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Linkage Between Fields of Concentration in High School Career-Technical Education and College Majors

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Abstract

In this descriptive study, we use longitudinal student-level administrative records from 4 cohorts of high school graduates in Kentucky to examine the extent to which students persist and attain post-secondary credentials in the CTE fields of concentration they choose in high school. To our knowledge, this is the first paper to use student-level administrative data to examine how different fields of concentration in high school CTE are related to future postsecondary outcomes. We find that concentrating in a particular CTE field in high school is associated with both continuing on with that same field in college and obtaining a postsecondary credential in that field; this relationship is especially strong in health fields and especially for women in health. The secondary-postsecondary connection is the weakest among students concentrating in occupational fields in high school, who are also the most disadvantaged socioeconomically and academically before high school. Despite the existence of secondary-postsecondary pipelines of career interests, most students enroll and obtain credentials in fields that are *different* from the field of concentration in high school. In addition, relative to students with similar pre-high-school achievement as measured by grades and test scores, we find that CTE concentration in high school is strongly associated with being more likely to enroll in a two-year college and less likely to enroll in a four-year college.

1. Introduction

Career and technical education (CTE) is increasingly a key component of the high school curriculum. CTE offerings provide high school students with an opportunity to explore career interests and develop technical skills, academic knowledge, and employability skills required for further education and careers.[2] As such, a key objective of CTE program design is to streamline the transition between the secondary and postsecondary levels. A prime example of this effort is the introduction of CTE programs of study (POS) under the Carl D. Perkins Career and Technical Education Act of 2006 (Perkins IV). Under POS, the Office of Career, Technical, and Adult Education and Advance CTE established 16 "career clusters" that cover secondary and postsecondary levels.[3] Each career cluster provides a broad overview of essential knowledge and skills needed in those fields, the types of educational topics to be studied, and a list of sample career specialties or occupations. Although POS added more structure to strengthen the integration of secondary and postsecondary CTE, initiatives that strive to improve the secondary–postsecondary transition (such as through curriculum integration and dual enrollment) predated POS (Alfeld & Bhattacharya, 2013).

In this descriptive study, we use longitudinal, student-level administrative records from Kentucky to examine the extent to which students persist and obtain postsecondary credentials in the fields of CTE concentration they choose in high school. This investigation is motivated by one of the premises of POS and similar CTE practices: Students who choose a field of concentration in high school are more likely to persist in that field in college, which in turn may help increase college completion rates (Alfeld et al., 2013; Scott-Clayton, 2011). While this is a reasonable theory of change, its empirical support is lacking. Most existing research that links high school CTE participation and later educational and career outcomes focuses on the association between being a CTE concentrator and future student outcomes without

[2] Strengthening Career and Technical Education of the 21st Century Act of 2018, Sec. 3(5).
[3] See https://careertech.org/career-clusters for more details. These career clusters are further divided into 79 career pathways, defined as sequences of academic, career, and technical courses and training that progresses from secondary through postsecondary education (Harris et al., 2020).

differentiating between fields of concentration in high school (e.g., Cowan et al., 2019; Dougherty, 2016).[4]

Understanding the extent to which students follow through on their high school CTE choices in college has important implications. College completion and labor market returns vary considerably across fields. For example, among Kentucky community college students, the return to an associate's degree in health (relative to a high school diploma) is estimated to be about $4,000 per quarter, whereas returns for associate's degrees in humanities or business fields are not statistically significant (Jepsen et al., 2014). There is some evidence that students do not always make informed choices (Long et al., 2015). In a large-scale clustered randomization experiment, for example, female students were found to be not responsive to an informational intervention that provided high school students with wage information for STEM fields (Ding et al., 2021). Emerging evidence also suggests that students from lower socio-economic backgrounds are more likely to sort into programs and colleges with lower labor market returns (Lovenheim & Smith, 2022). If there is a close connection between high school CTE concentrations and college majors and credentials, it would provide additional evidence for the importance of helping students make informed choices *early* in their high school journeys.

On the other hand, if concentration in a particular field in high school CTE is only weakly related to the postsecondary credentials that students ultimately obtain, it is important to understand why students deviate from their initial choices despite significant commitment in high school. Some changes in a field of study may reflect new information that students have gained about the field and about themselves over time. However, switching fields of concentration has an opportunity cost, and excessive changes could lead to inefficiency. For example, Xu and colleagues (in press) found that one third of 2-year college students in Kentucky community colleges completed more credits than required without graduating or

[4] Other work focuses on the impact of students participating in specialized vocational programs, such as Career Academies (Hemelt et al., 2019; Kemple & Willner, 2008) and regional vocational and technical high schools (Brunner et al., 2019; Dougherty, 2018), which also tend not to differentiate among fields of concentration.

transferring to a 4-year college, and frequent program switching is one possible cause of such inefficiency.

The evidence that links specific areas of focus in high school and college, published in a set of closely related studies discussed below, is based mostly on a single data source: the Education Longitudinal Study of 2002 (ELS:2002) (e.g., Gottfried & Plasman, 2018; Plasman et al., 2017; Plasman et al., 2019). To our knowledge, this is the first study to use administrative data from an entire state to classify students into CTE fields in high school based on the courses they took to link their high school experiences with later postsecondary outcomes. As discussed in more detail below, administrative data has several advantages over longitudinal surveys, including diminished prospects for nonresponse bias and not relying on self-reporting for information about college fields of study.

This study complements the existing evidence on the connection between CTE coursetaking in high school and college majors. First, our study provides an important update to the existing evidence with more recent data and a much larger sample. The ELS:2002 followed a nationally representative sample of about 15,000 10th-grade students in 2002 from high school through college. By comparison, this study includes 4 cohorts of 190,000 students who graduated high school between 2013 and 2016. Second, previous studies on the topic have focused on the correlation between the number of CTE credits earned in a particular field in high school and college outcomes. Such correlation may not be linear, and this study examines whether passing a critical threshold—being a high school CTE concentrator in a field of study—predicts college major choices. Third, our study examines both declared majors at the start of college and the fields in which credentials were obtained. Studies that focus on earned credentials fail to consider students who do not complete postsecondary credentials or how initial college majors may differ from earned credentials. Because 40% of college students fail to complete any postsecondary credentials (Shapiro et al., 2018) and students frequently switch majors in college (Holzer & Xu, 2021), those studies exclude important information that could help high school students evaluate how their choices of CTE fields may be related to the chances of completing postsecondary credentials in those fields.

We find that concentrating in a given CTE field in high school is associated with continuing on with that same field in college and ultimately obtaining a postsecondary credential in that field, especially in health fields and especially for women in health. The secondary-postsecondary connection is the weakest among students concentrating in occupational fields in high school, who are also the most disadvantaged socioeconomically and academically before high school. Across all fields, however, most students enroll and obtain credentials in fields that are *different* from the field of concentration in high school. We also find that a meaningful share of CTE concentrators in high school lack a clear career focus, but college enrollment and credential attainment rates do not differ by whether a student focuses high school CTE coursework in a particular field or not. However, we also find that CTE concentrators are less likely to enroll in four-year colleges and more likely to enroll in two-year colleges.

In the sections that follow, we first review the existing evidence on the association between fields of concentration in high school and college. We then discuss the data, sample, and methods used in this study, followed by a presentation of our findings. Finally, we discuss the policy implications of our findings.

2. Secondary–Postsecondary Persistence in Career Interests

Prior work suggests a close connection between high school coursework and college major (Gurantz, 2021; Warne et al., 2019). The sooner a student commits to a field of study once they are in college, the more likely they will earn a postsecondary credential (Jenkins & Cho, 2012). These findings are consistent with the theory that choosing a field of concentration early will help students focus their study and reduce the likelihood of deviating from the path toward college completion (Scott-Clayton, 2011). However, a central goal of high school CTE is to provide students with opportunities to explore their career interests. Surveys suggest that high school students generally do not have a good understanding about the careers in which they have expressed interest, and their stated career objectives align poorly with the CTE courses they take (DeFeo, 2015). Thus, CTE coursework in high school does not necessarily reflect students' true career interests, and fields of concentration in high school CTE may not mark the beginning of a well-defined pipeline of career interest.

Empirical evidence suggests that, despite the observed confusion about CTE courses and careers, high school students who took more courses in a high school CTE cluster were more likely to earn postsecondary credentials in the same cluster. For example, Plasman and colleagues (2017) found that each additional health CTE credit earned in high school increased the likelihood of a student earning a postsecondary credential (associate's, bachelor's, or postgraduate degree) in health by 11.1 percentage points. The association is weaker for other career clusters, but it remains statistically significant. Gottfried and Plasman (2018) added evidence on engineering, demonstrating that taking more engineering CTE courses in high school is associated with a higher likelihood of completing a bachelor's degree or higher in engineering, but not an associate's degree in engineering. The authors also found that the strength of the association between high school and college engineering is stronger for women than for men.

Plasman and colleagues (2019) also found that CTE coursetaking in high school was linked to overall CTE coursetaking in the first year of college. However, the relationship varies by areas of focus, and it is significant only for 4-year college students. Focusing on declared college majors, Gottfried and associates (2016) reported that students who received credit for an applied science, technology, engineering, and mathematics (STEM) course in high school (a binary variable) were more likely to major in applied STEM in college. However, the relationship is not statistically significant among 2-year college students, nor is it significant among students with disabilities (Gottfried et al., 2014).

Relative to the level of federal and state interest in facilitating a seamless transition between high school CTE and college and career, the empirical basis for the connection between the fields of concentration in high school and college majors is limited. All the evidence except for that presented by Gottfried and associates (2014), who used the National Longitudinal Survey of Youth 1997 (NLSY97),[5] is based on ELS:2002. In addition to the homogeneity of data sources, the strength of the existing evidence is challenged by the characteristics of the survey data. For example, nonresponse is a great challenge, especially for longitudinal surveys. Liu and Burns (2020) noted that just over half of the baseline ELS:2002 sample graduated from high school with complete high school transcripts, which are necessary to categorize high school CTE coursework. The authors found that nonresponse bias could only be reduced but not eliminated by applying nonresponse adjustments.[6] Similarly, Gottfried and colleagues (2014) reported that high school transcripts were collected for 69.4% of the baseline NSLY97 sample. To study college outcomes, data from additional waves of follow-up are required, which likely exacerbates survey nonresponse.[7] In addition, classification of high school CTE courses poses another challenge in these surveys. Course classification depends on the judgment of coders. The way in which courses are classified varies depending on whether they are coded using the Classification of Secondary School Courses (Ingels et al., 2007) or the School Courses for the Exchange of Data (Liu & Burns, 2020). The fluidity of course classification suggests that course types (academic, vocational, or enrichment) may not accurately reflect the course types intended by local school districts and states. Another challenge of using ELS:2002 and NSLY97 is that declared college majors were collected through interviews in both surveys. In addition to errors typically associated with retrospective self-reports, staff coding of verbatim responses may introduce another source of error (Ingels et al., 2007).

