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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?

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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?

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In Indiana and Minnesota the state education agency, state higher education agency, and the state workforce agency have collaborated to develop career and technical education courses intended to improve high school students' college and career readiness. These agencies partnered with the Regional Educational Laboratory Midwest to examine whether high school graduates in each state who completed a large number of career and technical education courses in a single career-oriented program of study (concentrators) had different college and workforce outcomes from graduates who completed fewer (samplers) or no career and technical education courses (nonparticipants). The study found that in the 2012/13–2017/18 graduation cohorts, male graduates were more likely to be concentrators than female graduates, and graduates who received special education services were more likely to be concentrators than those who did not receive services. Graduates who were not proficient in reading in grade 8 also were more likely to become concentrators than those who were proficient. Graduates who attended urban and suburban schools were more likely than students who attended town and rural schools to be nonparticipants. Concentrators were less likely than samplers and nonparticipants with similar characteristics to enroll in college, but the differences reflect mainly enrollment in four-year colleges. Concentrators were more likely to enroll in two-year colleges. Concentrators also were less likely than similar samplers and nonparticipants to complete a bachelor's degree within four to six years. Finally, compared with similar samplers and nonparticipants, concentrators were employed at higher rates in the first five years after high school and had higher earnings.

Why this study?

In Indiana and Minnesota, career and technical education programs are intended to provide pathways to both postsecondary education and careers after high school. Each state's education agency, higher education agency, and workforce agency have collaborated to develop career and technical education courses and sequences of courses intended to improve high school students' college and career readiness.

The agencies in both states partnered with the Regional Educational Laboratory Midwest to study those efforts. They wanted to know whether the background characteristics of high school graduates and their schools were associated with completion of career and technical education courses in one or more areas of concentration. They also wanted to know whether graduates who completed a large number of career and technical education courses in a single career-oriented program of study (concentrators) have different rates of college enrollment and certificate or degree attainment, different employment rates, or different earnings five years after high school graduation than graduates with similar chacteristics who completed fewer (samplers) or no career and technical education courses (nonparticipants; see box 1 for definitions of key terms).

For additional information, including the typology of career types in Indiana and Minnesota, technical methods, detailed findings for each state, and other analyses, see the appendices for the report on the Institute of Education Sciences website.

Box 1. Key terms

Concentrator. A high school student who completed a large number of career and technical education courses in one topic area. In Indiana, concentrators attained six or more semester credits (about three academic years of work) in career and technical education courses in one of the state's 64 career pathways, which are grouped into 12 career clusters (see table A1 in appendix A). In Minnesota, concentrators completed at least 150 hours of instruction (the approximate amount of instruction time for a full-year course that meets 51 minutes every day and five days per week; roughly equivalent to 2 semester credits) in career and technical education courses in one of the state's 79 career pathways, which are grouped into 16 career clusters and six career fields (see table A2 in appendix A).[1]

Explorer. A high school student who completed a large number of career and technical education courses in multiple topic areas. In Indiana, explorers attained six or more semester credits in career and technical education courses in multiple career pathways but fewer than six credits in courses in in a single pathway. In Minnesota, 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.

Sampler. A high school student who completed just one or two career and technical education courses. In Indiana, samplers attained at least half a semester credit but fewer than six semester credits in career and technical education courses. In Minnesota, samplers completed at least 1 hour but fewer than 150 hours of instruction in career and technical education courses.

Nonparticipant. A high school student who did not earn any credits in career and technical education courses.

Note

1. Indiana's definition is that used under the federal Carl D. Perkins Career and Technical Education Act of 2006. New requirements will apply to students entering high school in 2023/24. Minnesota's definition is that adopted under the federal Strengthening Career and Technical Education for the 21st Century Act of 2018 and applies to the cohort of high school students who entered grade 9 in 2019/20.

The agencies' interest in participation rates in career and technical education courses stems from concerns over equitable access to career and technical education course opportunities. If enrollment and completion of career and technical education courses are more common among students with certain characteristics or in particular types of schools, school districts might need assistance in recruiting students to participate in career and technical education or in developing career and technical education courses. Research conducted with national samples suggests that participation rates in career and technical education differ by student gender and socioeconomic status (Arbeit et al., 2017). However, trends might vary from state to state. One study of Arkansas students who graduated from high school between 2011/12 and 2013/14 found that students of all demographic backgrounds participated in career and technical education but that White students, students with disabilities, and female students were overrepresented among concentrators (Dougherty, 2016). A similar study of Texas students who graduated from high school in 2013/14 found few racial/ethnic or socioeconomic differences in completion rates of multiple courses in a single career-oriented field (Giani, 2019). No such study has been performed in Indiana or Minnesota.

Most policy and research efforts focus on career and technical education concentrators because students who concentrate in a career-focused program of study are expected to be better prepared to succeed in that career field. The Strengthening Career and Technical Education for the 21st Century Act of 2018 (commonly known as Perkins V), which provides federal support for career and technical education programs in all 50 states and U.S. territories, requires states to report typical secondary school outcomes for concentrators, such as the percentage graduating from high school, the percentage passing state standardized tests, and the percentage going on to postsecondary education or employment shortly after graduation. States are also required to develop plans for improving those outcomes and reducing performance gaps across student demographic groups and programs.

In general, prior longitudinal and quasi-experimental studies that have examined the relationship between taking career and technical education courses in high school and college enrollment, employment, and earnings during

the first several years after high school graduation show inconsistent results (Brunner et al., 2019; Dalton, 2015; Dougherty, 2016). One study using data from the Education Longitudinal Study of 2002 found that among students who graduated from high school in 2004, concentrators were less likely than nonconcentrators to attain a bachelor's degree or higher, but it found no differences in employment rates or earnings (Dalton, 2015). Another study found that one year after high school graduation, concentrators in Arkansas were more likely to enroll in a two-year college, were more likely to be employed, and were paid higher wages than similar nonconcentrators, but it found no differences in enrollment rates in four-year college (Dougherty, 2016). A third study found that over eight years, male students who attended one of 15 technical high schools in Connecticut had higher earnings than male students who did not attend one of the schools but were less likely to enroll in college; it found no differences among female students (Brunner et al., 2019).

Efforts to examine differences in college and workforce outcomes among concentrators, explorers, samplers, and nonparticipants must confront the possibility that members of these groups might have differed even before they had the opportunity to participate in career and technical education. To isolate the effect of sustained participation in career and technical education from the effects of other factors, the study team identified samplers and nonparticipants who attended the same high schools at the same time as the concentrators and explorers and who were most similar to them in gender, race/ethnicity, eligibility for the national school lunch program, special education status, English learner status, and proficiency in math and English language arts/reading in grade 8. By comparing concentrators and explorers with similar samplers and nonparticipants, the study team could be more confident that differences in outcomes were due to graduates' participation in career and technical education rather than to other factors.

