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Carly Urban

Montana State University

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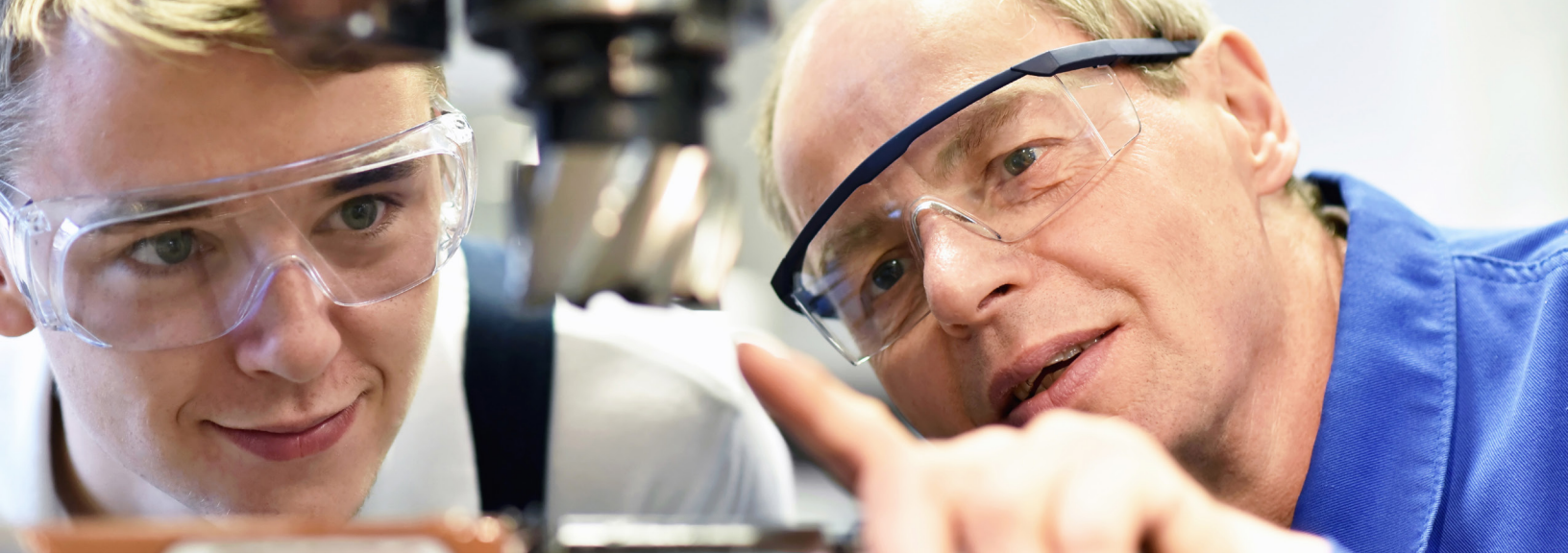


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Trends in Career and Technical Education in Montana

Carly Urban

Montana State University

Career & Technical Education Policy Exchange

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Context

Career and Technical Education (CTE) is the most rapidly-evolving and in-demand facet of U.S. education today, and it is championed by policymakers and politicians of all stripes. It is also one of the most understudied. In America's secondary schools, the academic landscape has shifted from a model where high schools focus on academic preparation—ostensibly for college—to a model preparing students to be college and career ready. As a result, CTE enrollment is near an all-time high, accompanied by a dramatic rise in the number and diversity of programs, new and varied delivery models, innovations in credentialing, dual enrollment programs, and work-based learning experiences.

This Report

Montana is now a member of the Career & Technical Education Policy Exchange (CTEx), which is a consortium of researchers and education policymakers studying how state contexts affect participation in high school CTE programs and student outcomes.¹ CTEx produces an annual multi-state analysis on CTE participation and subsequent outcomes.² This report supplements that multi-state analysis by examining CTE participation in Montana—the most rural state in the CTEx consortium. In this report, I explore the degree to which CTE participation varies over time by gender, academic achievement, race and ethnicity, and the remoteness of the school.

Key Findings

- Compared to other CTEx states (Massachusetts, Michigan, Tennessee, and Washington), Montana has a very high rate of high school students concentrating in or completing a CTE program. Almost half of the students in Montana are CTE concentrators.
- CTE concentration rates are 15 percentage points higher among male students than female students. Yet, female CTE concentration rates are still higher in Montana than male students in Massachusetts, Michigan, and Washington.
- Students in schools outside of the six most-populated cities in Montana are

15 percentage points more likely to be CTE concentrators than students in schools within the six most-populated cities. Female students in schools outside of these top six cities are equally likely to concentrate in CTE as male students in schools within these top six cities.

- Students reaching concentrator status are more likely to graduate high school. This high school graduation advantage is particularly pronounced for students outside of the biggest six cities and students with identified disabilities.

Overview and Purpose

This report examines CTE participation in a very rural state: Montana. I explore the degree to which CTE participation varies over time by gender, academic achievement, race and ethnicity, and the remoteness of the school. The entire state of Montana has 187 public schools, and the average high school has 922 students, though the median school size is 681 students. In Montana, every high school graduate must complete one credit of vocational/technical education (i.e., CTE). Given that most schools are small, the availability of CTE courses can vary year-over-year (especially when teachers are in short supply).

