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ACCESS

COMPUTER SCIENCE IN CALIFORNIA'S SCHOOLS:

2016 AP CS Results and Implications

SUMMARY

As computing and computational thinking are increasingly becoming recognized as critical skills needed for participation in our technology-based economy, efforts are underway in schools, districts, and states nationwide to increase access to computing. As described in the Computer Science for All national initiative launched by President Obama in January 2016, the nation must empower students with the computer science skills they need to thrive in a global economy.[1] Given the scope and size of California's technology economy, the state is uniquely poised to become a leader in computing education and workforce development. To do so, California must ensure that all students have access to computer science, especially students from traditionally underrepresented backgrounds, including girls, African American, Latinx and low-income students.

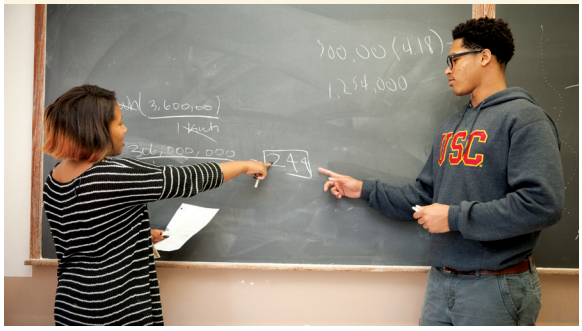
A key predictor of later participation and success in computing is early access to computing courses, particularly the Advanced Placement Computer Science (AP CS) A course.[2] Although there are other key indicators of computing knowledge and success, the College Board's yearly release of AP CS A data provides the opportunity to analyze trends in participation rates, access, and equity in computing by demographic groups, states, and years. This examination of 2016 AP CS A data reveals that California has a long way to go to provide access to computing courses for all students, and particularly students from backgrounds underrepresented in computing.

INTRODUCTION

Technology continues to drive economic growth in California and across the nation. Industry sectors as diverse as transportation, entertainment, telecommunications, healthcare, education, and national security all rely on innovation and productivity associated with technological advancements. Yet, our education system has not kept pace with the increasing demand for a skilled future workforce, where computational thinking and computing expertise will be needed across industries and fields.

KEY FINDINGS

- **0.5%** of 1.9 million high school students in CA took the AP CS A exam
- African American students comprised **1%** of the AP CS A test-takers in CA, decreasing from 148 to 146 since 2015
- Latinx students comprised **15%,** respectively of the AP CS A test-takers in CA, increasing by **52%** since 2015
- **1,487** of 1.02 million Latinx high school students took AP CS A
- **146** African-American students took AP CS A
- **27%** of AP CS A test-takers were female, and **77%** of female AP CS A test-takers were White or Asian
- **54** African American females took AP CS A; **359** Latinx females took AP CS A
- **7** Native American/Alaskan Native students took the AP CS A exam; Just **1** Native American/Alaskan Native female took the AP CS A exam



Computing and mathematical occupations are projected to be among the fastest-growing of any occupational group, with 1.3 million job openings in computing-related fields projected by 2022.[3] The state of California, home to Silicon Valley, is one of the largest technology economies in the country. California leads the nation in the number of technology workers (1.5 million), the number of technology job gains in 2015 (59,500, almost 4x higher than second-ranking Texas), and salaries of technology industry workers.[4] California also accounts for approximately 30% of all technology jobs created across the United States,[5] and 41% of venture-backed companies in the U.S. are located in California.[6]

Despite the strong outlook for the technology economy in California, there are major challenges in meeting the growing demand for skilled technology workers[7] and preparing Californians to participate in the workforce of the future:

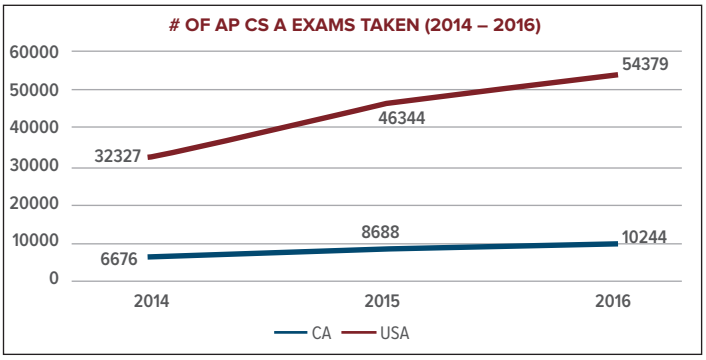
- **The lack of computer science standards, courses, and teachers and the lack of alignment between computing pathways and workforce needs.** Roughly 65% of high schools in California offer no computing classes and the state has yet to develop a statewide plan for computing education.[8]
- **The lack of diversity in the computing education pipeline and within the technology sector, particularly given the rapidly-increasing diversity of California's population.** 60% of California's student population is Latinx or African American, yet these students comprise just 16% of students taking AP CS A and 15% of the technology workforce.[9, 10]

This report provides a synthesis of outcomes in AP CS A in 2016 for the state of California, and specifically examines state comparisons, participation and success by race, gender, and trends over time. This report concludes with a set of recommendations for expanding access and equity in computer science across California.

California Statewide AP Computer Science Participation

Across California, a total of 10,244 high school students took the AP CS A exam in 2016, a mere 0.5% of the approximately 1.9 million public high school students in the state. From 2015 to 2016, the number of AP CS A test-takers in California has grown by 15%, while the national rate of growth in participation over the past year is 17% (Figure 1).[11, 12] Yet, over 99% of California's high school students graduate without taking AP CS A coursework.

Figure 1. AP CS A Participation Rates in California and USA (2014 – 2016)



Source: College Board (2016)

State-by-State Comparisons

California ranked first overall for AP CS A participation in raw numbers, followed by Texas, New York, New Jersey, and Illinois (Table 1). When examining AP CS A participation rates by population size, however, California falls to number 7. Virginia, New Jersey, Massachusetts and Maryland have the highest per capita AP CS A participation[13] (Table 2).

Table 1. Top 5 States for AP CS A Participation

TOP 5 STATES FOR AP CS A PARTICIPATION
1. California (10,244)
2. Texas (6,060)
3. New York (3,761)
4. New Jersey (3,056)
5. Illinois (2,938)

Source: B. Ericson (2016). Analysis of AP CS A College Board Data

Table 2. Highest Per Capita AP CS A Participation

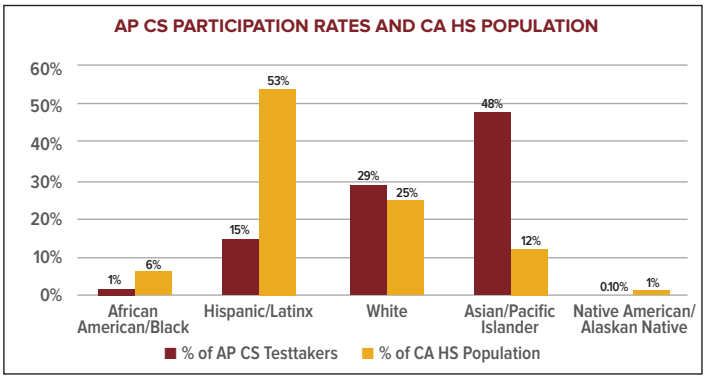
TOP 10 STATES FOR # OF AP CS A EXAMS PER 100,000 OF POPULATION
1. Virginia (35)
2. New Jersey (34)
3. Massachusetts (34)
4. Maryland (33)
5. Washington (28)
6. District of Columbia (28)
7. California (27)
8. Connecticut (26)
9. Texas (23)
10. Illinois (23)

Source: B. Ericson (2016). Analysis of AP CS A College Board Data

AP Computer Science Participation, by Race and Gender

When examining California's AP CS A participation rates by race and gender, data demonstrate that students of color are significantly underrepresented among AP CS A test-takers compared to their percentage of the state's high school student population. Asian/Pacific Islander students comprise the majority of AP CS A test-takers in California (48% compared to 12% of the California high school population), and White students participate in AP CS A at slightly higher levels (29%) than their overall percentage of the population (25%). Latinx students comprise 53% of California's high school-aged population, but just 15% of AP CS A test-takers in California. Similarly, African American students comprise 6% of the high school population yet just 1% of all California AP CS A test-takers. While Native American/Alaskan Native students are just a small percentage of the California high school population (12,000 total students, ~1%), just 7 Native American/Alaskan Native students took the AP CS A exam statewide (Figure 2).