If comparisons between concentrators and similar samplers and nonparticipants show benefits for career and technical education coursetakers, education and workforce leaders in Indiana and Minnesota might want to publicize the benefits to similar student populations throughout their state and ensure that all students have equitable access to career and technical education courses. Further, information about differences in college enrollment and completion between concentrators and similar samplers and nonparticipants will help state agencies know whether career and technical education courses need to convey more information to students about how to obtain more specialized training at the postsecondary level.

Research questions

The study team conducted state-specific analyses of K–12 data, postsecondary education data, and employment data for five cohorts of Indiana high school graduates and for six cohorts of Minnesota high school graduates. Findings from those analyses address four research questions:

1. What percentage of high school graduates in each state were career and technical education concentrators, explorers, samplers, and nonparticipants?

2. What background characteristics of high school graduates and their high schools are associated with being a career and technical education concentrator in each state?

3. How does being a career and technical education concentrator affect high school graduates' college enrollment and degree attainment in each state?

4. How does being a career and technical education concentrator affect high school graduates' employment and earnings in each state?

Box 2 summarizes the study's data sources, samples, and methods; appendix B provides additional details.

Box 2. Data sources, sample, and methods

Data sources. The study team analyzed the following types of data from state longitudinal data systems administered by the Indiana Management Performance Hub and the Minnesota Office of Higher Education:

- **Data on high school graduates' achievement and experience in grades 8–12.** The study team received data on each high school graduate's courses completed in high school, year of graduation, demographic characteristics (gender, race/ethnicity, eligibility for the national school lunch program, English learner status, and special education status), and proficiency in math and English language arts/reading based on grade 8 scores on their state's standardized achievement test.[1] The states provided the demographic characteristics of graduates' high schools (percentage of students who are members of a racial/ethnic minority group, percentage of students who are eligible for the national school lunch program, percentage of students who are English learner students, percentage of students who receive special education services, and school locale). Indiana provided information for the 2013/14–2017/18 cohorts of graduates, and Minnesota provided information for the 2012/13–2017/18 cohorts of graduates.
- **Data on graduates' postsecondary education experiences.** For high school graduates who attended an in-state public college or university, the agencies administering each state's longitudinal data system provided the study team with data on whether and when each graduate enrolled in college, courses attempted and completed, college degrees or certificates attained, and college or colleges enrolled in and from which the degree or certificate was attained. Both states' higher education agencies have access to National Student Clearinghouse data, which provides information about their graduates' college outcomes. The Indiana Commission for Higher Education's contract with the National Student Clearinghouse provides data on college enrollment only, so data on degree attainment for Indiana were limited to graduates attending in-state public colleges. The Minnesota Office of Higher Education's contract with the National Student Clearinghouse provides data on both college enrollment and degree attainment, so the data for Minnesota include graduates attending in-state and out-of-state public and private colleges.[2] For both states data on the accumulation of college credits were limited to graduates attending an in-state public college. All postsecondary education data include information for the 2013/14–2018/19 academic years (for Indiana) or the 2012/13–2018/19 academic years (for Minnesota).
- **Data on graduates' employment status and earnings.** The study team obtained high school graduates' employment status (defined as receiving any earnings for their labor) and quarterly earnings between 2013 and 2019. Neither state's data included employment or earnings records 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).

Samples. For research questions 1 and 2 the study team analyzed the data from the entire universe of students who graduated from a public high school in Indiana between 2013/14 and 2017/18 (333,280 graduates) and in Minnesota between 2012/13 and 2017/18 (350,191 graduates).

For research questions 3 and 4 the study team focused on concentrators and similar samplers and nonparticipants from cohorts of graduates with available college and employment data. Findings for the first year after high school graduation involved the 2013/14–2017/18 cohorts of graduates in Indiana (135,090 graduates) and the 2012/13–2017/18 cohorts in Minnesota (171,778 graduates). Findings for five years after graduation were limited to the 2013/14 cohort from Indiana (20,678 graduates) and the 2012/13 and 2013/14 cohorts from Minnesota (55,438 graduates; see table B4 in appendix B).

Methodology. To answer research questions 1 and 2, the study team classified the high school graduates in each state as concentrators, explorers, samplers, or nonparticipants and cross-tabulated these classifications with background characteristics of graduates and their high schools. For these population data the study team—in partnership with stakeholders from the relevant agencies in each state—determined that differences between groups of at least 5 percentage points were meaningful.

To answer research questions 3 and 4, the study team matched career and technical education concentrators with samplers and nonparticipants in the same cohort and school for each state. The study team matched concentrators with samplers and nonparticipants on their demographic characteristics (see "Data on high school graduates' achievement and experience in grades 8–12" bullet point above) and their proficiency in math and reading in grade 8. A similar process was used to match

explorers with samplers and nonparticipants. The matched samples enabled the team to estimate the effects of being a concentrator or explorer compared with being a sampler or nonparticipant for an otherwise similar high school graduate. The team developed logistic regression models for binary outcomes (enrolling in college, attaining a college degree, and becoming employed) and linear regression models for continuous outcomes (college credits earned and annual earnings). These models estimated the size of the difference in outcomes between concentrators and similar samplers and nonparticipants while controlling for other background characteristics of graduates and their high schools. The models adjusted for nesting of students in schools. Separate regression models compared outcomes between career and technical education explorers and similar samplers and nonparticipants.

All analyses were conducted separately for each state using the same methods. However, because the contexts for career and technical education, postsecondary education, and employment were different in the two states, findings for the two states are not directly comparable. More details on the methodology used for this study are in appendix B.

Limitations. This study has five main limitations. First, in both states data on college credit attainment could be obtained only for high school graduates who enrolled in an in-state public college or university; employment and earnings information could be obtained only for high school graduates who were employed in the state and not for graduates who were self-employed, who entered military service, or whose employer did not report wages to the state (such as employees of the federal government); and data on college degree attainment in Indiana also were limited to graduates who attended an in-state college. The study team had no way of determining whether graduates who lacked data on these outcomes were not enrolled or employed, were living outside the state, or were working for a federal agency. Thus, findings for these outcomes might be biased to the degree that concentrators, explorers, samplers, or nonparticipants moved disproportionally to different states.