Analysis Sample and Creation of Common Terms

For this report, I focus on whether a student “concentrated” in a CTE program of study. States have historically had a fair amount of discretion in defining a concentrator for federal reporting purposes, particularly under Perkins IV. CTE courses and programs (including mode of delivery and how credits are assigned) also vary. Any cross-state comparisons regarding CTE concentrators should be interpreted with caution, even when care is taken to reconcile definitions across states. Under Perkins IV, states could establish their own performance requirements and define populations for reporting data. The U.S. Department of Education had flexible guidelines for these and other definitions under Perkins IV and defined a concentrator as

[a] secondary student who has earned three (3) or more credits in a single CTE program area (e.g., health care or business services), or two (2) credits in a single CTE program area, but only in those program

Table 1. Definitions of CTE Concentrator Status Across Other CTE States

State	Concentrator definition in this report
Massachusetts	Student was identified by the school of district as being a participant in a CTE program for two or more academic years.
Michigan	Student completed at least seven out of 12 segments in a program of study. ⁷
Tennessee	Student completed at least three credits in a program of study.
Washington	Student completed at least three credits in a program of study.

areas where 2 credit sequences at the secondary level are recognized by the State and/or its local eligible recipients.³

In Montana, the current definition of a concentrator is as follows:

A Career & Technical Education (CTE) Concentrator is a 12th grade student who has earned two or more credits in one or more Montana Career Pathway(s) throughout their entire high school career. To be considered a Concentrator, they must have earned at least two credits in an approved Pathway.⁴

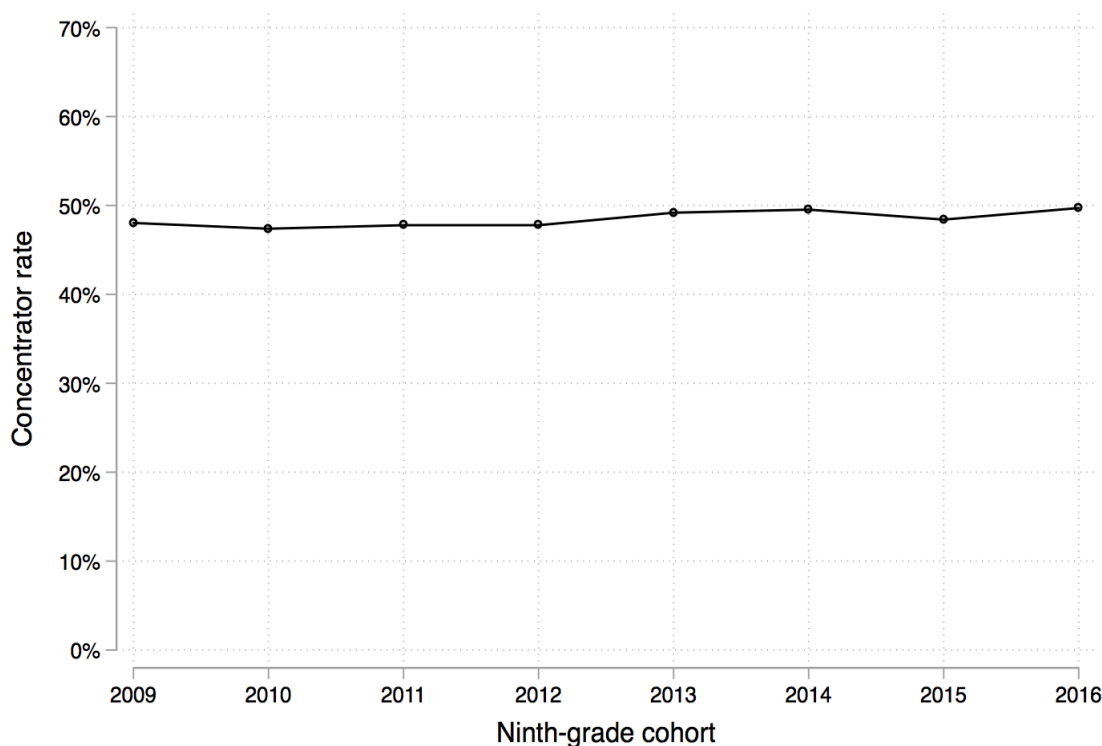
For context, how other CTE states define concentrators is in Table 1. Notably, Tennessee and Washington have definitions that require an additional credit.

Analysis Sample

The analysis sample is defined by first-time ninth-graders I observe for at least four years in the administrative data. The sample retains students with irregular grade progression, such as students retained in grade. This limits bias from attrition (e.g., moving out of state).

The main disadvantage is that my findings do not include students who move into or out of public school after Grade 9 from other states. If CTE participation is more common among students who would likely graduate (even in its absence) than among students who are more likely to drop out (before attending school for four years), I will *underestimate* any positive relationship between CTE and high school graduation, and consequently, I will *overestimate* any negative relationship. In these Montana data, the earliest ninth-grade cohort entered high school in the 2008-09 school year (SY), and the latest ninth-grade cohort entered high school in SY 2015-16. The last available year of administrative data used is for SY 2018-19.

