REL NORTHWEST

CAREER AND TECHNICAL EDUCATION IN OREGON

Exploring who participates in high school and the outcomes they achieve

July 28, 2020

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About REL Northwest

Regional Educational Laboratory (REL) Northwest, operated by Education Northwest, partners with practitioners and policymakers to strengthen data and evidence use. As one of 10 federally funded regional educational laboratories, we conduct research studies, provide training and technical assistance, and disseminate research findings. Our work focuses on regional challenges, such as turning around low-performing schools, improving college and career readiness, and promoting equitable and excellent outcomes for all students. For more information, please go to ***https://ies.ed.gov/ncee/edlabs/regions/northwest/index.asp.***

Acknowledgments

The authors thank the Oregon Department of Education, Higher Education Coordinating Commission, and the State of Oregon Employment Department for providing data for this study, and they gratefully acknowledge Jennell Ives, Lauren Dressen, Laura Foley, Donna Lewelling, Kelly Zinck, and Brenda Turner for feedback on the draft of the report. We would also like to thank our colleagues Havala Hanson, Traci Fantz, and Sam Riggs for their thorough and thoughtful reviews of this report and the analysis code, as well as our communications team, Bracken Reed, Lisa Rummler, Valerie Brodnikova, and Ilona Wall, for their work in copy editing and designing the report.

This report was prepared under Contract ED-IES-17-C-0009 by Regional Educational Laboratory Northwest, administered by Education Northwest. The content does not necessarily reflect the views or policies of the Institute of Education Sciences or the U.S. Department of Education, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.

Three expert reviewers who were not involved with this study offered comments to a previous draft of this report. The authors revised the report based on their comments. Any errors or omissions are the responsibility of the authors.

Suggested citation

Arneson, A., Hodara, M., & Klein, S. (2020). *Career and technical education in Oregon: Exploring who participates in high school and the outcomes they achieve.* Portland, OR: Education Northwest, Regional Educational Laboratory Northwest.

Executive summary

REL Northwest conducted this study in collaboration with the Oregon Department of Education (ODE) and the Higher Education Coordinating Commission (HECC) to provide information about the changing secondary career and technical education (CTE) landscape in Oregon. This is the first study to examine secondary CTE school offerings and student participation and outcomes in Oregon under the *Carl D. Perkins Career and Technical Education Act of 2006* (*Perkins IV*). Results presented in this study are from data collected during the state's implementation of *Perkins IV,* from 2007/08 through 2017/18. Oregon has developed a new state CTE plan under *Perkins V,* the reauthorization of this legislation, which will be implemented in the 2020/21 school year. In this time of transition to the new state plan, summarizing the CTE landscape under *Perkins IV* can provide baseline information to guide implementation.

Prior research points to the importance of depth over breadth in CTE (Dougherty, 2016, 2018; Gottfried & Plasman, 2018; Kreisman & Strange, 2017), and Oregon sets credit thresholds that identify CTE participants who achieve concentrator status. To examine depth of experience in CTE during and after the period of transition to programs of study, this study classified students into four categories, based on CTE credits earned while enrolled in grades 9 through 12:

- ***Nonparticipants —*** secondary students who earned fewer than 0.5 CTE credits
- ***Participants —*** secondary students who earned 0.5 or more CTE credits in a single CTE program
- ***Concentrators —*** participants who earned one or more CTE credits in a single secondary CTE program
- ***Concentrators+ —*** concentrators who earned two or more CTE credits in a single secondary CTE program

The definition of concentrator used in this study aligns closely with the definition Oregon used during the *Perkins IV* era. Beginning in 2020/21, the state will adopt a new definition of a secondary concentrator under the *Perkins V* legislation. That definition is more closely aligned with this study's concentrator+ definition. Oregon's CTE reporting to the federal government focuses on students meeting concentrator status. Concentrator+ rates contained in this report can inform how the reporting of CTE performance outcomes related to *Perkins V* may change given the state's new definition.

The study findings provide Oregon with data on CTE outcomes, including trends over time in program offerings and students' depth of experience in CTE. Key findings from this study include:

The number of secondary CTE programs has increased since 2015.

- The average number of CTE programs offered by Oregon public high schools declined from 3.4 in 2007/08 to 2.5 in 2013/14, then began to increase with the 2014/15 school year, with the steepest increase in urban schools. By 2017/18, high schools offered, on average, 3.1 CTE programs.

Secondary CTE participation and concentration have also increased, but disparities persist across student demographic groups.

- Paralleling patterns in school CTE offerings, student participation in secondary CTE programs declined from 66 percent for the class of 2011 to 61 percent for the class of 2015. Rates began increasing with the class of 2016. The class of 2018 had the highest participation rate of all previous cohorts in the study period (67 percent of students participated in a CTE program).
- Forty-three percent of concentrators in the class of 2018 achieved concentrator+ status. There were no large differences in the demographic make-up of concentrators and concentrators+.
- Female students participated and concentrated in CTE programs at lower rates than their male peers overall, but there was variation among career areas. Male students participated at higher rates in agriculture, food, and natural resource systems; arts, information, and communications; business and management; and industrial and engineering systems programs. Female students participated at higher rates in human resources and health sciences programs.
- Participation and concentration gaps were small for economically disadvantaged students, but those gaps persisted over time, while gaps for students in special education and students of color narrowed over time. There were larger gaps for current English learner students and those gaps persisted over time.

CTE concentration was positively related to higher high school graduation rates and annual earnings after high school.

- CTE concentrators graduated high school in four years at higher rates than students who did not participate or those who participated but did not concentrate in CTE. This relationship held even after controlling for other important factors.
- Concentrators and nonconcentrators who graduated from high school in four years had similar college enrollment rates within 16 months after graduation and, among those who enrolled, similar rates of college completion after adjusting for other factors associated with college-going outcomes.

- In-state employment rates in 2018 were similar for CTE concentrators and nonconcentrators for the classes of 2011 and 2012, but CTE concentrators had higher annual earnings in 2018 after adjusting for other factors associated with workforce outcomes.

The study findings have five implications for policy and practice:

1. The state may wish to consider policies that help rural, small, and low-income high schools offer a minimum threshold of CTE programs. These schools have the lowest average number of CTE programs compared to high schools in other locales, larger schools, and higher income schools. New policies could help promote more equitable access to CTE across the state.

2. Further investigation of equity gaps in public high school students' participation and concentration in CTE programs is needed. For example, implications of these gaps will depend in part on the high school coursework or programs that students are taking instead of CTE courses. This will help determine whether they are having different experiences that lead to similar outcomes. One line of inquiry is to examine patterns of high school course-taking by student demographic groups to see what types of elective (for example, Advanced Placement) or program-specific (for example, English learner-specific course) offerings are taken by key demographic groups instead of CTE. Program-specific course requirements may be a barrier to students participating in CTE.

3. The state may wish to consider strategies for expanding student participation and retention in CTE programming, given the differential rates of concentration overall and within different program areas, especially by student gender.

4. The study findings provide information about how the group of secondary students for which the state will be held accountable will differ under *Perkins V* as compared to *Perkins IV*. This has implications regarding equity. Oregon's adoption of a higher threshold for CTE secondary concentrator status—requiring two credits to reach this status instead of one—reduces the size of the group for which outcomes will be reported, although there is no evidence that it changes its demographic makeup. As concentrators+ are demographically similar to concentrators, Oregon can use the information about equity gaps learned under *Perkins IV* as they transition into the *Perkins V* era to drive policy and supports for CTE providers.

5. The study uncovered differences in student outcomes by career area, with concentrating in the health sciences related to the most positive outcomes. More research is needed to understand what drives these differences so that CTE programs in all areas contribute to positive outcomes for students.

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Career and technical education in Oregon: Exploring who participates in high school and the outcomes they achieve

Career and technical education (CTE) programs of study in Oregon aim to provide students with the academic and technical skills needed to pursue advanced education and training and/or employment in high-wage, in-demand careers. Oregon has made major investments in its CTE programs, and very little research has been conducted to determine whether those investments are leading to positive outcomes. This study looks at the CTE programs that public high schools in Oregon are offering, who is participating and persisting in these programs, and what educational and workforce outcomes CTE students are achieving. The findings will also inform national research on CTE. Most of the existing research has focused on general course-taking or career academies (Bishop & Mane, 2004; Kemple, 2008; Kreisman & Strange, 2017; Meer, 2007), with relatively little attention given to CTE *programs*.

This study focuses on four levels of participation in CTE programs: nonparticipants, participants, concentrators, and concentrators+ (box 1).

Box 1. Key CTE terms

A CTE program of study is a sequenced, nonduplicative set of courses, spanning the secondary and postsecondary education levels, that leads to the award of an industry-recognized credential or certificate or an associate or baccalaureate degree. As a means of strengthening the delivery of CTE instruction, the *Carl D. Perkins Career and Technical Education Act of 2006 (Perkins IV)* introduced the requirement that all local CTE providers receiving Perkins funds offer at least one program of study. This report focuses on secondary coursework and participation only.

This study classifies secondary students into four categories, based on the number of CTE credits they earned in grades 9 through 12. Historically, in Oregon, most CTE courses have been half-year courses worth 0.5 credits each.

- ***Nonparticipants*** are secondary students who earned fewer than 0.5 credits in a CTE program.
- ***Participants*** are secondary students who earned 0.5 or more credits in a single CTE program (that is, at least one half-year course) (Oregon Department of Education, 2015).
- ***Concentrators*** are participants who earned one or more credits in a single CTE program (that is, two half-year courses or one full-year course).
- ***Concentrators+*** are concentrators who earned two or more credits in a single CTE program (that is, at least four half-year courses or two full-year courses).

At the postsecondary level, there are state and federal definitions for both CTE ***participants*** and ***concentrators.*** As this report focuses on secondary-level CTE, however, all uses of the terms participants and concentrators refer to the definitions provided in this box.

This study's definition of concentrators closely aligns to the definition used by Oregon for accountability purposes under *Perkins IV,* except that the state imposed the additional requirement that at least 0.5 credits be designated as a required course for the program (Oregon Department of Education, 2015). Since the state has been phasing out the "required" versus "optional" course designations in CTE programs, however, the study authors chose to define concentrators as any student with one or more CTE credits in a single program, regardless of whether those credits came from coursework designated as required.

The study's definition of concentrators+ aligns with Oregon's new definition of concentrator, which includes the stipulation that one of those credits must be earned from courses designated as intermediate or advanced. Because these CTE course designations are not yet available, we count all course credits in a CTE program toward concentrator+ status.

To date, relatively little state-level research has been conducted on student participation in CTE. In Oregon, a recent Regional Educational Laboratory Northwest report found that CTE dual-credit courses in Oregon (one component of a CTE program of study) were associated with positive outcomes for students (Hodara & Pierson, 2018). Specifically, students who took CTE dual-credit courses were 32 percentage points more likely to graduate from high school, 16 percentage points more likely to enroll in college, and 13 percentage points more likely to persist in college compared to similar peers who did not take any college credit opportunities in high school. However, given that not all CTE programs of study offer dual credit, findings cannot be generalized to all CTE programs of study in the state.

The Oregon CTE context

In the 2007/08 academic year, Oregon set the requirement that within five years (that is, by 2012/13) all CTE programs offered within the state must meet program of study criteria. Programs of study are based on partnerships between a school district and one or more postsecondary institutions and are intended to prepare students for a seamless transition across education levels and into the workforce. A CTE program of study integrates rigorous academic knowledge and industry-validated technical and employability skills that progress in specificity. High school students may also have the opportunity to earn college credits. Students can continue in the program (in high school or as a college student) to earn an industry-recognized credential, a certificate, or an associate or baccalaureate degree. Prior to the transition to programs of study, Oregon did not require CTE programs to have a prescribed sequence of courses nor explicit postsecondary connections. Because the data for this study includes both programs of study and the historical programs, we refer to CTE programming with the general term CTE *programs.*

By 2012/13, a secondary CTE program of study in Oregon typically included two to five credits (that is, between four and 10 courses at 0.5 credits per half-year course). In Oregon, CTE programs are aligned to one of six broad career areas:

1. Agriculture, food, and natural resource systems
2. Arts, information, and communications
3. Business and management
4. Health sciences
5. Human resources
6. Industrial and engineering systems

In the past five years, Oregon has invested even more in CTE programs of study. The Secondary Career Pathways Funding, established by House Bill 3072 in 2015, offers a sustained funding source for CTE in Oregon by providing schools with additional funding for students earning three credits (as well as industry-recognized credentials) in a CTE program leading to a high-wage, high-demand job. The legislation includes additional funding for historically underserved students who meet one of these criteria.

Other recent state investments are likely to motivate continued CTE program of study expansion in the coming years. For example, measure 98 (funded in 2017 and renewed in 2019), is specifically intended to help school districts establish or expand CTE programs, and the CTE Revitalization Grant (originally funded in 2011 and subsequently renewed four times, most recently for the 2019–2021 biennium) promotes student engagement in and completion of CTE to boost local and regional economic development. Given these significant investments, Oregon stakeholders requested information on program offerings, participation, equitable access to programs, and student outcomes.

This study examines CTE participation and outcomes both before and during this period of state CTE investment. Historically, some policymakers and other stakeholders argued that CTE programs were being used to track students of color and economically disadvantaged students into low-level jobs (Oakes, 2005). With the resurgence of CTE—and the added focus on providing high-quality college and career preparation, as dictated by *Perkins IV* and *Perkins V* (Rosen, Visher, & Beal, 2018)—it is important to describe the population of students who participate in CTE programs at different levels and the outcomes associated with concentrating in these programs. The state may wish to consider the association between enrollment and concentration in CTE programs and high school performance and postsecondary education and workforce outcomes of students from different demographic backgrounds.

To better understand changes in CTE participation and outcomes, this study also applied the state's new definition of a student concentrator in CTE. State-level performance is reported to the federal government based on a set of indicators specified in the *Perkins V* legislation and is focused solely on concentrators. Oregon's new state CTE plan under *Perkins V* raises the threshold for concentration from at least one CTE credit to at least two CTE credits, essentially reporting on concentrators+ rather than concentrators as defined in this report. The new definition will take effect in 2020/21, and all subsequent *Perkins V* reporting will use this new threshold. It is important to compare the characteristics of each of the concentrator and concentrator+ groups in past data, specifically to investigate whether the change in definition would have changed the demographic make-up of concentrators in past cohorts. Furthermore, so that Oregon can track demographic shift over time in CTE concentrators+, it is important to retroactively apply the *Perkins V* definition (concentrators+) to past student cohorts to construct the appropriate baseline or comparison groups. Students who were identified as concentrators under *Perkins IV* would not be an appropriate comparison group to students identified as concentrators under *Perkins V* (called concentrators+ in this report) as their definitions differ. By providing the demographic make-up of concentrators+ in past cohorts, Oregon can track demographic shift in CTE concentrators+ using appropriate baseline group(s) constructed under the same definition as is used in their *Perkins V* state plan.

What this study examined

In response to the needs and interests of Oregon stakeholders, this study addressed the following research questions:

1. From 2007/08 through 2017/18, on average, how many CTE programs did schools offer by career area and overall and how did program offerings vary by school characteristics?
2. What were the demographic characteristics of students in the classes of 2011 to 2018 with different levels of credit attainment in CTE programs overall? Did those characteristics vary by career area?
3. What was the relationship between concentrating in a CTE program and high school graduation for students in the classes of 2011 to 2018; college enrollment for students in the classes of 2011 to 2017; and college completion, employment, and annual earnings in 2018 for students in the classes of 2011 and 2012?

It is important to note that the results of the investigation into research question 3 cannot be interpreted causally, as the analysis only produces evidence for a relationship between CTE and student outcomes and provides no insight into the causal direction of that relationship. For example, evidence that annual earnings and CTE concentration in high school

are positively associated cannot be extended to claims that CTE concentration leads to higher earnings. A range of other factors that we are unable to account for in this analysis could contribute to differences in earnings and the other student outcomes examined. Associations explored in this study could point to potential effects that can be examined in future studies, possibly employing a quasi-experimental design.

A summary of the data sources, sample, and methods used to conduct this study is in box 2. For more detail, see appendix B.

Box 2. Data sources, sample, and methods

Data sources: The Oregon Department of Education (ODE) provided student-level data from 2004/05 through 2017/18 for students who started high school in the years 2007/08 through 2015/16. This allowed us to examine data from grades 6–12 for all students. These data also include postsecondary outcomes from National Student Clearinghouse (NSC) data through spring 2018. ODE also provided CTE course-enrollment and performance data from 2007/08 through 2017/18. The Oregon Employment Department (OED) provided individual-level wage and employment data on select cohorts. The study team also compiled publicly available school and district data from Common Core of Data between 2007/08 and 2017/18 on school locale and program-level information for state-approved CTE programs from the ODE website (Oregon Department of Education, 2019).

Sample: For research question 1, the study team included all public high schools in Oregon from 2007/08 through 2017/18. For research question 2, the student sample included Oregon public high school students in the classes of 2011 to 2018 (that is, students expected to graduate in 2010/11 through 2017/18 based on having entered grade 9 four years prior). This includes all students whose first grade 9 year in a public Oregon high school fell between the 2007/08 and 2014/15 academic years. We excluded students without a grade 9 year in an Oregon public school (that is, those who started in an Oregon public school in grade 10, 11, or 12). For research question 3, the student sample included different classes depending on the outcome (see research questions for specific cohorts included). Further, inclusion in the analysis sample for each postsecondary academic outcome was conditioned on the previous outcome; college enrollment was examined only for high school graduates, and college completion was examined only for students who enrolled in college.