3. Data and Measures

[5] NSLY97 followed a nationally representative sample of about 9,000 students between the ages of 12 and 16 at the end of 1996.
[6] See https://nces.ed.gov/pubs2020/2020010_TechnicalNotes.pdf.
[7] See https://nces.ed.gov/statprog/handbook/pdf/els.pdf.

We used administrative records from 4 cohorts of all high school graduates from Kentucky public schools between school years 2013 and 2016. Longitudinally linked data, compiled by the Kentucky Center for Statistics, tracked these students from the eighth grade through high school and into college.

Secondary School Data

Secondary school data include student background characteristics such as race/ethnicity, sex, school lunch eligibility, special education status, and limited English proficiency; test scores on end-of-grade and end-of-course standardized tests as well as the ACT, which is mandatory for all high school juniors in the state; and transcript data.

We used student characteristics and eighth-grade test scores as control variables in this study. Controlling for *pre*-high school student proficiency instead of measures of high school proficiency, which is often used in this type of research, is important since postsecondary decisions may occur in middle school or earlier (e.g., Roderick et al., 2006; Swail & Perna, 2002; Wimberly & Noeth, 2005). Moreover, high school grades and test scores are likely affected by the types of courses that students choose to take in high school; therefore, they are not ideal baseline controls to use when comparing CTE concentrators and otherwise similar non-concentrators.

High school transcripts provide the detailed course-taking data required to identify CTE courses and categorize them based on the Classification of Instructional Programs (CIP) codes. Because courses were reported by each school using Kentucky Uniform Academic Course Codes, we can accurately and systematically identify the types of courses as intended (academic, CTE, enrichment, etc.) by each school and district. CIP codes—contained in the first two digits of the course number—were used to categorize courses into fields of study. Following prior studies (e.g., Holzer & Xu, 2021; Jenkins & Weiss, 2011), we arranged high school CTE courses into four broad categories: applied STEM, occupational fields, health, and business. Whereas the health and business categories are self-explanatory, applied STEM includes subjects like computer and information sciences, data processing, engineering technology, automobile/automotive mechanics, and industrial mechanics and maintenance. The occupational category includes subjects such as criminal justice administration, teacher assistant/aide, social work, childcare, and fire science/firefighting.[8]

Fields of Concentration

The definition of a high school CTE concentrator is not uniform. In past U.S. Department of Education reports, CTE concentration was defined as either completing three or more CTE credits in an occupational field (e.g., Hudson & Laird, 2009; Levesque et al., 2008) or taking three or more CTE courses in a career cluster (e.g., U.S. Department of Education, 2014). Current federal legislation, known as Perkins V, defines high school CTE concentrators as students who have completed at least two courses in a single CTE program or POS (Strengthening Career and Technical Education for the 21st Century Act, 2018). State definitions of CTE concentrators at the secondary level also vary, with 15 states requiring three or more credits in a single occupational area, 18 states requiring other credit thresholds, and the remaining states applying other types of definitions (U.S. Department of Education, 2014). Research studies use completion of at least four CTE credits—regardless of field—to define CTE concentration (e.g., Cowan et al., 2019; Theobald et al., 2019) or enrolling in at least three CTE courses in an occupationally aligned POS (e.g., Dougherty, 2016).

This study defines CTE concentrators as students who have taken four or more CTE courses in high school, although as discussed below, results are robust to alternative definitions. In addition, if more than half of those courses were in a particular field, we consider them to be concentrators in that field.[9] Our data in Figure 1 show the distribution of the number of CTE courses taken in high school. For bars that represent four or more courses, we also display fields of concentration. We were unable to follow the

[8] Specifically, we assigned CIP codes 1, 2, 3, 11, 21, 47, and 49 to applied STEM; 20, 32, 33, 46, 48, and 58 to occupational fields; 17 to health; and 6, 7, and 8 to business.
[9] Our data does not allow us to differentiate yearlong courses from one-semester courses, and so we use "courses taken" instead of "credits" to define CTE concentration.

current federal definition of CTE concentrator under Perkins V because we do not have information on career clusters and pathways as formally defined under POS.[10] However, one advantage of our definition of CTE concentrators is that it includes students who had a clear CTE orientation but were undecided about which field to focus on. In particular, Figure 1 shows that many students made a substantial commitment to CTE in high school but had no concentration in any particular field. At its minimum, a concentrator in a particular field under our definition would have taken four CTE courses, with two of those courses in the same field—a criterion very similar to the current federal definition. At the end of the findings section below, our study applied an alternative definition of CTE, and the results (presented in supplemental tables) were not substantively different.

College Data

College data include all students attending postsecondary institutions, including both public and private 2- and 4-year colleges in Kentucky. A lack of data from students who enroll in out-of-state colleges is a potential limitation. However, National Student Clearinghouse data for the 2013 cohort of high school juniors—the last cohort for which Kentucky received out-of-state college attendance data for its public high school students—suggests that out-of-state enrollment accounted for less than 3% of students around the ACT college readiness benchmarks (Xu et al., 2022), which is the proficiency range in which most CTE-oriented students score.[11] As a result, the lack of out-of-state college enrollment data is not expected to have a material impact on the study findings.

College transcript data included students' intended field of study and desired credential each semester. We used information collected in the semester when students first enrolled in college to categorize their

[10] Information about career clusters and pathways has been collected in Kentucky's Technical Education Database System (TEDS), which is separate from the administrative data we have. TEDS uses yet another definition to categorize high school CTE students, who are divided into "preparatory" (those who have completed two credits in a career pathway and are enrolled in the third credit) or "exploring" (everyone else who has not met the preparatory status).

[11] The college readiness benchmarks are 18 for English, 19 for math, and 20 for reading. Michaels and Liu (2020), for instance, reported that high school students who completed CTE pathways scored between 16.01 and 18.89 in English, between 18.53 and 21.47 in math, and between 18.36 and 20.92 in reading.

initial college majors into distinct groups: applied STEM, occupational fields, health, business, liberal arts, STEM, undeclared, and non-degree. The first four groups follow the same categorizations for high school CTE courses. The liberal arts group includes majors such as foreign languages, legal professions and studies, social sciences, and performing arts. STEM includes subjects that are not considered to be high school CTE subjects, such as the physical sciences, mathematics and statistics, biological and biomedical sciences, and engineering.[12]

Information on declared major enabled us to include students who failed to complete postsecondary credentials. However, declared major represents a stated preference, which does not always correspond to revealed preference, i.e., the courses and program in which students subsequently enrolled (Zeidenberg et al., 2015). As a result, in addition to the initially declared college major, we used college data to examine whether students earned credentials (including a certificate, diploma, associate's degree, or bachelor's degree) in a particular field of study within 4 years after graduating from high school.

4. Population Characteristics and Summary Statistics

Sixty-one percent of high school graduates in Kentucky took at least four CTE courses during the study period (Figure 2).[13] Among these CTE concentrators, 27% focused on an occupational field; 21%, on applied STEM; 17%, on a business field; and 5%, on a health field. The largest share (29%) of CTE concentrators did not focus on any single field.

Student Attributes

Table 1 summarizes the characteristics of the study population. The first column presents the characteristics of all high school graduates in Kentucky public schools between 2013 and 2016. Note that

[12] The liberal arts include CIP codes 5, 16, 22, 23, 24, 30, 33, 35, 38, 39, 42, 45, 50, and 54. STEM includes CIP codes 14, 26, 27, and 40, which constitute the regulatory definition of "STEM field" used by the Department of Homeland Security.
[13] Comparing of this number to the CTE share measured in other contexts is made challenging by the varied definitions of CTE concentration noted above.

average test scores are positive because test scores are normalized for the entire population of Kentucky in eight grade and the sample used in the paper consists of high school graduates. The next two columns present the contrast between high school CTE concentrators and non-concentrators. The remaining columns break out the CTE concentrator population by field of concentration in high school.

CTE concentrators in high school scored at least a quarter of a standard deviation lower than non-concentrators on eighth-grade state standardized tests in math, reading, and English (columns 2 and 3). Proficiency gaps of this size suggest that CTE concentrators were at least a year behind non-concentrators academically before starting high school (Lipsey et al., 2012). Compared with non-concentrators, CTE concentrators in our study sample were also significantly more likely to be eligible for free or reduced-price lunch, to have limited English proficiency, to receive special education, and to be White. These patterns are consistent with Cowan and colleagues' (2019) findings in Washington state.

Student attributes vary across fields of concentration in high school. CTE students who concentrated on health and business in high school scored higher on eighth-grade tests than CTE concentrators in other fields, although the test scores of health and business CTE students were still significantly lower than those of non-concentrators. Health and business CTE concentrators also appear to be less likely to receive special education services than CTE concentrators in other fields. High school CTE concentrators in occupational fields tend to be the most disadvantaged. This group has the highest percentage of students eligible for free or reduced-price lunch (50%) and the lowest pre-high school proficiency, scoring between 0.41 and 0.47 of a standard deviation below non-concentrators on eighth-grade tests. This means that students who chose to focus on occupational CTE in high school were 2 years behind their peers academically before they entered high school. As discussed in the methods section below, although we include controls for test scores and grades prior to high school in order to account for the sorting of different types of students into different CTE fields, these sample selection concerns mean that the results do not necessarily have a causal interpretation.

We also see evidence of what Katz referred to as "identity mismatch"—the unwillingness of men to enroll in fields they associate with women and vice versa (Katz, 2017). Eighty-four percent of students who concentrated in health CTE were female, whereas among applied STEM concentrators only 26% were female.