Second, the study's focus on high school graduates in each state means that the study does not provide a comprehensive view of all effects of being a concentrator on post–high school outcomes. The study did not examine whether concentrating in a career and technical education course of study was associated with high school graduation. Thus, any effects of being a career and technical education concentrator on postsecondary education, employment, and earnings outcomes that occur indirectly due to changes in the likelihood of graduating high school are not reflected in these results.

Third, while the study team attempted to match concentrators and explorers with similar samplers and nonparticipants in the same school, these matches could be based only on the student information available in each state's longitudinal data system. Concentrators and explorers and their sampler or nonparticipant matches might differ in ways that are not routinely measured and stored in states' longitudinal data systems, such as motivation and family expectations. To the extent that graduates are not matched on these factors, differences in outcomes between concentrators and their sampler or nonparticipant matches, as well as between explorers and their sampler or nonparticipant matches, could be related to those unmeasured factors rather than to career and technical education courses.

Fourth, the inability to match some concentrators and explorers with samplers and nonparticipants means that results cannot be generalized to all graduates in these groups. The purpose of the matching analyses was to produce estimates of the effects of being a career and technical education concentrator or explorer relative to being a sampler or nonparticipant and not to generalize to the full population of concentrators in each state.

Fifth, the study team obtained five years of data on Indiana graduates and six years of data on Minnesota graduates after high school graduation, and many graduates are likely to obtain a postsecondary degree and enter the workforce five or more years after graduation. The findings therefore might not reflect longer-term college completion, employment, and earnings trajectories.

Notes

1. Most Indiana high school graduates completed the Indiana Statewide Testing for Educational Progress—Plus assessment, which measures proficiency in English language arts and math in grade 8. Minnesota graduates completed the Minnesota Comprehensive Assessment series II or series III, which measures proficiency in reading and math in grade 8.

2. Data from the National Student Clearinghouse indicate that among Indiana graduates who enrolled in college, 71 percent enrolled in an in-state college, and 29 percent enrolled in an out-of-state college. Among Minnesota graduates who enrolled in college, 76 percent enrolled in an in-state college, and 24 percent enrolled in an out-of-state college.

Findings for Indiana

This section presents the main findings for Indiana and focuses on differences between career and technical education concentrators and similar samplers and nonparticipants. This section also describes differences between explorers and similar samplers and nonparticipants to show whether taking a diverse set of career and technical education courses (that is, courses in more than one career cluster) also affects postsecondary and workforce outcomes. Detailed findings are in appendix C.

About one-fifth of graduates from Indiana public high schools between 2013/14 and 2017/18 were concentrators, and the percentage of concentrators increased over time

Among the 333,280 students who graduated from an Indiana public high school between 2013/14 and 2017/18, 21 percent were concentrators, 8 percent were explorers, 48 percent were samplers, and 22 percent were nonparticipants. The percentage of graduates in each cohort who were concentrators increased over time, from 15 percent in the 2013/14 cohort to 28 percent in the 2017/18 cohort. Conversely, the percentage of nonparticipants decreased from 27 percent in the 2013/14 cohort to 18 percent in the 2017/18 cohort (see table C1 in appendix C).

Indiana high school graduates who were male, graduates who were White, graduates who received special education services, and graduates who were not proficient in English language arts in grade 8 were more likely than their peers without those characteristics to be concentrators

Student gender, race/ethnicity, special education status, and proficiency in English language arts are all associated with rates of concentration in career and technical education in Indiana. The percentage of male high school graduates who were concentrators (24 percent) was higher than the percentage of female graduates (18 percent; see table C1 in appendix C). White students (22 percent) were more likely than Asian students (9 percent) and Native Hawaiian/Pacific Islander students (14 percent) to be concentrators. Graduates who received special education services (28 percent) were more likely to be concentrators than graduates who never received special education services (21 percent). Graduates who were not proficient in English language arts in grade 8 (28 percent) also were more likely to be concentrators than graduates who were proficient in English language arts (18 percent). Concentrator status was not associated with graduates' eligibility for the national school lunch program or their English learner status.

Indiana graduates who attended larger schools, graduates who attended schools with larger percentages of students receiving special education services, and graduates who attended schools with larger percentages of students proficient in English language arts were more likely to be concentrators, and graduates who attended high schools in urban and suburban areas were more likely to be nonparticipants

Indiana high school graduates' career and technical education classification was associated with the size of their school, the percentage of their school's population that received special education services, the percentage of their school's population that was proficient in English language arts in grade 8, and the school's locale. Schools with large and mid-sized enrollments had higher percentages of students who were concentrators (21 percent and 22 percent) than schools with small enrollments (5 percent; see table C2 in appendix C).[1] Schools with large

1. High school classifications were based on quartiles for each characteristic. Schools classified as having a large enrollment or large percentage for a characteristic were in the highest quartile, those classified as being mid-sized or having a mid-level percentage were in the middle two quartiles, and those classified as having a small enrollment or small percentage for a characteristic were in the lowest quartile for that characteristic.

and mid-level percentages of students who received special education services also had higher percentages of concentrators (30 percent and 21 percent) than schools with small percentages of students who received services (7 percent). In addition, schools with large and mid-level percentages of students that were proficient in English language arts in grade 8 had higher percentages of concentrators (18 percent and 25 percent) than schools that served small percentages of students who were proficient (12 percent).

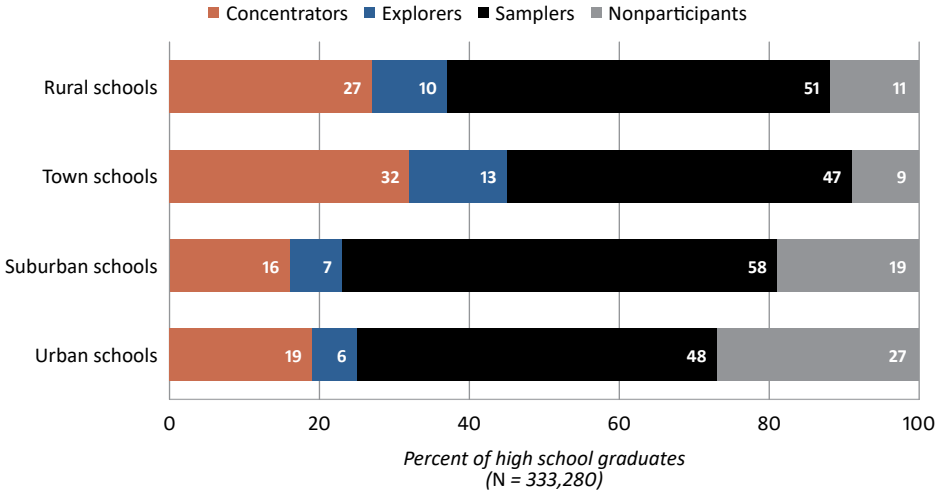
The percentage of Indiana graduates who were concentrators was higher in schools in towns and rural areas (32 percent and 27 percent) than in schools in urban and suburban areas (19 percent and 16 percent). Similarly, the percentage of nonparticipants was higher in schools in urban and suburban areas (27 percent and 19 percent) than in schools in towns and rural areas (9 percent and 11 percent; figure 1).