Methods: For research question 1, the study team computed the mean number of CTE programs offered by Oregon public high schools from 2007/08 to 2017/18 overall and by career area, and disaggregated results by school locale, income, and size.

For research question 2, the study team computed rates of CTE concentrators+, concentrators, participants, and nonparticipants across and for each of the classes from 2011 through 2018 to describe patterns and trends in CTE participation over time. The study team also calculated the percentage of participants, concentrators, and concentrators+ among subgroups of students: English learners, defined as students who received English learner services at any point in grades 9–12; students in special education, defined as students who had an individualized education program at any point in grades 6–12; students who had been economically disadvantaged, defined as ever eligible for free or reduced-price lunch in grades 6–12; and race/ethnicity (Asian, American Indian/Alaska Native, Black, Hispanic/Latinx, Multiracial, Pacific Islander, White).

(Continued on next page)

Methods (Continued): For research question 3, the study team employed logistic regression to investigate the relationships between CTE concentration and student academic and workforce outcomes: high school graduation within four years, college enrollment within 16 months of high school exit, college completion as of the 2017/18 academic year, and employment and earnings in Oregon for the 2018 calendar year (any student with reported wages in Oregon was counted as employed in Oregon; those not employed in Oregon may be unemployed, employed in a different state, or hold a job for which wages are not reported to OED). The covariate of interest in each of the regression models is an indicator for CTE concentrator status. The regression models included a set of student-level demographic characteristics and achievement measures (standardized grade 11 math and English language arts test scores), as well as an indicator for the school district in which the student attended high school.

The study team used marginal probabilities to summarize the results of the regression analyses. These probabilities can be interpreted as a weighted average across the categorical covariates included in our models (gender, race/ethnicity, special education status, English learner status, free or reduced-price lunch status, and cohort) applying to students with average math and average English language arts achievement.

Because the study team examined data for the entire population of interest, we examined the magnitude of differences in rates as opposed to conducting tests of statistical significance. We determined what differences could be considered small and large with stakeholder input. Any difference from 2 to 4 percentage points was considered small; any difference greater than 4 percentage points was considered large; and any difference less than 2 percentage points was considered negligible.

As the data sources are all administrative, the study team did not encounter major issues related to missing data. More details on the methods, outcome definitions, and missing data are in appendix B.

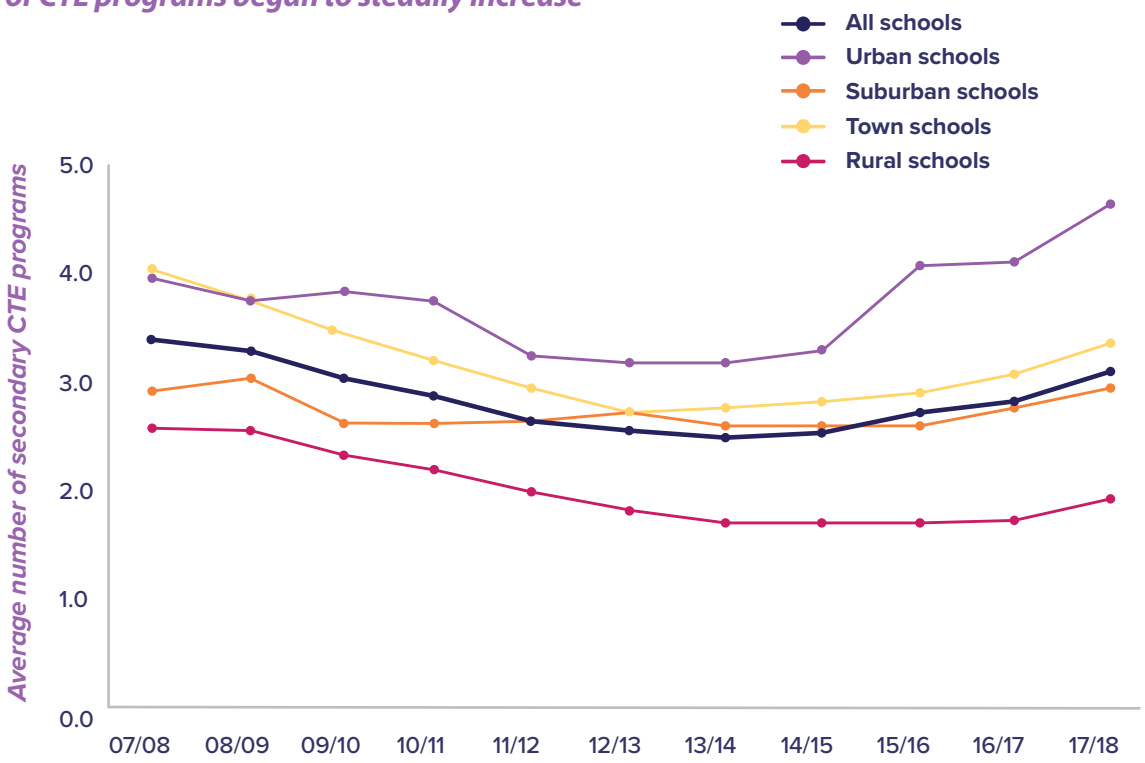
Findings

The number of secondary CTE programs has increased since 2015.

The average number of CTE programs offered by Oregon public high schools declined from 3.4 in 2007/08 to 2.5 in 2013/14, then it began to increase with the 2014/15 school year, with the steepest increase in urban schools. By 2017/18, high schools offered, on average, 3.1 CTE programs.

The average number of CTE programs per public high school declined from 2007/08 to 2014/15 (see figure 1). In 2007/08, public high schools offered, on average, 3.4 CTE programs, totaling 785 programs statewide (see table C1 in appendix C). The average number of CTE programs within schools dropped to a low of nearly 2.5 CTE programs in 2013/14, when 599 CTE programs were offered statewide. This trend reversed beginning in the 2014/15 school year; by 2017/18, public high schools offered, on average, 3.1 CTE programs, with 765 total CTE programs offered statewide.

Figure 1. The average number of CTE programs offered in Oregon public high schools declined between 2007/08 and 2013/14; in 2014/15 the average number of CTE programs began to steadily increase



Notes:

- See table C2 in appendix C for data underlying this figure.
- National Center for Education Statistics locale codes are grouped as follows: urban includes city – large (11), city – midsize (12), and city – small (13); suburban includes suburban – large (21), suburban – midsize (22), and suburban – small (23); town includes town – fringe (31), town – distant (32), and town – remote (33); and rural includes rural – fringe (41), rural – distant (42), and rural – remote (43).

Source: Authors' analysis of 2007/08–2017/18 data from the Oregon Department of Education and the Common Core of Data.

Statewide trends in the overall average number of CTE programs may be at least partially explained by changes in federal and state policy and funding over the same time period. For example, from 2007/08 through 2013/14 all CTE programs in Oregon were required to transition to programs of study. The drop in the number of programs may be due to schools phasing out programs that did not or could not meet the rigorous requirements of a program of study. Further, the period of decline also coincides with a decline in federal *Perkins IV* allotments to states (Tech Prep, Title II funding ceased in 2011), and as a result, many school districts shuttered CTE programs during this time.

The increase that followed 2013/14 coincides with the passage of House Bill 3362 in 2011 at the state level, which directed state funding toward CTE through the CTE Revitalization

Grant Program (H.B. 3362, Or., 2011). Grant funds, which were distributed on a competitive basis beginning in 2011 and reauthorized for 2013, 2015, and 2017, were intended to support school districts in improving or expanding their CTE programs. Given the lag between funding allocation and the development of new programs, state funding may have helped stabilize CTE program offerings and driven districts to invest in new programs beginning with the 2014/15 school year.

Urban high schools consistently offered more CTE programs than high schools in other locales. As of 2017/18, urban high schools were offering an average of 4.6 CTE programs, compared to an average of 3.3 in town schools, 2.9 in suburban schools, and 1.9 in rural schools. The average number of CTE programs offered in town and rural schools in 2017/18 was lower than the number offered a decade before. For example, in 2007/08, rural schools offered an average of 2.6 CTE programs, which declined to an average of 1.9 in 2017/18.

All types of schools saw a decrease in the average number of programs during the program of study transition period from 2007/08 to 2013/14. Town schools had the largest drop in average (1.3 programs below the average in 2007/08). Once the state completed the transition, all types of schools increased their average number of programs offered, with the largest increase occurring in urban schools (1.5 more programs, on average).

School enrollment appears to be related to the average number of CTE programs offered. Generally, schools with larger enrollment were more likely to offer a greater number of CTE programs. In 2017/18, on average, the smallest high schools offered 1.0 CTE programs, medium-size schools offered 2.6 programs, and the largest schools offered 5.6 programs (see table C2 in appendix C). High schools with larger enrollments were more likely to be urban or suburban while schools with smaller enrollments were more likely to be in towns or rural areas. This pattern was the same across study years (2007/08–2017/18). In 2017/18, the average high school enrollment in Oregon was 1,225 in urban schools, 1,035 in suburban schools, 553 in town schools, and 227 in rural schools.

Schools with higher prevailing family income (those with lower percentages of students who were eligible for free or reduced-priced lunch) also offered more CTE programs, on average. In 2017/18, on average, the high schools with the lowest prevailing family incomes offered 2.2 CTE programs, middle-income high schools offered 3.3 programs, and the highest-income high schools offered 3.7 programs (see table C2 in appendix C). High schools with higher prevailing family income tended to be in suburban areas, followed by schools in urban and rural areas, and then towns. This pattern was the same across study years (2007/08–2017/18). Specifically, in 2017/18, in Oregon, the average percentage of students who were eligible for free or reduced-price lunch was 45 percent in suburban high schools, 52 percent in urban schools, 57 percent in rural schools, and 62 percent in town schools.

In terms of CTE program variety across the state, the largest number of CTE programs have been offered in the industrial and engineering systems career area. In 2017/18, 55 percent of high schools offered at least one program in industrial and engineering systems (see table B3 in appendix C), and there were 220 of these programs across the state (see table C1 in appendix C). The next largest career area was business and management: 50 percent of schools offered at least one program, and there were 193 of these programs across the state. This was followed by agriculture, food, and natural resource systems (37 percent of schools offered at least one program) and arts, information, and communications (34 percent). The remaining two areas were relatively less likely to be offered: 26 percent of schools offered at least one program in health sciences and 22 percent of schools offered at least one course in human resources.

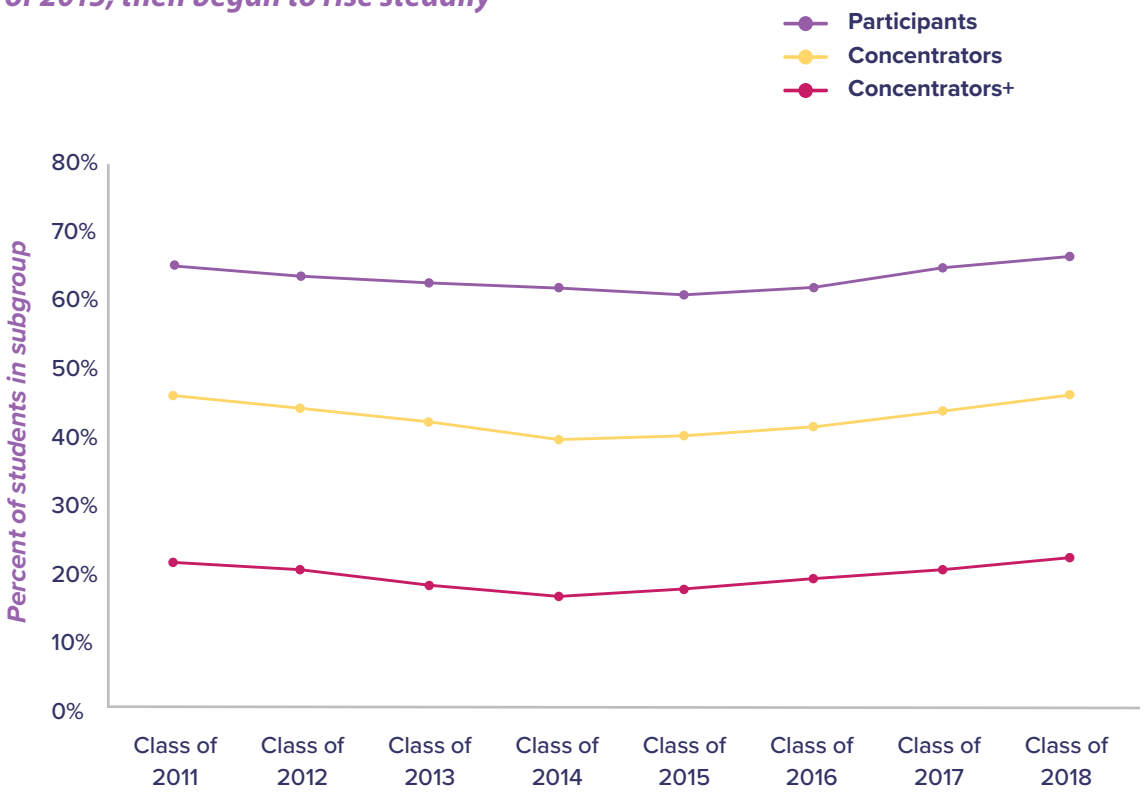
Secondary CTE participation and concentration have also increased, but disparities persist across student demographic groups.

Paralleling patterns in school CTE offerings, student participation in secondary CTE programs declined from 66 percent for the class of 2011 to 61 percent for the class of 2015. Rates began increasing with the class of 2016. The class of 2018 had the highest participation rate of all previous cohorts in the study period.

As average school-level CTE program offerings declined and subsequently rebounded, so too did rates of student participation in CTE programs. Participation rates fell from 66 percent of students for the class of 2011 to 61 percent for the class of 2015, which also had the lowest rate of CTE program participation across all cohorts (figure 2). Participation rates increased by 6 percentage points between the class of 2015 and the class of 2018, when 67 percent of students were CTE program participants.

The trend in the proportion of students in each cohort attaining concentrator and concentrator+ status was similar to the trend in participants, both dipping the lowest for the classes of 2014 and 2015 and rising afterwards. Across the eight study cohorts, 44 percent of students attained at least concentrator status, with the most recent cohort (class of 2018) having about 47 percent of students attaining at least concentrator status.

Figure 2. Participation rates in CTE declined from the class of 2011 to the class of 2015, then began to rise steadily



Notes:

- See table C4 in appendix C for data underlying this figure.
- This display depicts the highest level of participation a given student reached across all CTE programs in which he or she participated. Students with concentrator or concentrator+ status in one program may have participated at equivalent or lower levels in other CTE program(s).
- Total cohort sizes for each year were as follows: class of 2011, 46,296; class of 2012, 45,554; class of 2013, 45,624; class of 2014, 45,486; class of 2015, 44,900; class of 2016, 45,589; class of 2017, 45,621; and class of 2018, 45,656.

Source: Authors' analysis of 2007/08 to 2017/18 Oregon Department of Education data.

Within each career area, differing proportions of CTE program participants went on to attain concentrator or concentrator+ status. For the class of 2018, the health sciences career area had the highest proportion of participants attaining concentrator or concentrator+ status, with 72 percent of participants in health sciences programs earning one or more CTE credits. Agriculture, food and natural resource systems followed closely behind, with 67 percent of participants attaining concentrator or concentrator+ status. The remaining career areas had concentration rates as follows: industrial and engineering systems, 57 percent; arts, information and communications, 52 percent; business and management, 52 percent; and human resources, 37 percent (see table C10 in appendix C for counts of participants and concentrator rates for each cohort).

Forty-three percent of concentrators in the class of 2018 achieved concentrator+ status. There were no large differences in the demographic make-up of concentrators and concentrators+.

As Oregon will implement a new definition of concentrator for *Perkins V* starting in the 2020/21 school year (effectively moving from the concentrator to concentrator+ definition) the study authors chose to explore both the size and demographic distributions in each of these groups in the data covering the *Perkins IV* era. For the class of 2018, 47 percent of students attained concentrator status and 21 percent of students attained concentrator+ status (figure 2), an overall difference of 25 percentage points. In relative terms, 43 percent of concentrators achieved concentrator+ status. This means that had the *Perkins V* definition (concentrator+) been applied during the *Perkins IV* years, the group for which outcomes were reported would have been 57 percent smaller.

There were few differences in the demographic make-ups of students achieving concentrator status and students achieving concentrator+ status. For the class of 2018, there were negligible differences in the gender, special education, and English learner distributions and small differences in the race/ethnicity (2 percentage points) and economic disadvantage (4 percentage points) distributions (figure 3).

Figure 3. There were small differences in the demographic make-up of concentrators and concentrators+, class of 2018

Notes:

- See box 2 or table B3 in appendix B for details on the definitions of these student characteristics.
- This display depicts the highest level of participation a given student reached across all CTE programs in which he or she participated. Students achieving at least concentrator status in one program may have participated at equivalent or lower levels in other program(s).
- The total number of concentrators in the class of 2018 was 21,479 and the total number of concentrators+ was 9,791. Note that all concentrators+ are also considered concentrators; these groups are not mutually exclusive.

