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POLICY BRIEF

Expanding Computer Science Education in Texas

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Executive Summary

Computer science (CS) K-12 education has expanded greatly in Texas over the last decade, but much work is still needed as currently less than half of Texas high schools offer a CS course and less than 5% of high school students take a CS course in a given school year.

We examined the current state and growth of CS education over time and across subpopulations in K-12 Texas schools, specifically investigating school capacity for, student access to, and student participation in CS education. We found that the number of teachers certified to teach CS, the percentage of high schools that offer a CS course, and the percentage of high school students who enroll in a CS course have all increased in Texas. However, many Texas high school still do not have teachers certified to teach CS courses, and significant disparities exist in which students have access to and enroll in CS courses.

Our findings showed that schools in rural areas and charter schools were less likely to offer CS courses than schools in urban or suburban areas, and smaller schools were less likely to offer CS compared to larger schools. Schools with larger populations of Hispanic/Latino students were also less likely to offer CS courses, whereas schools with larger populations of Asian students were more likely to offer CS. Student enrollment in CS courses has increased over time for groups who are traditionally underrepresented in CS, including girls, students with economic disadvantage, students with disabilities, students who are Black, and students who are Hispanic/Latino, but enrollment for these students remains lower than for students overall.

Substantial investment, accountability for existing policies, and democratizing data about student enrollment and outcomes in CS education are needed to ensure that all Texas students can participate and have positive experiences in CS education.

What We Studied

CS education for all K-12 students has become increasingly important over the last decade as the need for a CS-trained workforce has grown. With a rapidly expanding computing industry in Texas, it is essential to prepare Texas students to take advantage of the economic opportunities in their home state and meet future CS workforce demands. However, there remains a shortage of qualified CS professionals, primarily because of the continued lack of access to CS education in K-12 schools. When we began our research in 2019, only 48% of public high schools in Texas offered a CS course (TACC, 2024). Understanding efforts to expand CS education for all students at the K-12 level is critical to ensuring that Texas remains at the forefront of the innovation economy and that our students are prepared for the future.

WeTeach_CS is an initiative that was developed to improve access to high quality K-12 CS education for all students, through training CS educators and leaders. Starting in the 2014-15 school year, WeTeach_CS has trained educators throughout Texas to achieve the following goals: increase the number of certified CS teachers, increase the percentage of high schools offering CS courses, increase the number of high school students enrolling in CS courses, broaden and expand the variety of students who are enrolled in CS courses, and expand opportunities for students in K-8 to build a

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pipeline of CS-related programs of study. Researching longitudinal Texas CS education trends allowed us to examine state changes in CS education following the launch of WeTeach_CS.

We utilized the CAPE framework (Fletcher & Warner, 2021) to examine CS education at multiple levels of the education system and to understand the necessary conditions and the barriers to expanding CS education for all students. The framework divides CS education into four components: capacity, access, participation, and experience. *Capacity for CS education* refers to having the resources needed to support and maintain high-quality CS instruction. Such resources include teachers, funding, and policies that make implementing CS instruction possible. *Access to CS education* means that students have the opportunity to enroll in CS courses. We operationalized access as attending a school that offers CS courses. *Participation in CS education* refers to students enrolling in CS courses when offered by their school (i.e., when they have access). *Experiences of CS education* encompass a variety of student CS education outcomes, including academic achievement, sense of belonging, and subsequent course-taking.

This research explored the nature and growth of CS education over time and across subpopulations in K-12 Texas schools. We examined trends and factors related to the capacity for, access to, and participation in CS education to better understand the state of and efforts to expand CS education in Texas. Additionally, we explored the development of data dashboards to inform educators, administrators, and policy makers about the state of CS education in Texas. Due to a lack of data on students' experiences of CS education, namely student learning outcomes in CS like course grades or Advanced Placement (AP) exam performance, we focused this research on the first three components of the CAPE framework.

Research Questions

1. What is the state of CS capacity, access, and participation in K-12 education in Texas? What differences exist in these areas between student subpopulations, geographic location, or types of schools?
2. What factors (including student, school, and community characteristics) predict whether students will have access to and participate in CS in high school and college?
3. What is the impact of the WeTeach_CS collective impact model on expanding K-12 CS education in Texas?