After other factors were adjusted for, Indiana concentrators had lower college enrollment rates within one year of high school graduation than similar samplers and nonparticipants, and concentrators were more likely to enroll in a two-year college but less likely to enroll in a four-year college

After characteristics of graduates and their high schools were adjusted for, Indiana concentrators from the 2013/14–2017/18 cohorts of graduates were less likely (52 percent) than similar samplers and nonparticipants (56 percent) to enroll in college within one year of high school graduation (figure 2; see also table C6 in appendix C). However, enrollment patterns differed for two-year and four-year colleges. Concentrators were more likely (16 percent) than similar samplers and nonparticipants (12 percent) to enroll in a two-year college but less likely to enroll in a four-year college (36 percent versus 44 percent). College enrollments during the study period (up to five years after high school graduation) show the same pattern (see table C7 in appendix C).

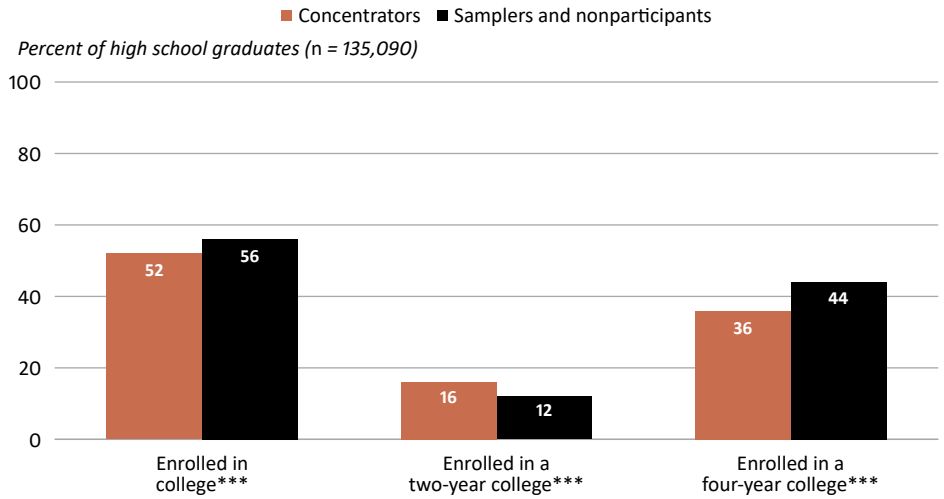
The analyses comparing college enrollment for explorers and similar samplers and nonparticipants produced similar results (see tables C12 and C13 in appendix C). Explorers were more likely than similar samplers and nonparticipants to enroll in a two-year college within one year of high school graduation but less likely to enroll in a four-year college. However, the overall college enrollment rate within one year of high school graduation was not statistically different for explorers and similar samplers and nonparticipants.

Figure 1. The percentage of Indiana graduates who were nonparticipants was higher in high schools in urban and suburban areas than in schools in towns and rural areas, 2013/14–2017/18 cohorts



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

Figure 2. After other factors were adjusted for, Indiana career and technical education concentrators were less likely than similar samplers and nonparticipants to enroll in college—especially a four-year college—within one year of high school graduation but more likely to enroll in a two-year college, 2013/14–2017/18 cohorts



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

Note: Data are based on Indiana administrative records and National Student Clearinghouse records and were therefore available for graduates who attended in-state public colleges as well as graduates who attended private colleges and out-of-state colleges. College enrollment rates are based on all years of data available for each cohort of graduates and were generated using regression models that adjusted for the background characteristics of graduates and their high schools. See table C6 in appendix C for more details.

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

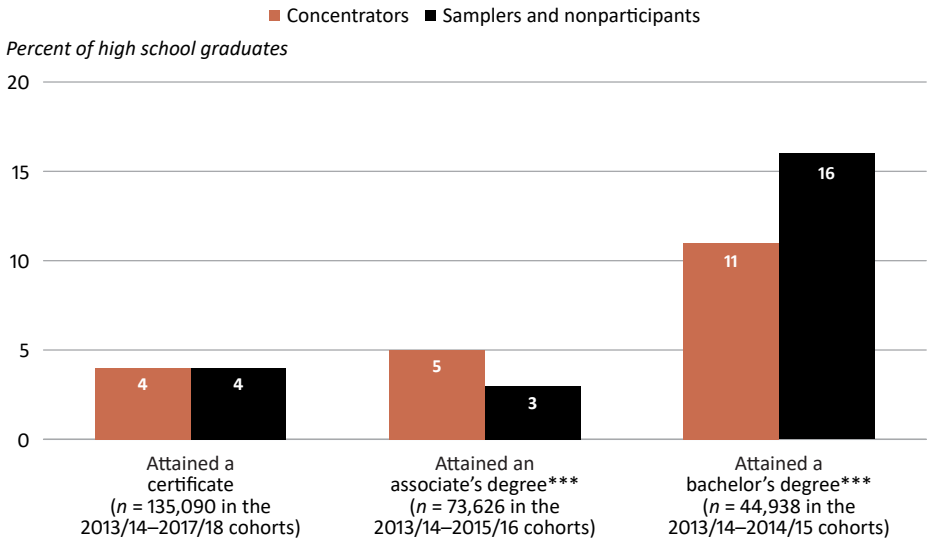
After other factors were adjusted for, Indiana concentrators earned fewer credits within one year of high school graduation, were more likely to attain an associate's degree, and were less likely to attain a bachelor's degree than similar samplers and nonparticipants

On average, Indiana concentrators earned 9.8 credits within one year of high school graduation compared with 10.9 credits for similar samplers and nonparticipants (see table C8 in appendix C). Concentrators and similar samplers and nonparticipants attained a certificate at similar rates (figure 3). About 5 percent of concentrators attained an associate's degree compared with 3 percent of similar samplers and nonparticipants. The opposite pattern was true for attaining a bachelor's degree: 11 percent of concentrators attained a bachelor's degree compared with 16 percent of similar samplers and nonparticipants.[2]

The analyses comparing college outcomes for explorers and similar samplers and nonparticipants produced similar results, except that explorers and similar samplers and nonparticipants earned a similar number of credits within one year of high school graduation (about 11) and explorers earned fewer credits within three years of high school graduation (see tables C14 and C15 in appendix C).