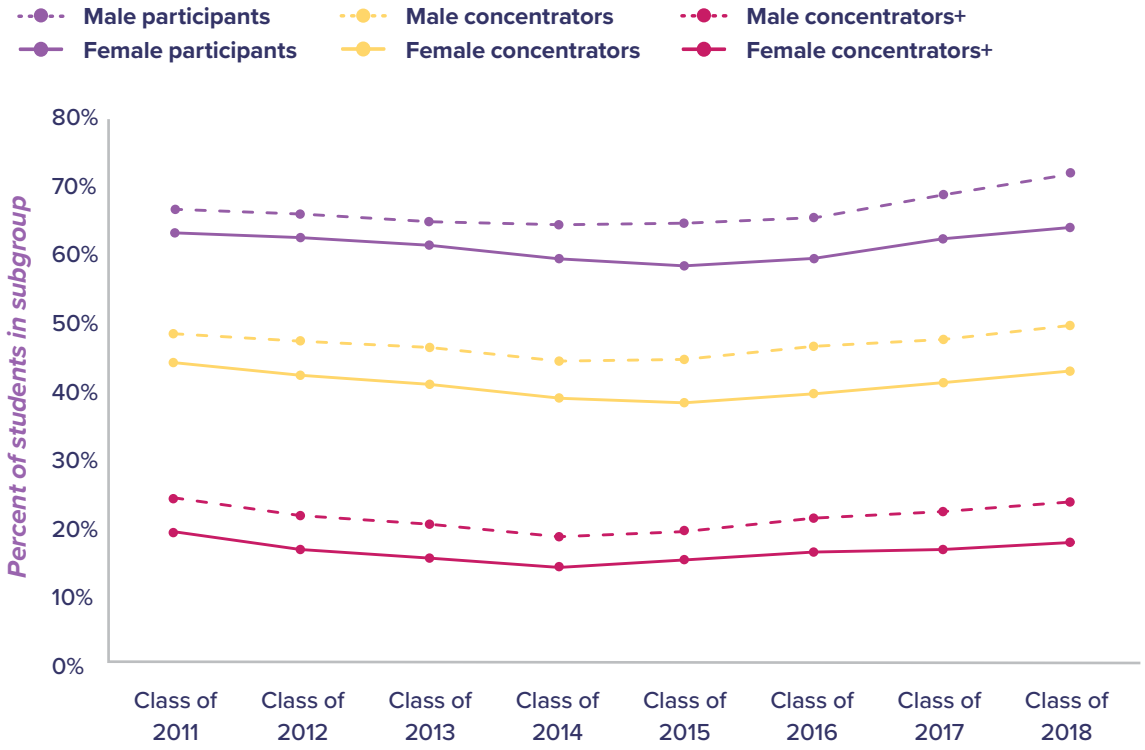
Source: Authors' analysis of 2014/15 to 2017/18 Oregon Department of Education student data.

Female students participated and concentrated in CTE programs at lower rates than their male peers overall, but there was variation among career areas.

Across all cohorts, a higher proportion of male students participated in CTE programs than female students, evidenced by a large gender gap of 6 percentage points (67 percent compared to 61 percent). This finding was consistent across years, with a gender gap of at least 4 percentage points observed in every cohort from the class of 2011 through the class of 2018 (figure 4). The gap between male and female participation rates has widened with time: the smallest gap was recorded for the class of 2013 (4 percent difference) and the largest for the class of 2018 (8 percent difference).

Concentrator and concentrator+ rates by gender show similar gaps. Across all cohorts, the male-female gaps were 7 percentage points for concentrators and 5 percentage points for concentrators+. The gap in the concentrator rate ranged from 5 percentage points (class of 2011) to 9 percentage points (class of 2017) while the concentrator+ gap ranged from 4 percentage points (class of 2011) to 6 percentage points (class of 2016).

Figure 4. Male students consistently participated and concentrated in CTE programs at higher rates than female students, classes of 2011 through 2018



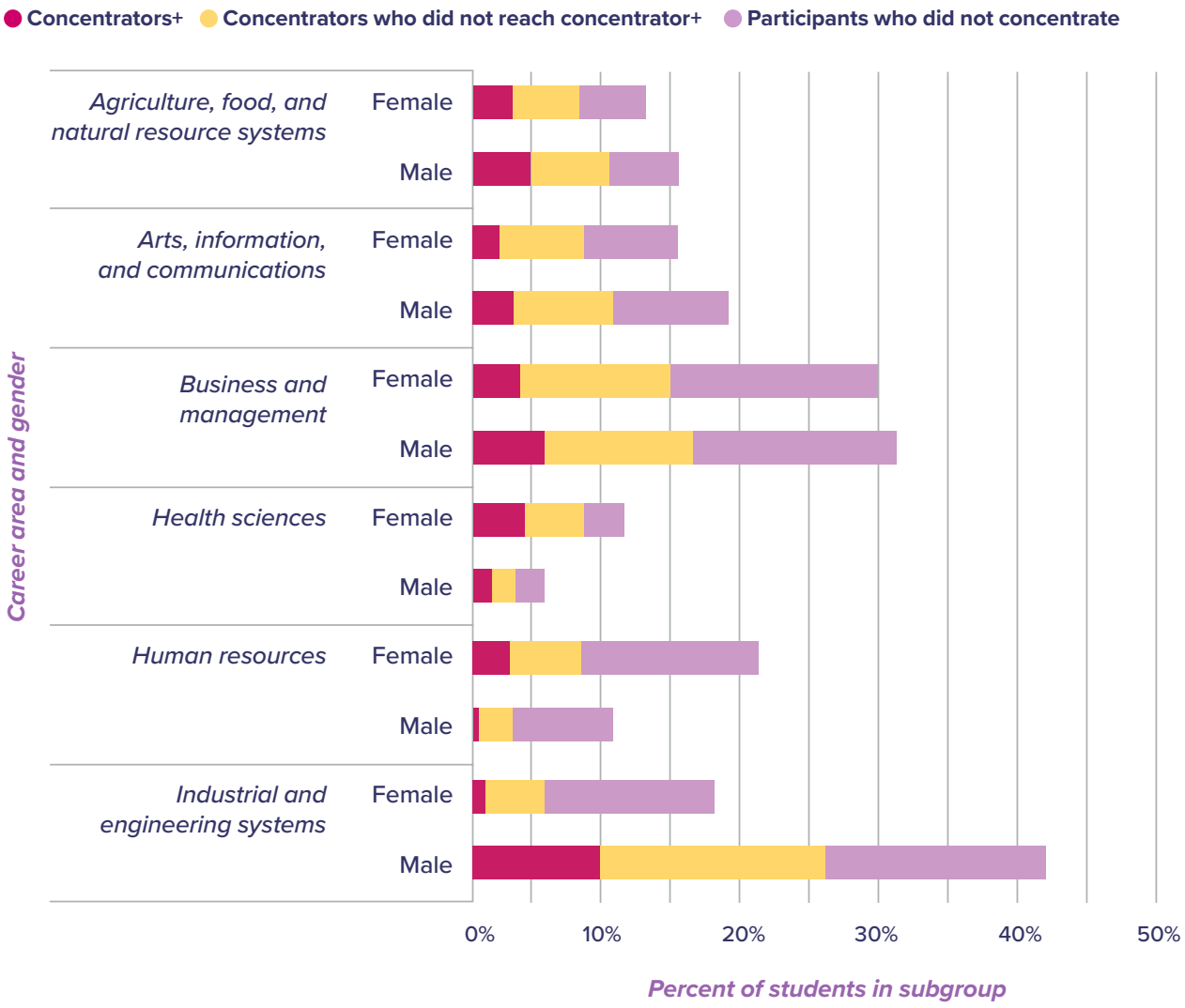
Notes:

- See table C5 in appendix C for data underlying this figure.
- This display depicts the highest level of participation a given student reached across all CTE programs in which he or she participated. Students achieving at least concentrator status in one program may have participated at equivalent or lower levels in other program(s).
- The total number of female students for each class ranged from 21,961 to 22,379 and the total number of male students for each class ranged from 22,851 to 23,917. Exact counts for each cohort are in table C5.

Source: Authors' analysis of 2007/08 to 2017/18 Oregon Department of Education student data.

The magnitude and direction of the male-female student gap varied across the six career areas in the class of 2018 (figure 5). These patterns were consistent across cohorts (results for other cohorts are in table C11 in appendix C). The largest participation gap was 29 percentage points, and it occurred in the industrial and engineering systems career area: 42 percent of male students in the class of 2018 participated in that career area compared to 13 percent of female students. Within the class of 2018, participation rates were similar in the agriculture, food and natural resource systems; arts, information and communication; and business and management career areas, although there were still more male students than female students in each of these areas. The health sciences and human resources career areas served more female students than male students, each with a female participation rate nearly twice that of their male peers.

Figure 5. The percentage of male and female students who participated, concentrated, or attained concentrator+ status varied by career area, class of 2018



Notes:

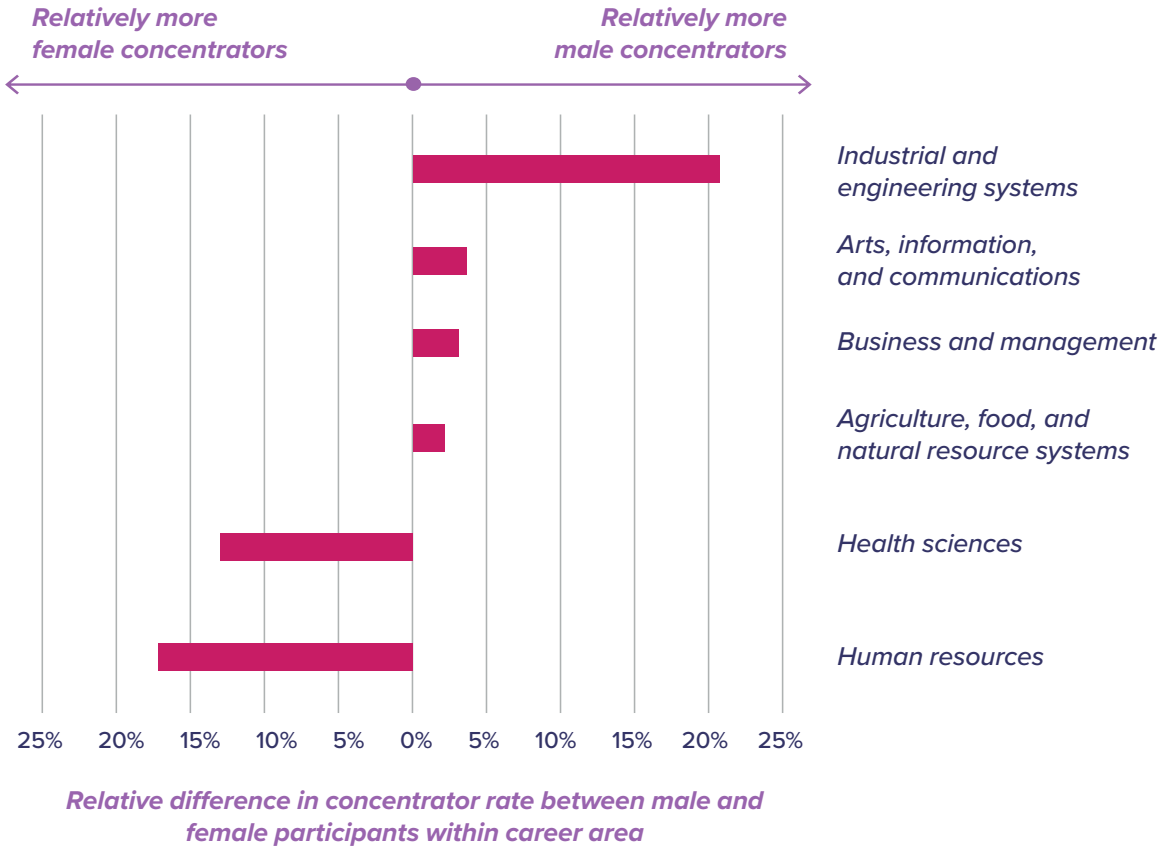
- See table C11 in appendix C for data underlying this figure.
- The total number of female students in the class of 2018 was 22,213 and the total number of male students in the class of 2018 was 23,443. These are the denominators for each of the rates shown in the figure.

Source: Authors' analysis of 2014/15 to 2017/18 Oregon Department of Education data.

Rates of student progression from participant to concentrator differed by gender within career areas, with gaps most pronounced in industrial and engineering, human resources, and health sciences (figure 6). For instance, in the industrial and engineering systems area, there was a 20 percentage point gap in which 61 percent of male participants in the class of 2018 progressed to at least concentrator status, compared to 41 percent of female participants. A smaller but still relatively large gender gap of 9 percentage points existed with the more rigorous concentrator+ definition: Within the class of 2018, 10 percent of male participants completed two or more credits in that career area compared to just 1 percent of female participants.

In the health sciences and human resources areas, there was a similar pattern but in reverse. Fewer male students participated in these areas overall, and those who did progressed at substantially lower rates than female participants (see figures 5 and 6).

Figure 6. Among participants in each career area, male participants were relatively more likely than female participants to attain at least concentrator status in industrial and engineering systems, and female participants were more likely than male participants to attain at least concentrator status in health sciences and human resources, class of 2018



Notes:

- Concentration rates were calculated by dividing the number of concentrators by the number of participants within each career area. See table C11 in appendix C for these counts.
- Career areas are arranged by the largest to smallest male-female concentrator rate gap.

Source: Authors' analysis of 2014/15 to 2017/18 Oregon Department of Education student data.

Participation and concentration gaps were small for economically disadvantaged students, but those gaps persisted over time, while gaps for students in special education and students of color narrowed over time. There were larger gaps for current English learner students and those gaps persisted over time.

Economically disadvantaged students. Gaps in concentration rates between economically disadvantaged students and students who were not economically disadvantaged were large, but gaps in concentrator+ and participation rates were small. For the class of 2018, there was a large difference in concentrator rates between economically disadvantaged students and students who were not economically disadvantaged (7 percentage points; 45 percent compared to 52 percent), but only a small difference in the rates of achieving concentrator+ status (4 percentage points; 19 percent compared to 23 percent). There was a small gap in CTE participation (4 percentage points) between economically disadvantaged students and students who were not economically disadvantaged (see figure C1 in appendix C). The small gap in participation was consistent over time, ranging from 2 to 4 percentage points for all cohorts, and the large gaps in concentrator rates were also consistent, with nearly all years showing a difference greater than 4 percentage points.

Current English learner students. CTE program participation, concentration, and concentration+ rates for each cohort were lower for English learner students than for students not classified as such in high school (see figure C2 in appendix C). Aggregated across all cohorts, there was a 13 percentage point gap in participation (52 percent for English learner students versus 65 percent for non-English learner students), a 14 percentage point gap in concentration (31 percent versus 45 percent), and a 10 percentage point gap in concentration+ (10 percent versus 20 percent).

Students in special education. Similarly, students receiving special education services were less likely than those not receiving special education services to participate and concentrate in CTE programs, although unlike English learner students, the gaps have narrowed over time (see figure C3 in appendix C). For example, in the class of 2011, 56 percent of students in special education participated in a CTE program versus 68 percent of students not in special education, a gap of 12 percentage points. For the class of 2018, this gap was considerably lower, although still large at 8 percentage points; 61 percent of students in special education participated in CTE programs compared to 69 percent of students not in special education.

Among students attaining concentrator status and concentrator+ status, gaps between students in special education and students not in special education have been consistently large over time, with the maximums occurring for the class of 2011 at 12 and 8 percentage points for concentrators and concentrators+, respectively. By the class of 2018, that gap had narrowed to 9 and 6 percentage points, respectively, but remained a large gap.

Students of color. There were differences in participation and concentration rates among student racial/ethnic groups (table C9 in appendix C). In 2018, compared to White students, American Indian/Alaska Native, Black, and Pacific Islander students had large participation and concentration gaps, each with a rate more than 4 percentage points lower than the rate for White students. Asian students, on the other hand, had higher participation rates than White students. Specifically, the concentrator gap between Asian and White students was large, with Asian students concentrating at a rate 6 percentage points higher than White students.

CTE concentration was positively related to higher high school graduation rates and annual earnings after high school.

CTE concentrators graduated high school in four years at higher rates than students who did not participate or those who participated but did not concentrate in CTE. This relationship held even after controlling for other important factors.

