



**GEORGIA  
POLICY LABS**



# **A Multi-State Analysis of Trends in Career and Technical Education**

Massachusetts, Michigan, Montana, Tennessee, and Washington

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## Introduction

In spring 2020, the onset of the COVID-19 pandemic and subsequent school closures shocked the U.S. educational system. How did these shocks affect high school students focusing on career and technical education (CTE)? Because CTE tends to have more hands-on courses, CTE students may have experienced more disruption due to the pandemic than other students. Were schools and students able to adapt? Did students change the CTE clusters in which they chose to concentrate? Were gaps in CTE concentration across student gender, race, ethnicity, identified disability status, and district urbanicity exacerbated during the pandemic?

This report seeks to understand changes in CTE concentration just before and just after the pandemic began using administrative data across five states: Massachusetts, Michigan, Montana, Tennessee, and Washington. The bulk of our analysis tracks three cohorts: ninth graders in the 2014–15 school year (SY), ninth graders in SY 2015–16, and ninth graders in SY 2016–17. The latter cohort was the first to be affected by the COVID disruptions. In two states—Michigan and Montana—we have data for one additional cohort who endured COVID disruptions for over a year.

The findings suggest that CTE concentration did not substantively change with the first cohorts affected by the start of the pandemic, except in Tennessee, where the class of 2020 was significantly more likely to concentrate in CTE than the previous cohorts. In all states, gaps in concentration by student gender, race, and ethnicity did not widen at the onset of the pandemic. However, one year into the pandemic, students with identified disabilities in Michigan and Montana were less likely to concentrate in CTE than students without identified disabilities.<sup>1</sup>

We then explore differences in CTE concentration by urbanicity, where these comparisons differ by state. Michigan, Montana, and Tennessee have higher concentration rates among rural students when compared to students in urban areas. In Washington, concentration rates across rural and urban areas are very similar, and in Massachusetts, students in urban areas concentrate at higher rates than rural students.

Students concentrating in CTE were more likely to graduate from high school than those not concentrating in CTE before and after the start of the pandemic. In Massachusetts, Michigan, Tennessee, and Washington, there were no large changes in how students were distributed across CTE clusters before

versus after the start of the pandemic. Montana, by contrast, saw larger swings across some clusters one year into the pandemic.

## Research Questions

We address the following key research questions:

1. Did CTE concentration rates change at the start of the pandemic?
2. Did gaps in concentration rates change by student race, ethnicity, gender, or identified disability status?
3. What are the differences in concentration rates across rural and urban areas, and have these gaps changed over time?
4. Were CTE concentrators more likely to graduate from high school, and did this change at the start of the pandemic?
5. Which career clusters have seen the largest changes in participation?

## Measures and Samples

We define the analysis sample in the same manner as our two prior multi-state reports and prior report in Montana. The interested reader should refer to the [2020 report](#) for a detailed description of the samples across states and the creation of common definitions, the [2021 report](#) for more information on longer-run trends, and the [2021 Montana report](#) for more on CTE trends in that state.

We focus on measuring whether a student “concentrated” in a CTE program of study. Concentrating in a CTE program is a more intense measure of engagement than participation but not necessarily the same as completing a CTE program. States have a fair amount of discretion in defining participators, concentrators, and completers for federal reporting purposes (particularly under Perkins V), and CTE courses and programs (including mode of delivery and how credits are assigned) also vary across state contexts. Nevertheless, state definitions are more similar for CTE concentration than for CTE participation,<sup>2</sup> and indicators for program completion are not available across all states in our [Career & Technical Education Policy Exchange](#) consortium.

**Table 1. State-Specific Definitions of CTE Concentrator Status**

State	Concentrator definition in this report
Massachusetts	Student was identified by the school or district as being a participant in a CTE program for two or more academic years.
Michigan	Student completed, with grade C or better, courses covering seven or more segments (which represented more than 50% of the program), regardless of the number of courses taken.
Montana	Student earned at least two credits in at least one Montana Career Pathway.
Tennessee	2017–18 and 2018–19 graduates: Student was identified by the school or district as having completed at least three courses in a program of study. 2019–20 graduates (first year of Perkins V implementation): Student completed at least two courses in a program of study.
Washington	Student completed at least three credits in a program of study.

*Sources.* Personal communication with research staff in respective state CTE offices. The overarching federal definitions are available in “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](https://s3.amazonaws.com/PCRN/docs/nonregulatory/studentdef.pdf)

With these similarities and differences in state CTE policy and practice in mind, we focus on students who concentrate in a program of study, which also includes completers.<sup>3</sup> Differences in concentration rates across states reflect, in part, differences in the share of students who take CTE courses in addition to differences in how states define two or three courses in a sequence. Table 1 provides definitions of CTE concentrators for each state included in this report.<sup>4</sup>

The analysis sample in each state is defined by first-time ninth graders whom we observe for at least four years in administrative data. The samples include students with irregular grade progression, such as students retained in grade, as long as they are enrolled for at least four years in the state’s public schools. The cohorts that comprise the analysis sample are shown below in Table 2.