2. Degree attainment rates for the 2013/14–2015/16 cohorts are based on three to five years of data post–high school graduation. National statistics indicate that 26 percent of students in four-year colleges are unable to complete their degree within six years (National Center for Education Statistics, 2019), making it likely that many of the Indiana graduates who enrolled in a four-year college were still working toward their degree after the fifth year. The 2013/14 cohort has five years of post–high school data, the most of any Indiana cohort, but it is still short of the six-year bachelor's degree completion benchmark used by the U.S. Department of Education.

Figure 3. After other factors were adjusted for, Indiana career and technical education concentrators were more likely than similar samplers and nonparticipants to attain an associate's degree but less likely to attain a bachelor's degree, 2013/14–2017/18 cohorts



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

Note: Data are limited to graduates who attended an in-state public college and university. Certificate and degree completion rates are based on all years of data available for each cohort of graduates and were generated using regression models that adjusted for the background characteristics of graduates and their high schools. See tables C8 and C9 in appendix C for more details.

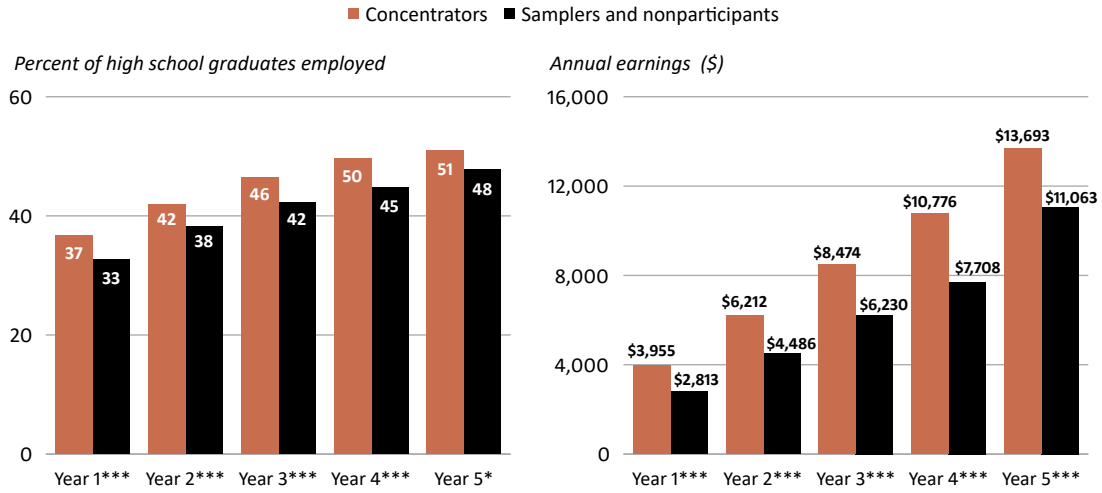
Source: Authors' analysis of data provided by the Indiana Management Performance Hub.

After other factors were adjusted for, Indiana concentrators were more likely than similar samplers and nonparticipants to be employed and had higher earnings during the first five years after high school graduation

During the first five years after high school graduation, Indiana concentrators were employed at a rate 3–5 percentage points higher than similar samplers and nonparticipants (figure 4; see also table C10 in appendix C). Annual earnings were $1,142–$3,068 higher for concentrators than for similar samplers and nonparticipants, and the largest difference occurred in the fourth year after high school graduation (see table C11; see also appendix E for employment and earnings for graduates enrolled in college and for graduates not enrolled in college).

There were no differences in employment rates between explorers and similar samplers and nonparticipants, except that the employment rate in the fourth year after high school graduation was 3 percentage points higher for explorers than for similar samplers and nonparticipants (see table C16 in appendix C). However, annual earnings during the first four years after graduation were $321–$1,456 higher for explorers than for similar samplers and nonparticipants (see table C17 in appendix C).

Figure 4. After other factors were adjusted for, Indiana career and technical education concentrators were more likely than similar samplers and nonparticipants to be employed and had higher earnings during the first five years after high school graduation, 2013/14–2017/18 cohorts



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

Note: n = 135,090 high school graduates for year 1, 106,692 graduates for year 2, 73,626 graduates for year 3, 44,938 graduates for year 4, and 20,678 graduates for year 5. Employment rates and earnings were generated using regression models that adjusted for background characteristics of graduates and their high schools. Employment information was not available for 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 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. See tables C10 and C11 in appendix C for more details.

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

Findings for Minnesota

This section presents the main findings for Minnesota and focuses on differences between career and technical education concentrators and similar samplers and nonparticipants. This section also describes differences between explorers and similar samplers and nonparticipants to show whether taking a diverse set of career and technical education courses (that is, courses in more than one career field) also affects postsecondary and workforce outcomes. Detailed findings are in appendix D.

Nearly half of graduates from Minnesota public high schools between 2012/13 and 2017/18 were concentrators, and the percentage of concentrators was consistent over time

Among the 350,191 students who graduated from a Minnesota public high school between 2012/13 and 2017/18, 44 percent were concentrators, 15 percent were explorers, 24 percent were samplers, and 17 percent were nonparticipants. The percentages of graduates classified as nonparticipants, samplers, explorers, and concentrators was consistent over time (see table D1 in appendix D).

Minnesota high school graduates who were male, graduates who were White, graduates who received special education services, graduates who were proficient in math in grade 8, and graduates who were not proficient in reading in grade 8 were more likely than their peers without those characteristics to be concentrators

Student demographic characteristics and math and reading proficiency in grade 8 were all associated with rates of concentration in career and technical education in Minnesota. The percentage of male graduates who were concentrators (48 percent) was higher than the percentage of female graduates who were (39 percent; see

table D1 in appendix D). A higher percentage of White graduates (46 percent) than of Asian/Pacific Islander graduates (33 percent) and Black graduates (34 percent) were concentrators. Graduates who were not English learner students (44 percent) were more likely than graduates who were English learner students (32 percent) to be concentrators. About 49 percent of graduates who received special education services in high school became concentrators compared with 43 percent of graduates who did not receive services. The associations between graduates' concentrator status and math and reading proficiency showed different patterns. Graduates who were proficient in math in grade 8 were more likely than graduates who were not proficient to become concentrators (23 percent compared with 15 percent). However, graduates who were not proficient in reading were more likely to become concentrators than graduates who were proficient (52 percent compared with 41 percent). Concentrator status was not associated with graduates' eligibility for the national school lunch program.