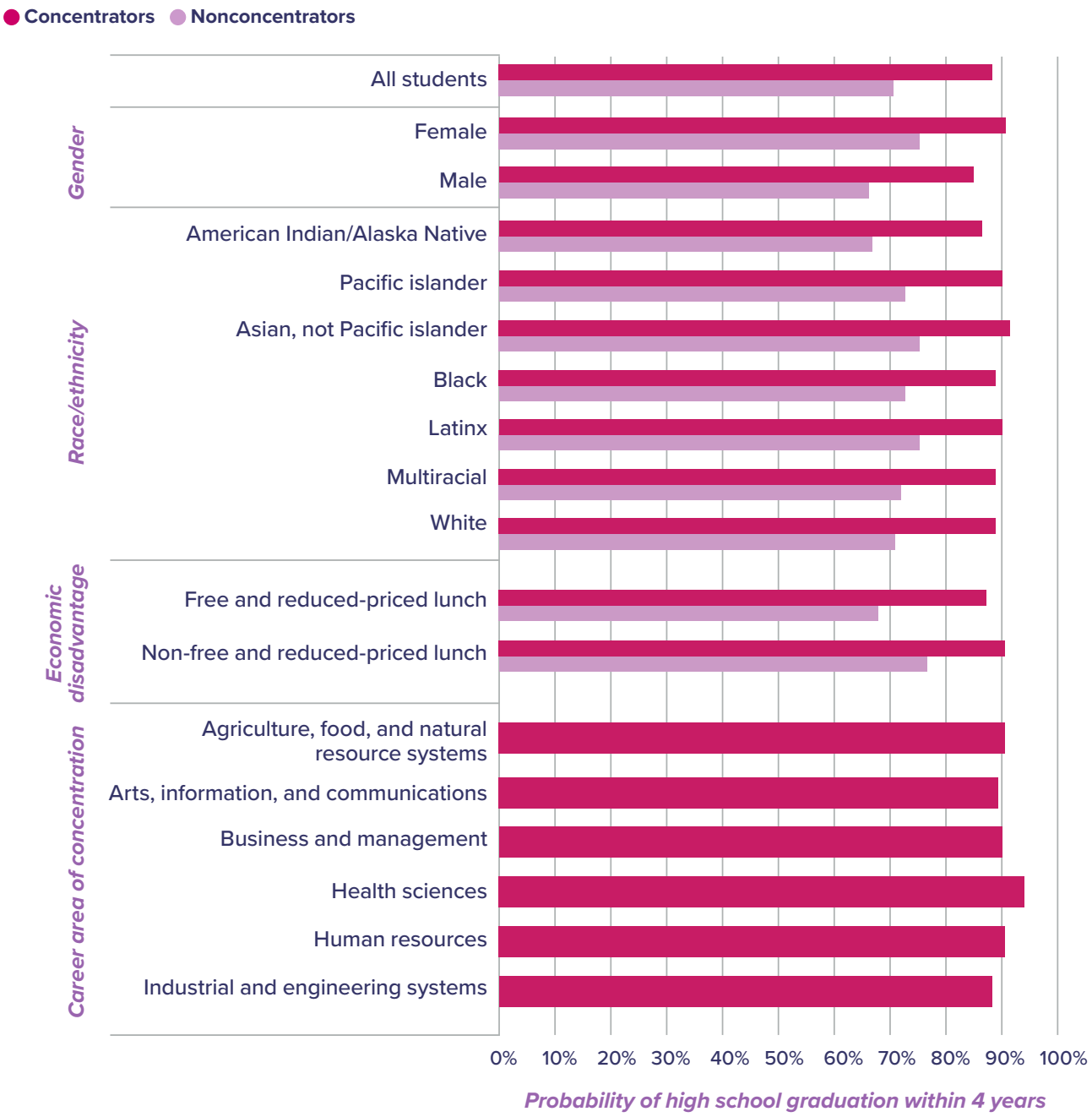
There was a positive relationship between high school graduation and CTE concentration. Across all cohorts in this analysis, 87 percent of secondary students who achieved at least concentrator status (that is, earned one or more credits in a CTE program) graduated from high school within four years, as compared to 61 percent of students who did not attain this status. This strong positive relationship between CTE concentrator status and high school graduation remained after controlling for student demographics and other student-level factors.[1]

Specifically, after adjusting for demographic and background characteristics, students with average math and ELA achievement[2] attaining at least CTE concentrator status were 17 percentage points more likely to graduate from high school on time than comparable students who did not attain that status (both nonparticipants and participants who did not concentrate) (figure 7). This large difference in favor of CTE concentrators was consistent among student subgroups defined by gender, race/ethnicity, and economic disadvantage, with differences ranging from 15 percentage points (Latinx students) to 19 percentage points (male students). The regression analysis accounted for student demographics, academic achievement in math and English language arts in grade 11, suspensions and expulsions, average high school attendance, cohort, and school district (see table C12 in appendix C for full regression results).

[1] The outcome model controlled for student gender; race/ethnicity; cohort; free or reduced-price lunch status; current English learner status; special education status; discipline events (in-school suspension, out-of-school suspension, and expulsion); attendance rate; English language arts achievement; math achievement; and school district. See appendix B for details.

[2] Marginal probabilities were calculated using the regression estimates and setting all covariates to their mean. These probabilities can be interpreted as a weighted average across the categorical covariates included in our models (gender, race/ethnicity, special education status, English learner status, free or reduced-price lunch status, and cohort) applying to students with average math and average English language arts achievement.

Figure 7. After adjusting for other important factors, the positive relationship between CTE concentration and high school graduation was consistent across student demographic groups, classes of 2011 through 2018



Notes:

- Until the 2010/11 school year, the Oregon Department of Education had a single "Asian/Pacific Islander" category. The model used to calculate predicted probabilities for student race/ethnicity groups included an indicator for this category for students who exited Oregon high schools prior to the 2010/11 school year. Predictions for this student group (353 students comprising 0.1 percent of the analysis sample) are not shown here but are provided in appendix C.

- The probabilities depicted in this figure are predicted probabilities for the students with average math and ELA achievement. They were obtained from logistic regression models. See appendix B for further details on the methods and table C12 in appendix C for full regression results.
- "Concentrators" Includes students who attained concentrator or concentrator+ status.

Source: Authors' analysis of 2007/08 to 2017/18 Oregon Department of Education and National Student Clearinghouse student data.

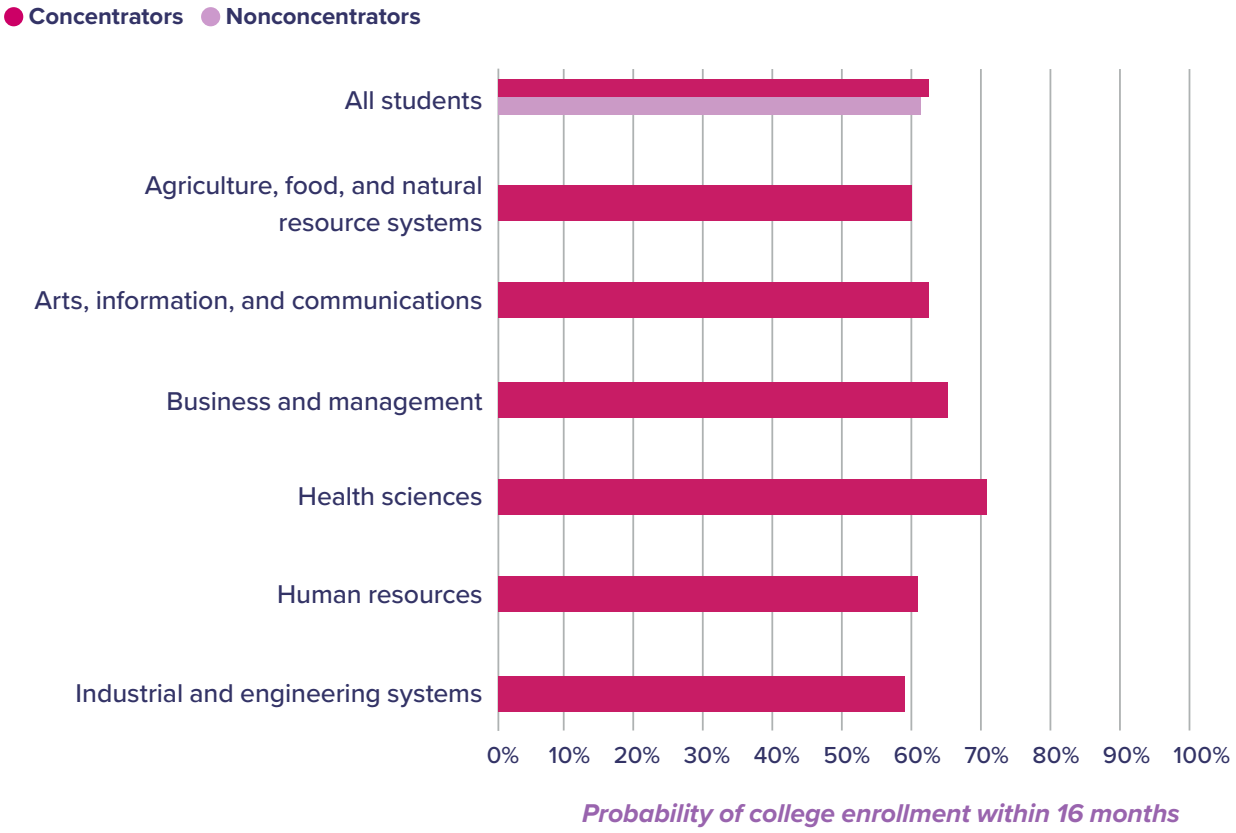
Concentrators and nonconcentrators who graduated from high school in four years had similar college enrollment rates and, among those who enrolled, similar rates of college completion after adjusting for other factors associated with college-going outcomes.

After controlling for other factors, there was a positive but negligible relationship between concentrating in a CTE program in high school and enrolling in college for students who graduated from high school (see table C13 in appendix C). Among high school graduates, the college enrollment rate was approximately 63 percent for students who concentrated in a CTE program and 62 percent for graduates who did not concentrate in a CTE program: a difference of less than 1 percentage point.

For college enrollees who had average math and ELA achievement in high school, there was also a negligible relationship between CTE concentration and college completion. Secondary concentrators and nonconcentrators with average math and ELA achievement who enrolled in college after high school graduation were predicted to complete college at a rate of approximately 46 and 45 percent, respectively (see table C14 in appendix C for full regression results). (This analysis was performed only for the classes of 2011 and 2012 to allow for at least six years after expected high school graduation.)

Although there was no evidence of relationships between high school concentrator status and college enrollment and completion when all career areas were considered together, the relationship between high school concentrator status and these outcomes varied by career area, when accounting for important student-level characteristics. For high school graduates with average math and ELA achievement, those who concentrated in a program within the health sciences career area had the highest predicted probability of college enrollment at 71 percent, while comparable students who concentrated in an industrial and engineering systems program in high school had the lowest probability at 59 percent (figure 8). The difference in probabilities in the health sciences area and all other areas were all large (greater than 4 percentage points). These data reflect secondary concentration only and do not account for whether students pursued the same career pathways in postsecondary education.

Figure 8. After adjusting for other important factors, the probability of college enrollment for high school graduates with average math and ELA achievement who concentrated in a CTE program varied by career area, classes of 2011 through 2017



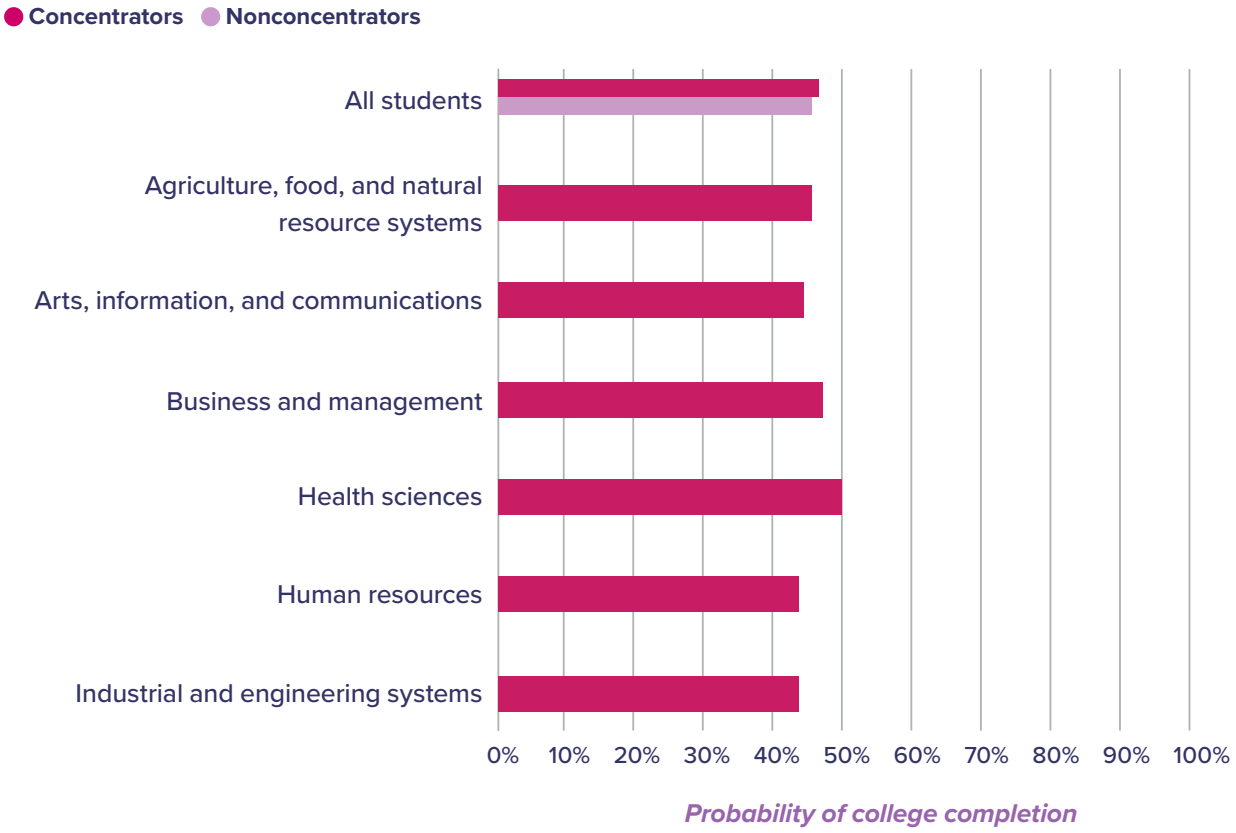
Notes:

- "Concentrators" Includes students who attained concentrator or concentrator+ status.
- The probabilities depicted in this figure are predicted probabilities for students with average math and ELA achievement. They were obtained from logistic regression models. See appendix B for further details on the methods and table C13 in appendix C for full regression results.

Source: Authors' analysis 2007/08 to 2017/18 data from the Oregon Department of Education and National Student Clearinghouse.

The probability of college completion also varied by career area for CTE concentrators in the classes of 2011 and 2012 (figure 9). For college enrollees in these cohorts with average math and ELA achievement, those who concentrated in a health sciences program in high school were the most likely to have completed college within six years of their high school graduation. College enrollees who concentrated in health sciences in high school were 3 to 6 percentage points more likely to complete college than those who concentrated in other career areas in high school.

Figure 9. After adjusting for other important factors, the probability of college completion for college enrollees with average high school math and ELA achievement who concentrated in a CTE program in high school varied by career area, classes of 2011 and 2012



Notes:

- "Concentrators" Includes students who attained concentrator or concentrator+ status.
- The probabilities depicted in this figure are predicted probabilities for students with average math and ELA achievement. They were obtained from logistic regression models. See appendix B for further details on the methods and table C14 in appendix C for full regression results.

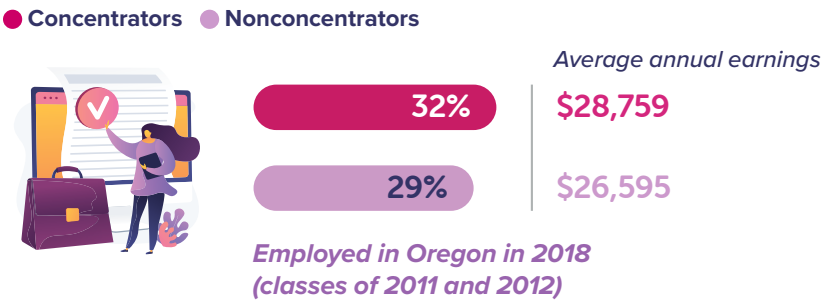
Source: Authors' analysis 2007/08 to 2017/18 data from the Oregon Department of Education and National Student Clearinghouse.

In-state employment rates in 2018 after high school were similar for CTE concentrators and nonconcentrators for the classes of 2011 and 2012, but CTE concentrators had higher annual earnings in 2018 after adjusting for other factors associated with workforce outcomes.

Among all students in the classes of 2011 and 2012, regardless of high school graduation or college enrollment, those who concentrated in a CTE program in high school and those who did not were employed in Oregon at similar rates. For students with average math and ELA achievement from the classes of 2011 and 2012, there was a small difference (3 percentage points) in the predicted probability of being employed, part or full time, in Oregon in 2018 (six to seven years after expected high school graduation), controlling for other factors (figure 10; see table C15 in appendix C for full regression results).

Although the likelihood of employment in Oregon was similar for concentrators and nonconcentrators, CTE concentrators had higher average annual earnings at six and seven years after their expected high school graduation year. There was a positive relationship with earnings in 2018 for concentrators compared to nonconcentrators, controlling for student demographics, high school attendance and behavior, academic performance, high school graduation, and college enrollment and completion. On average, students who reached concentrator status in high school earned approximately $2,200 more annually than students who were not concentrators six and seven years after high school, controlling for other factors (see table C16 in appendix C for full regression results).

Figure 10. After adjusting for other important factors, the probability of being employed in Oregon in 2018 was similar for high school CTE concentrators and nonconcentrators, but annual earnings were higher for CTE concentrators, classes of 2011 and 2012



Notes:

- The probabilities and earnings depicted in this figure are marginal predictions for students with average math and ELA achievement. They were obtained from logistic regression models. See appendix B for further details on methods and tables C15 and C16 for full regression results.
- Students who were not employed in Oregon may be unemployed, employed in a different state, or holding a job for which wages are not reported to the state employment department.