College Choices and Outcomes

On average, CTE concentrators were more likely to enroll in a 2-year college (30%) than non-concentrators (23%) but less likely to enroll in a 4-year college (31% vs. 46%). Figure 3 depicts a more nuanced relationship among college enrollment, high school CTE concentration, and eighth-grade test score decile. The y-axis of the figure is the college enrollment rate among high school graduates, and the x-axis is the decile of academic proficiency measured by students' eighth-grade test scores (averaged across math, reading, and English). High school CTE concentrators are represented by the blue line; non-concentrators, by the red line. The left panel represents overall college enrollment. As expected, pre-high school academic proficiency is a strong predictor of enrollment in a 4-year college, regardless of CTE concentrator status in high school, although non concentrators are more likely to enroll in college in every decile except the top. However, the middle and right panels, which show 4-year and 2-year college enrollment separately, show that the overall college enrollment picture masks important trends by type of postsecondary institution.

Although non-concentrators were more likely than concentrators to enroll in a 4-year college along the entire distribution of academic proficiency, the differences were the widest among students in the sixth to eighth decile. In contrast, the relationship between 2-year college enrollment and academic proficiency is not linear. For both concentrators and non-concentrators, 2-year college enrollment rates increased with pre-high school proficiency and peaked at the fourth decile on the proficiency distribution. Enrollment rates in 2-year colleges declined as eighth-grade test scores increased above the fourth decile, but the decline was more precipitous for non-concentrators than for high school CTE concentrators. Among those who scored in the 60th percentile or higher on eighth-grade tests, high school CTE concentrators were more likely to enroll in a 4-year college than in a 2-year college.

Table 1 (columns 4 through 8) shows that college outcomes varied by field of concentration in high school CTE. About 40% of health and business CTE concentrators enrolled in a 4-year college (compared to no more than 30% for CTE concentrators in other fields), and more than 20% earned an associate's degree or higher (compared to no more than 15% for concentrators in other fields). In fact, the likelihood of earning an associate's degree or higher was not statistically different between non-concentrators and CTE concentrators in health. Across fields of concentration, students who concentrated in CTE occupational fields in high school were the least likely to enroll in college or earn postsecondary credentials of any type.

Alignment Between High School CTE Concentration and College Major

Table 2 presents the distribution of initial major choices in college and postsecondary credentials obtained by CTE concentration in high school (the organization of the columns is the same as in Table 1). On average, the distribution of initial major choices did not differ substantially between high school CTE concentrators and non-concentrators in fields other than applied STEM, health, and STEM. High school CTE concentrators were more likely to declare a major in applied STEM (10% vs. 6%) and health (13% vs. 10%), whereas non-concentrators were more likely to major in STEM (13% vs. 8%).

The association between initial major choices in colleges and fields of concentration in high school CTE was the strongest in health. One third of high school graduates who concentrated in health CTE in high school declared a health major in college, compared to 15% in business and about 20% in applied STEM and occupational fields. However, the most frequently declared college major was liberal arts, regardless of the field of concentration in high school CTE. This may be expected to have labor market implications because the return to liberal arts tends to be lower than to other fields (Jepsen et al., 2014; Lovenheim et al., 2022). At the same time, we note that in the results below, CTE concentration in high school is associated with being less likely to initially choose liberal arts in college, especially for students who enroll in two-year colleges.

Although 30% of high school graduates declared liberal arts as their initial college major, only 9% of non-concentrators and 6% of CTE concentrators obtained postsecondary credentials in liberal arts. In general, high school graduates were more likely to obtain postsecondary credentials in the same field as their high school CTE concentration. The association was the strongest in health, with 15% of health CTE concentrators in high school eventually obtaining postsecondary CTE credentials. However, most high school CTE concentrators did not obtain postsecondary credentials in a field on which they had focused in high school (in part because these summary statistics also include high school graduates who did not enroll in college). Even in health, 18% of high school health CTE concentrators obtained credentials in a non-health field.

5. Methods

Summary statistics in Table 1 show that students who later chose different CTE concentrations in high school differed substantially in attributes and pre-high school academic proficiency. It is therefore important to account for student heterogeneity when estimating the association between being a CTE concentrator in a particular field in high school and the likelihood of majoring in that field in college, as well as obtaining a postsecondary credential in the field. It is important to note that, while we can account for observable differences among students, there are likely unobserved factors that led students to choose a particular field of CTE concentration in high school. These same factors could also have affected postsecondary choices and outcomes. We estimate the following binary logistic regression model:

$$\log\left(\frac{\Pr(Y_i = 1)}{1 - \Pr(Y_i = 1)}\right) = \beta_0 + \sum_{j=1}^{5} \beta_j \, CTE_{ij} + X_i\gamma + \varepsilon_i$$

In this model, $Y_i = 1$ if student i enrolled in college, chose a particular major, or obtained credentials in a particular field. CTE_{ij} are indicator variables if student i was a high school CTE concentrator in field j. X_i

is a vector of student attributes, including student race/ethnicity; special education status; limited English proficiency status; school lunch eligibility; and eighth-grade test scores in math, reading, and English. In one of the alternative specifications, we also included eighth-grade grade point average to account for student heterogeneity that may not be captured by test scores. Because the relationship between test scores and college outcomes is not linear (Figure 3), cubic polynomials of test scores were used. To allow for gender to fully interact with all covariates, we estimated this model separately for female students instead of including it as one of the control variables. To facilitate interpretation, estimated coefficients are reported as marginal effects.

To test the robustness of estimated associations, we included school fixed effects in an alternative specification using a linear probability model to account for unobserved heterogeneity across high schools.[14] High schools offer a wide variety of opportunities (such as dual enrollment, articulated credit agreements, etc.) to support the transition between secondary and postsecondary levels, and school-level differences account for a significant portion of the variation in later college and labor market outcomes. For example, Altonji and Mansfield (2011) estimated that 27% of the variance in the 4-year college enrollment rate could be explained by between-school variations. In the context of CTE, state education agencies work with local employers and colleges to provide a portfolio of programs aimed at streamlining the transition from high school to college to the local labor market (Harris et al., 2020). As a result, the estimated association between high school CTE concentration and college majors and credentials could reflect the level of coordination between partnering high schools and colleges. The nature and strength of secondary–postsecondary partnership in CTE could vary systematically across schools. A high school fixed-effects model allows for comparisons of college outcomes of students in the same high school who chose different levels and fields of CTE concentration.

[14] Results are also similar when using a linear probability model without school fixed effects.

While the available data can capture a great degree of heterogeneity across students, including test scores and course grades prior to high school, these results should not necessarily be interpreted in a causal manner. It is difficult to separate the actual impact of being exposed to a particular CTE field in high school with a student's interest in that field that led him or her to enroll in those courses in the first place. While we note that Dougherty (2018) found similar results for OLS and regression discontinuity when examining the effect of enrolling in specialized vocational and technical high schools on later high school outcomes, this doesn't necessarily mean that controls fully account for sample selection in our setting. In particular, the treatment (chosen CTE concentration in high school) and outcome (preference for college major) are very closely related in a way that controls may not be able to account for.

6. Results

College Enrollment Patterns

Table 3 reports the estimated association between college enrollment patterns and high school CTE concentration. The first three columns report results for 4-year college enrollment, the next three columns report results for 2-year college enrollment, and the last three columns report results for enrollment in college regardless of level. In each set of regressions, we begin by controlling for student attributes only, including cubic polynomials of eighth-grade test scores in math, reading, and English. In the following specification, we add grade point average from eighth grade (including an indicator for missing GPA for students who don't have graded courses in eighth grade). Finally, high school fixed effects are added to investigate the sensitivity of the estimates to school heterogeneity. Because estimates change minimally across these three specifications, we take the basic model in the first column to be our main specification for future tables.

The top panel in Table 3 shows that concentration in CTE in high school is associated with a lower likelihood of enrolling in a 4-year college by about 8 percentage points and an increased likelihood of enrolling in a 2-year college by about 5 percentage points. This is consistent with the patterns discussed earlier regarding Figure 3. Compared with direct comparisons of enrollment rates without controlling for baseline differences in student and school attributes (a 15- and 7-percentage-point difference for 4- and 2-year enrollment rates, respectively; Table 1), baseline differences explain about half of the enrollment gap in 4-year colleges but little about the observed enrollment gap in 2-year colleges. In other words, whether a student concentrated in high school CTE (and unobserved attributes that led the student to focus on CTE) consistently predicts 2-year college enrollment regardless of observed attributes.

In the bottom panel of Table 3, high school CTE concentrators are separated by field of concentration, including students who were CTE concentrators without focusing on any particular field. The overall college enrollment patterns remained the same across fields of concentration in high school CTE. That is, CTE concentrators in high school were less likely to enroll in a 4-year college and more likely to enroll in a 2-year college than non-concentrators. However, variation in enrollment patterns across fields of concentration is notable. Focusing on business in high school CTE is associated with the smallest drop in 4-year college enrollment rate (2 percentage points), and focusing on health is associated with the largest increase in 2-year college enrollment rate (14 percentage points). Overall, students who focused on health CTE in high school were 10 to 12 percentage points more likely than non-concentrators to enroll in college. Similarly, students who focused on business CTE in high school were more likely than non-concentrators to enroll in college overall (by 3 percentage points).

Initial College Majors

For students who enrolled in college, Table 4 reports the estimated association between CTE concentration in high school and major declared at the beginning of college. Each column represents the probability of choosing a particular field of study in college as a function of students' chosen CTE field in high school. Bolded coefficients (and standard errors) show the estimates of same-field association. All models control for student characteristics and eighth-grade test scores. Analytic samples were all college students in the top panel of the table, and 2-year college students were only in the bottom panel.

Overall, concentration in CTE in high school reduced, by less than 2 percentage points, the likelihood that a student would start college with an undeclared major or in a non-degree program. Recall that about 20% of college students started in a non-degree program or with an undeclared major (Table 2). Thus, the magnitude of the reduction in student uncertainty about what to study in college is modest. Among all college students, focusing on a CTE field in high school is positively associated with choosing a college major in the same field. For instance, compared to non-concentrators, concentrators in applied STEM in high school were about 11 percentage points more likely to declare an applied STEM major in college. This represents a massive change in percentage terms, as the baseline for applied STEM majors among non-concentrators is only 6 percent of the sample. The association in field of study between high school and college is the strongest in health (coefficient = 0.15) and the weakest in occupational fields (coefficient = 0.05).