Minnesota graduates who attended schools with larger percentages of racial/ethnic minority students, schools with smaller percentages of students eligible for the national school lunch program, schools with smaller percentages of students receiving special education services, and schools with higher percentages of students who were proficient in reading were more likely to be concentrators

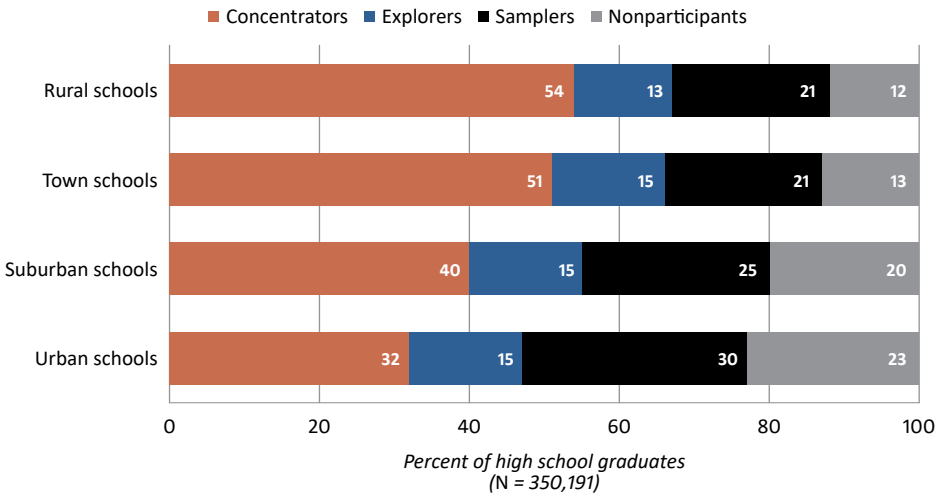
Minnesota high schools that served smaller percentages of racial/ethnic minority students, smaller percentages of students eligible for the national school lunch program, smaller percentages of English learner students, smaller percentages of students receiving special education services, and larger percentages of students who were proficient in reading in grade 8 had higher percentages of students who were concentrators than schools that did not have these characteristics (see table D2 in appendix D). Schools with small percentages of racial/ethnic minority students had a higher percentage of graduates who were concentrators (55 percent) than schools with mid-level (43 percent) and large percentages of racial/ethnic minority students (31 percent). Schools with small and mid-level percentages of students eligible for the national school lunch program also had higher percentages of concentrators (46 percent and 44 percent) than schools with large percentages of students eligible for the program (34 percent). Schools with small and mid-level percentages of English learner students had higher percentages of concentrators (46 percent) than schools with high percentages of English learner students (38 percent). Schools with small and mid-level percentages of students receiving special education services had higher percentages of concentrators (45 percent and 44 percent) than schools with large percentages of students receiving special education services (31 percent). Schools with high and mid-level percentages of students who were proficient in reading in grade 8 also had higher percentages of concentrators (46 percent and 44 percent) than schools with low percentages of proficient students (35 percent). Finally, schools in urban areas and suburban areas had lower percentages of concentrators (32 percent and 40 percent) than schools in towns (51 percent) and rural areas (54 percent; figure 5; see also table D2 in appendix D). Conversely, schools in urban areas and suburban areas had higher percentages of nonparticipants (23 percent and 20 percent) than schools in towns (12 percent) and rural areas (13 percent).

After other factors were adjusted for, Minnesota concentrators had lower college enrollment rates within one year of high school graduation than similar samplers and nonparticipants, and concentrators were more likely to enroll in a two-year college but less likely to enroll in a four-year college

After characteristics of graduates and their high schools were adjusted for, Minnesota concentrators from the 2012/13–2017/18 cohorts were less likely (73 percent) than similar samplers and nonparticipants (80 percent) to enroll in college within one year of high school graduation (figure 6; see also table D6 in appendix D). However, enrollment patterns differed for two-year and four-year colleges. About 23 percent of concentrators enrolled in a two-year college compared with 16 percent of similar samplers and nonparticipants. In contrast, 45 percent concentrators enrolled in a four-year college compared with 61 percent of similar samplers and nonparticipants. College enrollments during the study period (up to six years after high school graduation) show the same pattern (see table D7 in appendix D).

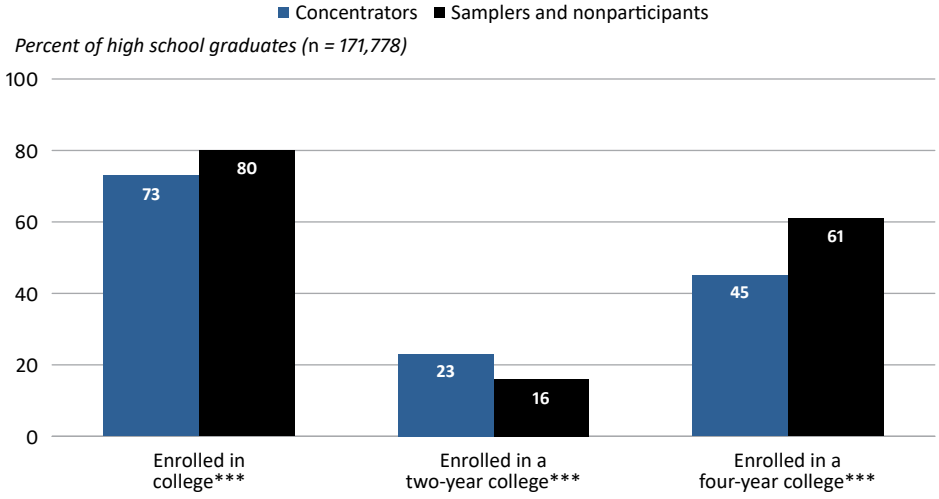
The analyses comparing college enrollment for explorers and similar samplers and nonparticipants produced similar results (see tables D12 and D13 in appendix D).

Figure 5. The percentage of Minnesota graduates who were nonparticipants was higher in high schools in urban and suburban areas than high schools in towns and rural areas, 2012/13–2017/18 cohorts



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

Figure 6. After other factors were adjusted for, Minnesota career and technical education concentrators were less likely than similar samplers and nonparticipants to enroll in college—especially a four-year college—within one year of high school graduation but more likely to enroll in a two-year college, 2012/13–2017/18 cohorts



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

Note: Data are based on Minnesota administrative records and National Student Clearinghouse records and were therefore available for graduates who attended in-state public colleges as well as graduates who attended private colleges and out-of-state colleges. College enrollment rates are based on all years of data available for each cohort of high school graduates and were generated using regression models that adjusted for the background characteristics of graduates and their high schools. See table D6 in appendix D for more details.