**Table 2. Ninth-Grade Cohorts**

Cohort name	Ninth-grade	On-time graduation	Included states
2015	SY 2014–15	SY 2017–18	MA, MI, MT, TN, WA
2016	SY 2015–16	SY 2018–19	MA, MI, MT, TN, WA
2017*	SY 2016–17	SY 2019–20	MA, MI, TN, WA
2018*	SY 2017–18	SY 2020–21	MI, MT

*Notes.* Only Michigan and Montana have made sufficiently recent data available to include the 2018 cohort at publication time. Montana CTE data for the 2017 cohort was collected using a different system and is not directly comparable to other cohorts. Graduation data from Washington for the 2017 cohort are not yet available. \*Cohorts are those that were affected by the COVID-19 pandemic.

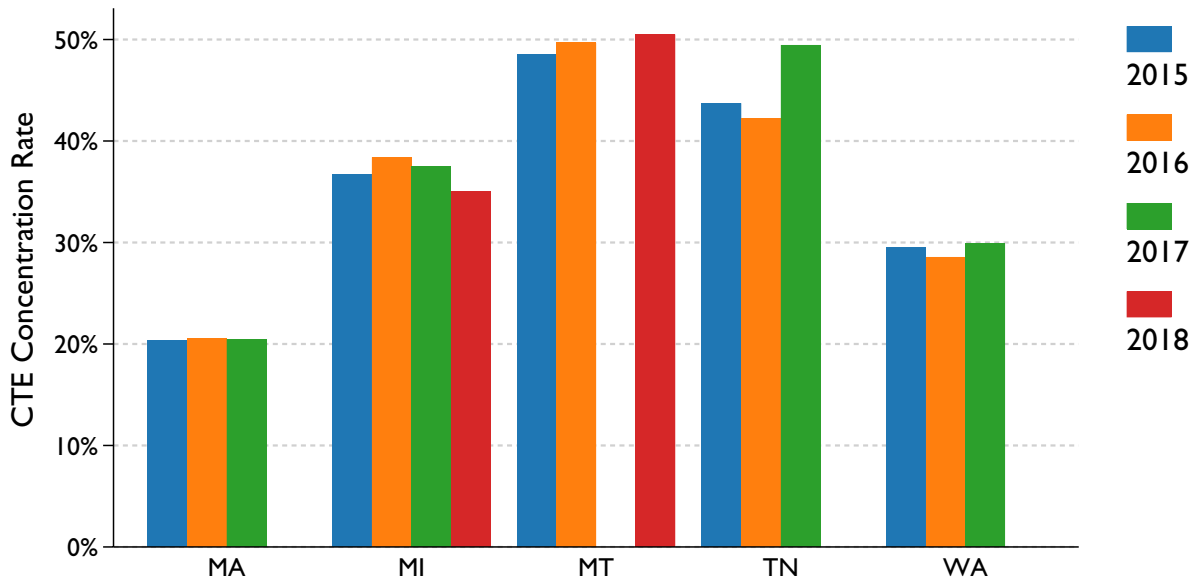
**Table 3. Proportion of Students by Subgroup and State for the 2016 Ninth-Grade Cohort**

Subgroup	State				
	MA	MI	MT	TN	WA
Female	0.488	0.491	0.479	0.491	0.489
Black, non-Hispanic	0.096	0.185	0.0089	0.218	0.038
White, non-Hispanic	0.612	0.710	0.823	0.648	0.530
Another race, non-Hispanic	0.095	0.039	0.134	0.043	0.241
Hispanic	0.195	0.066	0.034	0.091	0.191
Students with identified disabilities	0.201	0.131	0.103	0.104	0.119
Rural	0.862	0.335	0.584	0.026	0.245
Urban	0.138	0.665	0.416	0.974	0.755

Notes. We use NCES definitions for urban and rural areas for Massachusetts, Michigan, and Washington; we classify both urban and suburban areas into an “urban” category and consider towns and rural areas to be “rural.” We use USDA ERS definitions for rural and urban areas for Tennessee. Schools in Montana cities with over 30,000 people are considered “urban,” and all other schools are considered “rural.”