Figure 1. CTE Concentrator Rate in Montana, by Ninth-Grade Cohort



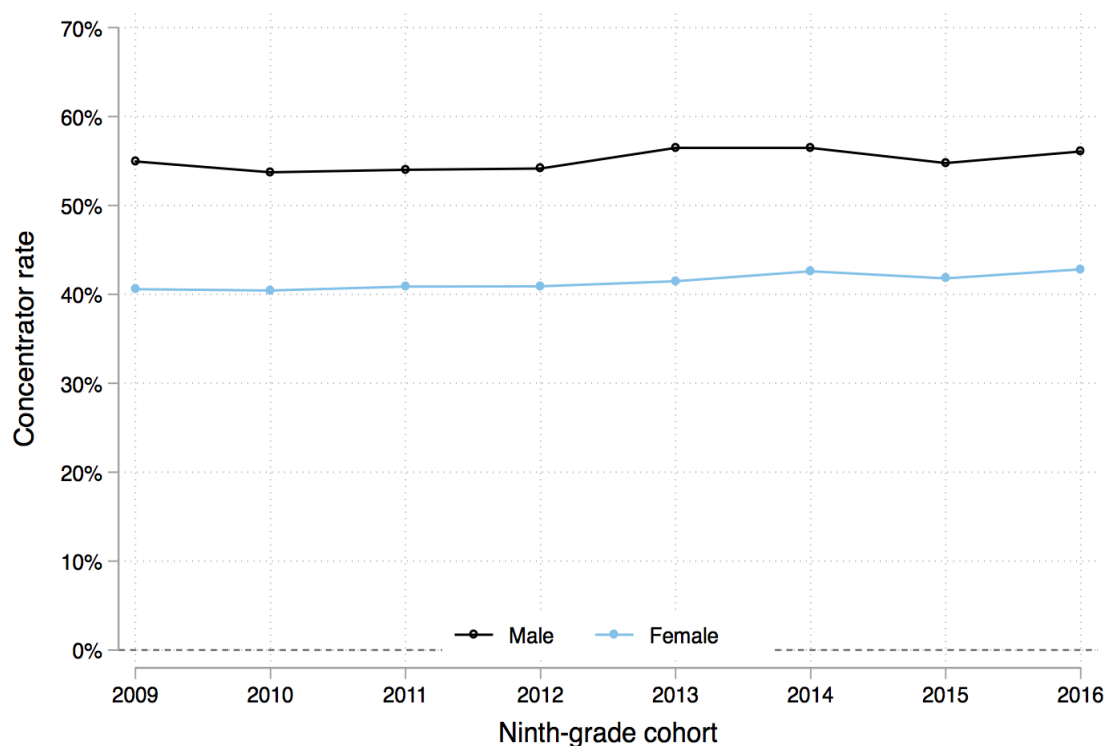
Notes. The sample is students who attended high school for four consecutive years. Concentrators are defined using Montan-specific definitions for students who concentrate in or complete a CTE program. Ninth-grade cohort is the school year for first-time ninth graders (e.g., 2016 means first-time ninth graders in SY 2015-16).

Results

Overall Picture

Figure 1 shows that the rate of CTE concentration remained relatively flat and close to 50% for the cohort of students in ninth-grade cohorts from SY 2008-09 to SY 2015-16. In comparison to the other CTE states, the concentrator rates are most comparable to Tennessee. In Tennessee, concentrator rates approached (but did not reach) 50% from SY 2009-10 to SY 2013-14. In most CTE states (Massachusetts, Michigan, Tennessee, and Washington), the concentrator rate (like in Montana) remained constant from SY 2008-09 to SY 2015-16.

Figure 2. CTE Concentrator Rate in Montana, by Ninth-Grade Cohort and Gender

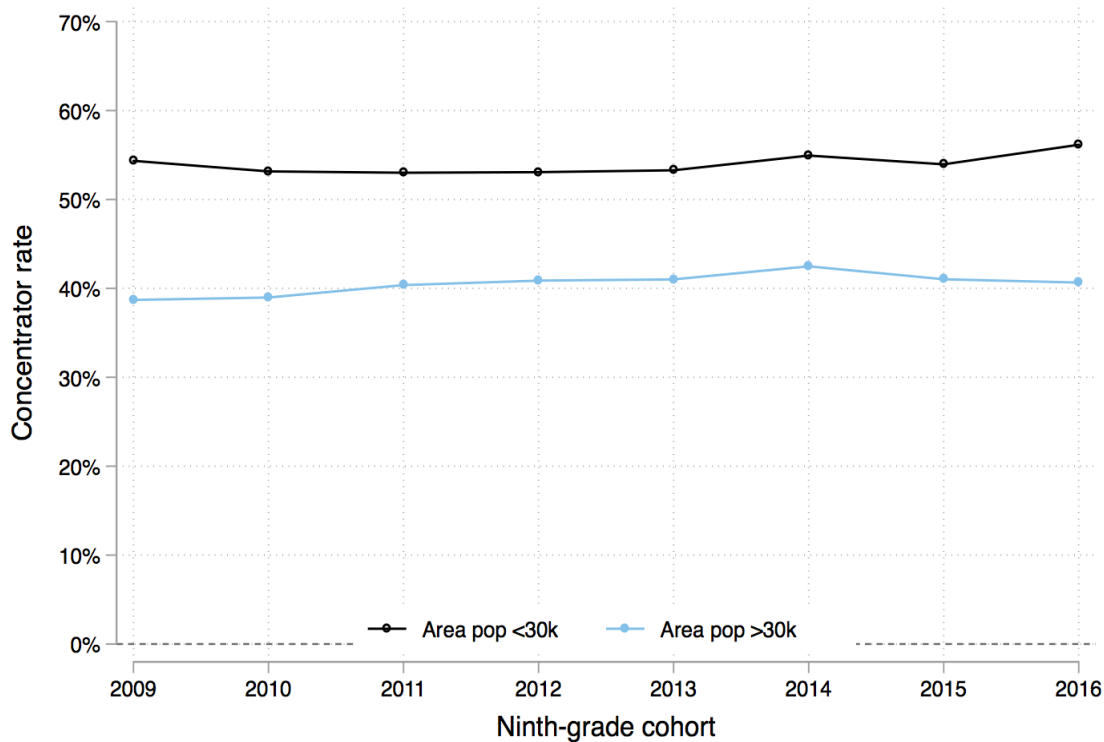


Notes. The sample is students who attended high school for four consecutive years. Concentrators are defined using Montana-specific definitions for students who concentrate in or complete a program of study. Ninth-grade cohort is the school year for first-time ninth graders (e.g., 2016 means first-time ninth graders in SY 2015-16).

