplers and nonparticipants (percentage points)



* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

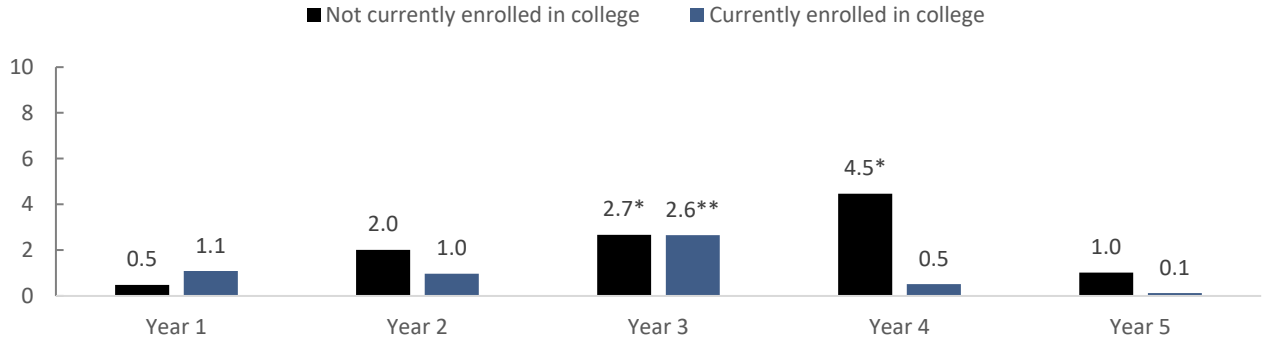
Note: n = 171,778 graduates for year 1, 142,726 for year 2, 114,126 for year 3, 85,076 for year 4, and 55,438 for year 5. The significance sign (*) on the "Year 4" horizontal axis label indicates that the gap that year between concentrators and matched samplers and nonparticipants differed by whether graduates were currently enrolled in college. A significance sign (*, **, or ***) on the label on top of a bar indicates that the difference that year between concentrators and matched samplers and nonparticipants in each subgroup (represented by each bar) was statistically significant. Employment rates are adjusted to account for prior demographic and academic characteristics of the graduates and their high schools. Positive differences in employment rates favor concentrators. Employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Among Minnesota graduates who were not enrolled in college, explorers had a higher employment rate than similar samplers and nonparticipants in the third and fourth years after high school graduation (figure E6). Among graduates who were enrolled in college, explorers had higher employment rates than similar samplers and nonparticipants only in the third year after high school graduation. The gap in employment rates between explorers and similar samplers and nonparticipants did not differ by whether graduates were currently enrolled in college in the first five years after high school.

Figure E6. The gap in employment rates between Minnesota career and technical education explorers and similar samplers and nonparticipants did not differ by whether graduates were currently enrolled in college, 2012/13–2017/18

Difference in employment rates between explorers and similar samplers and nonparticipants (percentage points)



* Significant at $p < .05$; ** significant at $p < .01$.

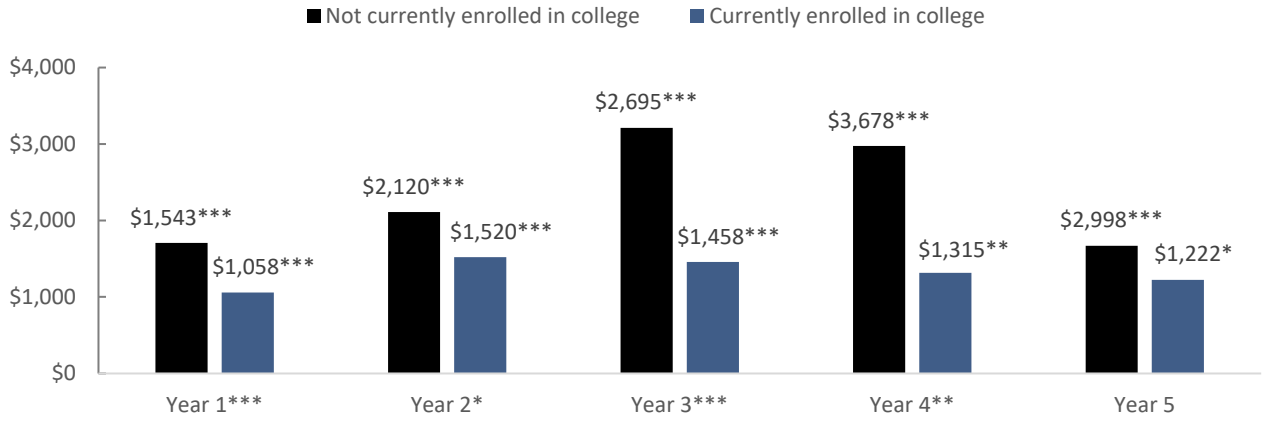
Note: n = 64,810 graduates for year 1, 54,074 for year 2, 43,362 for year 3, 32,770 for year 4, and 21,822 for year 5. None of the gaps between concentrators and matched samplers and nonparticipants in a given year significantly differed by whether graduates were currently enrolled in college. A significance sign (* or **) on the label on top of a bar indicates that the difference that year between concentrators and matched samplers and nonparticipants in each subgroup (represented by each bar) was statistically significant. Employment rates are adjusted to account for prior demographic and academic characteristics of the graduates and their high schools. Positive differences in employment rates favor explorers. Employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Minnesota concentrators had higher annual earnings than similar samplers and nonparticipants in the first five years after high school graduation, both among graduates who were enrolled in college and among graduates who were not enrolled in college (figure E7). In the first four years after high school graduation, the gap in earnings between concentrators and similar samplers and nonparticipants differed by whether graduates were currently enrolled in college. The gap was larger among high school graduates not enrolled in college than among graduates enrolled in college.

