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Black students are the most likely student group to take computer science courses when access is available, finds new study on trends in computer science education

Female students are less likely than male students to take computer science courses and the gender gap widens when access is increased.

Chicago Public Schools (CPS) led the nation in the expansion of computer science (CS) education with the CS for All (CS4ALL) initiative in 2013 and later on announcing that computer science would be a graduation requirement starting with the class of 2020. The district ultimately waived the requirement for the class of 2020 due to the challenges of COVID-19 and remote learning. A new [study](#) from the University of Chicago Consortium on School Research and the Federal Reserve Bank of Chicago analyzes results from the expansion of computer science programs in CPS high schools and provides implications that may be useful for other districts expanding their own programs. The researchers analyzed CPS data from 2008 to 2018 of more than 311,000 students in 108 CPS high schools.

Between 2014 and 2018, the percentage of CPS schools offering CS courses doubled

By spring 2018, 80 percent of CPS schools offered a CS course, and 92 percent of students had access to a CS course. Course access was geographically widespread across the district. However, in 2018 one-fifth of high schools were not offering any type of CS course despite the graduation requirement. Schools still lacking a course were primarily small neighborhood high schools serving Black, Latino, and low-income students. CPS reports that in the 2019-20 school year, all district run high schools offered CS.

Expanded access to CS courses narrowed enrollment differences by race but gender gaps widened

As anticipated, enrollment in CS courses increased for all students, regardless of race, gender, and socioeconomic status, after the adoption of the graduation requirement. However, the rate of increase differed across student groups. Access to courses and eligibility to waive the CS graduation requirement may help explain some of these differences.

Differences in enrollment rates by race/ethnicity and neighborhood socioeconomic status at the district level were largely related to differences in access to CS courses. Black students were the least likely overall to enroll in a CS course in part because they were the most likely to attend a school that did not offer CS. Once researchers accounted for differences in access to CS, Black students were the most likely to enroll in a CS course.

Male students were more likely to enroll in a CS course than female students, even within schools offering CS. This enrollment rate difference widened even after the increased access to computer science curriculum.

“Ultimately, the goal in expanding access to CS courses is to open opportunities for Black, Latino, and female students who have been underrepresented in the growing technology workforce, said Lisa Barrow, Senior Economist and Research Advisor, Federal Reserve Bank of Chicago. According to a recent [NPR story](#), only 3% of Google employees and 9% of Apple employees are Black. “Our research shows that making CS courses available can help to close the opportunity gap among racial groups,” said Barrow.

“But more than increased access will likely be needed to overcome barriers for female students, such as changing narratives about who belongs and succeeds within CS.”

Qualified teachers and scheduling tradeoffs may be the main challenges for districts expanding computer science programs and policies

Recruiting, training, and retaining skilled CS teachers may be one of the main challenges for districts to overcome. According to the [website](#) Title II, only 100 teachers—across the entire country—graduated in 2017 from a Title II teacher preparation institution to teach CS, compared to 10,000 graduating math teachers. Competition with the private tech industry for skilled talent is fierce and many districts turn to training and certifying their existing teacher workforce to teach introductory CS courses.

Implementing CS as a graduation requirement may involve tradeoffs for students, counselors, and administrators juggling class schedules. “Districts nationwide are working to increase access and enrollment in CS courses because they consider CS as essential as biology for students to thrive in a 21st century economy, said Silvana Freire, Research Analyst at the UChicago Consortium. “For college-bound students encouraged to take more credits in math, science, social studies and world language, a CS course may be difficult to fit into an already crowded schedule.” Nearly 60 percent of the CPS class of 2020 had not yet enrolled in a CS course by the end of tenth grade. If those students were ineligible for a waiver or could not get a seat in a course, the graduation requirement might have delayed their graduation if the requirement had not been waived.

Research Questions and Key Findings

How did CS offerings change over time, and did CS offerings differ by school characteristics?

- Access to CS increased steadily following the announcement of the Computer Science for All initiative. By 2018, more than 90 percent of students attending CPS high schools were enrolled in a high school that offered at least one CS course.
- Annual enrollment in CS increased steadily following the introduction of the Exploring Computer Science curriculum in the 2012-2013 school year, especially in introductory-level courses. Cohort enrollment rates also increased over time, with particularly large increases for the cohorts subject to the new CS graduation requirement.

How did student enrollment in CS change over time?

- While Asian students remained more likely to enroll in a CS course than other students in the district, enrollment rates increased for all race/ethnicity groups. Differences in enrollment rates by race/ethnicity and neighborhood SES at the district level were due in part to differences in access to CS courses.
- Black students were the least likely overall to enroll in a CS course, in part because they were the least likely to attend a school that offered CS. After accounting for differences in access to CS, Black students were the most likely to enroll in a CS course.
- Enrollment rates increased for both male and female students, but male students were more likely to enroll in a CS course than female students, even within schools offering CS. This enrollment rate difference widened after the introduction of the Exploring Computer Science curriculum.

How well did students perform in CS courses?

- Overall and across student subgroups, students earned higher average grades in CS courses than in core courses, and few students failed CS courses.

Cite as:

Barrow, L., Freire, S., & de la Torre, M. (2020) *Trends in computer science education: Access, enrollment, and performance in CPS High Schools*. Chicago, IL: University of Chicago Consortium on School Research.

About the University of Chicago Consortium on School Research

With the goal of supporting stronger and more equitable educational outcomes for students, the [UChicago Consortium](#) conducts research of high technical quality that informs and assesses policy and practice in the Chicago Public Schools (CPS). We seek to expand communication among researchers, policymakers, practitioners, families, and communities as we support the search for solutions to the challenges of school improvement. The UChicago Consortium encourages the use of research in policy action and practice but does not advocate for particular policies or programs. Rather, we help to build capacity for school improvement by identifying what matters most for student success, creating critical indicators to chart progress, and conducting theory-driven evaluation to identify how programs and policies are working.

About the Federal Reserve Bank of Chicago

The [Federal Reserve Bank of Chicago](#) is one of 12 regional Reserve Banks that, along with the Board of Governors in Washington, DC, make up the nation's central bank. The Chicago Reserve Bank serves the seventh Federal Reserve District, which encompasses the northern portions of Illinois and Indiana, southern Wisconsin, the Lower Peninsula of Michigan, and the state of Iowa. In addition to participation in the formulation of monetary policy, each Reserve Bank supervises member banks and bank holding companies, provides financial services to depository institutions and the U.S. government, and monitors economic conditions in its District.

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