Concentration and Completion Rates by Gender

Figure 2 breaks out trends in CTE concentration by gender. While male students concentrate at higher rates across all years, the gap between male and female students remains comparable over time (a roughly 15-percentage-point difference). When comparing this to other states, there are three important takeaways. First, all other CTE states (except Tennessee) have a gender difference in CTE participation. Second, despite the substantial difference in male and female participation rates, female students in ninth-grade cohorts entering Montana high schools concentrated at higher rates than male students in Massachusetts, Michigan, and Washington. Third, this underlines the high CTE participation rates in Montana as compared to the other participating states.

Figure 3. CTE Concentrator Rate in Montana, by Ninth-Grade Cohort and Area Population



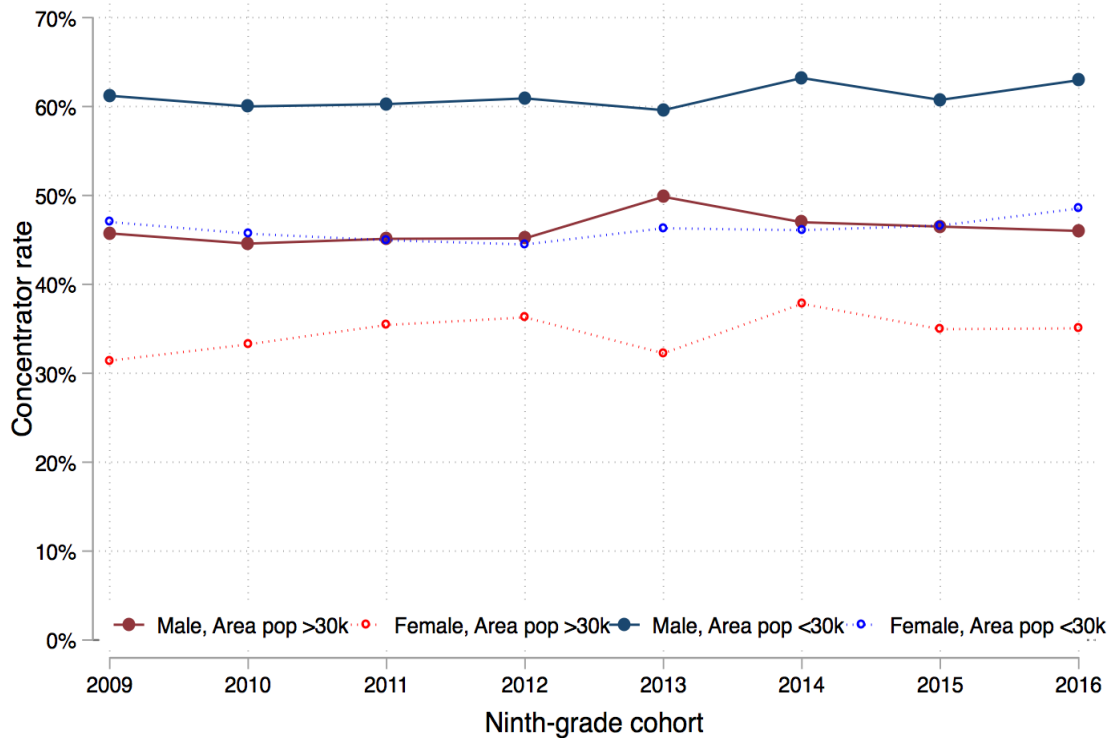
Notes. The sample is students who attended high school for four consecutive years. Concentrators are defined using Montana-specific definitions for students who concentrate in or complete a program of study. Ninth-grade cohort is the school year for first-time ninth graders (e.g., 2016 means first-time ninth graders in SY 2015-16).

CTE Participation in Rural Montana

Montana is a uniquely rural state with many schools in remote areas. Care must be taken to study how CTE differs accordingly. The most-populated city, Billings, has a population of just over 100,000, and the top six cities all have over 30,000 residents.⁵ The seventh-largest city, Kalispell, has a population of roughly 23,000 residents.

Comparing the most-populated cities to the more-rural areas within the state gives a sense of how CTE concentration differs across these areas.⁶ Figure 3 shows the rate of CTE concentrators by area population, where more rural areas (schools in areas with populations under 30,000) have higher rates of CTE concentration. In these rural areas, the CTE concentration rate remains over 50% across all years. These findings point to a higher demand for CTE in rural areas. Concentration rates are close to 40% within the more-populated areas.