How We Analyzed the Data

We analyzed longitudinal teacher-, student-, and school-level data from the Texas Education Research Center (ERC) from the 2011-12 to 2022-23 academic years to explore our research questions. We utilized student and teacher demographic information from the Texas ERC to examine differences between subpopulations.

Our first research question focused on describing the trends in K-12 CS education in Texas and exploring progress over time. We used data about CS teacher certification (capacity), CS course offerings at schools (access), student enrollment in CS courses (participation), and demographic data to calculate descriptive statistics to show trends over time and to investigate the extent and nature of inequities for students typically underrepresented in CS education. Additionally, we assessed interactions between variables to determine, for example, whether disparities based on gender, income, or race are further exacerbated when students live in rural communities. Descriptive statistics for employment of CS certified teachers, course offerings, and enrollment were also calculated by school to create an interactive data dashboard with visualizations of trends in CS education across Texas for all districts and Education Service Center regions (TACC, 2024).

Our second research question explored factors that may be contributing to observed disparities in whether students have access to and participate in CS courses. We conducted regression analyses to study the relationship between person-level characteristics (e.g., race/ethnicity, economic disadvantage), school-level characteristics (e.g., location, size, and student body demographics), community-level characteristics (e.g., unemployment rates), and outcomes of students attending a school that offers CS and enrolling in a CS course.

We explored our final research question by analyzing trends in CS education capacity, access, and participation before and after the launch of the WeTeach_CS initiative in 2014-15. We descriptively examined changes in the rate of change over time with respect to capacity, access, and participation.

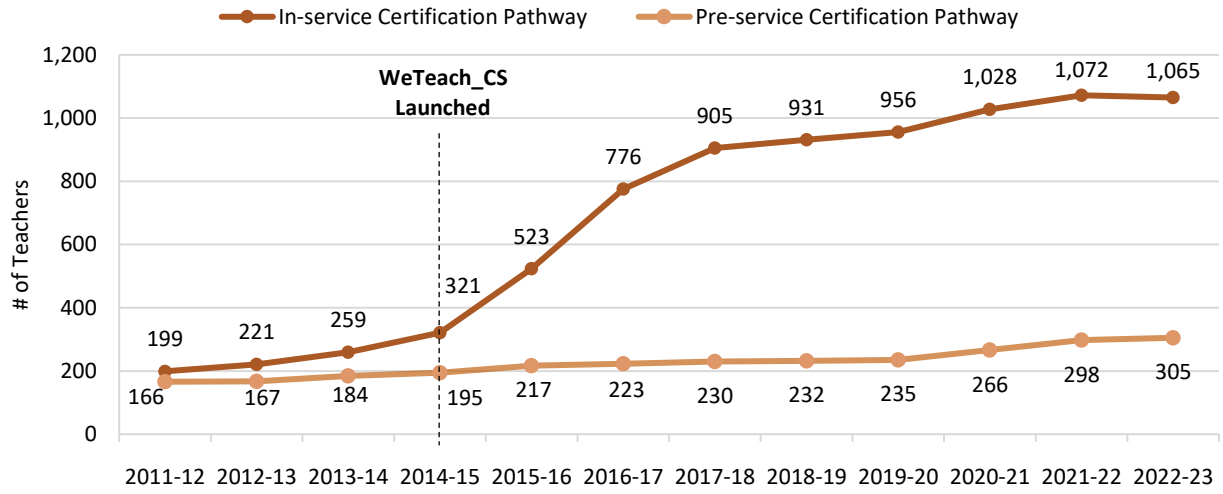
What We Discovered

Capacity

Overall, capacity for CS education in Texas has increased over time, and targeted investment in teacher CS certification preparation has significantly contributed to this increase. The WeTeach_CS initiative began in the 2014-15 school year, and provided professional development to in-service teachers, with a focus on preparing teachers to become certified to teach CS in Texas. Between the 2014-15 and 2022-23 school years, the number of CS certified teachers employed by Texas schools increased from 516 to 1,370, an increase of 166% (see Figure 1). The vast majority of these teachers were drawn from the ranks of existing in-service educators rather than from educators who were CS certified through a pre-service pathway.