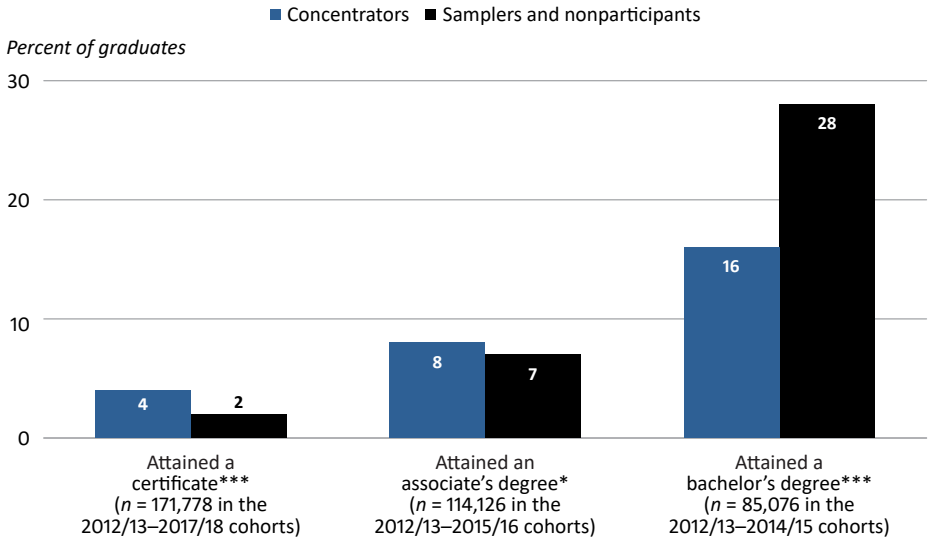
Source: Authors' analysis of data provided by the Minnesota Statewide Longitudinal Education Data System.

After other factors were adjusted for, Minnesota concentrators earned fewer credits in college than similar samplers and nonparticipants and were more likely to attain a certificate but less likely to attain a bachelor's degree

On average, Minnesota concentrators earned 9.5 credits within one year of high school graduation and 28.5 credits within three years of high school graduation compared with 10.9 credits within one year and 32.8 credits within three years for similar samplers and nonparticipants (see table D8 in appendix D). Concentrators were more likely (4 percent) than similar samplers and nonparticipants (2 percent) to attain a certificate (figure 7). Concentrators in the 2012/13–2015/16 cohorts (those with at least three years of post–high school data) also were more likely (8 percent) than similar samplers and nonparticipants (7 percent) to attain an associate's degree.[3] Among Minnesota graduates in the 2012/13–2014/15 cohorts,[4] concentrators were less likely (16 percent) than similar samplers and nonparticipants (28 percent) to attain a bachelor's degree four to six years after high school graduation.

The analyses comparing college outcomes for explorers and similar samplers and nonparticipants produced similar results, except that there was no difference between explorers and similar samplers and nonparticipants in the probability of attaining an associate's degree (about 7 percent; see tables D14 and D15 in appendix D).

Figure 7. After other factors were adjusted for, Minnesota career and technical education concentrators were more likely than similar samplers and nonparticipants to attain a certificate but less likely to attain a bachelor's degree, 2012/13–2017/18 cohorts



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

Note: Data are based on Minnesota administrative records and National Student Clearinghouse records and were therefore available for graduates who attended in-state public colleges as well as graduates who attended private colleges and out-of-state colleges. Certificate and degree completion rates are based on all years of data available for each cohort of high school graduates and were generated using regression models that adjusted for the background characteristics of graduates and their high schools.

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

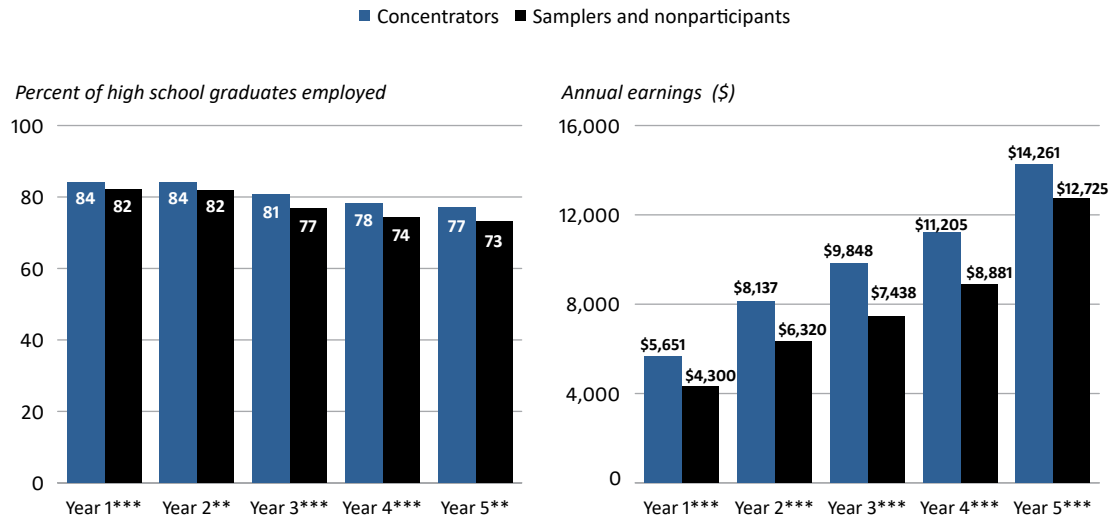
3. These probabilities of attaining an associate's degree do not account for graduates who transfer from a two-year to a four-year college before attaining an associate's degree.
4. Only the 2012/13 cohort has six years of post–high school data, which is the bachelor's degree completion benchmark used by the U.S. Department of Education.

After other factors were adjusted for, Minnesota concentrators were more likely than similar samplers and nonparticipants to be employed and had higher earnings during the first five years after high school graduation

During the first five years after high school graduation, Minnesota concentrators were employed at a rate 2–4 percentage points higher than similar samplers and nonparticipants were (figure 8; see also tables D10 and D11 in appendix D). Annual earnings were $1,352–$2,410 higher for concentrators than for similar samplers and nonparticipants, with the largest difference in the third year after high school graduation (see table D11; see also appendix E for employment and earnings findings for graduates enrolled in college and for graduates not enrolled in college).

The analyses comparing employment rates for explorers and similar samplers and nonparticipants produced different results. Explorers had higher employment rates than similar samplers and nonparticipants in the third year after high school, but in other years there were no statistically significant differences in employment rates between explorers and similar samplers and nonparticipants (see table D16 in appendix D). Explorers earned more than similar samplers and nonparticipants during the first four years after graduation but not in the fifth year (see table D17 in appendix D).