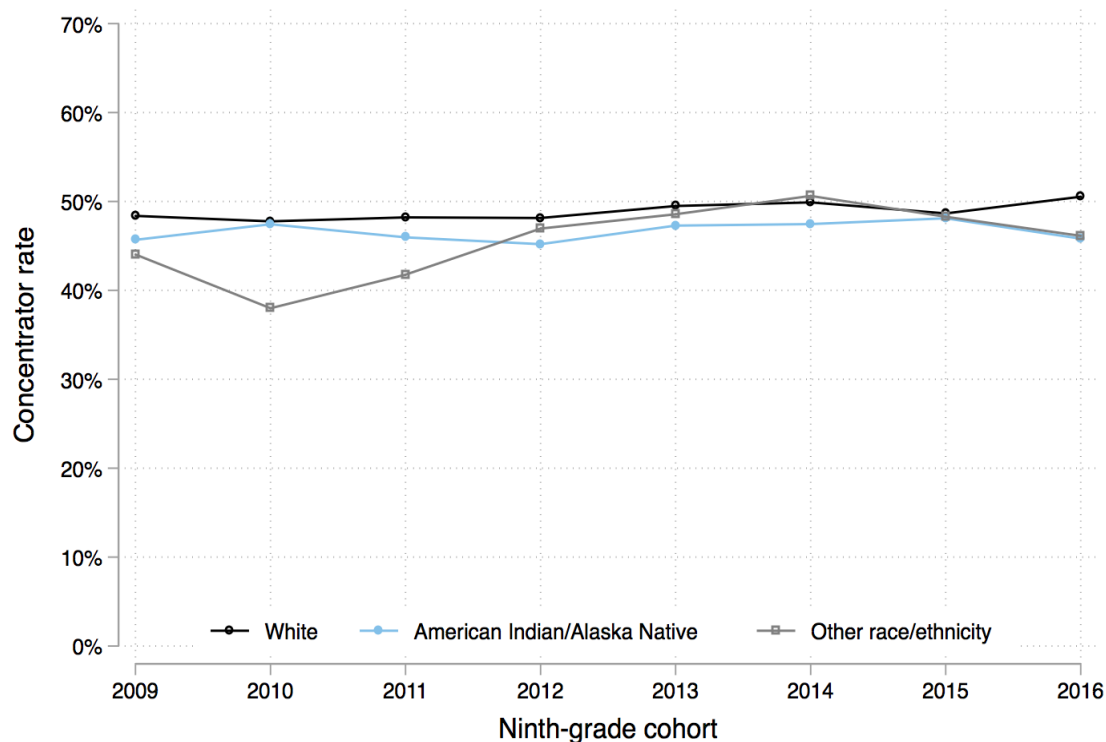
Figure 4. CTE Concentrator Rate in Montana, by Ninth-Grade Cohort, Area Population, and Gender



Notes. The sample is students who attended high school for four consecutive years. Concentrators are defined using Montana-specific definitions for students who concentrate in or complete a program of study. Ninth-grade cohort is the school year for first-time ninth graders (e.g., 2016 means first-time ninth graders in SY 2015-16).

Figure 4 explores the trend in concentration by gender and area population. Male students in more-remote areas concentrate at the highest rates (over 60% are concentrators). Female students in less-populated areas concentrate at similar rates as male students in more-populated areas (approximately 46%). This suggests more demand for CTE in relatively more-remote areas for both male and female students. Concentration rates are lowest for female students living in more-populated areas. Though concentration rates for female students in the most-populated areas are consistently lower than other categories in Montana (approximately 37%), they are still higher than female concentration rates in Massachusetts and Washington (approximately 10% and 25%, respectively) and male concentration rates in Massachusetts (approximately 22%).

Figure 5. CTE Concentrator Rate in Montana, by Ninth-Grade Cohort and Race and Ethnicity



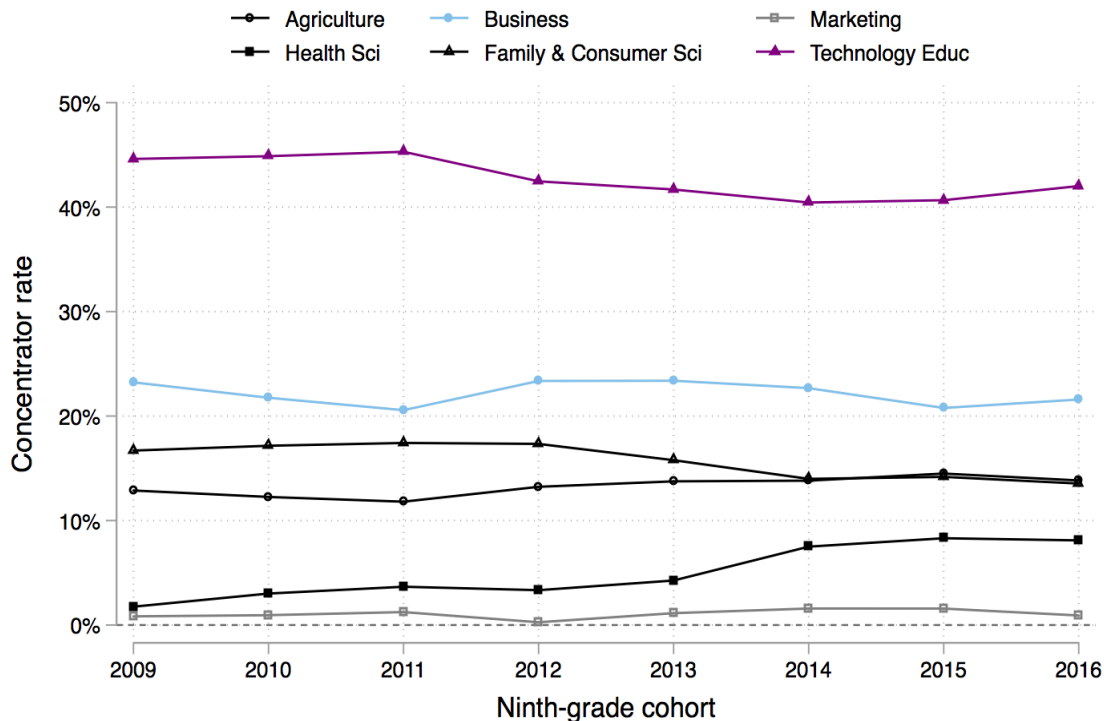
Notes. The sample is students who attended high school for four consecutive years. Concentrators are defined using Montana-specific definitions for students who concentrate in or complete a program of study. Ninth-grade cohort is the school year for first-time ninth graders (e.g., 2016 means first-time ninth graders in SY 2015-16).