In contrast to evidence of same-field association between high school and college, cross-field association tends to be weak. In some cases, choosing a high school CTE field of concentration sharply reduced the likelihood that a student would enroll in a different field of study in college. For example, being a concentrator in health in high school reduced the likelihood that a student would declare in an occupational major in college by 10.8 percentage points, an applied STEM major by 7.0 percentage points, and a business major by 6.6 percentage points.

Estimates in the bottom panel of Table 4 suggest that the association between high school CTE concentration and initial college major is largely the same among 2-year college students. The secondary–postsecondary pipeline of career focus is evident, and the health pipeline appears to be the most well defined, with the least "leakage" into other fields of study.

Postsecondary Credentials

Table 4 demonstrates that students' stated preferences (i.e., declared major at the start of college) were consistent with the field of concentration they chose in high school CTE. In Table 5, we examine whether secondary–postsecondary pipelines of career preferences ultimately led to postsecondary credentials in the same field (revealed preferences). The columns are arranged by earned credential type, with the top panel reporting results for all college students and the bottom panel reporting results for 2-year college students only.

The first and last columns of Table 5 present the estimated correlation between high school CTE concentration and the probability of completing an associate's degree or higher or a certificate or diploma. Associate's degrees or higher are broken out by field of study in the middle five columns. Because the number of awarded certificates and diplomas was small, those credentials were not investigated separately by fields of study.

Although CTE concentrators in high school were less likely than non-concentrators to enroll in college overall (Table 3), they were more likely to attain postsecondary credentials once enrolled (Table 5). Specifically, among college students with similar attributes and pre-high school test scores, CTE concentrators in high school were more likely than non-concentrators to complete an associate's degree or higher (2 percentage points) or a certificate/diploma (by 3.6 percentage points). This pattern holds regardless of the CTE field in which a student concentrated in high school. Compared with non-concentrators, students who concentrated in health in high school CTE had the largest gain in completing an associate's degree or higher (4.5 percentage points), and students who concentrated in applied STEM had the largest gain in earning a certificate/diploma (5.4 percentage points). Again, these are large changes relative to the baseline share of high school graduates who earn college degrees. In the study period, 18 percent of students would earn an associate's degree or higher (Table 1), meaning the 4.5 percentage point increase associated with health CTE in high school is an increase of 25%.

Estimates for 2-year college students (Table 5, Panel B) are mixed for degree attainment but stronger for completing a certificate/diploma. Taken together, these estimates suggest that the overall gains in degree attainment associated with high school CTE concentration were likely driven by CTE concentrators who enrolled in a 4-year college, whereas the gains in certificates/diplomas were mostly driven by CTE concentrators who enrolled in a 2-year college. Another notable finding is that concentrating in health and business in high school appears to be doubly beneficial in that focusing on these fields is associated with higher rates of college enrollment (Table 3) and postsecondary credential attainment (Table 5).

The middle columns of Table 5 present the estimated association between fields of concentration in high school and the fields in which students completed an associate's degree or higher. As with the relationship between high school CTE and initial college majors shown in Table 4, the correlation between the fields of earned degree and high school CTE concentration is apparent in Table 5. However, the estimated correlations are about half as large as those between initial college majors and fields of concentration in high school CTE. For example, relative to non-concentrators, similar students who concentrated in health CTE in high school were 7 percentage points more likely to complete a degree in health, even though they were 15 percentage points more likely to major in health initially.

Results for Subsamples

Summary statistics in Table 1 show that male and female students tend to choose CTE fields of concentration that historically have been dominated by students of their own gender. In the supplemental analyses reported in Tables A1 through A3, we investigate whether there are also gendered differences in the secondary–postsecondary pipeline of career interests. For female students, being a CTE concentrator in high school is associated with a 7-percentage-point drop in the 4-year college enrollment rate and a 5-percentage-point increase in the 2-year college enrollment rate (Table A1). Both estimates are similar to the estimated relationship for the general student population.

Among female students who enrolled in college, the association between initial college major and field of concentration in high school CTE was largely similar to that for all students (Table A2). The only exception is that for females, being an applied STEM concentrator in high school is a much weaker predictor of enrolling in an applied STEM major in college (0.042 vs. 0.108 for all students). Finally, the estimated correlations between the field in which a student completed a degree and the student's field of concentration in high school are generally weaker for females than the population averages, except in health. For females, concentrating in health in high school CTE increased the likelihood of completing a health degree by 8.9 percentage points (compared to a population average estimate of 7.3 percentage points).

In results available from authors, we also examined a sample of Black and Hispanic students, pooled together for sample size considerations. We find that while the relationship between CTE concentration in college and 2-year and 4-year college enrollment is somewhat attenuated (about -5 percentage points for 4-year and +4 for 2-year), the relationships between CTE field of study in high school and choice of major and eventual credential attainment conditional on college enrollment is largely similar to the full sample.[15]

7. Conclusion

Reducing the friction in the secondary to postsecondary transition has been a focus of CTE programs and initiatives. Although CTE participation in high school has been found to produce positive college and career outcomes in general, some of the benefits are limited to a few CTE fields (Plasman, 2019). Thus, it is important to examine the secondary–postsecondary CTE pipeline by field of concentration. This study adds several important findings to the existing evidence base.

First, a meaningful share of CTE concentrators in high school appear to lack a clear career focus despite their commitment to CTE by taking four or more CTE courses. Although a lack of concentration may raise concerns about haphazard course choices, it could also reflect the objective of high school CTE

[15] To test the robustness of the main findings to alternative definitions of a high school concentrator, we also experimented with redefining CTE concentrators as students who took three or more CTE courses in high school. If more than half of those courses were in a single field, then the students were considered to be concentrators in that field. Using this alternative definition, we reproduce the main results presented in Tables 3 through 5 and report the new estimates in appendix Tables A4 through A6. Estimates based on the alternative definition of CTE concentration are directionally consistent with the main findings. Taking three or more CTE courses in high school is associated with a reduction in 4-year college enrollment rate of 12.0 to 13.6 percentage points (compared with 8.0 to 8.4 percentage points in the main findings) and an increase in the 2-year college enrollment rate by 6.5 to 7.7 percentage points (compared with 5.2 to 5.3 percentage points in the main findings). The estimated association between field of concentration in high school and initial college major is quite consistent with those reported in the main findings.

programs to offer students opportunities to explore their career interests. Estimates in our study show that students without a field of concentration in high school enrolled in college and earned postsecondary credentials at a rate similar to that of the average CTE concentrator.

Second, the health pipeline appears to be the most well defined, in that focusing on health coursework in high school is associated with an increased likelihood of enrolling in and graduating from a health major in college, as well as a significantly reduced likelihood of enrolling in another field of study. By comparison, students who focused on an occupational field in high school tend to have less strong relationships between their high school CTE concentration and eventual field of study in college. Although there is a positive correlation between occupational coursework in high school and college outcomes in the same fields, occupational coursework is also correlated with increased rates of enrolling in college and completing credentials in applied STEM and health.

The tenuous secondary–postsecondary link in occupational fields warrants closer scrutiny. Occupational CTE is the most popular field of concentration among high school CTE concentrators. At the same time, occupational concentrators are the most disadvantaged, lagging other CTE concentrators by 1 year academically before entering high school and by 2 years relative to non-concentrators. Moreover, in contrast to health, which in recent years has consistently been among the highest-demand occupations (known as "Bright Outlook occupations"), occupational fields are more heterogeneous and more volatile in market demand. Occupational concentrators therefore need to overcome the disadvantages they face and be prepared to adapt to labor market conditions. Course offerings that are more rigorous and flexible, and more accurate labor market projections, potentially could help strengthen the career pipeline, which has important implications for equity.

The findings from this study are largely consistent with the existing evidence. However, despite the connection in field of concentration between high school and college, most concentrators did not enroll or complete credentials in the field in which they focused in high school CTE. Across all fields of concentration in high school, a high percentage of students enrolled in liberal arts or had an undeclared major in college, suggesting that choosing a focus in high school CTE will not necessarily reduce the uncertainty about what to study in college. Such uncertainty continues to develop beyond the initial college major, which is reflected in the significantly weaker correlation between obtained credentials and high school CTE concentration.

The apparent links between high school CTE and college majors, coupled with evidence of significant leakiness of pipelines of career interests, may reflect the dual goals of high school CTE of providing students with opportunities to explore career interests and helping them focus on a particular field as early as possible. A natural policy question is to what extent students should be steered to a particular field of concentration (or whether to concentrate in CTE at all). Although there is an extensive literature on the returns to college credentials and coursework, answer to this question is complicated by several factors. For example, our findings suggest a considerable decrease in 4-year college enrollment rates associated with focusing on CTE in high school. This is consistent with the diversion theory (Rouse, 1995) in that many students who could have attended 4-year colleges may have been drawn to 2-year colleges instead. However, our data also suggest that among students who enroll in college, regardless of level, being a CTE concentrator in high school is associated with higher completion rates. The tradeoff between reduced 4-year college enrollment and increased completion rate once enrolled varies by high school CTE concentration. Moreover, about a third of students who start in a community college transfer to a 4-year college later.[16] As a result, reduced likelihood of *starting* in a 4-year college does not necessarily portend a net loss in expected earnings.

Even if we had reliable estimates of the expected labor market returns by field, another important factor to consider is that these estimates do not always reflect what is the best for each individual student. Kirkeboen and colleagues (2016) found that the returns to most majors relative to students' next best choices were positive, suggesting that students know their own comparative advantage (in terms of skills

[16] NCES report, "Community College Students – Goals, Academic Preparation and Outcomes – Postsecondary Education Descriptive Analysis Reports." http://nces.ed.gov/pubs2003/2003164.pdf

and preferences) when selecting college majors. CTE policies in high school thus may do well to allow for students to experiment with different fields of concentration while at the same time being provided with information about the postsecondary and labor market prospects of each field.