As shown in Figure 1, there was a substantial increase in the number of CS certified in-service teachers beginning with the launch of the WeTeach_CS program in 2014-15 through 2017-18, while WeTeach_CS was funded by the federal National Science Foundation Math and Science Partnership to operate a CS teacher professional development network. After the funding concluded, there was a slower increase through 2021-22 and slight decrease in 2022-23. The rate of change between 2011-12 and 2016-17 was found to be statistically significant in prior research (Warner et al., 2019). The launch of WeTeach_CS appears to have more directly impacted capacity for CS than access to or participation in CS. We attribute this finding to the explicit focus of the initial WeTeach_CS funding on increasing the number of CS certified teachers in Texas.

Figure 1. Number of Texas K-12 Teachers Certified to Teach CS

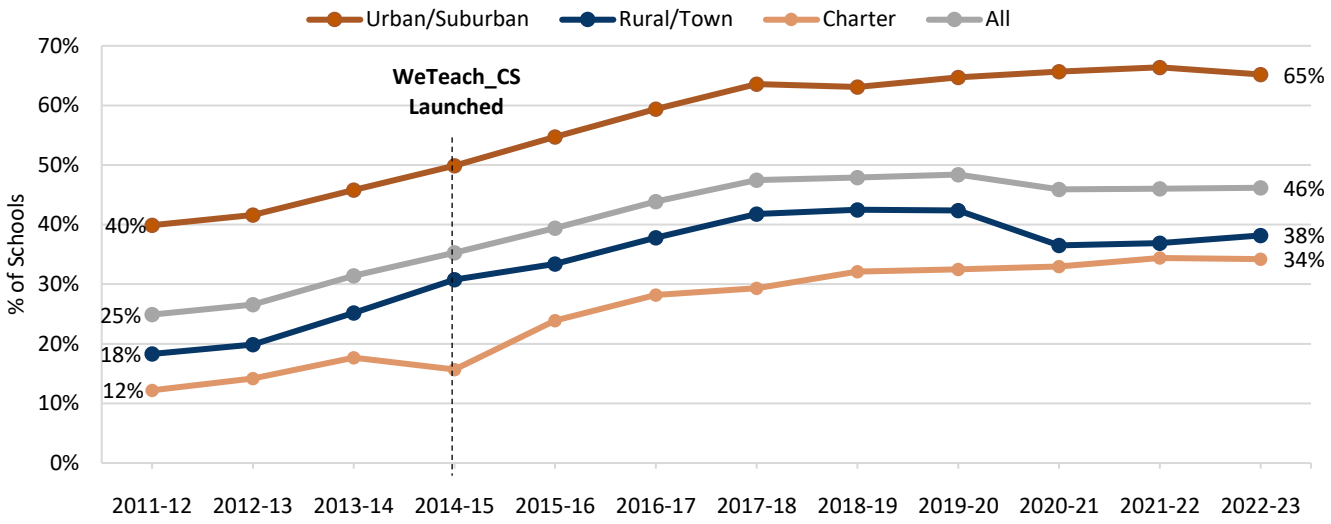


Access

Access to CS courses overall in Texas has increased over time, but many disparities have persisted in who has access. The percentage of Texas high schools offering a CS course increased from 25% in 2011-12 to 46% in 2022-23 (as shown in Figure 2). We examined differences in CS access by school based on Texas Education Agency (TEA) district types (TEA, 2023a), which we combined to create three categories, urban/suburban, rural/town, and charter schools. In each year since 2011-12, urban/suburban schools across the state provided more access to CS courses in high school than rural/town or charter schools. In 2022-23, 65% of urban/suburban schools in Texas offered at least one CS course while only 38% of rural schools and only 34% of charter schools offered CS.

We also found that the race/ethnicity of students at a school, size of the school, and education level of adults in the community all were related to whether a school offers CS courses (Haynes et al., 2022). More specifically, the percent of students at a school that were Hispanic/Latino was negatively related to the likelihood that a school offered CS, while the percent of students that were Asian was positively related to the likelihood that a school offered CS. Larger schools were more likely to offer CS than smaller school, and schools located in areas with higher percentages of adults with bachelor's degrees were also more likely to offer CS courses than schools in areas with lower percentages of adults with bachelor's degrees.