Concentration and Completion Rates by Race & Ethnicity

A similar breakout by race and ethnicity highlights unconditional average differences in concentrator status across groups. Given the demographic breakdown of Montana's population, samples are large enough to consider differences in concentration rates by three groups: White non-Hispanic students, American Indian/Alaska Native (AIAN) students, and students of all other races or ethnic backgrounds. The differences presented do not account for differences in course availability or other factors correlated with race and ethnicity that might affect CTE participation or concentrator status.

In Figure 5, I focus on differences in CTE concentration rates by race and ethnicity. White non-Hispanic and AIAN students were relatively similar for the 2009 through 2015 cohorts. Concentration rates then grew larger among White non-Hispanic students than AIAN students for the 2016 cohort. Non-

Figure 6. CTE Concentrator Rate in Montana, by Ninth-Grade Cohort and Career Cluster



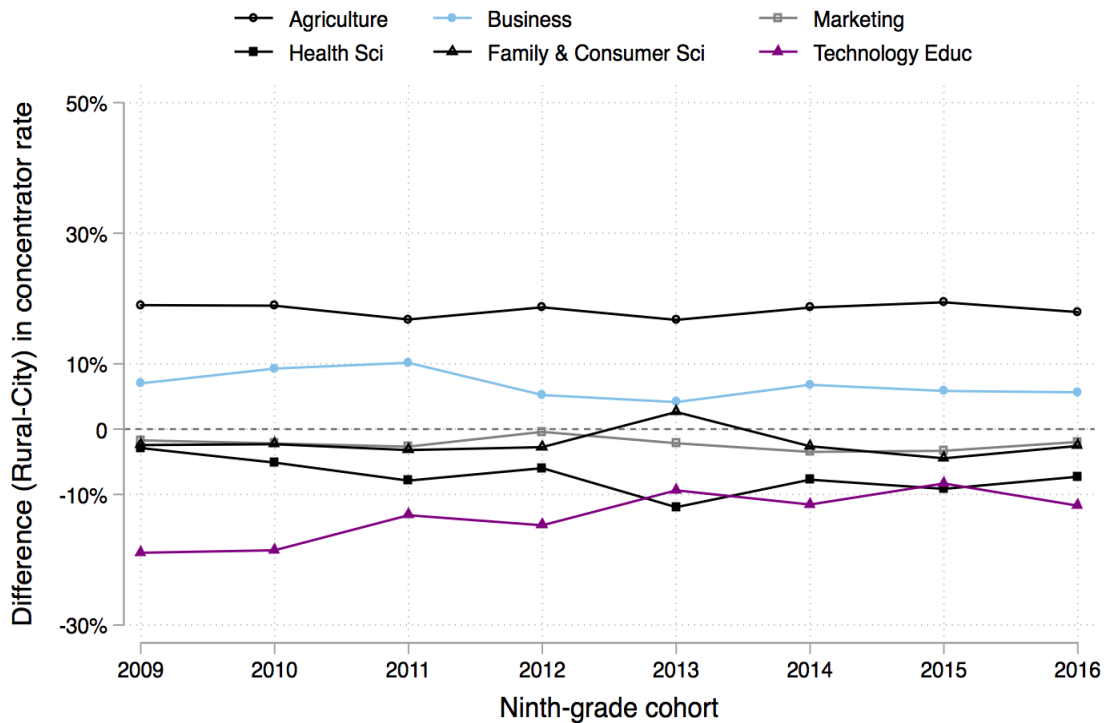
Notes. The sample is students who attended high school for four consecutive years. Concentrators are defined using Montana-specific definitions for students who concentrate in or complete a program of study. Ninth-grade cohort is the school year for first-time ninth graders (e.g., 2016 means first-time ninth graders in SY 2015-16).

White and non-AIAN students (labeled Other race/ethnicity) had lower concentration rates in 2009 through 2011 and more closely followed the other two groups for the remainder of the sample period. While the gap in participation for the 2016 cohort is relatively small (less than 5 percentage points), the drop in concentration rates among AIAN and non-White, non-AIAN students compared to non-Hispanic White students should continue to be watched.

Popular Clusters

CTE encompasses a wide variety of pathways. Figure 6 shows the share of CTE concentrators in each of the six major clusters over time. The most popular CTE clusters are Business, Management, and Administration; Technology Education and Industrial Arts; and Agriculture, Food, and Natural Resources. In the United States and the other CTEx states, Health Science is much more

Figure 7. Difference in CTE Concentrator Rate in Montana Between Rural Areas and Cities, by Ninth-Grade Cohort and Career Cluster