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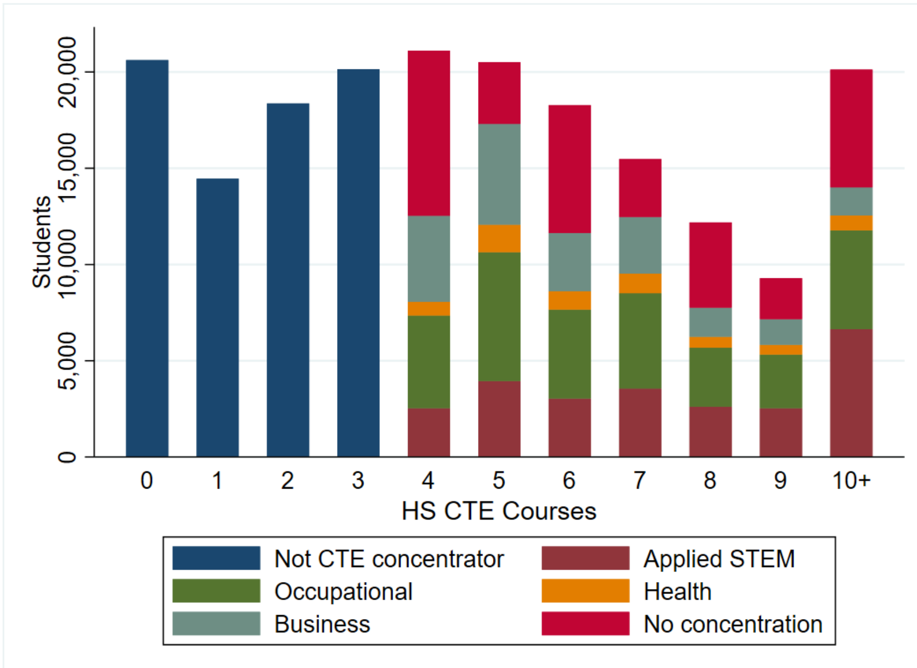
Figures and Tables

Figure 1. Distribution of high school graduates by the number of high school CTE courses taken and fields of concentration



Note. High school CTE concentrators are defined as students who took at least four CTE courses. To be a concentrator in a particular field, more than half of the CTE courses that a concentrator took must be in that field.

Figure 2. Percentage distribution of high school graduates by CTE concentration in high school: 2013–2016

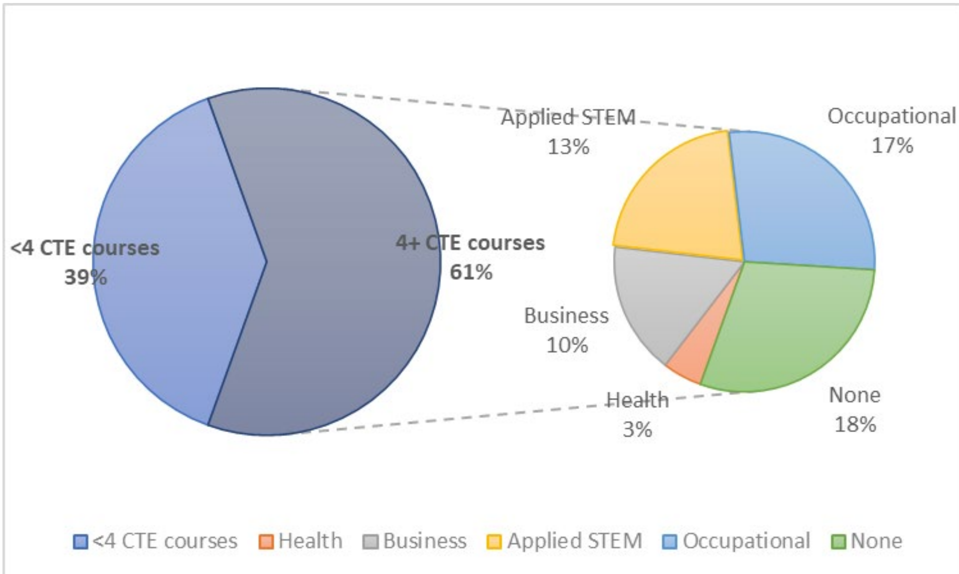


Figure 3. College enrollment by CTE concentration and achievement decile

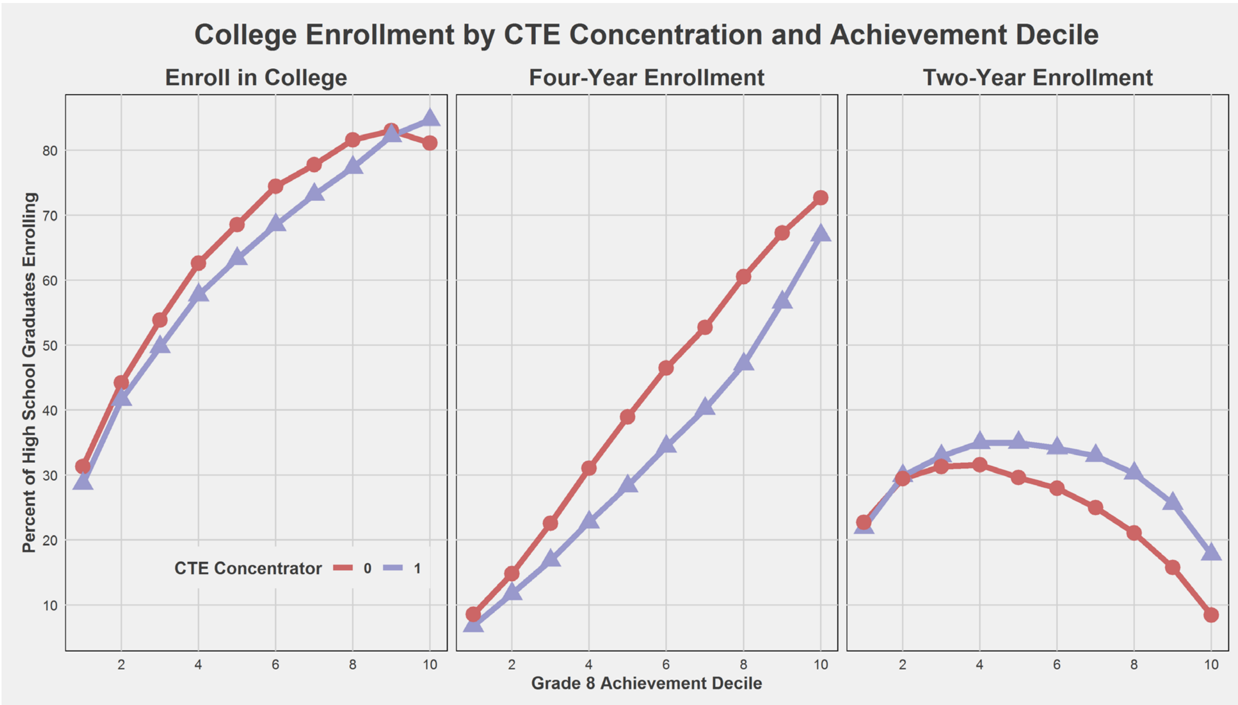


Table 1. Student test scores and attributes (means and standard deviations), by high school CTE concentration: 2013–2016

	All	0–3 CTE	4+ CTE	By CTE Concentration in High School				
				Applied STEM	Occupational	Health	Business	None
Grade 8 math	0.06	0.22	-0.04	0.02	-0.19	0.09	0.12	-0.05
	(0.98)	(1.03)	(0.94)	(0.98)	(0.93)	(0.83)	(0.94)	(0.93)
Grade 8 reading	0.05	0.24	-0.06	-0.06	-0.18	0.13	0.06	-0.06
	(1.00)	(1.07)	(0.94)	(0.97)	(0.89)	(0.92)	(0.97)	(0.92)
Grade 8 English	0.06	0.27	-0.07	-0.09	-0.20	0.15	0.07	-0.06
	(1.00)	(1.07)	(0.93)	(0.95)	(0.90)	(0.90)	(0.95)	(0.92)
School lunch eligibility	0.40	0.35	0.44	0.40	0.50	0.47	0.39	0.42
	(0.49)	(0.48)	(0.50)	(0.49)	(0.50)	(0.50)	(0.49)	(0.49)
Limited English proficiency	0.01	0.00	0.01	0.00	0.01	0.01	0.01	0.00
	(0.07)	(0.07)	(0.08)	(0.06)	(0.08)	(0.10)	(0.08)	(0.07)
Special education	0.06	0.05	0.07	0.08	0.09	0.02	0.04	0.07
	(0.24)	(0.22)	(0.26)	(0.27)	(0.29)	(0.15)	(0.20)	(0.25)
Female	0.50	0.53	0.48	0.26	0.54	0.84	0.45	0.53
	(0.50)	(0.50)	(0.50)	(0.44)	(0.50)	(0.36)	(0.50)	(0.50)
White	0.83	0.81	0.84	0.93	0.82	0.81	0.78	0.83
	(0.38)	(0.39)	(0.37)	(0.26)	(0.39)	(0.39)	(0.42)	(0.37)
Asian	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01
	(0.10)	(0.12)	(0.08)	(0.07)	(0.07)	(0.08)	(0.10)	(0.08)
Black	0.10	0.10	0.09	0.02	0.11	0.11	0.14	0.09
	(0.29)	(0.30)	(0.29)	(0.16)	(0.31)	(0.31)	(0.35)	(0.29)
Two+ races	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02
	(0.14)	(0.15)	(0.13)	(0.11)	(0.13)	(0.15)	(0.15)	(0.14)
Hispanic	0.04	0.05	0.04	0.03	0.05	0.05	0.04	0.04
	(0.20)	(0.21)	(0.20)	(0.16)	(0.21)	(0.21)	(0.20)	(0.20)
Other race	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.01
	(0.08)	(0.08)	(0.08)	(0.07)	(0.08)	(0.06)	(0.07)	(0.08)
Enroll in 2-yr	0.27	0.23	0.30	0.30	0.28	0.40	0.29	0.31
	(0.45)	(0.42)	(0.46)	(0.46)	(0.45)	(0.49)	(0.45)	(0.46)
Enroll in 4-yr	0.36	0.46	0.31	0.26	0.25	0.39	0.42	0.31
	(0.48)	(0.50)	(0.46)	(0.44)	(0.43)	(0.49)	(0.49)	(0.46)
Earned associate's degree or higher	0.18	0.22	0.16	0.15	0.11	0.23	0.21	0.15
	(0.38)	(0.42)	(0.36)	(0.36)	(0.32)	(0.42)	(0.41)	(0.36)
Earned certificate	0.06	0.04	0.07	0.08	0.06	0.09	0.06	0.07
	(0.24)	(0.21)	(0.25)	(0.27)	(0.24)	(0.29)	(0.24)	(0.25)
Earned diploma	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
	(0.10)	(0.07)	(0.11)	(0.14)	(0.10)	(0.12)	(0.09)	(0.11)
Observations	190,583	73,596	116,987	24,883	32,083	5,928	19,984	34,109

Notes: Test scores centered for entire grade eight population, but this sample consists of high school graduates.