Source: Authors' analysis of 2008/09 to 2017/18 data from the Oregon Department of Education and National Student Clearinghouse and 2018 data from the Oregon Employment Department.

Implications for secondary CTE in Oregon

The study findings have implications in four main areas: improving access to CTE programs in small, rural, and low-income schools; further investigating gender and other equity gaps in public high school students' participation and concentration in CTE programs; understanding the implications of changing the concentrator definition; and investigating reasons underlying differences in student outcomes by career areas.

Improve access to CTE programs in small, rural, and low-income high schools

To ensure all students have equitable access to CTE, the state may wish to consider establishing a minimum threshold of CTE programs that all high schools should offer, as well as supports for meeting that threshold. Student access to secondary CTE programs varied by school type and geographic location, with small, rural, and low-income schools offering both a limited number and range of programs compared to their counterparts. Indeed, program offerings appear to have increased most precipitously in urban and suburban schools, which may be due, in part, to economies of scale. Establishing expectations for a program minimum (for example, two programs per school) will be particularly important for rural schools, which on average are able to offer fewer than two CTE programs. Given that different career areas are associated with different student outcomes and workforce demands, the state may also wish to encourage all districts to offer programs of study that will prepare students for careers in high-wage, in-demand fields while also considering the local community's workforce needs, which may vary substantially. This could require the state to expand funding for CTE in rural districts or implement new policies governing how federal and state funds can be used.

Further investigate gender and other equity gaps in public high school students' participation and concentration in CTE programs

Oregon can use the findings presented in this report to inform its ongoing efforts to address gender gaps in CTE program access and outcomes, as these participation rates can serve as a benchmark to determine whether those efforts are addressing these gaps. A necessary part of establishing this benchmark is to examine participation in other coursework or programs by gender to understand whether female students are pursuing other avenues for college and career preparation (for example, Advanced Placement coursework). While this was outside the scope of the current study, there is evidence

that female students are participating in accelerated learning in Oregon (i.e., dual credit, Advanced Placement, and International Baccalaureate) at higher rates than male students (Hodara & Pierson, 2018). Investigating what courses female students are taking instead of CTE courses is an important piece of the puzzle and an area in need of future research.

To ensure equitable access to CTE programs, the state may also wish to conduct targeted studies to determine why certain populations are not concentrating at similar rates as other students and to develop supports to enable these populations to succeed. The relatively low participation and concentration rates for current English learner students and students in special education indicate that the benefits of CTE program participation may not accrue to all students. For example, future research could examine whether English learner students and students in special education lack the flexibility to take CTE coursework because they have English learner– or special education–specific coursework that supplants their elective credits in high school. Or researchers may want to investigate whether these students lack the supports needed to succeed in advanced, upper-level CTE courses that may be more academically or technically rigorous.

Given differential rates of concentration overall and across program areas, the state may wish to consider strategies for expanding student participation and retention in CTE programming. This could include providing professional development to CTE instructors and school guidance counselors to assist them in understanding the educational and economic benefits that CTE can confer and the factors that dissuade some students from enrolling and/or persisting in programming.

Understand the implications of changing the secondary concentrator definition

Oregon can use the findings in this report to better understand how the change in the secondary concentrator definition may affect the state's federal reporting, accountability, and program improvement efforts starting in the 2020/21 school year. Oregon's adoption of a new, higher threshold for secondary CTE concentrator status (that is, moving from concentrator to concentrator+ as defined in this report) will result in the state including a smaller proportion of students in its *Perkins V* accountability reporting than it would have if the definition did not change. Comparing concentrator+ (*Perkins V* definition) and concentrator rates during the *Perkins IV* period, the concentrator+ group was approximately 57 percent smaller than the concentrator group.

For example, for the class of 2018, the concentrator rate was 47 percent across all students and the concentrator+ rate was 21 percent (see figure 2). As the state only examines and reports performance metrics for concentrators as defined in the state plan, targeting accountability indicators on concentrator+ may disproportionately focus educators' attention on this student group. Given the potential benefits that CTE can confer, it is

important that the outcomes of all students—not just this discrete group—are examined. Consequently, the state and/or local education agencies may want to consider examining the performance of CTE students who do not meet the threshold for *Perkins V* concentrator status and using these data in local decisionmaking and program improvement processes.

Investigate reasons underlying differences in student outcomes by CTE career area

This study uncovered differences in student postsecondary outcomes by career area, but more research is needed to understand why these differences exist and to demonstrate that all CTE programs contribute to positive outcomes for students. The probability of CTE concentrators enrolling in college within 16 months of graduating high school and, once enrolled, completing college within six years was highest for students in the health sciences career area, followed by the business and management career area. Rates of college enrollment and completion may be related to the credentials employers require for occupations in these fields. For example, it may be that students concentrating in health sciences require more advanced training to secure employment than those in, for example, the agriculture, food, and natural resource systems career area. To clarify these relationships, additional research to disentangle the reasons for differentiated rates of college enrollment and completion may be warranted.

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Appendix A. Existing research on CTE

Nationally, study findings support the value of CTE depth over breadth, as might be achieved by students who take multiple courses in a CTE program area. For example, advanced CTE coursework that offers greater specificity and complexity of skill training has a more demonstrated impact on high school completion outcomes than introductory CTE coursework (Gottfried & Plasman, 2018).

In Arkansas, students who took three or more courses in a single CTE program were 42 percentage points more likely to graduate from high school than those who took fewer than three courses and, one year after exiting, 8 percentage points more likely to be enrolled in college and 11 percentage points more likely to be employed (with average quarterly wages $224 higher) (Dougherty, 2016). In Massachusetts, enrollment at a regional vocational and technical high school (where all students participate in a CTE program) increased the likelihood of high school graduation by 7 to 10 percentage points as compared to students who did not attend those schools (Dougherty, 2018).

Nationally, students receive a wage increase of about 2 percentage points for completion of each additional year of advanced vocational courses, with no labor market gains from introductory vocational courses (Kreisman & Strange, 2017). Overall, this research suggests that students benefit from amassing CTE credits in a single CTE program area rather than by sampling introductory courses across technical fields.

There is limited information on the associations of high school CTE on college enrollment. In North Carolina, participation in a career academy increased both the likelihood of high school graduation and college enrollment by 8 percentage points (Hemelt, Lenard, & Paeplow, 2019). Conversely, attending a technical high school in Connecticut increased the likelihood of high school graduation by approximately 10 percentage points for male students but decreased their likelihood of college enrollment by 8 percentage points (Brunner, Dougherty, & Ross, 2019).

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Appendix B. Data and methods

Methods for each research question

1. From 2007/08–2017/18, on average, how many CTE programs did schools offer by career area and overall and how did CTE program offerings vary by school characteristics?

To investigate the first research question, the study team aggregated student-level career and technical education (CTE) course-taking data to the school level. These data included all coursework taken as part of a state-approved CTE program in all public high schools in Oregon. We summed the total number of programs offered within each career area and the total within each school. A CTE program was defined as the unique combination of a school, year, and career cluster. Career clusters are an organizing unit for CTE programs of study in Oregon one level below career areas. Career clusters are listed in table B1.

Student-level data provided by the Oregon Department of Education (ODE) were aggregated to determine the percentage of high school students who qualified for free or reduced-price lunch (FRPL) in each year (school prevailing income) and the total number of students enrolled at a school across all grade levels served in each year (school size) for each of the academic years 2007/08 through 2017/18. For each of these characteristics, schools were separated into three groups: low, middle, and high.

High-income schools are schools in the lowest third of percentage of students eligible for FRPL (on average, across years, 27 percent of students in high-income schools qualified for FRPL). Middle-income schools are schools in the middle third of percentage of students eligible for FRPL (on average, across years, 48 percent of students in middle income schools qualified for FRPL). Low-income schools are schools in the highest third of percentage of students eligible for FRPL (on average, across years, 74 percent of students in low-income schools qualified for FRPL).

The smallest schools are schools in the lowest third of student enrollment (on average, across years, these schools had 126 students and school size ranged from 1 to 230). Medium-size schools are schools in the middle third of student enrollment (on average, across years, these schools had 448 students, and school size ranged from 231 to 809). Largest schools are schools in the highest third of school enrollment (on average, across years, these schools had 1,522 students, and school size ranged from 810 to 3,394).

School locale (urban, suburban, town, and rural) was defined by National Center for Education Statistics (NCES) locale codes and was obtained using Common Core of Data directory information for the years 2007/08 through 2017/18. The NCES locale codes were organized into four groups—urban, suburban, town, and remote—with the mapping of codes as follows:

- Urban: city – large (11), city – midsize (12), and city – small (13)
- Suburban: suburban – large (21), suburban – midsize (22), and suburban – small (23)
- Town: town – fringe (31), town – distant (32), and town – remote (33)
- Rural: rural – fringe (41), rural – distant (42), and rural – remote (43)

Using the resulting school-level data, the average number of programs offered were calculated across all schools in Oregon, within each of the three income categories, within each of the three size categories, and within each of the four locale categories.

Table B1. CTE program of study career clusters

Career area	Agriculture, food, and natural resource systems	Arts, information, and communications	Business and management	Health sciences	Human resources	Industrial and engineering systems
Clusters	Agriculture, food, and natural resources	Arts, A/V technology, and communications Information and communications Technology	Business, management, and administration Finance Hospitality and tourism Marketing	Health sciences	Education and training Government and public administration Human services Law, public safety, and security	Architecture and construction Automotive and heavy equipment Engineering technology Manufacturing Transportation

Source: https://www.oregon.gov/ode/learning-options/CTE/resources/Pages/CTEPOS_Application_Resources.aspx

2. What were the demographic characteristics of students in the classes of 2011 to 2018 with different levels of credit attainment in CTE programs overall? Did those characteristics vary by career area?

The sample for research question 2 includes Oregon public high school students in the classes of 2011 to 2018, meaning students expected to graduate in the 2010/11 through 2017/18 school years. This includes all students whose first grade 9 year in an Oregon public

high school fell between the 2007/08 and 2014/15 school years. We excluded students without a grade 9 year in an Oregon public high school from the analysis sample. That included those who started in an Oregon public high school in grades 10, 11, or 12 or those who exited Oregon public schools prior to their grade 9 year.

For each student, we calculated the number of earned credits within each CTE program, defined by the unique combination of school and career cluster. Using these sums, we determined the participation level (nonparticipant, participant, concentrator, concentrator+) of each student within and across career areas using the definitions presented in box 1 in the main body of this report. The "overall" participation status of a student was determined by taking the "highest" level earned across career areas, starting with nonparticipant as the lowest, to participant, then concentrator, then concentrator+.

For the student demographics of gender and race/ethnicity, we took the last reported value on these variables in the student data. To determine English learner students, we considered all students who were classified as an English learner at any point in high school, grades 9–12. For special education, we considered all students who had an individualized education program (IEP) any time in middle or high school, grades 6–12. Similarly, for identifying students with economic disadvantage, we considered all students who qualified for FRPL at any point in middle or high school, grades 6–12.

The study team summarized participation rates across all students and all cohorts, as well as disaggregated by cohort and student subgroups as defined by gender, English learner status, special education status, and FRPL status.

3. What was the relationship between concentrating in a CTE program and high school graduation for students in the classes of 2011 to 2018; college enrollment for students in the classes of 2011 to 2017; and college completion, employment, and annual earnings in 2018 for students in the classes of 2011 to 2012?

For research question 3, the study team employed multivariate logistic regression to investigate the relationships between CTE concentration and student academic outcomes and employment while controlling for student characteristics. For the wage outcome, multivariate linear regression was used as the outcome was continuous. Table B2 provides details on the outcomes used for each regression. The covariate of interest in our regression models is an indicator for CTE concentrator status. For this binary variable, all students who achieved concentrator status were coded as 1 (includes both concentrators and concentrators+) while students who did not reach concentrator status were coded as 0 (includes all nonparticipants and participants who did not reach concentrator status in any program). Table B3 provides the definitions and details pertaining to the other covariates and interactions of covariates included in our regression models.

Table B2. Outcome variables for regression models

Outcome name	Variable type	Values	Source and additional details
High school graduation	Binary	0 = student did not graduate high school within four years of entering grade 9 in Oregon 1 = student graduated high school within four years of entering grade 9 in Oregon	Source: Oregon Department of Education (ODE). Students who transferred out of state were not tracked.
College enrollment	Binary	0 = student not enrolled in a two- or four-year postsecondary institution in the United States within 16 months of high school exit 1 = student enrolled in a two- or four-year postsecondary institution in the United States within 16 months of high school exit	Source: National Student Clearinghouse (NSC). Students who enrolled in an institution outside the United States were not tracked.
College completion	Binary	0 = student did not complete a credential or degree program at a two- or four-year postsecondary institution during or before the 2017/18 academic year 1 = student completed a credential or degree program at a two- or four-year postsecondary institution during or before the 2017/18 academic year	Source: NSC. Students who completed a degree program outside the United States were not tracked.
Employment in Oregon	Binary	0 = no wages reported to OED in 2018 (may be unemployed, employed in a different state, or hold a job for which wages are not reported to OED) 1 = any wages earned in Oregon reported to OED in the 2018 calendar year	Source: Oregon Employment Department (OED). See notes on wages below.
Annual earnings	Continuous	Amount in thousands of U.S. dollars ($) earned as wages, tips, commissions, bonuses, or holiday pay in the state of Oregon in the 2018 calendar year.	Source: Oregon Employment Department (OED). These are pre-tax wages earned by workers in Oregon who are covered by unemployment insurance and do not include benefits. This covers approximately 90 percent of wages earned in Oregon, but notably does not include wages from self-employment, out-of-state employment, or military pay.

Table B3. Covariates included in regression models

Variable name	Variable type	Values	Additional details
Conc x Agriculture, food, and natural resource systems	Binary	0 = did not concentrate in any CTE program in the specified career area 1 = concentrated in a CTE program in the specified career area	Students may have concentrated in none, one, or more than one area. Career area indicators are not mutually exclusive.
Conc x Arts, information, and communications	Binary		
Conc x Business and management	Binary		
Conc x Health sciences	Binary		
Conc x Human resources	Binary		
Conc x Industrial and engineering systems	Binary		
Female	Binary	0 = student does not identify as specified gender 1 = student identifies as specified gender	Gender indicators are mutually exclusive. Binary indicators (male/female only) are used by the Oregon Department of Education.
Male	Binary		
American Indian/Alaska Native	Binary	0 = student does not identify as specified race/ethnicity 1 = student identifies as specified race/ethnicity	Race/ethnicity indicators are mutually exclusive. Each student is classified into exactly one race/ethnicity category. In the regression models, the reference group is White students. Prior to the 2010/11 academic year, ODE did not disaggregate the Asian/Pacific Islander category into Asian, not Pacific Islander (PI) and Asian, Pacific Islander. Students who did not have this disaggregation available (who left the data set prior to 2010/11) are coded as Asian/PI while all students who had this disaggregation available are coded as one of those categories (and not the combined Asian/PI)
Asian/Pacific Islander	Binary		
Pacific Islander	Binary		
Asian, not Pacific Islander	Binary		
Black	Binary		
Latinx	Binary		
Multiracial	Binary		
White	Binary		
Class of 2011	Binary	0 = student is not in the specified cohort 1 = student is in the specified cohort	Cohort indicators are mutually exclusive. In the regression models, the reference group is the class of 2011.
Class of 2012	Binary		
Class of 2013	Binary		
Class of 2014	Binary		
Class of 2015	Binary		
Class of 2016	Binary		
Class of 2017	Binary		
Class of 2018	Binary		

Variable name	Variable type	Values	Additional details
FRPL (grades 6–12)	Binary	0 = student did not qualify for FRPL at any point in grades 6–12 1 = student qualified for FRPL at any point in grades 6–12	
English learner (grades 9–12)	Binary	0 = student was not classified as an English learner at any point in grades 9–12 1 = student was classified as an English learner at any point in grades 9–12	
Individualized education program (grades 6–12)	Binary	0 = student did not have an IEP at any point in grades 6–12 1 = student had an IEP at any point in grades 6–12	
In-school suspension (ISS) (grades 9–12)	Binary	0 = student had no ISS events in grades 9–12 1 = student had at least one ISS event in grades 9–12	
Out-of-school suspension (OSS) (grades 9–12)	Binary	0 = student had no OSS events in grades 9–12 1 = student had at least one OSS event in grades 9–12	
Expulsion (grades 9–12)	Binary	0 = student was expelled in grades 9–12 1 = student was not expelled at any point in grades 9–12	
Attendance rate	Continuous	Student's average attendance rate across all high school years, grades 9–12	
Math achievement	Continuous	Student's last reported score on state math test	Standardized to have a mean of 0 and standard deviation of 1 within each administration year
ELA achievement	Continuous	Student's last reported score on state English language arts (ELA) test	Standardized to have a mean of 0 and standard deviation of 1 within each administration year

Variable name	Variable type	Values	Additional details
District fixed effects	Binary (set of indicators)	0 = student was not enrolled in specified district in his or her last year of high school 1 = student was enrolled in specified district in his or her last year of high school	

For the binary outcomes examined, we used logistic regression, and as students are nested within school districts (student *i* in district *j*), we included a fixed effect for district. Robust standard errors were estimated using the clustered sandwich estimator. Equation 1 displays our generic outcome model:

$$\textit{(1)}\quad \text{logit}\,[\Pr(Outcome_{ij}=1)] = \alpha + \tau\,(Concentrator_{ij}) + \boldsymbol{\beta X}_{ij} + \boldsymbol{\gamma Z}_{j}$$

For the continuous outcome of annual earnings, we used linear regression as shown in equation 2:

$$\textit{(2)}\quad earnings_{ij} = \alpha + \tau\,(Concentrator_{ij}) + \boldsymbol{\beta X}_{ij} + \boldsymbol{\gamma Z}_{j} + \boldsymbol{\epsilon}_{ij}$$

We used fixed effects for districts because we were not interested in generalizing beyond Oregon, and we have data from the entire population of public districts in the state. The parameter of interest in this equation is τ, which is the average difference in the log odds of the outcome between concentrator students and students who do not concentrate in a program of study, controlling for the vector of student-level covariates $\boldsymbol{X}_{ij}$ and $\boldsymbol{Z}_{j}$ and the fixed effect of district *j*. In the models for high school graduation, college enrollment, and college completion, $\boldsymbol{X}_{ij}$ included all variables listed in table B2 as control variables.