Figure E7. In the first four years after high school graduation, the gap in earnings between Minnesota career and technical education concentrators and similar samplers and nonparticipants was larger among graduates who were not enrolled in college than among graduates who were enrolled in college, 2012/13–2017/18

Difference in annual earnings between concentrators and similar samplers and nonparticipants ($)



** Significant at $p < .01$; *** significant at $p < .001$.

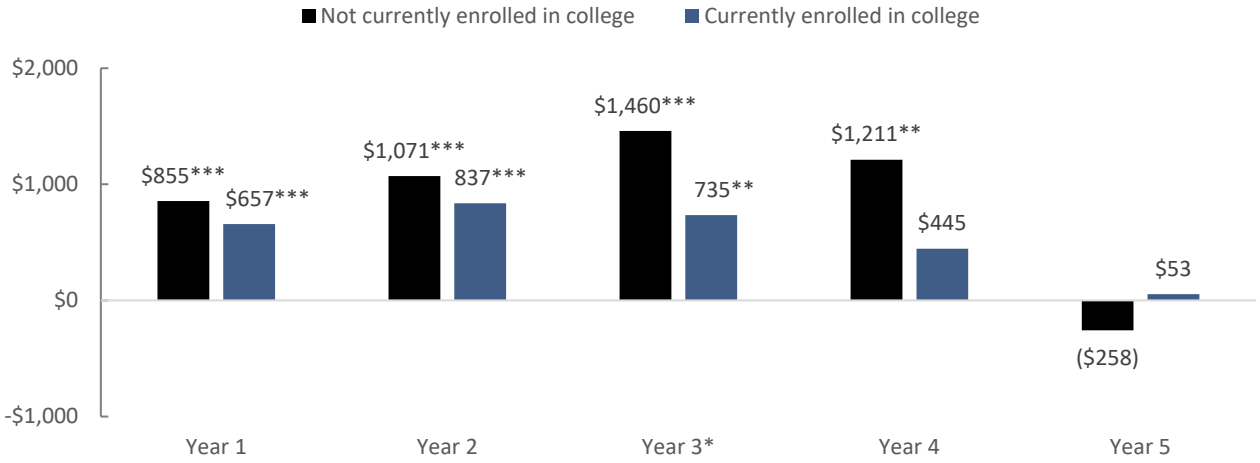
Note: n = 171,778 graduates for year 1, 142,726 for year 2, 114,126 for year 3, 85,076 for year 4, and 55,438 for year 5. A significance sign (** or ***) on the horizontal axis label indicates that the gap that year between concentrators and similar samplers and nonparticipants differed by whether graduates were currently enrolled in college. A significance sign (** or ***) on the label on top of a bar indicates that the difference that year between concentrators and similar samplers and nonparticipants in each subgroup (represented by each bar) was statistically significant. Average annual earnings are adjusted to account for prior demographic and academic characteristics of the graduates and their high schools. Positive differences in earnings favor concentrators. Employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses. Earnings for graduates designated as unemployed are $0. Annual earnings were converted to 2013 dollar values using inflation calculations based on the Consumer Price Index for All Urban Consumers, Midwest Region.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

Among Minnesota graduates who were not enrolled in college, explorers had higher earnings than similar samplers and nonparticipants in the first four years after high school graduation; in the fifth year after high school graduation, the similar samplers and nonparticipants had higher earnings, but the difference was not statistically significant (figure E8). Among graduates who were enrolled in college, explorers had higher employment rates than similar samplers and nonparticipants in the first three years after high school graduation. In the third year after high school graduation, the gap in earnings between explorers and similar samplers and nonparticipants was larger among graduates not enrolled in college than among graduates enrolled in college.

Figure E8. In the third year after high school graduation, the gap in earnings between Minnesota career and technical education explorers and similar samplers and nonparticipants was larger among graduates who were not enrolled in college than among graduates who were enrolled in college, 2012/13–2017/18

Difference in annual earnings between explorers and similar samplers and nonparticipants ($)



* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

Note: n = 64,810 graduates for year 1, 54,074 for year 2, 43,362 for year 3, 32,770 for year 4, and 21,822 for year 5. The significance sign (*) on the "Year 3" horizontal axis label indicates that the gap that year between concentrators and matched samplers and nonparticipants differed by whether graduates were currently enrolled in college. A significance sign (** or ***) on the label on top of a bar indicates that the difference between concentrators and matched samplers and nonparticipants in each subgroup (represented by each bar) was statistically significant. Average annual earnings are adjusted to account for prior demographic and academic characteristics of the graduates and their high schools. Positive differences in earnings favor explorers. Employment information was not available for high school graduates who were employed outside the state, who were self-employed, who entered military service, or whose employer did not report wages to the state (including employees of the federal government), so it was not possible to distinguish them from unemployed high school graduates. They were treated as unemployed in these analyses. Earnings for graduates designated as unemployed are $0. Annual earnings were converted to 2013 dollar values using inflation calculations based on the Consumer Price Index for All Urban Consumers, Midwest Region.

Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.