We use four mutually-exclusive categories to describe student race and ethnicity: non-Hispanic Black students, non-Hispanic White students, Hispanic students, and non-Hispanic students of another race. On-time high school graduation is defined as graduating within four years after first entering Grade 9. We use NCES definitions for urban and rural areas for Massachusetts, Michigan, and Washington, and we use USDA ERS classifications for Tennessee. We classify urban and suburban areas into an “urban” category, and we consider towns and rural areas to be “rural.” As nearly all of Montana would be considered rural by this definition, schools in Montana cities with over 30,000 people are considered “urban,” and all other schools are considered “rural.” Table 3 shows the proportion of students by subgroup and state for the 2016 cohort.

Figure 1. CTE Concentration Rates by Ninth-Grade Cohort



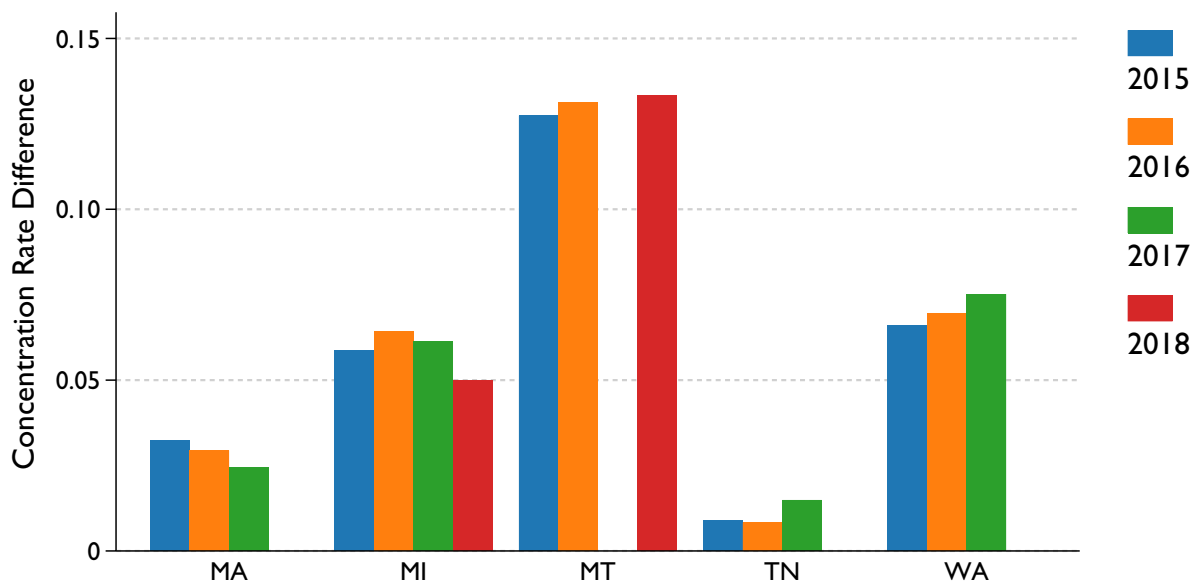
Notes. A new concentrator definition was adopted in MI in SY 2020–21; thus, the concentrator rate for the 2018 cohort should not be directly compared to earlier cohorts. Montana CTE data for the 2017 cohort was collected using a different system and is not directly comparable to other cohorts.

## Finding 1: CTE Concentration Rates Early in the Pandemic

**CTE concentration rates minimally changed in most states at the start of the COVID-19 pandemic.**

Figure 1 shows CTE concentration rates by cohort for each of the five states. In Massachusetts, Michigan, Montana, and Washington, concentration rates remained relatively similar for cohorts with on-time graduation years before and just after the pandemic. One notable exception is a six-percentage-point uptick in CTE concentration rates in Tennessee for the 2017 cohort, whose on-time graduation would have been in 2020. The Tennessee graduating class of 2020 was the first whose concentration status was tied to two courses in a program of study rather than three, which may explain the sudden change.