To investigate differences in the relationship between a given outcome and the area in which a CTE student concentrates, we altered our regression models to include indicators for concentration within each of the six career areas. The generic logistic regression model with these interactions is provided in equation 3. The linear regression model used for the wage outcome is similarly structured, but with $wages_{ij}$ on the left-hand side of the equation and an error term, ϵ_{ij}, on the right-hand side.

$$\begin{aligned}\textit{(3)}\quad \text{logit}\,[\Pr(Outcome_{ij}=1)] &= \alpha + \tau\,(Concentrator_{ij}) + \beta_1\,(Concentrator_{ij} \times Agriculture_{ij}) \\ &+ \beta_2\,(Concentrator_{ij} \times Arts,\ Information\ and\ Communications_{ij}) + \beta_3\,(Concentrator_{ij} \\ &\times Business\ and\ Management_{ij}) + \beta_4\,(Concentrator_{ij} \times Health\ Sciences_{ij}) + \beta_5 \\ &(Concentrator_{ij} \times Human\ Resources_{ij}) + \beta_6\,(Concentrator_{ij} \times Industrial\ and\ Engineering \\ &Systems_{ij}) + \boldsymbol{\beta X}_{ij} + \boldsymbol{\gamma Z}_{j}\end{aligned}$$

In order to look across cohorts and other control variables, we calculated probabilities for a theoretical "average" student using logistic regression models. These probabilities can be interpreted as a weighted average across the categorical covariates included in our models (gender, race/ethnicity, special education status, EL status, FRPL status, cohort, suspensions, and expulsions) applying to students with average math achievement, average English language arts (ELA) achievement, and average attendance.

Missing data

The study team encountered a limited amount of missing data. The following variables had no missing data: gender (female, male indicators), race/ethnicity, cohort, FRPL, IEP, in-school suspension, out-of-school suspension, expulsion, and school district. The extent of missingness of the other variables—high school attendance rate, math achievement, and ELA achievement—that impacted our regression modeling is summarized in table B4 for each of the regression models sets.

Table B4. Missing data and the regression models

Outcome of regression model	Students in sample	Sample size	Analysis sample size (no missing data)	Percent reduction of sample size due to missing data
High school graduation	Classes of 2011 through 2018	364,726	356,305	2.31
College enrollment	Four-year graduates from the classes of 2011 through 2017	231,409	230,648	0.33
College completion	College enrollees from the classes of 2011 and 2012	45,342	45,087	0.56
Employment in Oregon	Classes of 2011 and 2012	91,850	89,589	2.46
Earnings	Students employed in Oregon in 2018 from the classes of 2011 and 2012	26,175	25,842	1.27

In the regression models, students who were missing values for any of the variables were excluded from the analysis using listwise deletion. As is shown in the rightmost column of table B4, approximately 2 percent of the sample was removed for the high school graduation regression analysis and less than 1 percent of the sample was lost for each of the college enrollment and college completion regression analyses. For the employment and earnings models, approximately 2 and 1 percent of the sample was lost, respectively.

Appendix C. Detailed results

School results

Tables C1–C3 provide the underlying data and additional context for the findings that answer the first research question: From 2007/08–2017/18, on average, how many CTE programs did schools offer overall and by career area and how did CTE program offerings vary by school characteristics?

Table C1. Total number of CTE programs per year in Oregon

Year	Number of public high schools	Total number of CTE programs	*Total number of programs per career area*					
			Agriculture, food, and natural resource systems	Arts, information, and communications	Business and management	Health sciences	Human resources	Industrial and engineering systems
2007/08	234	785	116	51	247	54	61	256
2008/09	234	760	113	55	240	46	60	246
2009/10	237	713	108	50	225	43	52	235
2010/11	238	679	104	42	214	44	50	225
2011/12	239	624	107	48	189	45	39	196
2012/13	242	613	108	47	184	43	38	193
2013/14	243	599	101	49	174	43	37	195
2014/15	242	603	98	52	127	46	86	194
2015/16	248	664	101	72	184	43	40	224
2016/17	247	690	105	114	180	45	40	206
2017/18	249	765	98	133	193	65	56	220

Source: Authors' analysis of 2007/08 to 2017/18 Oregon Department of Education data.

Table C2. Average number of CTE programs offered at public high schools per year in Oregon

Year	All schools	Urban schools	Suburban schools	Town schools	Rural schools	Highest-income schools	Middle-income schools	Lowest-income schools	Largest schools	Medium-size schools	Smallest schools
2007/08	3.4	3.9	2.9	4.0	2.6	3.5	3.5	3.1	5.5	3.2	1.4
2008/09	3.2	3.7	3.0	3.8	2.6	3.6	3.4	2.7	5.3	3.1	1.3
2009/10	3.0	3.8	2.6	3.4	2.3	2.9	3.7	2.4	5.0	2.8	1.2
2010/11	2.9	3.7	2.6	3.2	2.2	2.9	3.2	2.5	4.8	2.6	1.1
2011/12	2.6	3.2	2.6	2.9	2.0	2.9	2.8	2.1	4.4	2.5	1.0
2012/13	2.5	3.1	2.7	2.7	1.8	2.7	2.9	1.9	4.3	2.2	1.1
2013/14	2.5	3.1	2.6	2.7	1.7	2.6	3.2	1.7	4.2	2.1	1.0
2014/15	2.5	3.3	2.5	2.8	1.7	2.6	2.7	2.1	4.3	2.2	1.0
2015/16	2.7	4.0	2.6	2.9	1.7	2.7	3.4	2.0	4.8	2.3	1.0
2016/17	2.8	4.1	2.7	3.0	1.7	3.1	3.3	1.9	5.0	2.4	1.0
2017/18	3.1	4.6	2.9	3.3	1.9	3.7	3.3	2.2	5.6	2.6	1.0

Notes: School definitions are the following:

- Urban, suburban, town, and rural defined by National Center for Education Statistics locale codes.
- Highest-income schools are schools in the lowest third of percentage of students eligible for free or reduced-price lunch (FRPL) (on average, across years, 27 percent of students were FRPL). Middle-income schools are schools in the middle third of percentage of students eligible for FRPL (on average, across years, 48 percent of students were FRPL). Lowest-income schools are schools in the highest third of percentage of students eligible for FRPL (on average, across years, 74 percent of students were FRPL).
- Smallest schools are schools in the lowest third of student enrollment (on average, across years, these schools had 126 students). Medium-size schools are schools in the middle third of student enrollment (on average, across years, these schools had 448 students). Largest schools are schools in the highest third of school enrollment (on average, across years, these schools had 1,522 students).

Source: Authors' analysis of 2007/08 to 2017/18 data from the Oregon Department of Education and the Common Core of Data.

Table C3. Percentage of Oregon public high schools that offered at least one CTE program in any career area and each career area by school characteristics, 2017/18

School characteristic	At least one CTE program	Agriculture, food, and natural resource systems	Arts, information, and communications	Business and management	Health sciences	Human resources	Industrial and engineering systems
All schools	80%	37%	34%	50%	26%	22%	55%
Urban schools	82%	22%	64%	60%	40%	44%	60%
Suburban schools	59%	16%	36%	48%	11%	23%	55%
Town schools	80%	46%	34%	56%	32%	20%	62%
Rural schools	89%	51%	13%	38%	18%	8%	45%
Highest income	87%	40%	51%	60%	25%	22%	66%
Middle income	83%	41%	28%	54%	30%	18%	58%
Lowest income	69%	31%	24%	35%	22%	25%	41%
Largest schools	95%	34%	73%	77%	40%	46%	84%
Medium-size schools	86%	49%	22%	54%	24%	11%	57%
Smallest schools	58%	29%	7%	18%	13%	8%	24%

Notes: School definitions are the following:

- Urban, suburban, town, and rural defined by National Center for Education Statistics locale codes.
- Highest-income schools are schools in the lowest third of percentage of students eligible for free or reduced-price lunch (FRPL) (on average, across years, 27 percent of students were FRPL). Middle-income schools are schools in the middle third of percentage of students eligible for FRPL (on average, across years, 48 percent of students were FRPL). Lowest-income schools are schools in the highest third of percentage of students eligible for FRPL (on average, across years, 74 percent of students were FRPL).
- Smallest schools are schools in the lowest third of student enrollment (on average, across years, these schools had 126 students). Medium-size schools are schools in the middle third of student enrollment (on average, across years, these schools had 448 students). Largest schools are schools in the highest third of school enrollment (on average, across years, these schools had 1,522 students).

Source: Authors' analysis of 2007/08 to 2017/18 data from the Oregon Department of Education and the Common Core of Data.

Participation results

Tables C4–C11 and figures C1–C4 provide the underlying data and additional context for the findings that answer the second research question: What were the demographic characteristics of students in the classes of 2011 to 2018 with different levels of credit attainment in CTE programs overall? Did those characteristics vary by career area?

Table C4. CTE participation rates, classes of 2011 through 2018

Cohort	Total cohort size	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1	Nonparticipants (<0.5 credits)
Class of 2011	46,296	22%	25%	18%	34%
Class of 2012	45,554	20%	26%	19%	35%
Class of 2013	45,624	18%	26%	20%	36%
Class of 2014	45,486	16%	25%	20%	38%
Class of 2015	44,900	18%	24%	20%	39%
Class of 2016	45,589	19%	24%	20%	37%
Class of 2017	45,621	20%	25%	21%	34%
Class of 2018	45,656	21%	26%	20%	33%
All cohorts combined	364,726	19%	25%	20%	36%

Note: Totals may not sum to 100 percent due to rounding.

Source: Authors' analysis of 2007/08 to 2017/18 Oregon Department of Education data.

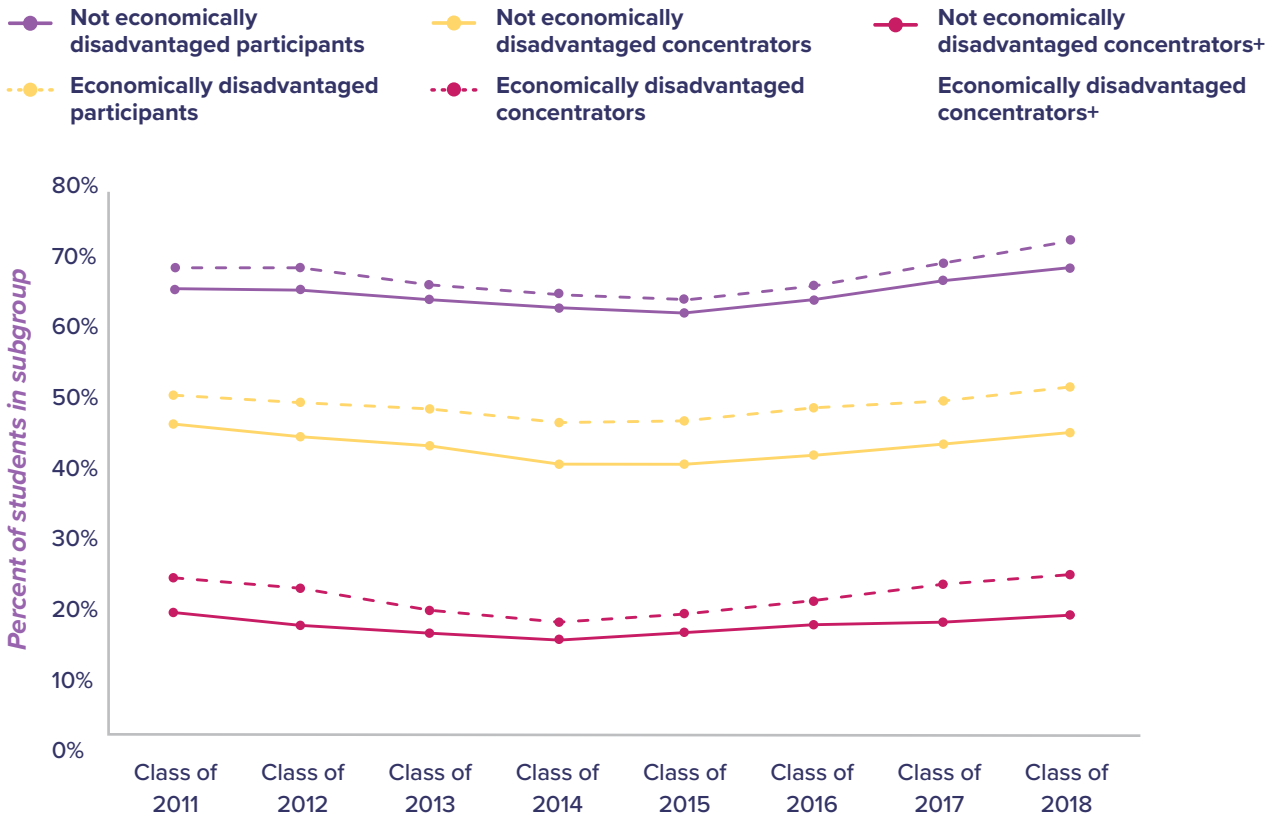
Table C5. CTE participation rates by gender, classes of 2011 through 2018

Gender	Cohort	Total cohort size	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1	Nonparticipants
Male students	Class of 2011	23,917	24%	26%	18%	32%
	Class of 2012	23,593	23%	27%	18%	33%
	Class of 2013	23,422	20%	27%	19%	34%
	Class of 2014	23,453	18%	26%	20%	36%
	Class of 2015	22,851	20%	25%	19%	36%
	Class of 2016	23,385	21%	26%	19%	34%
	Class of 2017	23,514	23%	27%	20%	31%
	Class of 2018	23,443	24%	27%	20%	29%
	All cohorts combined	187,578	22%	26%	19%	33%
Female students	Class of 2011	22,379	20%	25%	19%	37%
	Class of 2012	21,961	18%	25%	19%	38%
	Class of 2013	22,202	16%	25%	21%	39%
	Class of 2014	22,033	14%	24%	21%	40%
	Class of 2015	22,049	15%	23%	21%	41%
	Class of 2016	22,204	16%	23%	21%	40%
	Class of 2017	22,107	17%	23%	22%	38%
	Class of 2018	22,213	19%	24%	21%	37%
	All cohorts combined	177,148	17%	24%	21%	39%

Note: Totals may not sum to 100 percent due to rounding.

Source: Authors' analysis of 2007/08 to 2017/18 Oregon Department of Education data.

Figure C1. Economically disadvantaged students participated and concentrated in CTE programs at lower rates than students who were not economically disadvantaged, but the participation differences were small, classes of 2011 through 2018



Notes:

- See table C6 for data underlying this figure.
- This display depicts the highest level of participation a given student reached across all CTE programs in which he or she participated. Students with completer or concentrator status in one program may have participated at equivalent |or lower levels in other CTE program(s).
- The total number of economically disadvantaged students for each class ranged from 27,416 to 30,128 and the total number of not economically disadvantaged students for each class ranged from 15,461 to 18,880. Exact counts for each cohort are in table C6.

Source: Authors' analysis of 2007/08 to 2017/18 Oregon Department of Education student data.