Table 2. Percentage of high school graduates who enrolled in college majors and obtained postsecondary credentials, by high school CTE concentration: 2012–2016

			By CTE Concentration in High School				
	0–3 CTE	**4+ CTE**	**Applied STEM**	**Occupational**	**Health**	**Business**	**None**
Enroll in college	0.68	0.61	0.56	0.53	0.79	0.71	0.62
Initial Major Choice							
Applied STEM	0.06	0.10	**0.21**	0.07	0.02	0.08	0.08
Occupational	0.12	0.13	0.13	**0.19**	0.05	0.10	0.12
Health	0.10	0.13	0.07	0.11	**0.33**	0.09	0.16
Business	0.06	0.07	0.05	0.05	0.02	**0.15**	0.06
Liberal Arts	0.30	0.30	0.26	0.32	0.34	0.29	0.31
STEM	0.13	0.08	0.10	0.05	0.10	0.08	0.08
Other	0.01	0.01	0.00	0.01	0.00	0.01	0.01
Non-degree	0.03	0.03	0.05	0.03	0.03	0.03	0.03
Undeclared	0.18	0.15	0.12	0.15	0.09	0.17	0.16
Degree Attainment							
Applied STEM degree	0.02	0.03	**0.07**	0.02	0.01	0.03	0.02
Occupational degree	0.05	0.05	0.05	**0.05**	0.03	0.05	0.04
Health degree	0.04	0.05	0.03	0.04	**0.15**	0.04	0.06
Business degree	0.03	0.02	0.02	0.01	0.02	**0.06**	0.02
Liberal Arts degree	0.09	0.06	0.05	0.05	0.09	0.08	0.06
STEM degree	0.03	0.01	0.02	0.01	0.03	0.01	0.01
Observations	73,596	116,987	24,883	32,083	5,928	19,984	34,109

Table 3. Estimated association between college enrollment and high school CTE concentration

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Enroll in 4-Year College			Enroll in 2-Year College			Enroll in Any College		
Panel A: All CTE concentrators									
4+ CTE courses	-0.082**	-0.080**	-0.084**	0.053**	0.052**	0.052**	-0.036**	-0.034**	-0.032**
	(0.002)	(0.002)	(0.005)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.005)
Panel B: By high school CTE field of concentration									
Applied STEM	-0.126**	-0.124**	-0.125**	0.048**	0.048**	0.042**	-0.080**	-0.078**	-0.083**
	(0.003)	(0.003)	(0.007)	(0.004)	(0.004)	(0.005)	(0.003)	(0.003)	(0.006)
Occupational	-0.110**	-0.106**	-0.108**	0.036**	0.034**	0.032**	-0.074**	-0.072**	-0.076**
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.007)
Health	-0.041**	-0.043**	-0.039**	0.139**	0.138**	0.137**	0.119**	0.115**	0.097**
	(0.006)	(0.006)	(0.011)	(0.006)	(0.006)	(0.010)	(0.007)	(0.007)	(0.009)
Business	-0.019**	-0.017**	-0.018*	0.052**	0.051**	0.052**	0.029**	0.032**	0.034**
	(0.003)	(0.003)	(0.007)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.006)
None	-0.081**	-0.079**	-0.086**	0.058**	0.057**	0.062**	-0.030**	-0.028**	-0.023**
	(0.003)	(0.003)	(0.006)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.005)
Student covariates	X	X	X	X	X	X	X	X	X
Grade 8 GPA		X	X		X	X		X	X
School FE			X			X			X
Observations	190,583	190,583	190,583	190,583	190,583	190,583	190,583	190,583	190,583

Note. ** significant at p < .05. Standard errors in parentheses. Marginal effects are reported for logistic regressions. Student covariates include race/ethnicity; special education status; limited English proficiency status; school lunch eligibility; and cubic polynomials of eighth-grade test scores in math, reading, and English. Columns with school FE included fixed effects for the high school a student attended.

Table 4. Estimated association between initial college majors and high school CTE concentration

	Initial College Major							
	STEM	Applied STEM	Occupational	Health	Business	Liberal Arts	Undeclared	Non-degree
Panel A: Students enrolling in college								
4+ CTE courses	-0.025**	0.045**	0.001	0.024**	0.025**	-0.042**	-0.014**	-0.004**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.001)
By high school CTE field of concentration								
Applied STEM	-0.011**	**0.108****	0.003	-0.032**	-0.002	-0.083**	-0.038**	0.008**
	(0.003)	**(0.002)**	(0.003)	(0.004)	(0.003)	(0.005)	(0.004)	(0.002)
Occupational	-0.044**	0.020**	**0.046****	0.009**	0.001	-0.029**	-0.009**	-0.003
	(0.003)	(0.003)	**(0.003)**	(0.003)	(0.003)	(0.004)	(0.004)	(0.002)
Health	0.004	-0.070**	-0.108**	**0.152****	-0.066**	-0.028**	-0.061**	-0.006*
	(0.004)	(0.008)	(0.007)	**(0.004)**	(0.007)	(0.007)	(0.007)	(0.003)
Business	-0.034**	0.023**	-0.023**	-0.015**	**0.069****	-0.045**	0.006*	-0.011**
	(0.003)	(0.003)	(0.004)	(0.003)	**(0.002)**	(0.005)	(0.004)	(0.002)
None	-0.021**	0.030**	-0.014**	0.047**	0.014**	-0.029**	-0.011**	-0.010**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.004)	(0.003)	(0.002)
Observations	121,467	121,467	121,467	121,467	121,467	121,467	121,467	121,467
Panel B: Students enrolling in a 2-year college								
4+ CTE courses	-0.000	0.044**	0.004	0.014**	0.010**	-0.049**	-0.011**	-0.008**
	(0.000)	(0.004)	(0.004)	(0.004)	(0.003)	(0.006)	(0.003)	(0.003)
By high school CTE field of concentration								
Applied STEM	-0.000	**0.122****	0.010*	-0.074**	-0.009*	-0.122**	-0.011**	0.014**
	(0.000)	**(0.004)**	(0.005)	(0.006)	(0.004)	(0.008)	(0.004)	(0.003)
Occupational	-0.001	0.019**	**0.050****	-0.001	-0.001	-0.056**	-0.012**	-0.006*
	(0.000)	(0.005)	**(0.005)**	(0.005)	(0.003)	(0.007)	(0.004)	(0.003)
Health	-0.001	-0.163**	-0.136**	**0.149****	-0.057**	0.015	-0.058**	-0.015**
	(0.001)	(0.017)	(0.012)	**(0.006)**	(0.009)	(0.011)	(0.009)	(0.005)
Business	-0.001*	0.019**	-0.027**	-0.017**	**0.041****	-0.017*	-0.001	-0.018**
	(0.001)	(0.005)	(0.006)	(0.006)	**(0.003)**	(0.008)	(0.004)	(0.004)
None	-0.000	0.023**	-0.014**	0.044**	0.005*	-0.033**	-0.012**	-0.021**
	(0.000)	(0.005)	(0.005)	(0.004)	(0.003)	(0.007)	(0.004)	(0.003)
Observations	51,957	51,957	51,957	51,957	51,957	51,957	51,957	51,957

Note. * significant at $p < .10$, ** significant at $p < .05$. Standard errors in parentheses. Marginal effects are reported for logistic regressions. Bolded estimates represent same-field association. Student covariates include race/ethnicity; special education status; limited English proficiency status; school lunch eligibility; and cubic polynomials of eighth-grade test scores in math, reading, and English.

Table 5. Estimated association between fields of obtained postsecondary credentials and high school CTE concentration

	Associate's Degree or Higher							
	Overall	STEM Degree	Applied STEM Degree	Occupational Degree	Health Degree	Business Degree	Liberal Arts Degree	Earned Cert/Dip
Panel A. Students enrolling in college								
4+ CTE courses	0.019**	-0.017**	0.021**	-0.001	0.011**	0.010**	-0.040**	0.036**
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
By high school CTE field of concentration								
Applied STEM	0.028**	-0.014**	**0.056****	0.008**	-0.021**	-0.006**	-0.057**	0.054**
	(0.003)	(0.002)	**(0.002)**	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Occupational	0.008**	-0.028**	0.007**	**0.017****	0.006*	-0.004*	-0.039**	0.036**
	(0.003)	(0.002)	(0.002)	**(0.002)**	(0.003)	(0.002)	(0.003)	(0.003)
Health	0.045**	-0.003	-0.031**	-0.047**	**0.073****	-0.016**	-0.030**	0.039**
	(0.004)	(0.003)	(0.005)	(0.005)	**(0.003)**	(0.004)	(0.005)	(0.004)
Business	0.015**	-0.021**	0.004*	-0.008**	-0.004	**0.035****	-0.030**	0.017**
	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	**(0.002)**	(0.003)	(0.003)
None	0.017**	-0.013**	0.010**	-0.011**	0.022**	0.004*	-0.039**	0.035**
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Observations	121,467	121,467	121,467	121,467	121,467	121,467	121,467	121,467
Panel B. Students enrolling in a 2-year college								
4+ CTE courses	-0.010*	-0.003**	0.026**	0.018**	0.005	0.001	-0.037**	0.041**
	(0.004)	(0.001)	(0.003)	(0.003)	(0.003)	(0.002)	(0.004)	(0.005)
By high school CTE field of concentration								
Applied STEM	-0.001	-0.003**	**0.063****	0.041**	-0.046**	-0.007**	-0.052**	0.070**
	(0.006)	(0.001)	**(0.003)**	(0.004)	(0.005)	(0.002)	(0.005)	(0.006)
Occupational	-0.031**	-0.006**	0.016**	**0.031****	-0.000	-0.009**	-0.050**	0.043**
	(0.006)	(0.001)	(0.003)	**(0.004)**	(0.004)	(0.002)	(0.005)	(0.006)
Health	0.023**	-0.003*	-0.071**	-0.038**	**0.078****	-0.007*	-0.021**	0.028**
	(0.008)	(0.001)	(0.011)	(0.008)	**(0.005)**	(0.004)	(0.007)	(0.009)
Business	0.002	-0.004**	0.009*	-0.005	-0.010*	**0.015****	-0.015**	0.015*
	(0.006)	(0.001)	(0.004)	(0.005)	(0.005)	**(0.002)**	(0.005)	(0.007)
None	-0.017**	-0.003**	0.010**	0.007*	0.021**	0.000	-0.037**	0.039**
	(0.005)	(0.001)	(0.003)	(0.004)	(0.004)	(0.002)	(0.005)	(0.006)
Observations	51,957	51,957	51,957	51,957	51,957	51,957	51,957	51,957