Figure 2. Difference in Concentration Rates Between Male and Female Students



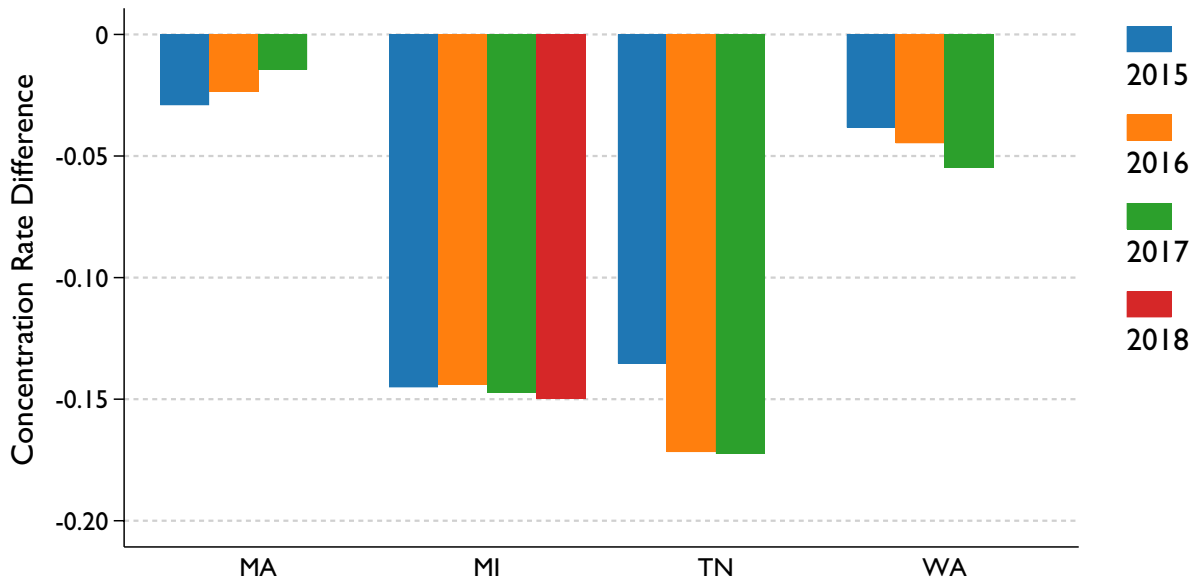
Notes. A new concentrator definition in MI in SY 2020–21 may have affected the difference in concentration rates for the 2018 ninth-grade cohort. Montana CTE data for the 2017 cohort was collected using a different system and is not directly comparable to other cohorts

## Finding 2: CTE Concentration by Gender, Race, and Ethnicity

The gaps in CTE concentration by gender, race, and ethnicity largely did not widen at the start of the pandemic.

Figure 2 shows the gaps in CTE concentration rates between male and female students. The height of each bar in Figure 2 is equal to the male CTE concentration rate minus the female rate. Overall, the gender gap did not dramatically increase in any state at the start of the pandemic. In Washington, the state with the largest increase, the gender gap only grew by 0.9 percentage points between the 2015 and 2017 cohorts. Tennessee has the lowest gender gap—a 1.5-percentage-point difference across male and female students—and Montana has the largest gap: Male students are 13 percentage points more likely to concentrate in CTE than female students. Massachusetts saw a small, steady decline in the gender gap at the onset of the pandemic. In Michigan, the 2018 cohort exhibited a smaller gap between male and female concentration than before the pandemic; however, we cannot exclude the possibility that a

Figure 3. Differences in Concentration Rates Between Black and White Students



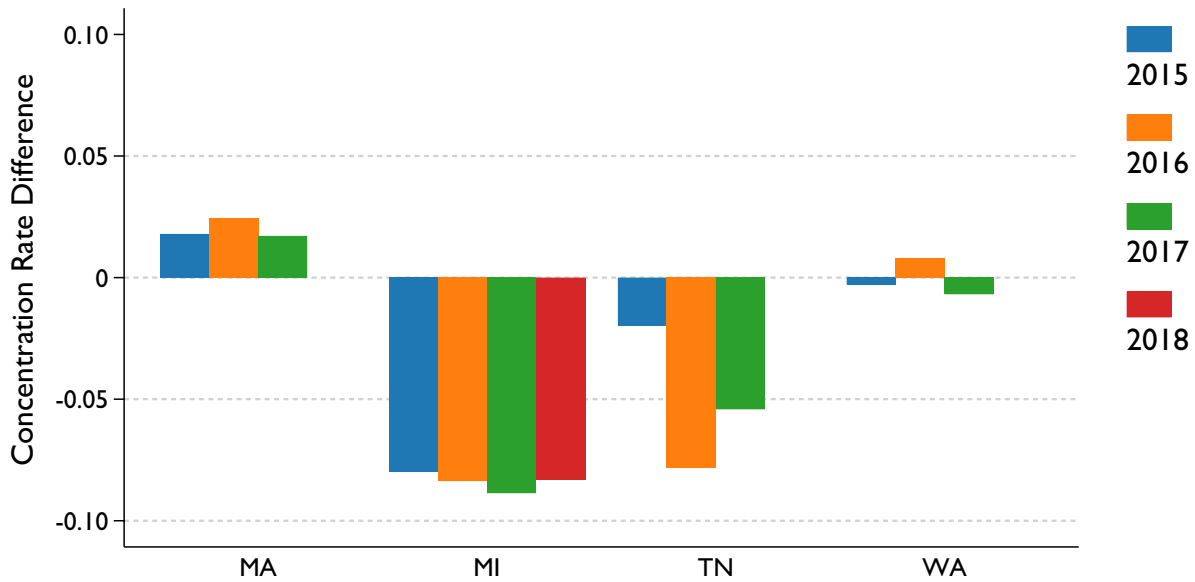
Notes. A new concentrator definition in MI in SY 2020–21 may have affected the difference in concentration rates for the 2018 ninth-grade cohort. Montana CTE data for the 2017 cohort was collected using a different system and is not directly comparable to other cohorts

definitional change in CTE concentration affecting the 2018 cohort (and later cohorts) may have contributed to a smaller gap relative to earlier cohorts.