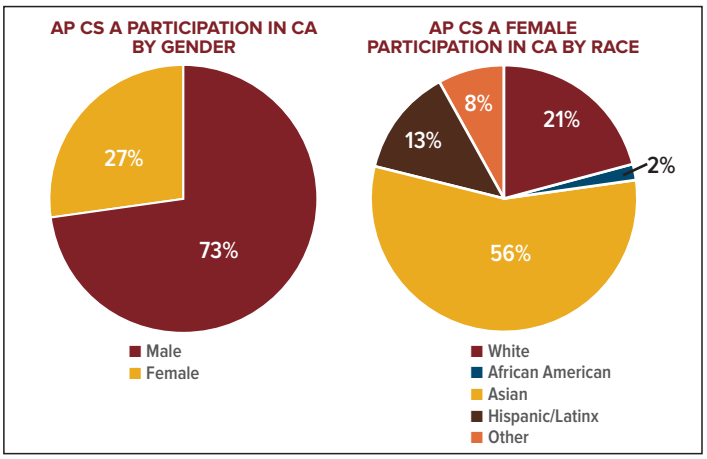
Figure 2. AP CS A Participation Rates and High School Population, by Race/Ethnicity



Source: California Department of Education (2016); College Board (2016)

Female students comprised only 27% of all AP CS A test-takers in California, although they are 49% of the state's high school population (Figure 3). Of the female AP CS A test-takers, 77% are either White or Asian. Just 54 African American females and 359 Latinx females took AP CS A in 2016 in California, demonstrating additional gaps by race, gender, and the intersection of race and gender (Figure 4).

Figure 3. AP CS A Participation, by Gender and Figure 4. AP CS A Female Participation, by Race

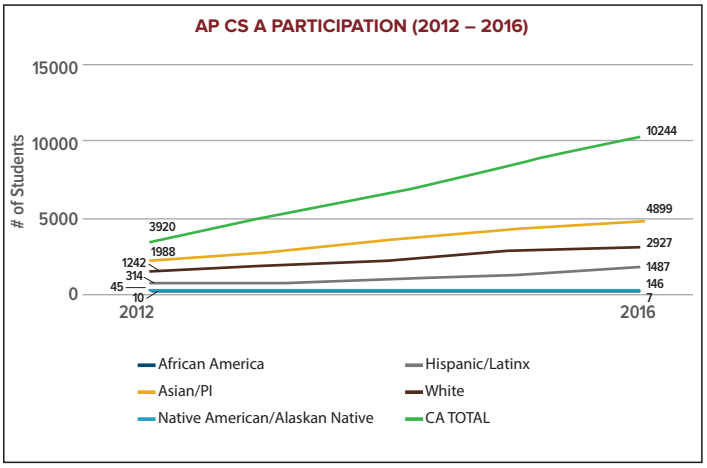


Source: College Board (2016)