Note. * significant at p < .10, ** significant at p < .05. Standard errors in parentheses. Marginal effects are reported for logistic regressions. Bolded estimates represent same-field association. Student covariates include race/ethnicity; special education status; limited English proficiency status; school lunch eligibility; and cubic polynomials of eighth-grade test scores in math, reading, and English.

Appendix

Table A1. Estimated association between college enrollment and high school CTE concentration—Females

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Enroll in 4-Year College			Enroll in 2-Year College			Enroll in Any College		
Panel 1: All CTE concentrators									
4+ CTE courses	-0.071**	-0.069**	-0.070**	0.060**	0.058**	0.058**	-0.015**	-0.015**	-0.013**
	(0.004)	(0.003)	(0.006)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.005)
Panel 2: By high school CTE field of concentration									
Applied STEM	-0.066**	-0.066**	-0.071**	0.064**	0.064**	0.064**	-0.007	-0.007	-0.008
	(0.006)	(0.006)	(0.008)	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.008)
Occupational	-0.095**	-0.091**	-0.092**	0.038**	0.035**	0.034**	-0.056**	-0.055**	-0.058**
	(0.005)	(0.005)	(0.007)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.007)
Health	-0.064**	-0.063**	-0.057**	0.130**	0.129**	0.123**	0.077**	0.075**	0.066**
	(0.007)	(0.007)	(0.011)	(0.007)	(0.007)	(0.010)	(0.007)	(0.007)	(0.009)
Business	-0.021**	-0.020**	-0.020*	0.046**	0.044**	0.042**	0.020**	0.021**	0.022**
	(0.005)	(0.005)	(0.009)	(0.006)	(0.006)	(0.007)	(0.005)	(0.005)	(0.007)
None	-0.081**	-0.080**	-0.084**	0.068**	0.066**	0.072**	-0.017**	-0.017**	-0.012*
	(0.005)	(0.004)	(0.008)	(0.005)	(0.005)	(0.006)	(0.004)	(0.004)	(0.006)
Student covariates	X	X	X	X	X	X	X	X	X
Grade 8 GPA		X	X		X	X		X	X
School FE			X			X			X
Observations	95,040	95,040	94,653	95,040	95,040	94,653	95,040	95,040	94,653

Note. * significant at p < .10, ** significant at p < .05. Standard errors in parentheses. Marginal effects are reported for logistic regressions. Student covariates include race/ethnicity; special education status; limited English proficiency status; school lunch eligibility; and cubic polynomials of eighth-grade test scores in math, reading, and English. Columns with school FE included fixed effects for the high school a student attended.

Table A2. Estimated association between initial college majors and high school CTE concentration--Females

	Initial College Major							
	STEM	Applied STEM	Occupational	Health	Business	Liberal Arts	Undeclared	Non-degree
	Panel A: Students enrolling in college							
4+ CTE courses	-0.023**	0.013**	-0.001	0.058**	0.016**	-0.031**	-0.013**	-0.009**
	(0.003)	(0.002)	(0.003)	(0.004)	(0.002)	(0.004)	(0.003)	(0.002)
	By high school CTE field of concentration							
Applied STEM	-0.015**	**0.042****	0.003	0.032**	-0.004	-0.011	-0.045**	-0.007**
	(0.004)	**(0.002)**	(0.005)	(0.006)	(0.004)	(0.008)	(0.006)	(0.003)
Occupational	-0.043**	-0.003	**0.055****	0.019**	0.000	0.026**	-0.018**	-0.014**
	(0.004)	(0.002)	**(0.003)**	(0.004)	(0.002)	(0.005)	(0.004)	(0.002)
Health	0.000	-0.018**	-0.112**	**0.173****	-0.055**	0.028**	-0.099**	-0.002
	(0.005)	(0.004)	(0.008)	**(0.005)**	(0.007)	(0.008)	(0.008)	(0.002)
Business	-0.022**	0.000	-0.002	-0.000	**0.047****	-0.004	-0.016**	-0.007**
	(0.004)	(0.002)	(0.005)	(0.006)	**(0.002)**	(0.006)	(0.005)	(0.002)
None	-0.021**	0.002	-0.015**	0.089**	0.001	0.012*	-0.025**	-0.013**
	(0.003)	(0.002)	(0.004)	(0.004)	(0.002)	(0.005)	(0.004)	(0.002)
Observations	67,178	67,178	67,178	67,178	67,178	67,178	67,178	67,178
	Panel B: Students enrolling in a 2-year college							
4+ CTE courses	-0.001	0.007**	-0.009*	0.047**	0.010**	-0.020**	-0.015**	-0.016**
	(0.001)	(0.002)	(0.005)	(0.006)	(0.003)	(0.008)	(0.004)	(0.003)
	By high school CTE field of concentration							
Applied STEM	-0.000	**0.026****	-0.024**	-0.002	0.007	-0.023*	0.006	-0.009*
	(0.001)	**(0.003)**	(0.008)	(0.011)	(0.005)	(0.012)	(0.006)	(0.005)
Occupational	-0.001	0.004	**0.036****	0.007	0.006	-0.021*	-0.014**	-0.018**
	(0.001)	(0.003)	**(0.005)**	(0.008)	(0.004)	(0.009)	(0.005)	(0.004)
Health	-0.001	-0.023**	-0.126**	**0.168****	-0.049**	-0.021*	-0.069**	-0.006
	(0.001)	(0.007)	(0.012)	**(0.009)**	(0.009)	(0.012)	(0.010)	(0.004)
Business	-0.001	0.007*	-0.018*	-0.003	**0.038****	-0.016	-0.012*	-0.011**
	(0.001)	(0.003)	(0.007)	(0.010)	**(0.004)**	(0.011)	(0.006)	(0.004)
None	-0.001	0.001	-0.029**	0.079**	0.002	-0.019*	-0.017**	-0.025**
	(0.001)	(0.003)	(0.005)	(0.007)	(0.004)	(0.009)	(0.005)	(0.004)
Observations	22,405	28,511	28,511	28,511	28,511	28,511	28,511	28,511

Note. * significant at p < .10, ** significant at p < .05. Standard errors in parentheses. Marginal effects are reported for logistic regressions. Bolded estimates represent same-field association. Student covariates include race/ethnicity; special education status; limited English proficiency status; school lunch eligibility; and cubic polynomials of eighth-grade test scores in math, reading, and English.

Table A3. Estimated association between fields of obtained postsecondary credentials and high school CTE concentration—Females

	Associate's Degree or Higher							
	Overall	STEM Degree	Applied STEM Degree	Occupational Degree	Health Degree	Business Degree	Liberal Arts Degree	Earned Cert/Dip
Panel A. Students enrolling in college								
4+ CTE courses	0.019**	-0.013**	0.007**	-0.007**	0.032**	0.012**	-0.044**	0.029**
	(0.003)	(0.002)	(0.001)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
By high school CTE field of concentration								
Applied STEM	0.026**	-0.009**	**0.030****	-0.013**	0.019**	0.004	-0.052**	0.028**
	(0.005)	(0.003)	**(0.002)**	(0.005)	(0.005)	(0.003)	(0.006)	(0.005)
Occupational	0.002	-0.022**	-0.001	**0.006***	0.013**	0.000	-0.048**	0.023**
	(0.004)	(0.003)	(0.002)	**(0.003)**	(0.004)	(0.003)	(0.004)	(0.004)
Health	0.043**	-0.004	-0.008*	-0.054**	**0.089****	-0.017**	-0.052**	0.037**
	(0.005)	(0.003)	(0.003)	(0.006)	**(0.005)**	(0.004)	(0.006)	(0.005)
Business	0.025**	-0.013**	0.002	0.007*	0.014**	**0.035****	-0.026**	0.026**
	(0.004)	(0.003)	(0.002)	(0.004)	(0.005)	**(0.002)**	(0.005)	(0.004)
None	0.018**	-0.012**	-0.001	-0.017**	0.042**	0.007**	-0.045**	0.034**
	(0.004)	(0.002)	(0.002)	(0.003)	(0.004)	(0.002)	(0.004)	(0.004)
Observations	67,178	67,178	67,178	67,178	67,178	67,178	67,178	67,178
Panel B. Students enrolling in a 2-year college								
4+ CTE courses	-0.011*	-0.004**	0.003*	-0.002	0.029**	0.005*	-0.036**	0.028**
	(0.006)	(0.001)	(0.002)	(0.003)	(0.006)	(0.002)	(0.005)	(0.006)
By high school CTE field of concentration								
Applied STEM	0.004	-0.003*	**0.015****	-0.003	0.012	0.006*	-0.026**	0.029**
	(0.009)	(0.001)	**(0.002)**	(0.005)	(0.009)	(0.004)	(0.008)	(0.009)
Occupational	-0.042**	-0.006**	0.001	**0.005**	0.010	-0.004	-0.057**	0.021**
	(0.008)	(0.002)	(0.002)	**(0.004)**	(0.007)	(0.003)	(0.007)	(0.008)
Health	0.014	-0.004*	-0.010*	-0.024**	**0.082****	-0.010*	-0.040**	0.023*
	(0.009)	(0.002)	(0.004)	(0.006)	**(0.008)**	(0.005)	(0.009)	(0.010)
Business	0.022**	-0.004**	0.003	-0.000	0.008	**0.020****	-0.003	0.031**
	(0.008)	(0.002)	(0.002)	(0.005)	(0.008)	**(0.003)**	(0.008)	(0.009)
None	-0.021**	-0.004**	-0.003	-0.005	0.040**	0.001	-0.043**	0.035**
	(0.007)	(0.001)	(0.002)	(0.004)	(0.007)	(0.003)	(0.007)	(0.007)
Observations	28511	27365	28388	28511	28511	28511	28511	28511

Note. * significant at p < .10, ** significant at p < .05. Standard errors in parentheses. Marginal effects are reported for logistic regressions. Bolded estimates represent same-field association. Student covariates include race/ethnicity; special education status; limited English proficiency status; school lunch eligibility; and cubic polynomials of eighth-grade test scores in math, reading, and English.