In Figure 3, we turn to gaps in concentration by race and ethnicity. The results do not include Montana due to the small size of population groups by race and ethnicity. The height of each bar is the Black concentration rate minus the White concentration rate. This is less than zero in the four states shown, where Black students are less likely to concentrate in CTE than White students. Massachusetts has the lowest Black-White gap in CTE concentration, and it decreases over time. Washington has the second-lowest gap, although it increased by 1.7 percentage points between the 2015 and 2017 cohorts. Michigan’s gap reflects a 15-percentage-point difference in participation between Black and White students, but the gap did not grow during the pandemic. Tennessee has the highest Black-White concentration gap, though it remained consistent with the start of the pandemic. Overall, most states—with the exception of Washington’s modest increase—did not see an uptick in the Black-White concentration gap.



Figure 4: Differences in Concentration Rates Between Hispanic and White Students



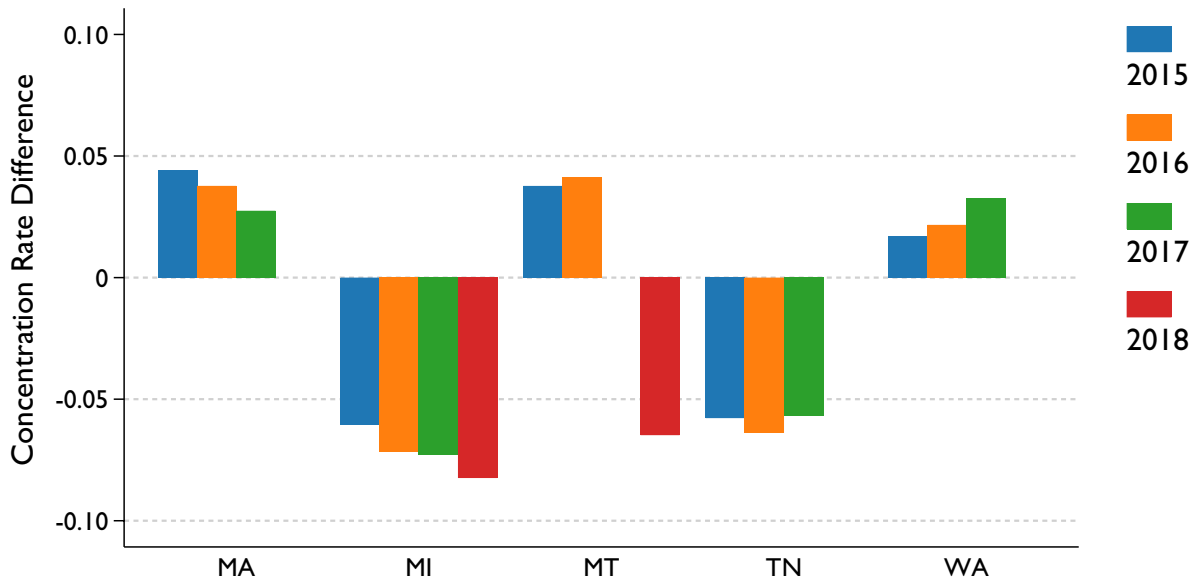
Notes. A new concentrator definition in MI in SY 2020–21 may have affected the difference in concentration rates for the 2018 ninth-grade cohort. Montana CTE data for the 2017 cohort was collected using a different system and is not directly comparable to other cohorts

Figure 4 shows that the gaps in CTE concentration across Hispanic and non-Hispanic White students did not widen at the start of the pandemic. In Massachusetts, Hispanic students were more likely to concentrate in CTE than White students for all cohorts, and in Washington, concentration rates were comparable across the two groups for all cohorts. In Michigan and Tennessee, White students were more likely to concentrate in CTE than Hispanic students, though the gaps decreased at the start of the pandemic. In these four states, the changes did not vary substantially pre- and post-COVID.

### Finding 3: CTE Concentration by Identified Disability Status

The gaps in CTE concentration by identified disability status did not widen in any state for the first cohort impacted by the pandemic. However, one year into the pandemic, concentration rates for students with an identified disability in two states fell compared to students without an identified disability.

