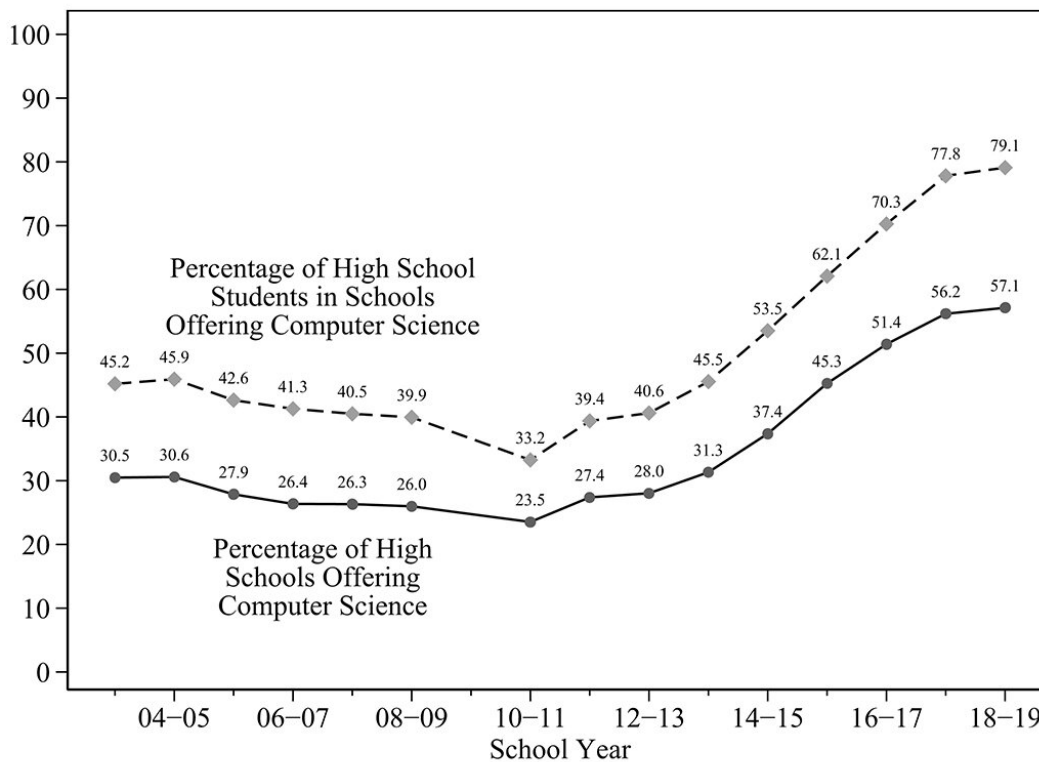


Studies examine effects of California's push for computer science education

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The percentages of California schools offering and students taking computer science courses dramatically increased from 2004-2019, according to data that schools reported to the state's Department of Education. Credit: Graphic provided

New studies of computer science education at California high schools

found that a greater emphasis on computer science education did not produce the anticipated spillover effects, neither improving or harming students' math or English language arts skills, according to school-level test scores.

However, one trade-off of increased enrollments in computing courses may be that students are taking fewer humanities courses such as the arts and social studies, researchers at the University of Illinois Urbana-Champaign found.

Paul Bruno and Colleen M. Lewis examined the implications of California's recent state policies promoting [computer science education](#) and the proliferation of these courses in the state's high schools. Bruno is a professor of education policy, organization and leadership, and Lewis is a professor of [computer](#) science in the Grainger College of Engineering, both at Illinois.

Using data that schools reported to the California Department of Education from 2003-2019, the researchers explored the effects on student test scores and the curricular trade-offs of student enrollments in computer science courses. That study was published in the journal *Educational Administration Quarterly*.

In a related project, the couple—who are marital as well as research partners—explored equity and diversity among California's computer science teachers and their students. That study was published in *Policy Futures in Education*.

The Google Computer Science Education Research Program supported both projects.

California has been near the forefront of a nationwide movement prioritizing technology curricula at the kindergarten-12th grade levels.

In 2018, the state adopted computer science standards for K-12 students, and the following year implemented a statewide strategic plan to expand access to computer science education.

The proportion of students attending California high schools that offered at least one computer science course jumped from 45% in 2003 to more than 79% in 2019, the data indicated.

"As someone who works in school administration, it raises a lot of questions about how schools—especially high schools—are going to implement this rapid change and offer these new courses effectively," Bruno said. "Schools are already having trouble offering all the courses that they need for students to graduate and go on to college—and finding enough qualified instructors to teach them, especially in science, technology, engineering and math subjects."

While school systems often promote computing courses as cultivating competencies and skills that improve [student](#) achievement in subjects such as math and reading, the researchers found no significant improvements in school-level standardized test scores in these subject areas.

Although they were not able to study individual students' test scores, a limitation they plan to address in their ongoing work, Bruno and Lewis said test scores are not all that matters.

"Ultimately, all students deserve the opportunity to understand the computational world around them, which computer science courses provide," Lewis said. "But in the U.S., low-income students and students who identify as Black, Hispanic and/or Indigenous are less likely to have access to computer science courses at their high school."

One trade-off of California high school students' increased enrollments

in computer science courses has been that their enrollments in humanities courses and electives declined.

"We're not able to see why or how schools or students are making these kinds of choices, but we think that's an important consideration," Bruno said. "If we want students to take more computer science, what are we comfortable with there being less of in the curriculum?"

Some [school districts](#) allow computer science courses to count toward graduation requirements in mathematics and foreign languages, while other schools haven't yet determined how to incorporate them, he said.

As schools add or expand computer science curricula, Bruno said it's important to be aware of the demands placed on the students' and schools' time and resources to ensure that these courses are offered in ways that benefit students, teachers and their communities.

"That means thinking carefully about who we have to teach these courses and how we adjust the curricula to make room for them. All of these things are important in thinking about what the actual costs and benefits of computer science education are," Bruno said.

With [school](#) districts across the country grappling with teacher shortages, flexible authorization requirements enabled California schools to staff their computer science courses with faculty members who had a wide range of credentials and experience, such as backgrounds in math, science or vocational education.

Yet, as a profession, computer science [education](#) is disproportionately white and male.

And Bruno and Lewis found significant racial and gender disparities among computer science students and teachers. Black, Hispanic and

Native American youths often were less likely to attend schools that offered computer science courses than their Asian or white peers. But even when they had similar access to these courses, all girls and Black, Hispanic and Native American boys were underrepresented in computer science enrollments—disparities that the researchers believe are influenced by the relative scarcity of computer science teachers who are women or racial and ethnic minorities.

"Effective and equitable computer science implementation requires more than enrolling ever-growing numbers of students in ever-growing numbers of courses," Lewis said. "Going forward, it will be increasingly important to develop better measures of computer [science](#) teacher quality that can be used to assess both the average strength of these teachers and the prevalence of gaps in teaching quality between differing groups of students."

The research was published in *Educational Administration Quarterly*.

More information: Paul Bruno et al, Computer Science Trends and Trade-offs in California High Schools, *Educational Administration Quarterly* (2021). [DOI: 10.1177/0013161X211054801](https://doi.org/10.1177/0013161X211054801)

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