Table A4. Estimated association between college enrollment and high school CTE concentration—Alternative definition

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Enroll in 4-Year College			Enroll in 2-Year College			Enroll in Any College		
Panel 1: All CTE concentrators	-0.070**	-0.066**	-0.074**	0.056**	0.054**	0.053**	-0.024**	-0.021**	-0.022**
3+ CTE courses	(0.003)	(0.003)	(0.006)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.005)
Panel 2: By high school CTE field of concentration									
Applied STEM	-0.114**	-0.110**	-0.115**	0.050**	0.049**	0.042**	-0.069**	-0.067**	-0.073**
	(0.004)	(0.004)	(0.007)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.006)
Occupational	-0.097**	-0.092**	-0.098**	0.041**	0.038**	0.036**	-0.062**	-0.058**	-0.062**
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.006)
Health	-0.037**	-0.038**	-0.036**	0.142**	0.141**	0.136**	0.123**	0.120**	0.100**
	(0.006)	(0.006)	(0.011)	(0.005)	(0.005)	(0.010)	(0.007)	(0.007)	(0.009)
Business	-0.014**	-0.010**	-0.015*	0.053**	0.051**	0.052**	0.034**	0.037**	0.037**
	(0.003)	(0.003)	(0.007)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)
None	-0.078**	-0.074**	-0.083**	0.064**	0.062**	0.066**	-0.023**	-0.021**	-0.017**
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.006)
Student covariates	X	X	X	X	X	X	X	X	X
Grade 8 GPA		X	X		X	X		X	X
School FE			X			X			X
Observations	190,583	190,583	190,583	190,583	190,583	190,583	190,583	190,583	190,583

Note. * significant at p < .10, ** significant at p < .05. Standard errors in parentheses. Marginal effects are reported for logistic regressions. Student covariates include race/ethnicity; special education status; limited English proficiency status; school lunch eligibility; and cubic polynomials of eighth-grade test scores in math, reading, and English. Columns with school FE included fixed effects for the high school a student attended.

Table A5. Estimated association between initial college majors and high school CTE concentration—Alternative definition

	Initial College Major							
	STEM	Applied STEM	Occupational	Health	Business	Liberal Arts	Undeclared	Non-degree
	Panel A: Students enrolling in college							
3+ CTE courses	-0.021**	0.041**	0.000	0.025**	0.028**	-0.042**	-0.007**	-0.007**
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.001)
	By high school CTE field of concentration							
Applied STEM	-0.004	**0.104****	-0.001	-0.026**	-0.000	-0.083**	-0.031**	0.004*
	(0.003)	**(0.003)**	(0.003)	(0.004)	(0.003)	(0.005)	(0.004)	(0.002)
Occupational	-0.039**	0.017**	**0.043****	0.016**	0.002	-0.028**	-0.008*	-0.007**
	(0.003)	(0.003)	**(0.003)**	(0.003)	(0.003)	(0.004)	(0.003)	(0.002)
Health	0.008*	-0.067**	-0.106**	**0.154****	-0.066**	-0.033**	-0.052**	-0.008**
	(0.004)	(0.007)	(0.007)	**(0.004)**	(0.007)	(0.007)	(0.007)	(0.003)
Business	-0.027**	0.019**	-0.021**	-0.006*	**0.063****	-0.041**	0.011**	-0.014**
	(0.003)	(0.003)	(0.003)	(0.003)	**(0.002)**	(0.004)	(0.003)	(0.002)
None	-0.020**	0.029**	-0.015**	0.051**	0.015**	-0.031**	-0.007*	-0.012**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.004)	(0.003)	(0.002)
Observations	121,467	121,467	121,467	121,467	121,467	121,467	121,467	121,467
	Panel B: Students enrolling in a 2-year college							
3+ CTE courses	-0.001	0.035**	0.007	0.009*	0.010**	-0.041**	-0.006*	-0.010**
	(0.000)	(0.004)	(0.004)	(0.004)	(0.003)	(0.006)	(0.003)	(0.003)
	By high school CTE field of concentration							
Applied STEM	-0.000	**0.114****	0.010*	-0.071**	-0.009*	-0.113**	-0.006	0.011**
	(0.000)	**(0.005)**	(0.006)	(0.006)	(0.004)	(0.008)	(0.004)	(0.003)
Occupational	-0.001*	0.011*	**0.051****	-0.001	-0.003	-0.046**	-0.010*	-0.010**
	(0.001)	(0.005)	**(0.005)**	(0.005)	(0.003)	(0.007)	(0.004)	(0.003)
Health	-0.001	-0.160**	-0.128**	**0.143****	-0.057**	0.017	-0.047**	-0.015**
	(0.001)	(0.016)	(0.012)	**(0.006)**	(0.008)	(0.011)	(0.008)	(0.005)
Business	-0.001	0.008	-0.019**	-0.017**	**0.035****	-0.010	0.004	-0.017**
	(0.001)	(0.005)	(0.006)	(0.006)	**(0.003)**	(0.008)	(0.004)	(0.004)
None	-0.000	0.017**	-0.011*	0.043**	0.004	-0.030**	-0.006	-0.023**
	(0.000)	(0.005)	(0.005)	(0.005)	(0.003)	(0.007)	(0.004)	(0.004)
Observations	51,957	51,957	51,957	51,957	51,957	51,957	51,957	51,957

Note. * significant at $p < .10$, ** significant at $p < .05$. Standard errors in parentheses. Marginal effects are reported for logistic regressions. Bolded estimates represent same-field association. Student covariates include race/ethnicity; special education status; limited English proficiency status; school lunch eligibility; and cubic polynomials of eighth-grade test scores in math, reading, and English.

Table A6. Estimated association between fields of obtained postsecondary credentials and high school CTE concentration —Alternative definition

	Associate's Degree or Higher							
	Overall	STEM Degree	Applied STEM Degree	Occupational Degree	Health Degree	Business Degree	Liberal Arts Degree	Earned Cert/Dip
Panel A. Students enrolling in college								
3+ CTE courses	0.019**	-0.016**	0.018**	-0.003	0.010**	0.014**	-0.042**	0.031**
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
	By high school CTE field of concentration							
Applied STEM	0.029**	-0.012**	**0.053****	0.004	-0.020**	-0.003	-0.059**	0.050**
	(0.003)	(0.002)	**(0.002)**	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Occupational	0.009**	-0.024**	0.005*	**0.014****	0.008**	0.000	-0.042**	0.032**
	(0.003)	(0.002)	(0.002)	**(0.002)**	(0.003)	(0.002)	(0.003)	(0.003)
Health	0.044**	-0.002	-0.030**	-0.048**	**0.073****	-0.014**	-0.033**	0.037**
	(0.004)	(0.002)	(0.005)	(0.005)	**(0.003)**	(0.004)	(0.005)	(0.004)
Business	0.014**	-0.018**	0.004*	-0.010**	-0.002	**0.033****	-0.032**	0.014**
	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	**(0.002)**	(0.003)	(0.003)
None	0.019**	-0.013**	0.008**	-0.012**	0.022**	0.006**	-0.043**	0.032**
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)
Observations	121,467	121,467	121,467	121,467	121,467	121,467	121,467	121,467
Panel B. Students enrolling in a 2-year college								
3+ CTE courses	-0.013**	-0.003**	0.021**	0.016**	0.003	0.001	-0.033**	0.034**
	(0.005)	(0.001)	(0.003)	(0.003)	(0.004)	(0.002)	(0.004)	(0.005)
	By high school CTE field of concentration							
Applied STEM	-0.005	-0.003**	**0.059****	0.038**	-0.046**	-0.007**	-0.049**	0.064**
	(0.006)	(0.001)	**(0.003)**	(0.004)	(0.005)	(0.003)	(0.005)	(0.006)
Occupational	-0.032**	-0.005**	0.011**	**0.030****	-0.001	-0.007**	-0.047**	0.037**
	(0.006)	(0.001)	(0.004)	**(0.004)**	(0.005)	(0.002)	(0.005)	(0.006)
Health	0.020*	-0.003*	-0.071**	-0.038**	**0.077****	-0.006*	-0.018*	0.027**
	(0.008)	(0.001)	(0.011)	(0.008)	**(0.005)**	(0.004)	(0.007)	(0.009)
Business	-0.003	-0.003**	0.004	-0.007	-0.009*	**0.013****	-0.014**	0.010
	(0.006)	(0.001)	(0.004)	(0.004)	(0.005)	**(0.002)**	(0.005)	(0.007)
None	-0.019**	-0.003**	0.007*	0.006	0.019**	-0.001	-0.035**	0.033**
	(0.006)	(0.001)	(0.004)	(0.004)	(0.004)	(0.002)	(0.005)	(0.006)
Observations	51,957	51,957	51,957	51,957	51,957	51,957	51,957	51,957

Note. * significant at $p < .10$, ** significant at $p < .05$. Standard errors in parentheses. Marginal effects are reported for logistic regressions. Bolded estimates represent same-field association. Student covariates include race/ethnicity; special education status; limited English proficiency status; school lunch eligibility; and cubic polynomials of eighth-grade test scores in math, reading, and English.