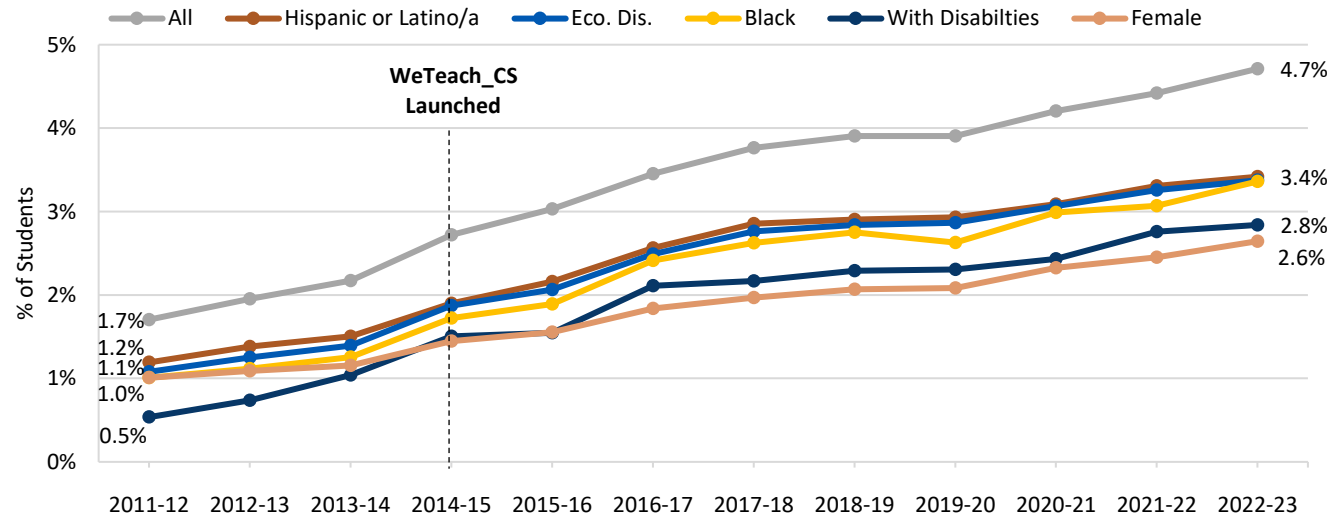
Figure 2. Percentage of Texas High Schools Offering CS Courses



Participation

Over time, there has been an increase in the percentage of Texas high school students taking at least one CS course during the school year. There has also been an increase in the percentage of students enrolled in CS for multiple groups that are traditionally underrepresented in CS, including girls, students with economic disadvantage, students with disabilities, students who are Black, and students who are Hispanic/Latino. As shown in Figure 3, the percentage of high school students enrolled in a CS course for each of these traditionally underrepresented groups has increased over time. However, as of 2022-23 each of these groups continued to have lower rates of enrollment in CS as compared to students overall, indicating that disparities still exist for these student groups.

Figure 3. Percentage of Texas High School Students Enrolled in One or More CS Courses*



**Eco. Dis.=Economically Disadvantaged*

We found multiple factors that were predictive of whether a student enrolls in a high school CS course, including student gender, race/ethnicity, socio-economic status, English proficiency, disability status, and whether a student took Algebra 1 before high school (Haynes et al., 2022). Compared to white boys, all other race/ethnicity and gender combinations (e.g., Hispanic girls, Black boys, white girls) were significantly less likely to take CS, with the exception of Asian and Native Hawaiian/Pacific Islander boys. Within each race/ethnicity group, males were more likely to take CS than females in the same race/ethnicity group. Students who were economically disadvantaged, had limited English proficiency, and/or had a disability were also less likely to take CS than other students. Further, our research showed that disparities in CS course

enrollment for students who are female, Black, Hispanic/Latino, or economically disadvantages are compounded for those who are members of multiple of these subgroups (Warner et al., 2022). Lastly, taking Algebra 1 before high school was shown to be the strongest predictor of a student taking a CS course in high school, doubling the odds of a student enrolling in CS when controlling for other variables (Torbey et al., 2020).