Figure 8. Minnesota career and technical education concentrators were more likely than similar samplers and nonparticipants to be employed and had higher annual earnings during the first five years after high school graduation, 2012/13–2017/18 cohorts



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

Note: $n = 171,778$ high school 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. Employment rates and earnings were generated using regression models that adjusted for the background characteristics of graduates and their high schools. Employment information was not available for 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. See tables D10 and D11 in appendix D for more details.

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

Limitations

Among the limitations discussed in box 2, two limitations are particularly important to consider when interpreting the study findings.

First, Indiana and Minnesota's longitudinal data systems store information only about students' academic history and demographics, and thus the estimated effects might reflect differences between the groups on factors that are unavailable in the data systems rather than the impact of being a career and technical education concentrator or explorer. While the study team attempted to match concentrators and explorers with similar samplers and nonparticipants in the same school, these matches could be based only on the student information available in each state's longitudinal data system. Concentrators and explorers and their sampler or nonparticipant matches might differ in ways that are not routinely measured and stored in states' longitudinal data systems, such as motivation and family expectations. To the extent that graduates are not matched on these factors, differences in outcomes between concentrators and their sampler or nonparticipant matches, as well as between explorers and their sampler or nonparticipant matches, could be related to those unmeasured factors rather than to career and technical education courses.

Second, the inability to match some concentrators and explorers with samplers and nonparticipants means that results cannot be generalized to all graduates in these groups. The purpose of the matching analyses was to produce estimates of the effects of being a career and technical education concentrator or explorer relative to being a sampler or nonparticipant and not to generalize to the full population of concentrators in each state. Concentrators and explorers were included in the analysis only if they could be matched to a similar sampler or nonparticipant. In Indiana 89 percent of concentrators were matched to similar samplers and nonparticipants, and in Minnesota 62 percent of concentrators were matched. In both states concentrators who were in special education and not proficient in math in grade 8 were less likely to be matched with a sampler or nonparticipant. In Minnesota concentrators who were male, concentrators who were eligible for the national school lunch program, and concentrators who were not proficient in reading in grade 8 also were less likely to be matched. Thus, the findings are less likely to apply to concentrators with those characteristics in each state.[5]

Implications

Despite differences in how Indiana and Minnesota defined concentrators and several unique associations between student and school characteristics and their participation in career and technical education, the findings on the differences in outcomes between concentrators and similar samplers and nonparticipants are fairly consistent across states. The findings from this study have three main implications.

First, state education agency staff might want to explore the reasons for the associations between student and high school characteristics and students' decisions to become a career and technical education concentrator. The associations might reflect differences in workforce needs in different parts of each state, differences in interests among different types of students, differences in student access to career and technical education courses or core courses, or some combination of these factors. If the associations reflect differences in access to course opportunities, state agencies might want to explore ways to increase students' access to a wider range of courses. For instance, state agencies could help career and technical education providers expand their course offerings, establish new course providers, or facilitate reciprocal enrollment options between neighboring course providers.

5. The study team also was able to match 91 percent of explorers in Indiana and 62 percent of explorers in Minnesota. In Indiana the probability of being matched was unrelated to high school graduates' demographic or academic proficiency characteristics. In contrast, Minnesota explorers who were members of a racial/ethnic minority group, eligible for the national school lunch program, or not proficient in reading were less likely to be matched to a sampler or nonparticipant.

Second, high school teachers and guidance counselors can use these findings to inform students' selection of courses. High school students who are considering taking career and technical education courses that align with their long-term aspirations might want to know the college enrollment, college completion, employment, and earnings outcomes among students who have made similar choices. High school educators could provide students and their families with information on the differences on these outcomes between concentrators and similar samplers and nonparticipants in the first five to six years after high school graduation. However, concentrating in a career-oriented course of study does not preclude students from enrolling in a two-year or four-year college, attaining a degree, or becoming employed. Many concentrators are still able to attain these outcomes.

Finally, these results can be expanded on in future research. Stakeholders in both states expressed interest in understanding how the results might vary for graduates who concentrate in different career pathways or career fields (for example, information technology, business and marketing, agriculture, or manufacturing) or in more specific content areas within each career pathway or field (see tables A1 and A2 in appendix A for career pathways and career fields offered in each state). More research is needed to determine whether high school graduates who concentrated in certain career pathways or career fields have better or worse outcomes than the outcomes revealed by the aggregate findings in this study. This additional research also can help career and technical education directors at the state and district levels identify which career and technical education courses are associated with students' longer-term college and workforce success. Future research could also explore the longer-term outcomes among concentrators, explorers, and similar samplers and nonparticipants. That research could examine whether concentrators continue to have higher employment rates and earnings than samplers and nonparticipants over a longer time or whether the differences between the two groups show a reversal as those who enrolled in a four-year college immediately after high school attain their degree and enter the workforce.

References

Arbeit, C. A., Leu, K., & Dalton, B. (2017). *Secondary career and technical education: Differences in access, participation, and outcomes in two national studies*. U.S. Department of Education, Office of Career, Technical, and Adult Education. https://eric.ed.gov/?id=ED584711.

Brunner, E., Dougherty, S., & Ross, S. (2019). *The effects of career and technical education: Evidence from the Connecticut Technical High School System* (EdWorkingPaper No. 19–112). EdWorkingPapers. https://www.edworkingpapers.com/ai19–112.

Carl D. Perkins Career and Technical Education Improvement Act of 2006. (2006). 20 U.S.C. § 2301 et seq.

Dalton, B. (2015). *Eight-year postsecondary outcomes of career and technical education students from the high school class of 2004.* U.S. Department of Education, Office of Career, Technical, and Adult Education. https://eric.ed.gov/?id=ED580321.

Dougherty, S. (2016). *Career and technical education in high school: Does it improve student outcomes?* Thomas Fordham Institute. https://eric.ed.gov/?id=ED570132.

Giani, M. S. (2019). *Who is the modern CTE student? A descriptive portrait of career and technical education students in Texas*. American Enterprise Institute. https://www.aei.org/wp-content/uploads/2019/03/Who-Is-the-Modern-CTE-Student.pdf?x91208.

Strengthening Career and Technical Education for the 21st Century Act of 2018. (2018). 20 U.S.C. § 2301 et seq.

U.S. Department of Education, National Center for Education Statistics. (2019). *Baccalaureate and beyond (B&B:16/17): A first look at the employment and educational experiences of college graduates, 1 year later* (NCES No. 2019–106). Retrieved April 1, 2021, https://nces.ed.gov/fastfacts/display.asp?id=569.

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