Figure 5: Difference in Concentration Rates Between Students with and without Disabilities

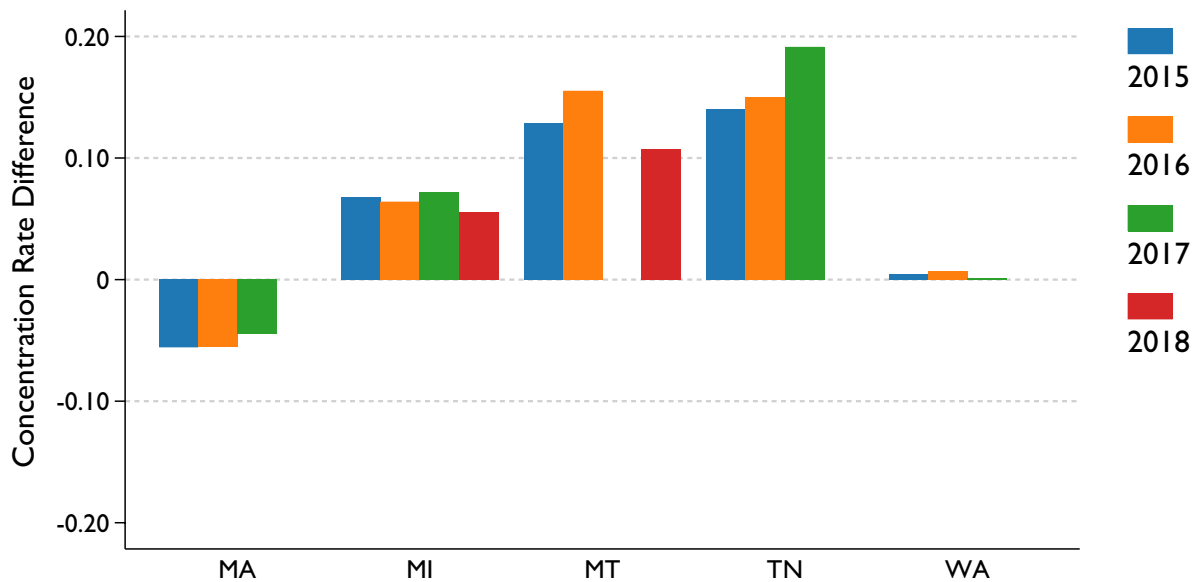


Notes. A new concentrator definition in MI in SY 2020–21 may have affected the difference in concentration rates for the 2018 ninth-grade cohort. Montana CTE data for the 2017 cohort was collected using a different system and is not directly comparable to other cohorts

Figure 5 documents the gap between CTE concentration for students with and without an identified disability. In Massachusetts and Washington, students with an identified disability are more likely to concentrate in CTE than students without an identified disability both before and at the start of the pandemic. In Michigan and Tennessee, students with an identified disability are less likely to concentrate in CTE than students without an identified disability both before and at the start of the pandemic.

In Michigan and Montana, the 2018 cohort saw a decrease in CTE concentration for students with an identified disability compared to students without an identified disability.<sup>5</sup> Pre-COVID, students with an identified disability in Montana were more likely to concentrate in CTE than students without an identified disability, but the 2018 cohort reversed the trend. Montana students with an identified disability became 6.5 percentage points less likely to concentrate in CTE than students without an identified disability. The fraction of students with an identified disability did not increase over the same time period in either state. Taken together, these findings suggest that students with an identified disability may have been particularly impacted by the disruptions of the pandemic, making it harder for them to concentrate in CTE.

Figure 6. Difference in Concentration Rates Between Rural and Urban Areas



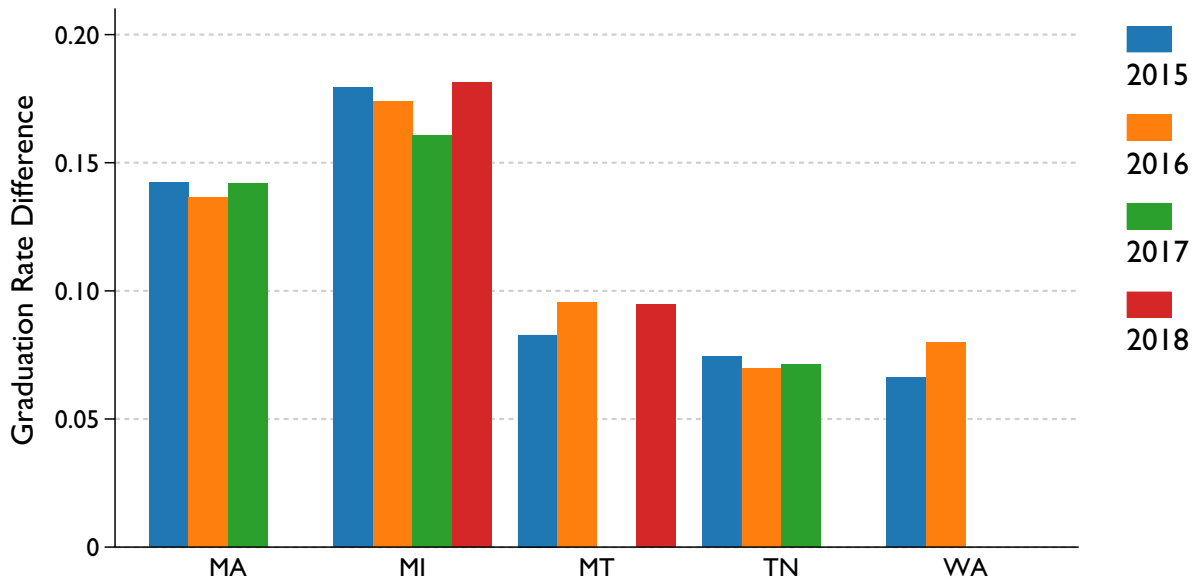
Notes. A new concentrator definition in MI in SY 2020–21 may have affected the difference in concentration rates for the 2018 ninth-grade cohort. Montana CTE data for the 2017 cohort was collected using a different system and is not directly comparable to other cohorts