Participation Trends Over Time

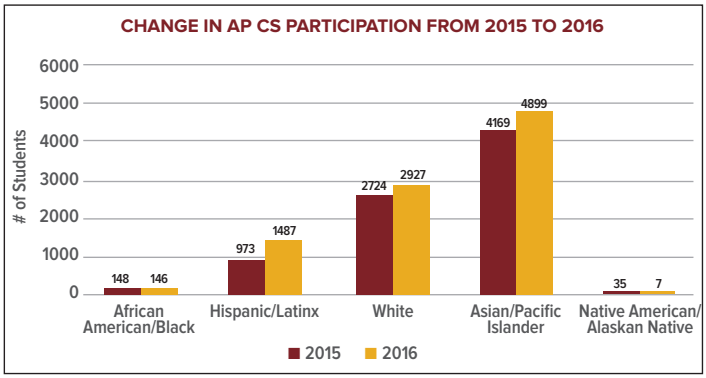
As demonstrated in Figure 4, there has been a steady increase in the number of students in California taking the AP CS A exam since 2012. Asian, Latinx, and White participation continues to increase from year to year. However, African American and Native American/Alaskan Native students have not seen significant growth. From 2015 to 2016, the number of African-American students who took AP CS A in California decreased from 148 to 146. Similarly, the number of Native American/Alaskan Native students taking AP CS A in the state decreased from 35 to 7 (Figure 5). By comparison, across the U.S., the number of African American AP CS A test-takers increased by 14% and the number of Latinx AP CS A test-takers increased by 46%.[14]

Figure 4. AP CS A Participation in California, from 2012 to 2016 in raw numbers



Source: College Board (2016)

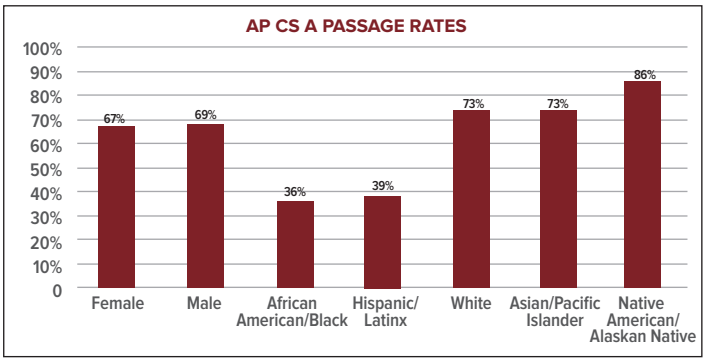
Figure 5. AP CS A Participation in California: Change from 2015 to 2016



Source: College Board (2015, 2016)

The rates of passage for the AP CS A exam also vary by race, with African American and Latinx students much less likely to pass the AP CS A exam than their counterparts (36% and 39%, respectively). Approximately 73% of White and Asian students and 30% of Asian students received passing scores on the AP CS A exam. Native American/ Alaskan Native passage rates are high (86%), but are based on a very small number of exams (n=7; Figure 4). These data suggest that in addition to lack of access and participation in courses, there are also varying levels of preparation and course/teacher quality and rigor that affect success in AP CS A.

Figure 6. Passage Rates in AP CS A



Source: College Board, 2016

POLICY RECOMMENDATIONS

The 2016 AP CS A data reveal that far too few students in California are taking AP CS A, a key predictor of future computer science pursuits.[15] While overall growth in participation over the past year is promising, other states still have far greater participation rates per capita than California. Further, stark disparities exist in participation in computer science by race and gender. While the number of Latinx students participating in AP CS A has increased, the number of African American students participating has decreased. Computational thinking skills, technological literacy, and programming skills found in computer science are critical for preparation and participation in the future workforce; access to and participation in computing courses at the secondary level cannot only be limited to a select few. Our national and state economy, sustainability of the technology industry, and future economic opportunities for youth and their families and communities require significant investments in broadening participation in computing.

As evidenced by research from the Level Playing Field Institute, Google/Gallup, and Change the Equation, students in schools in California and nationwide lack access to AP CS A coursework, with underrepresented students of color and low-income students far less likely to have access to computing courses.[16, 17, 18] Even when AP Computer Science courses are available, underrepresented students are less likely to have prior exposure to computer science at home or in out-of-school activities, and lack the scaffolding necessary to succeed in Advanced Placement courses.[19] Furthermore, students lack diverse role models, computing curriculum that makes connections with students' lives and cultures, encouragement from teachers and adults, and environment which counter stereotypes, all of which affect student participation in computer science courses and students' likelihood of persistence in computer science fields in college and career.