Many of these disparities in CS participation were also found to persist in higher education in Texas. Our research showed that females of all racial/ethnic subgroups were less likely to major in CS than white males. Black males and Hispanic/Latino males were also less likely than white males to major in CS, but not after controlling for economic status and prior math/CS course taking. Lastly, when we followed students to the workforce in Texas, we found that after graduating with a CS degree, females overall earned significantly less than males, and white and Asian females earned significantly less than white and Asian males (Warner et al., 2022).

Policy Recommendations

The state of Texas has made significant improvements in the overall capacity for, access to, and participation in K-12 CS education since 2014-15, but much work still needs to be done to ensure that every Texas student has access to and participates in meaningful and engaging CS learning experiences that will prepare them to thrive in an increasingly technology dependent world.

1. **Investment in Building Teacher Capacity**
   Approximately half of Texas high schools still do not offer a single CS course to their students. The primary reason administrators report not offering CS is due to a lack of trained and certified teachers. Rapid increases in the number of CS certified teachers in Texas between 2014-15 and 2017-18 were the direct result of federal Math and Science Partnership (MSP) funding which was granted to The University of Texas at Austin by TEA to launch the WeTeach_CS program. When the No Child Left Behind act was reauthorized, the MSP funding in Title II, Part B, which had been statutorily required to support math and science teacher professional development, was eliminated and those funds were shifted to the less restrictive Title IV part of the new Every Student Succeeds Act. At that point, TEA no longer funded statewide CS teacher professional development, and the number of teachers supported annually by the WeTeach_CS program to add a CS certification decreased significantly. In 2023, the 88th Texas Legislature, with support from the IT Caucus, appropriated $10 million over the biennium for the Texas CS Pipeline initiative through a budget rider. This marked the first investment of state funding in support for CS teacher certification in Texas history. Given the notable challenges that school districts face in finding and retaining qualified CS teachers, and the fact that half of Texas high schools still do not offer any CS courses, continued strategic support for growing educator capacity in CS is required. The legislature should continue its investment in the Texas CS Pipeline Initiative to support and incentivize educators to become proficient in computing education and bring these learning opportunities to every student.

2. **Requiring All Texas High School to Offer a CS Course**
   In 2014, the Texas State Board of Education made Texas the first state in the nation to require all high schools to offer a computing course. When the TEKS were updated in 2020, these requirements were modified in the Texas Administrative Code, which now states that all Texas high schools must offer at least one computer science course from the following list: Fundamentals of CS, CS 1, or AP CS Principles (Texas Legislature, 2020). Unfortunately, this regulation carries no accountability. With only half of Texas high schools offering a CS course in compliance with this regulation, additional accountability measures are needed to incentivize schools to meet the requirement. Examples could include linking the requirement to offer a CS course to the accountability system, or publishing whether a school met this requirement on the annual school report card published by TEA (2023b).

3. **Measuring Progress Toward Broadening Participation in Computing**
   While approximately 50% of Texas high schools offer at least one CS course, only 11% of students in the 2022 graduating class actually completed a CS course while they were in high school. In addition, the students who do earn credit for a CS course in high school are not reflective of the overall student population of the state of Texas, thus undermining our state's ability to prepare a citizenry that is positioned to thrive both personally and professionally in a world driven by technology. Similar to the prior recommendation to include offering a CS course in the accountability measures and school report card, the state should ensure that disaggregated data regarding enrollment

of students in CS is reported publicly through the school report card as well. In the 2022-23 school year, 91% of Texas students were identified as either female, Black, Hispanic, low-income, or qualified for 504 or special education services. These are all student populations who are underrepresented in high school CS courses as compared to their overall student population in Texas. Excluding such a large swath of students from CS undermines our state's ability to continue to be a leader in the innovation economy.

Data regarding the performance of Texas students on Advanced Placement (AP) exams is one consistent measure of student experience in CS courses. Unfortunately, this data is not readily available to researchers in the Texas ERC or from TEA. Texas should work with the College Board to make disaggregated students data available through the ERC, enabling independent evaluation of statewide progress toward broadening participation in computer science.

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