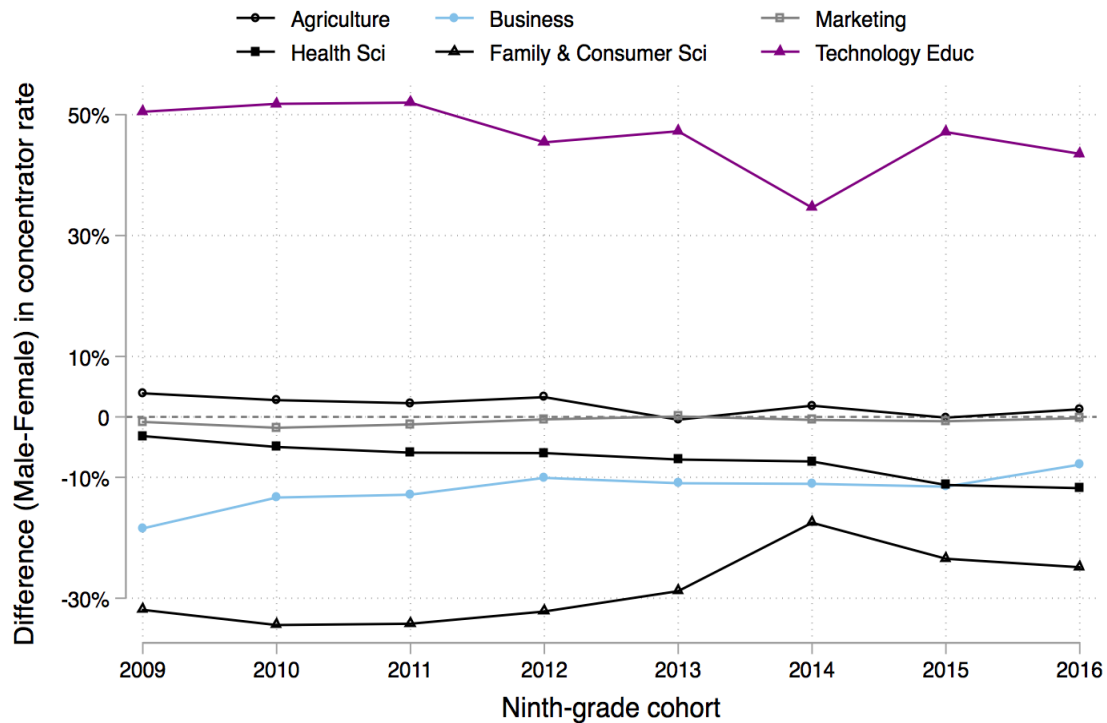


Notes. The sample is students who attended high school for four consecutive years. Concentrators are defined using Montana-specific definitions for students who concentrate in or complete a program of study. Ninth-grade cohort is the school year for first-time ninth graders (e.g., 2016 means first-time ninth graders in SY 2015-16).

popular among students than in Montana. Across all clusters, interest seems relatively flat over time, with increases in Health Sciences and decreases in Family and Consumer Science and Technology Education.

Figure 7 plots the difference in participation among rural areas (schools in areas with populations under 30,000) and cities (schools in areas with populations over 30,000). The lines above the dashed zero line represent clusters that are more popular among rural areas, and the lines below the dashed zero line represent clusters that are more popular among more-populated areas. Agriculture, Food, and Natural Resources is 15 percentage points more popular among students in rural areas, and that difference has not changed over time. Technology Education and Industrial Arts is more popular among students in cities, though that difference has decreased from 20 percentage points to almost 10 percentage points over my analysis period. Business is more popular

Figure 8. Difference in CTE Concentrator Rate in Montana Between Male and Female Students, by Ninth-Grade Cohort and Career Cluster

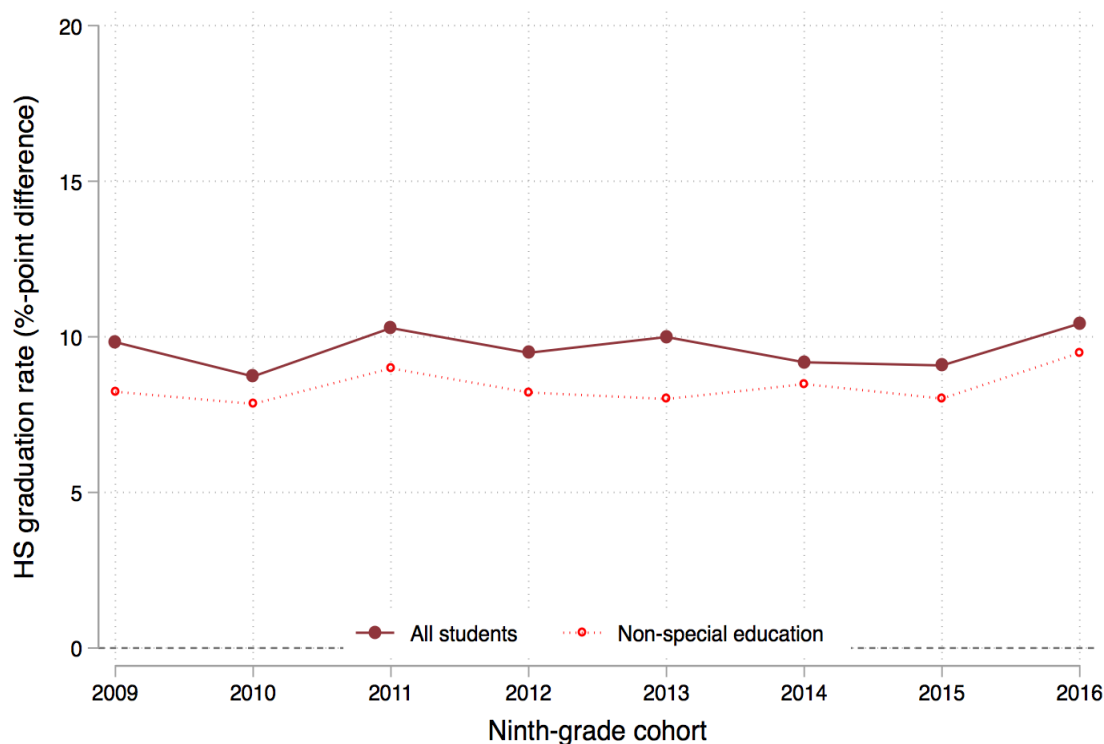


Notes. The sample is students who attended high school for four consecutive years. Concentrators are defined using Montana-specific definitions for students who concentrate in or complete a program of study. Ninth-grade cohort is the school year for first-time ninth graders (e.g., 2016 means first-time ninth graders in SY 2015-16).

among rural areas, and Health Science is more popular in areas with greater populations.