## Finding 4: CTE Concentration and Urbanicity

In Michigan, Montana, and Tennessee, students in rural areas are more likely to concentrate in CTE than students in urban areas. In Massachusetts, the reverse is true, and in Washington, CTE concentration rates are similar across geography types.

Figure 6 shows that the gaps between rural and urban concentration rates vary by state. Washington has virtually no difference in concentration rates across the two groups, and in Massachusetts, students in rural areas are less likely to concentrate in CTE than students in urban areas. In the remaining three states, rural CTE concentration is more prevalent than urban CTE concentration. In Massachusetts, Michigan, and Washington, the trends remain consistent pre- and post-pandemic, while Tennessee saw an increase in the rural-urban participation gap with the 2017 ninth-grade cohort (who were the first to be affected by the pandemic and by the state’s new CTE concentration definition). Montana saw the opposite trend: The gap between CTE concentration in students in rural and urban areas decreased post-pandemic.

Figure 7. Difference in High School Graduation Rates Between CTE Concentrators and Non-Concentrators



Notes. A new concentrator definition in MI in SY 2020–21 may have affected the difference in concentration rates for the 2018 ninth-grade cohort. Montana CTE data for the 2017 cohort was collected using a different system and is not directly comparable to other cohorts

## Finding 5: CTE Concentration and High School Graduation

CTE concentrators are more likely to graduate from high school than non-concentrators in all five states both before and after the pandemic, with consistent gaps over time.

Figure 7 shows that, in the four states with available high school graduation data, CTE concentrators are more likely to complete high school than non-concentrators.<sup>6</sup> The CTE-related boosts to high school completion are consistent in size both before and after the pandemic.

**Table 4. Changes in CTE Clusters, 2016 Cohort Compared to 2017 Cohort**

State	Biggest increase	Biggest decrease
MA	Health sciences 0.81	Information technology -0.70
MI	Law, public safety, corrections, & security 0.44	Business, management, & administration -1.1
TN	Health sciences 1.1	Business, management, & administration -0.20
WA	Education & training 0.31	Arts, audio visual, & communications -0.20

## Finding 6: Changes in CTE Clusters

Changes in CTE clusters were relatively small when comparing the cohorts who were on track to graduate just before and after the pandemic. The fields with the largest positive and negative swings varied by state.

Table 4 documents the CTE clusters with the biggest increase and decrease in concentration rates (or course-taking in Tennessee, where we do not observe a student’s concentration cluster) by state, comparing the 2016 and 2017 cohorts (or students whose on-time graduation was just before and just after the pandemic in spring 2020). There were no large changes in concentration rates across CTE clusters for the first cohort affected by the pandemic in Massachusetts, Michigan, Tennessee, or Washington. The largest changes were a 1.1-percentage-point decrease in the concentration rate in the Business, Management, and Administration cluster in Michigan, and a 1.1-percentage-point increase in the course-taking in the Health Sciences cluster in Tennessee.

**Table 5. Changes in CTE Clusters, 2016 Cohort Compared to 2018 Cohort**

State	Biggest increase	Biggest decrease
MT	Agriculture, food, & natural resources 7.56	Technology education and industrial arts -13.5

Notes. Only MT had time-consistent CTE concentration data for the 2018 cohort available. MT CTE data for the 2017 cohort was collected using a different system and is not directly comparable to the other years.

Table 5 uses data from Montana to document changes in concentration rates by cluster between the 2016 (pre-pandemic) and 2018 (one year post-pandemic) cohorts. This allows us to understand concentration rate differences across clusters for students whose high school education was more severely disrupted by the pandemic. Between the 2016 and 2018 cohorts, we observe larger swings in concentration rates. In Montana, concentration in the Technology Education and Industrial Arts cluster saw a 13.5-percentage-point decrease, while the Agriculture, Food, and Natural Resources cluster experienced a 7.6-percentage-point increase in CTE concentration.