In the fall of 2016, Governor Brown signed Assembly Bill AB 2329 which will establish an advisory group tasked with developing a strategic plan for equitable computer science education in California and ensure a computer science implementation plan is adopted by 2019. Simultaneously, AB 1539, signed in 2014, requires the State Board of Education to develop computer science standards from grades 1 through 12. Additional efforts to develop nationwide computing education standards, provide teacher training and professional development, and deploy a new AP CS Principles course are also underway. These efforts are vital steps forward to ensure access to computing education and in particular, that underrepresented populations have equal access and opportunity to pursue computing education. However, significant work remains to be done and this issue requires urgency. Based on our research and applied experiences with computer science education, we offer the following policy recommendations to be implemented in order to increase access, participation, persistence, and success in computing for students across California:

A. Ensure computational thinking is integrated throughout K-6 curriculum, introductory courses are available to scaffold learning, and advanced computing courses are available for all students. Create multiple computing education pathways for students pursuing both college and careers;

B. Ensure equitable access to computer science education for all K-12 students in California, especially for students traditionally underrepresented in the field such as girls, African American and Latinx students, rural and urban students, and students from under-resourced schools;

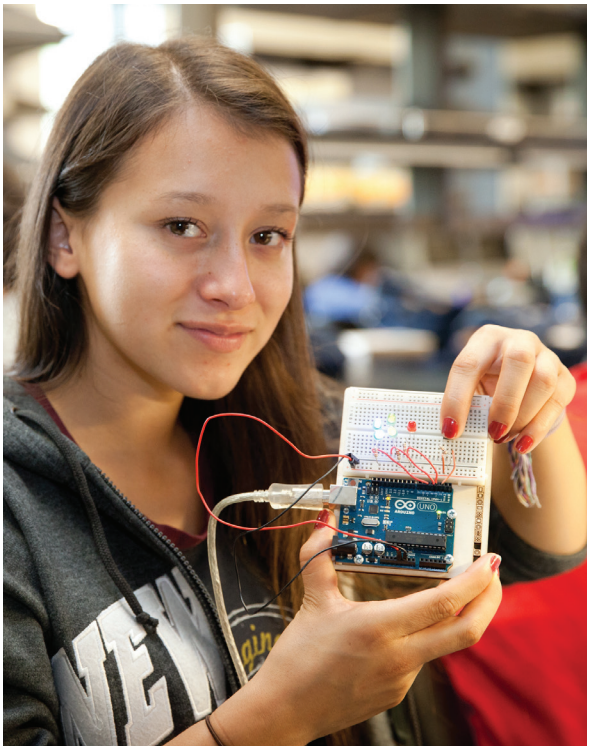
C. Ensure high schools count computer science coursework toward graduation and higher education requirements and college admissions, including UC/CSU;

D. Establish computer science teacher certification pathways for K-12 teachers and ensure teachers have access to quality professional development and ongoing support;

E. Ensure the Instructional Quality Commission recommends the development of a framework for computer science standards that includes engaging, rigorous, and culturally responsive curriculum and pedagogy;

F. Provide funding for computer science education which prioritizes the needs of under-resourced districts and includes staffing, professional development, hardware, software, and connectivity.

Increasing access and equity in computing education in California is critical to ensuring that all Californians are prepared to fully participate in the global tech economy of our future.



ABOUT US

Kapor Center for Social Impact (KCSI). KCSI aims to enhance diversity and inclusion in the technology and entrepreneurship ecosystem through increasing access to tech and STEM education programs, conducting research on access and opportunity in computing, investing in community organizations and gap-closing social ventures, and increasing access to capital among diverse entrepreneurs.

Alliance for California Computing Education for Students and School (ACCESS). ACCESS is dedicated to advocating for high-quality K-12 computer science education in California and ensuring its accessibility to all students, specifically underrepresented students in computer science: girls, students of color, and low-income students. ACCESS is a statewide network of computer science stakeholders including district leaders, K-12 teachers, professors from community colleges through universities, educational policy advocates, and related industry professionals.

KCSI and ACCESS work together to provide resources, research, data, and programming to build capacity in order to advocate for equitable, sustainable, and high-quality computer science education across the state of California.

To join the movement and stay informed about ways to support equity in computer science education, please visit www.access-ca.org and www.kaporcenter.org.

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