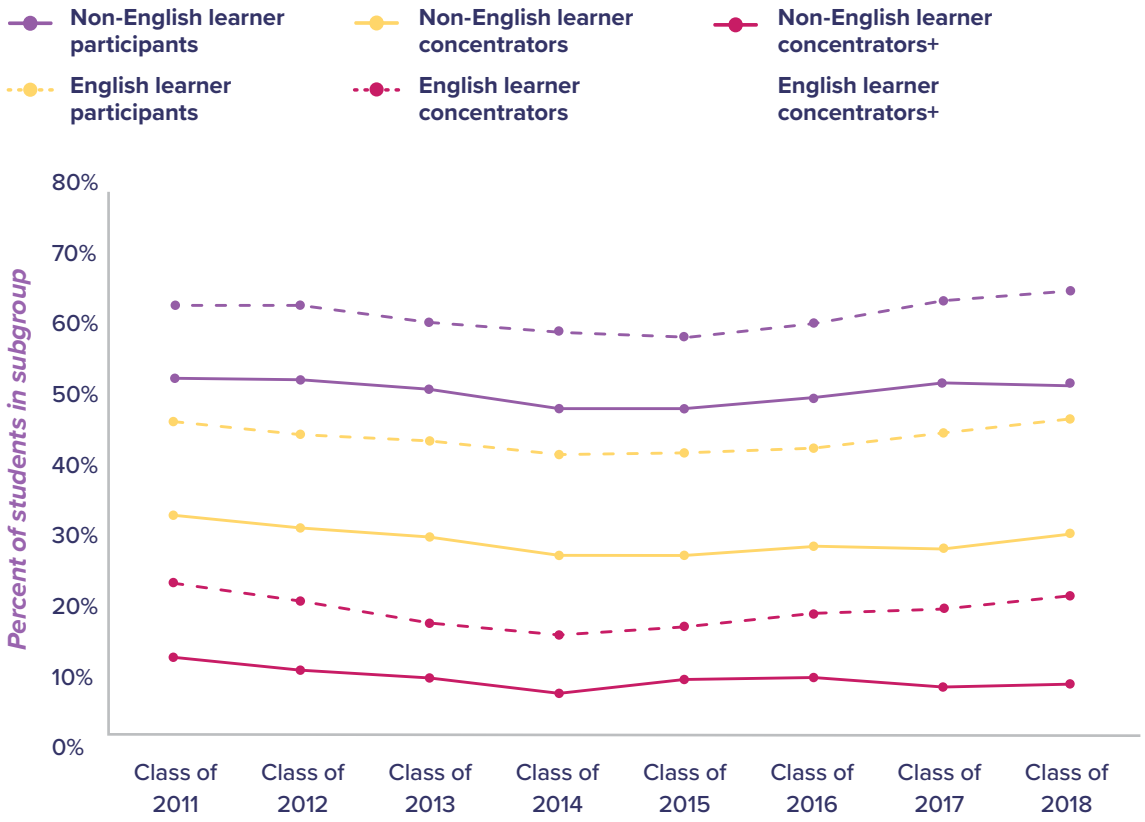
Table C6. CTE participation rates by economic disadvantage (FRPL status), classes of 2011 through 2018

FRPL status	Cohort	Total cohort size	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1	Nonparticipants
Non-FRPL students	Class of 2011	18,880	25%	26%	16%	33%
	Class of 2012	17,764	24%	26%	17%	34%
	Class of 2013	17,256	21%	26%	18%	35%
	Class of 2014	16,622	20%	26%	19%	36%
	Class of 2015	15,811	20%	25%	18%	38%
	Class of 2016	15,461	22%	24%	18%	36%
	Class of 2017	15,535	24%	25%	19%	32%
	Class of 2018	15,636	26%	26%	18%	30%
	All cohorts combined	132,965	23%	26%	18%	34%
FRPL students	Class of 2011	27,416	20%	25%	19%	35%
	Class of 2012	27,790	18%	26%	20%	36%
	Class of 2013	28,368	16%	26%	21%	37%
	Class of 2014	28,864	15%	25%	22%	39%
	Class of 2015	29,089	16%	24%	21%	39%
	Class of 2016	30,128	17%	24%	21%	38%
	Class of 2017	30,086	18%	25%	22%	35%
	Class of 2018	30,020	19%	25%	21%	34%
	All cohorts combined	231,761	17%	25%	21%	37%

Note: Totals may not sum to 100 percent due to rounding.

Source: Authors' analysis of 2007/08 to 2017/18 Oregon Department of Education data.

Figure C2. The overall CTE program participation, concentration, and concentration+ gaps between English learner students and non-English learner students have been consistently large over time, classes of 2011 through 2018



Notes:

- See table C7 for data underlying this figure.
- This display depicts the highest level of participation a given student reached across all CTE programs in which he or she participated. Students with completer or concentrator status in one program may have participated at equivalent or lower levels in other CTE program(s).
- The total number of English learner students for each class ranged from 1,383 to 2,787 and the total number of non-English learner students for each class ranged from 42,404 to 44,238. Exact counts for each cohort are in table C7.

Source: Authors' analysis of 2007/08 to 2017/18 Oregon Department of Education student data.

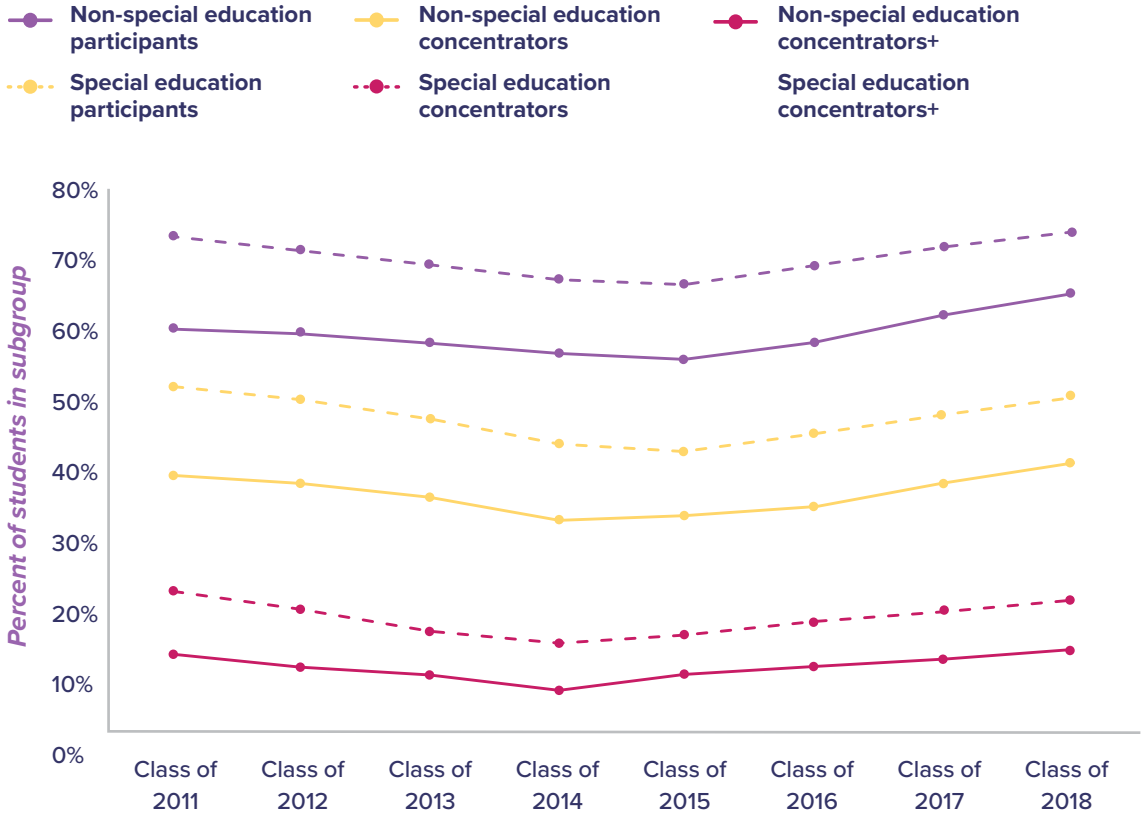
Table C7. CTE participation rates by English learner status, classes of 2011 through 2018

English learner status	Cohort	Total cohort size	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1	Nonparticipants
Non-English learner students	Class of 2011	42,760	23%	26%	18%	33%
	Class of 2012	42,404	21%	26%	18%	34%
	Class of 2013	42,837	18%	26%	20%	36%
	Class of 2014	43,135	17%	26%	20%	37%
	Class of 2015	43,086	18%	24%	20%	38%
	Class of 2016	44,074	19%	24%	20%	37%
	Class of 2017	44,238	20%	25%	21%	34%
	Class of 2018	44,105	22%	26%	20%	32%
	All cohorts combined	346,639	20%	25%	20%	35%
English learner students	Class of 2011	3,536	12%	22%	20%	46%
	Class of 2012	3,150	11%	22%	22%	46%
	Class of 2013	2,787	10%	21%	21%	48%
	Class of 2014	2,351	8%	19%	21%	51%
	Class of 2015	1,814	10%	17%	21%	52%
	Class of 2016	1,515	10%	18%	20%	51%
	Class of 2017	1,383	9%	20%	25%	47%
	Class of 2018	1,551	9%	20%	23%	47%
	All cohorts combined	18,087	10%	20%	21%	48%

Note: Totals may not sum to 100 percent due to rounding.

Source: Authors' analysis of 2007/08 to 2017/18 Oregon Department of Education data.

Figure C3. The CTE program participation and concentration rate gaps between students in special education and students not in special education have narrowed over time, classes of 2011 through 2018



Notes:

- See table C8 for data underlying this figure.
- This display depicts the highest level of participation a given student reached across all CTE programs in which he or she participated. Students with completer or concentrator status in one program may have participated at equivalent or lower levels in other CTE program(s).
- The total number of students in special education for each class ranged from 7,756 to 8,386 and the total number of students not in special education for each class ranged from 36,838 to 38,528. Exact counts for each cohort are in table C8.

Source: Authors' analysis of 2007/08 to 2017/18 Oregon Department of Education student data.

Table C8. CTE participation rates by special education status, classes of 2011 through 2018

Special education status	Cohort	Total cohort size	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1	Nonparticipants
Non-special education students	Class of 2011	38,528	23%	26%	18%	32%
	Class of 2012	37,798	22%	27%	19%	33%
	Class of 2013	37,699	19%	27%	20%	34%
	Class of 2014	37,402	17%	26%	20%	36%
	Class of 2015	36,838	19%	25%	20%	37%
	Class of 2016	37,203	20%	25%	20%	35%
	Class of 2017	37,337	21%	25%	21%	33%
	Class of 2018	37,367	23%	26%	20%	31%
	All cohorts combined	300,172	20%	26%	20%	34%
Special education students	Class of 2011	7,768	16%	22%	18%	44%
	Class of 2012	7,756	15%	22%	18%	44%
	Class of 2013	7,925	13%	21%	20%	46%
	Class of 2014	8,084	12%	21%	20%	47%
	Class of 2015	8,062	13%	20%	20%	47%
	Class of 2016	8,386	14%	21%	20%	45%
	Class of 2017	8,284	15%	22%	22%	41%
	Class of 2018	8,289	16%	24%	21%	39%
	All cohorts combined	64,554	14%	22%	20%	44%

Note: Totals may not sum to 100 percent due to rounding.

Source: Authors' analysis of 2007/08 to 2017/18 Oregon Department of Education data.

Table C9. CTE participation rates by race/ethnicity, classes of 2011 through 2018

Race/ethnicity	Cohort	Total cohort size	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1	Nonparticipants
American Indian/Alaska Native	Class of 2011	931	21%	23%	15%	41%
	Class of 2012	909	17%	25%	17%	41%
	Class of 2013	861	12%	23%	19%	45%
	Class of 2014	826	14%	23%	21%	42%
	Class of 2015	739	15%	23%	17%	45%
	Class of 2016	739	13%	19%	20%	49%
	Class of 2017	766	13%	24%	20%	43%
	Class of 2018	706	17%	24%	21%	38%
	All cohorts combined	6,477	16%	23%	19%	43%
Asian/Pacific Islander	Class of 2011	1,824	28%	22%	15%	35%
	Class of 2012	1,824	24%	23%	16%	36%
	Class of 2013	1,852	20%	25%	18%	37%
	Cohorts 2011–2013 combined	5,500	24%	23%	16%	36%
Pacific Islander	Class of 2014	268	10%	21%	24%	45%
	Class of 2015	245	10%	20%	19%	51%
	Class of 2016	260	11%	20%	21%	49%
	Class of 2017	295	14%	18%	27%	41%
	Class of 2018	280	13%	24%	21%	41%
	Cohorts 2014–2018 combined	1,348	12%	21%	23%	45%

Race/ethnicity	Cohort	Total cohort size	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1	Nonparticipants
Asian	Class of 2014	1,720	19%	25%	19%	37%
	Class of 2015	1,745	22%	24%	17%	37%
	Class of 2016	1,694	26%	24%	16%	34%
	Class of 2017	1,688	27%	26%	17%	30%
	Class of 2018	1,830	29%	25%	18%	28%
	Cohorts 2014–2018 combined	8,677	25%	25%	18%	33%
Black	Class of 2011	1,395	16%	17%	15%	52%
	Class of 2012	1,337	15%	16%	18%	50%
	Class of 2013	1,316	12%	18%	17%	53%
	Class of 2014	1,209	10%	19%	17%	55%
	Class of 2015	1,193	12%	16%	16%	56%
	Class of 2016	1,140	12%	16%	21%	51%
	Class of 2017	1,189	14%	20%	20%	46%
	Class of 2018	1,133	15%	20%	21%	44%
	All cohorts combined	9,912	13%	18%	18%	51%
Latinx	Class of 2011	8,812	17%	25%	20%	38%
	Class of 2012	8,977	16%	26%	20%	38%
	Class of 2013	9,359	15%	25%	22%	38%
	Class of 2014	9,657	13%	26%	22%	39%
	Class of 2015	9,888	15%	24%	22%	39%
	Class of 2016	10,476	17%	25%	22%	36%
	Class of 2017	10,475	18%	25%	23%	34%
	Class of 2018	10,893	19%	27%	22%	32%
	All cohorts combined	78,537	16%	25%	22%	36%

Race/ethnicity	Cohort	Total cohort size	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1	Nonparticipants
Multiracial	Class of 2011	1,074	20%	22%	19%	39%
	Class of 2012	1,180	18%	22%	18%	42%
	Class of 2013	1,301	14%	23%	19%	43%
	Class of 2014	1,617	13%	23%	22%	43%
	Class of 2015	1,680	15%	22%	20%	43%
	Class of 2016	1,888	16%	23%	21%	40%
	Class of 2017	2,042	18%	25%	22%	35%
	Class of 2018	2,208	20%	24%	21%	35%
	All cohorts combined	12,990	17%	23%	20%	40%
White	Class of 2011	32,260	23%	26%	18%	32%
	Class of 2012	31,327	22%	26%	18%	33%
	Class of 2013	30,935	19%	27%	19%	35%
	Class of 2014	30,189	18%	25%	20%	36%
	Class of 2015	29,410	19%	25%	19%	37%
	Class of 2016	29,392	19%	24%	20%	37%
	Class of 2017	29,166	21%	25%	20%	34%
	Class of 2018	28,606	22%	26%	19%	32%
	All cohorts combined	241,285	21%	26%	19%	35%

Notes:

• Totals may not sum to 100 percent due to rounding.

• Until the 2010/11 school year, the Oregon Department of Education had a single "Asian/Pacific Islander" category. Due to a small proportion of students who do not have the disaggregation between Asian, not Pacific Islander and Pacific Islander in the classes of 2011, 2012, and 2013, we present combined Asian/Pacific Islander figures. For all classes 2014 and after, we disaggregate by Asian, not Pacific Islander, and Pacific Islander.

Source: Authors' analysis of 2007/08 to 2017/18 Oregon Department of Education data.

Table C10. CTE participation rates by career area, classes of 2011 through 2018 career area students

Career area	Cohort	Participants	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1
Agriculture, food, and natural resource systems	Class of 2011	6,418	27%	38%	35%
	Class of 2012	6,233	34%	35%	31%
	Class of 2013	6,428	28%	41%	31%
	Class of 2014	6,035	26%	39%	34%
	Class of 2015	5,632	30%	37%	32%
	Class of 2016	5,859	29%	37%	33%
	Class of 2017	6,300	29%	38%	33%
	Class of 2018	6,570	30%	37%	33%
	All cohorts combined	49,475	29%	38%	33%
Arts, information, and communications	Class of 2011	5,624	21%	35%	44%
	Class of 2012	5,277	16%	38%	46%
	Class of 2013	5,183	12%	36%	53%
	Class of 2014	4,562	13%	33%	54%
	Class of 2015	4,677	12%	35%	53%
	Class of 2016	5,343	11%	35%	54%
	Class of 2017	6,956	14%	35%	51%
	Class of 2018	7,989	17%	36%	48%
	All cohorts combined	45,611	15%	35%	50%

Career area	Cohort	Participants	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1
Business and management	Class of 2011	18,087	18%	38%	44%
	Class of 2012	16,750	16%	38%	47%
	Class of 2013	15,636	16%	37%	47%
	Class of 2014	15,054	16%	36%	49%
	Class of 2015	14,212	15%	35%	50%
	Class of 2016	14,154	15%	34%	51%
	Class of 2017	14,455	16%	34%	50%
	Class of 2018	14,123	17%	35%	48%
	All cohorts combined	122,471	16%	36%	48%
Health sciences	Class of 2011	3,433	33%	36%	30%
	Class of 2012	3,061	36%	36%	29%
	Class of 2013	2,849	36%	32%	31%
	Class of 2014	3,118	30%	33%	37%
	Class of 2015	3,007	35%	33%	33%
	Class of 2016	3,167	31%	31%	38%
	Class of 2017	3,329	35%	34%	32%
	Class of 2018	4,032	35%	37%	28%
	All cohorts combined	25,996	34%	34%	32%

Career area	Cohort	Participants	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1
Human resources	Class of 2011	5,109	17%	35%	48%
	Class of 2012	4,673	17%	35%	48%
	Class of 2013	4,789	17%	32%	51%
	Class of 2014	4,567	15%	33%	52%
	Class of 2015	5,411	16%	31%	53%
	Class of 2016	5,941	17%	30%	53%
	Class of 2017	6,990	14%	27%	59%
	Class of 2018	7,211	13%	25%	63%
	All cohorts combined	44,691	16%	30%	54%
Industrial and engineering systems	Class of 2011	13,083	24%	34%	42%
	Class of 2012	12,510	22%	36%	42%
	Class of 2013	11,995	19%	35%	46%
	Class of 2014	11,776	19%	35%	46%
	Class of 2015	11,281	21%	35%	44%
	Class of 2016	12,225	22%	35%	43%
	Class of 2017	12,618	22%	34%	43%
	Class of 2018	12,767	21%	35%	43%
	All cohorts combined	98,255	21%	35%	44%

Note: Totals may not sum to 100 percent due to rounding.