## Recommendations

Early evidence from five states suggests that CTE concentration rates did not drop at the onset of the COVID-19 pandemic. Moreover, gaps in concentration rates by race, ethnicity, and identified disability status were not exacerbated at the start of the pandemic. The start of the pandemic did not see a dramatic change in concentration rates across career clusters. We reiterate that this study is not causal and only descriptive in nature.

First, we recommend that states continue efforts to adapt CTE education (which they began at the start of the pandemic), while placing a greater emphasis on students with an identified disability. Our findings may suggest that these efforts may have been successful in maintaining CTE concentration rates and limiting further increases in disparities among student experiencing vulnerabilities despite ongoing pandemic-related challenges. However, data from one year after the start of the pandemic suggest a widening gap in concentration rates between students with and without an identified disability in Michigan and Montana. The pandemic may have made it more difficult for students with an identified disability to continue CTE coursework. This finding could signal a cautionary tale for the other three states in this report, where the administrative data to analyze CTE one year after the start of the pandemic have not yet become available.

Second, we recommend that states check with schools on changing demand for or inability to supply specific CTE programs. While there were not large swings in concentration rates across career clusters for the cohort affected only by the start of the pandemic, concentration rates for the 2018 cohort in Montana decreased substantially for the Technology Education and Industrial Arts cluster.

Third, students who concentrate in CTE were more likely to earn their high school diploma than non-concentrators both before and after the pandemic began. At a time when teachers are more worn down than ever, it may be encouraging to relay this correlation back to CTE teachers.

Fourth, we encourage states to continue tracking CTE progress. The results for the 2017 cohort point to a lack of any immediate negative change at the start of the pandemic on CTE concentration rates. In two states where we have one additional year of data, we see mixed results. Montana had little to no change in CTE concentration, with increased concentration among students from schools within more-populated areas and decreased concentration among students from more-rural schools. Michigan saw a decreasing concentration disparity between male and female students. Uncovering how these trends continue in each state will help to inform states about how demand for CTE—both overall and for specific programs and career clusters—may have changed during the pandemic.

## Acknowledgments

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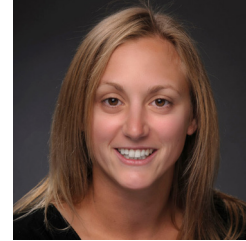
## Endnotes

1. A new concentrator definition in Michigan went into effect in SY 2020–21. In this report, the new measure, which affected the most-recent ninth-grade cohort, should only be used to consider gaps across student subgroups within the same cohort, not for level differences across cohorts.
2. It is not possible to consistently define CTE participants across states because, in some states, almost every high school student takes at least one CTE course.
3. A transitional definition of concentrator was applied in SY 2020–21 in Michigan to comply with Perkins V: a student who completed 8–12 segments of instruction with grade "C" or better, regardless of the number of courses taken. One course is four segments.
4. The definition in Massachusetts used in this report differs from the 2021 report, and the findings are not directly comparable.
5. We cannot exclude the possibility that a definitional change to CTE concentration in Michigan, which affects the 2018 cohort (and later cohorts), may have contributed to a larger gap relative to earlier cohorts.
6. We omit Washington from this graph, as it does not have high school graduation data for the cohort that would have finished high school in spring 2020.

## About the Authors

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Carly Urban is a 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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## Thomas Goldring

Thomas Goldring is the director of research at the Georgia Policy Labs. He supports the faculty directors in managing research projects and providing analytical and technical support across GPL's three components. His research focuses on K–12 education, including educational accountability, school finance, and graduation rates; early childhood education; career and technical education; post-secondary education; and education and mortality. He received his doctorate in public policy and management from Carnegie Mellon University and completed a post-doctoral fellowship at the University of Michigan.



## Daniel Kreisman

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## About the Georgia Policy Labs

The Georgia Policy Labs is an interdisciplinary research center that drives policy and programmatic decisions that lift children, students, and families—especially those experiencing vulnerabilities. We produce evidence and actionable insights to realize the safety, capability, and economic security of every child, young adult, and family in Georgia by leveraging the power of data. We work alongside our school district and state agency partners to magnify their research capabilities and focus on their greatest areas of need. Our work reveals how policies and programs can be modified so that every child, student, and family can thrive.

Housed in the Andrew Young School of Policy Studies at Georgia State University, we have three components: the Metro Atlanta Policy Lab for Education (metro-Atlanta K-12 public education), the Child & Family Policy Lab (supporting children, families, and students through a cross-agency approach), and the Career & Technical Education Policy Exchange (a multi-state consortium exploring high-school based career and technical education).

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