There are some interesting diversions in clusters based on gender. Figure 8 shows that Agriculture, Food, and Natural Resources is almost equally popular among male and female students. Technology Education and Industrial Arts is nearly 50 percentage points more common among male students than female students, and Family and Consumer Science is more common among female than male students, though this gap has decreased over time. Business follows the same trend: While it is more common among female than male students, the gap has decreased over time from a 20-percentage-point difference to a less than 10-percentage-point difference.

Figure 9. Difference in High School Graduation Rate in Montana by Special Education Status, by Ninth-Grade Cohort and Career Cluster



Notes. The sample is students who attended high school for four consecutive years. Concentrators are defined using Montana-specific definitions for students who concentrate in or complete a program of study. Ninth-grade cohort is the school year for first-time ninth graders (e.g., 2016 means first-time ninth graders in SY 2015-16).

CTE and High School Graduation

How does CTE relate to high school graduation rates? Because the sample is limited to students who enrolled in high school for four consecutive years, it is not possible to observe students who dropped out before their fourth year of high school. I define high school graduation as graduating within four years after first entering Grade 9. Students who do not graduate “on time” (i.e., within four years of first entering Grade 9) are defined as non-graduator in the following analyses.

I show graduation rates for all students and separately for students who were never classified as having an identified disability. For reference, 11% of students in Montana have an identified disability as defined by special education participation. Figure 9 plots the difference in high school graduation rates between CTE concentrators and non-concentrators over time. The dark red

Figure 10. Difference in High School Graduation Rate in Montana by Area Population, by Ninth-Grade Cohort and Career Cluster



Notes. The sample is students who attended high school for four consecutive years. Concentrators are defined using Montana-specific definitions for students who concentrate in or complete a program of study. Ninth-grade cohort is the school year for first-time ninth graders (e.g., 2016 means first-time ninth graders in SY 2015-16). Rural areas are areas with a population of less than 30,000 residents. %-point difference is the difference in graduation rates across students who did and did not concentrate in CTE.

line shows that CTE concentrators are between 7 and 11 percentage points more likely to graduate high school than non-concentrators. The gap is smaller for students without identified disabilities, suggesting the high school graduation rate advantage is larger among those students with identified disabilities. This is consistent with findings across other CTEx states.

Figure 10 shows a similar graduation advantage for CTE concentrators in less-populated areas of the state. Students in areas with populations under 30,000 have a high school graduation rate advantage from concentrating in CTE: Concentrators in more-rural areas are approximately 12 to 13 percentage points more likely to graduate high school than non-concentrators.

Conclusions

In this report, I undertake a descriptive analysis of CTE trends in Montana. Aligning with federal reporting requirements, I focus on concentrator status as my primary variable of interest. Please take caution in interpreting these results. Nothing in this report should be interpreted as causal.

There are key takeaways:

- Concentrator rates in Montana are close to 50%, and they have remained consistent over time.
- Female students are less likely to be CTE concentrators than male students, though female students in more-rural areas are equally likely to be concentrators as male students in more-populated areas within the state.
- Students who concentrate in a CTE program of study are more likely to graduate than non-concentrators. This advantage is even larger for students with identified disabilities as well as for students from less-populated areas of the state.
- Demand for CTE among Montana students, particularly students from more-rural areas, remains high when compared to many other CTE states (e.g., Massachusetts, Michigan, Tennessee, and Washington).

Acknowledgments

This research could not have been conducted without enthusiastic and generous participation from state partners in Montana. The author would like to thank the Montana Office of Public Instruction and the Statewide Longitudinal Data System team for providing the necessary data.

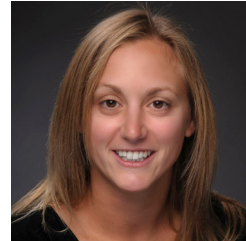
Endnotes

1. For more information, see gpl.gsu.edu/ctex.
2. Carruthers, C., Dougherty, S., Kreisman, D. & Martin, A. (2020). A multi-state analysis of trends in career and technical education: Massachusetts, Michigan, and Tennessee. Career & Technical Education Policy Exchange. Georgia Policy Labs. gpl.gsu.edu/publications/cross-state-analysis/
3. See Program Memorandum: "Student Definitions and Measurement Approaches for the Core Indicators of Performance Under the Carl D. Perkins Career and Technical Education Act of 2006 (Perkins IV)." Troy R. Justesen. Office of Vocational and Adult Education State Administration and Accountability Group. March 3, 2007. Accessed at s3.amazonaws.com/PCRN/docs/nonregulatory/studentdef.pdf on April 27, 2021.
4. The concentrator definition comes from the proprietary Achievement in Montana (AIM) Data Dictionary.
5. These are Billings, Bozeman, Butte, Great Falls, Helena, and Missoula.
6. Due to an error with the data collection for the cohort of freshmen who entered school in the 2012-2013 academic year, data from the Billings school districts were excluded for that cohort.
7. For each Program of Study, the Michigan Department of Education defines a set of standards that outline the basic contents and objectives a program should cover. To simplify monitoring and track student progress, the Michigan Department of Education defines 12 groupings of standards called segments, which are specific to each Program of Study. There are no requirements as to how many segments should be covered in one course or how many hours of instruction should be allocated to cover one segment.

About the Authors

Carly Urban

Carly Urban is an associate professor of economics at Montana State University and a research fellow at the Institute for Labor Studies (IZA). Her research focuses on school policies that affect student outcomes, such as the effects of requiring personal finance coursework in high school on credit scores and student loan borrowing. She earned a Ph.D. in economics from the University of Wisconsin-Madison and a bachelor's degree in economics and international affairs from the George Washington University.



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