Source: Authors' analysis of 2007/08 to 2017/18 Oregon Department of Education data.

Table C11. CTE participation rates by career area and gender, classes of 2011 through 2018 career area students

Career area and gender		Cohort	Participants	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1
Agriculture, food, and natural resource systems	Male students	Class of 2011	3,727	27%	38%	34%
		Class of 2012	3,629	34%	35%	31%
		Class of 2013	3,685	29%	40%	31%
		Class of 2014	3,473	27%	39%	34%
		Class of 2015	3,199	32%	35%	33%
		Class of 2016	3,391	31%	37%	33%
		Class of 2017	3,517	30%	38%	32%
		Class of 2018	3,625	31%	37%	32%
		All cohorts combined	28,246	30%	37%	32%
	Female students	Class of 2011	2,691	26%	37%	36%
		Class of 2012	2,604	34%	35%	31%
		Class of 2013	2,743	26%	42%	32%
		Class of 2014	2,562	25%	40%	35%
		Class of 2015	2,433	28%	40%	31%
		Class of 2016	2,468	28%	38%	34%
		Class of 2017	2,783	29%	38%	34%
		Class of 2018	2,945	28%	38%	34%
		All cohorts combined	21,229	28%	38%	33%

Career area and gender		Cohort	Participants	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1
Arts, information, and communications	Male students	Class of 2011	2,706	19%	33%	47%
		Class of 2012	2,613	15%	36%	49%
		Class of 2013	2,525	11%	34%	55%
		Class of 2014	2,265	13%	33%	54%
		Class of 2015	2,329	12%	36%	52%
		Class of 2016	2,768	12%	36%	52%
		Class of 2017	3,812	15%	37%	48%
		Class of 2018	4,542	19%	37%	44%
		All cohorts combined	23,560	15%	35%	49%
	Female students	Class of 2011	2,918	22%	37%	42%
		Class of 2012	2,664	17%	39%	44%
		Class of 2013	2,658	12%	37%	51%
		Class of 2014	2,297	13%	33%	54%
		Class of 2015	2,348	12%	35%	53%
		Class of 2016	2,575	10%	34%	57%
		Class of 2017	3,144	13%	32%	55%
		Class of 2018	3,447	14%	34%	52%
		All cohorts combined	22,051	14%	35%	51%

Career area and gender		Cohort	Participants	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1
Business and management	Male students	Class of 2011	9,022	18%	38%	44%
		Class of 2012	8,405	16%	38%	46%
		Class of 2013	7,752	16%	37%	47%
		Class of 2014	7,574	16%	36%	48%
		Class of 2015	7,055	16%	35%	48%
		Class of 2016	7,171	16%	34%	50%
		Class of 2017	7,590	18%	34%	48%
		Class of 2018	7,456	18%	35%	47%
		All cohorts combined	62,025	17%	36%	47%
	Female students	Class of 2011	9,065	19%	38%	44%
		Class of 2012	8,345	15%	37%	47%
		Class of 2013	7,884	15%	37%	48%
		Class of 2014	7,480	16%	35%	49%
		Class of 2015	7,157	14%	34%	52%
		Class of 2016	6,983	14%	33%	53%
		Class of 2017	6,865	14%	33%	53%
		Class of 2018	6,667	15%	35%	50%
		All cohorts combined	60,446	15%	35%	49%

Career area and gender		Cohort	Participants	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1
Health sciences	Male students	Class of 2011	1,273	26%	38%	36%
		Class of 2012	1,129	28%	36%	36%
		Class of 2013	1,047	28%	31%	41%
		Class of 2014	1,145	23%	28%	49%
		Class of 2015	1,026	27%	33%	39%
		Class of 2016	1,085	23%	31%	46%
		Class of 2017	1,092	25%	35%	40%
		Class of 2018	1,387	25%	38%	37%
		All cohorts combined	9,184	26%	34%	40%
	Female students	Class of 2011	2,160	38%	35%	27%
		Class of 2012	1,932	40%	35%	25%
		Class of 2013	1,802	41%	33%	26%
		Class of 2014	1,973	34%	35%	30%
		Class of 2015	1,981	38%	32%	29%
		Class of 2016	2,082	35%	31%	34%
		Class of 2017	2,237	40%	33%	27%
		Class of 2018	2,645	40%	36%	24%
		All cohorts combined	16,812	38%	34%	28%

Career area and gender		Cohort	Participants	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1
Human resources	Male students	Class of 2011	1,269	10%	31%	59%
		Class of 2012	1,145	11%	33%	56%
		Class of 2013	1,105	10%	29%	61%
		Class of 2014	1,055	8%	26%	66%
		Class of 2015	1,638	10%	28%	61%
		Class of 2016	1,846	10%	28%	62%
		Class of 2017	2,454	7%	23%	69%
		Class of 2018	2,498	6%	20%	74%
		All cohorts combined	13,010	9%	26%	65%
	Female students	Class of 2011	3,840	20%	36%	45%
		Class of 2012	3,528	20%	35%	45%
		Class of 2013	3,684	20%	32%	48%
		Class of 2014	3,512	17%	35%	48%
		Class of 2015	3,773	18%	33%	49%
		Class of 2016	4,095	20%	31%	49%
		Class of 2017	4,536	18%	29%	53%
		Class of 2018	4,713	16%	27%	57%
		All cohorts combined	31,681	19%	32%	50%

Career area and gender		Cohort	Participants	2+ credits	1 ≤ credits < 2	0.5 ≤ credits < 1
Industrial and engineering systems	Male students	Class of 2011	9,642	28%	36%	37%
		Class of 2012	9,351	26%	37%	36%
		Class of 2013	8,946	23%	38%	39%
		Class of 2014	8,833	23%	37%	40%
		Class of 2015	8,639	24%	37%	39%
		Class of 2016	9,260	26%	37%	37%
		Class of 2017	9,589	26%	37%	38%
		Class of 2018	9,823	24%	37%	39%
		All cohorts combined	74,083	25%	37%	38%
	Female students	Class of 2011	3,441	11%	31%	58%
		Class of 2012	3,159	10%	32%	58%
		Class of 2013	3,049	8%	28%	64%
		Class of 2014	2,943	8%	28%	64%
		Class of 2015	2,642	11%	29%	60%
		Class of 2016	2,965	10%	29%	61%
		Class of 2017	3,029	11%	27%	62%
		Class of 2018	2,944	11%	30%	59%
		All cohorts combined	24,172	10%	29%	61%

Note: Totals may not sum to 100 percent due to rounding.

Source: Authors' analysis of 2007/08 to 2017/18 Oregon Department of Education data.

Outcome results. Tables C12-C16 provide the full regression results for the findings that answer the third research questions: What was the relationship between concentrating in a CTE program and high school graduation for students in the classes of 2011 to 2018; college enrollment for students in the classes of 2011 to 2017; and college completion, employment, and annual earnings in 2018 for students in the classes of 2011 to 2012?

Table C12. Logistic regression results for high school graduation outcome models, classes of 2011 through 2018

Variable		Model 1: Base model Odds ratio	Model 2: By career area Odds ratio
CTE concentrator		3.083***	1.588***
Career area of concentration (not mutually exclusive)	Conc x Agriculture, food, and natural resource systems		1.553***
	Conc x Arts, information, and communications		1.646***
	Conc x Business and management		1.973***
	Conc x Health sciences		2.998***
	Conc x Human resources		1.844***
	Conc x Industrial and engineering systems		1.434***
Female		1.597***	1.542***
Race/ethnicity (reference group = White students)	American Indian/Alaska Native	0.847	0.853
	Asian/Pacific Islander (students with data prior to 2011 only)	0.00608	0.00626
	Pacific Islander	1.117	1.108
	Asian	1.316 ***	1.291 ***
	Black	1.117	1.106
	Latinx	1.208	1.199
	Multiracial	1.065	1.062

Variable		Model 1: Base model Odds ratio	Model 2: By career area Odds ratio
Cohort (reference group = Class of 2011)	Class of 2012	0.998	1.011
	Class of 2013	0.975	0.994
	Class of 2014	0.971	0.990
	Class of 2015	1.067 ***	1.092 ***
	Class of 2016	1.301	1.336
	Class of 2017	1.471	1.500
	Class of 2018	1.345	1.367
FRPL (grades 6–12)		0.630***	0.632***
English learner (grades 9–12)		0.857***	0.870***
Individualized education program (grades 6–12)		1.025***	1.040***
In-school suspension (grades 9–12)		0.750***	0.753***
Out-of-school suspension (grades 9–12)		0.769***	0.777***
Expulsion (grades 9–12)		0.601***	0.606***
Attendance rate		1.135***	1.134***
English language arts achievement		1.099***	1.100***
Math achievement		1.351***	1.348***
District fixed effects		***	***

*p < 0.05; ** p < 0.01; *** p < 0.001.

Note: Individual odds ratio estimates for districts (district fixed effects) are not reported in the table.

Source: Authors' analysis of 2007/08 to 2017/18 data from the Oregon Department of Education.

Table C13. Regression results for college enrollment outcome models, classes of 2011 through 2017

Variable		Model 1: Base model Odds ratio	Model 2: By career area Odds ratio
CTE concentrator		1.025*	1.083***
Career area of concentration (not mutually exclusive)	Conc x Agriculture, food, and natural resource systems		0.850***
	Conc x Arts, information, and communications		0.988
	Conc x Business and management		1.077***
	Conc x Health sciences		1.419***
	Conc x Human resources		0.892***
	Conc x Industrial and engineering systems		0.788***
Female		1.635***	1.543***
Race/ethnicity (reference group = White students)	American Indian/Alaska Native	1.036	1.033
	Asian/Pacific Islander (students with data prior to 2011 only)	2.215	2.196
	Pacific Islander	0.926	0.908
	Asian	1.643	1.586
	Black	1.855	1.810
	Latinx	1.009	0.995
	Multiracial	1.204	1.193

*** (Model 1)

*** (Model 2)

Variable		Model 1: Base model Odds ratio	Model 2: By career area Odds ratio
Cohort (reference group = Class of 2011)	Class of 2012	0.837	0.840
	Class of 2013	0.745	0.749
	Class of 2014	0.666 ***	0.669 ***
	Class of 2015	0.746	0.751
	Class of 2016	1.024	1.036
	Class of 2017	0.886	0.894
FRPL (grades 6–12)		0.612***	0.616***
English learner (grades 9–12)		0.762***	0.760***
Individualized education program (grades 6–12)		0.725***	0.731***
In-school suspension (grades 9–12)		0.751***	0.755***
Out-of-school suspension (grades 9–12)		0.749***	0.753***
Expulsion (grades 9–12)		0.772***	0.773***
Attendance rate		1.060***	1.059***
English language arts achievement		1.540***	1.528***
Math achievement		1.732***	1.729***
District fixed effects		***	***

*p < 0.05; ** p < 0.01; *** p < 0.001.

Note: Individual odds ratio estimates for districts (district fixed effects) are not reported in the table.

Source: Authors' analysis of 2007/08 to 2017/18 data from the Oregon Department of Education and National Student Clearinghouse.

Table C14. Regression results for college completion outcome models, classes of 2011 and 2012

Variable		Model 1: Base model Odds ratio	Model 2: By career area Odds ratio
Career area of concentration (not mutually exclusive)	Conc x Agriculture, food, and natural resource systems	1.014	1.022
	Conc x Arts, information, and communications		0.987
	Conc x Business and management		0.924
	Conc x Health sciences		1.071*
	Conc x Human resources		1.183***
	Conc x Industrial and engineering systems		0.901*
	Conc x Agriculture		0.895**
Female		1.870***	1.833***
Race/ethnicity (reference group = White students)	American Indian/Alaska Native	0.772	0.772
	Asian/Pacific Islander (students with data prior to 2011 only)	0.287	0.282
	Pacific Islander	0.642	0.635
	Asian	1.600 ***	1.569 ***
	Black	0.906	0.901
	Latinx	1.055	1.049
	Multiracial	0.895	0.887
Cohort (reference group = Class of 2011)	Class of 2012	0.866	0.867
FRPL (grades 6–12)		0.623***	0.624***
English learner (grades 9–12)		1.193**	1.196**
Individualized education program (grades 6–12)		0.719***	0.724***
In-school suspension (grades 9–12)		0.639***	0.640***

Variable	Model 1: Base model Odds ratio	Model 2: By career area Odds ratio
Out-of-school suspension (grades 9–12)	0.716***	0.717***
Expulsion (grades 9–12)	0.588***	0.589***
Attendance rate	1.093***	1.093***
English language arts achievement	1.100***	1.513***
Math achievement	1.996***	1.996***
District fixed effects	***	***

*p < 0.05; ** p < 0.01; *** p < 0.001.

Note: Individual odds ratio estimates for districts (district fixed effects) are not reported in the table.

Source: Authors' analysis of 2007/08 to 2017/18 data from the Oregon Department of Education and National Student Clearinghouse.

Table C15. Regression results for employed in Oregon in 2018 outcome models, classes of 2011 and 2012

Variable		Model 1: Base model Odds ratio	Model 2: By career area Odds ratio
CTE concentrator		1.164***	1.104***
Career area of concentration (not mutually exclusive)	Conc x Agriculture, food, and natural resource systems		1.020
	Conc x Arts, information, and communications		1.015
	Conc x Business and management		1.062*
	Conc x Health sciences		1.074
	Conc x Human resources		1.068
	Conc x Industrial and engineering systems		1.019
Female		1.339***	1.329***
Race/ethnicity (reference group = White students)	American Indian/Alaska Native	0.969	0.970
	Asian/Pacific Islander (students with data prior to 2011 only)	0.557	0.558
	Pacific Islander	1.563	1.560
	Asian	0.746	0.744
	Black	1.210	1.208
	Latinx	0.620	0.619
	Multiracial	1.001	1.000
Cohort (reference group = Class of 2011)	Class of 2012	1.062***	1.064***
FRPL (grades 6–12)		0.998	0.998
English learner (grades 9–12)		0.607***	0.608***
Individualized education program (grades 6–12)		0.956*	0.958
In-school suspension (grades 9–12)		1.039	1.040

Variable	Model 1: Base model Odds ratio	Model 2: By career area Odds ratio
Out-of-school suspension (grades 9–12)	1.003	1.004
Expulsion (grades 9–12)	1.029	1.029
Attendance rate	1.005***	1.005***
English language arts achievement	1.068***	1.069***
Math achievement	0.985	0.984
District fixed effects	***	***

*p < 0.05; ** p < 0.01; *** p < 0.001.

Note: Individual odds ratio estimates for districts (district fixed effects) are not reported in the table.

Source: Authors' analysis of 2007/08 to 2017/18 data from the Oregon Department of Education and National Student Clearinghouse and 2018 data from the Oregon Employment Department.

Table C16. Regression results for wage outcome models, classes of 2011 and 2012

Variable		Model 1: Base model Odds ratio	Model 2: By career area Odds ratio
CTE concentrator		2.164***	0.295
Career area of concentration (not mutually exclusive)	Conc x Agriculture, food, and natural resource systems		2.271***
	Conc x Arts, information and communications		-1.792**
	Conc x Business and management		1.277**
	Conc x Health sciences		2.610***
	Conc x Human resources		1.036
	Conc x Industrial and engineering systems		2.471***
Female		-4.349***	-4.073***
Race/ethnicity (reference group = White students)	American Indian/Alaska Native	-2.030	-2.100
	Asian/Pacific Islander (students with data prior to 2011 only)	0.166	0.156
	Pacific Islander	-3.935 ***	-3.917 ***
	Asian	-0.884	-0.945
	Black	-3.233	-3.166
	Latinx	-0.068	-0.067
	Multiracial	-1.545	-1.553
Cohort (reference group = Class of 2011)	Class of 2012	-2.015***	-2.020***
FRPL (grades 6–12)		-2.386***	-2.409***
English learner (grades 9–12)		0.473	0.596
Individualized education program (grades 6–12)		-3.521***	-3.500***
In-school suspension (grades 9–12)		-1.250***	-1.253***

Variable	Model 1: Base model Odds ratio	Model 2: By career area Odds ratio
Out-of-school suspension (grades 9–12)	-1.040**	-1.064**
Expulsion (grades 9–12)	-1.748	-1.676
Attendance rate	0.218***	0.216***
English language arts achievement	-1.226***	-1.172***
Math achievement	2.346***	2.297***
District fixed effects	***	***

*p < 0.05; ** p < 0.01; *** p < 0.001.

Note: Individual odds ratio estimates for districts (district fixed effects) are not reported in the table.

Source: Authors' analysis of 2007/08 to 2017/18 data from the Oregon Department of Education and National Student Clearinghouse and 2018 data from the Oregon Employment Department.