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State of Computer Science Education in Hawaii 2018

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"Of the 290 **AP CS test takers** in 2017, only 32 percent were female and only 4 percent—just 12 students statewide—identified as Native Hawaiian/Pacific Islander." (Page 6)

"Nationwide, only 75 new educators completed their pre-service **teacher preparation** in CS in 2016—and none of these teachers were prepared in Hawaii." (Page 8)

"In 2016, computer and mathematical occupations carried a **median hourly wage** of $35.87 in Hawaii, nearly double the median hourly wage of $19.24 for all jobs that year." (Page 10)

Current computer science policy and access in Hawaii

Current computer science policy in Hawaii

Despite a growing demand for K-12 computer science (CS) courses across the country, our public school system has lagged behind much of the nation when it comes to adopting policies that would support this much-needed classroom experience.

In Hawaii, high school students may only enroll in CS courses for elective credits, or to pursue a STEM* Honors or Academic Honors designation on their high school diploma. Yet 34 states and Washington, D.C. allow students to satisfy core graduation credit requirements through CS, providing them with more opportunities to pursue this area of study.[1] In most of these states, students can substitute CS classes for math or science credit requirements, while two states allow substitution for foreign language credits.[2]

Even if students in Hawaii could count their CS classes toward a math, science or foreign language credit, they would likely struggle to find schools that offer these courses by qualified educators. Unlike 28 other states and Washington, D.C., the Hawaii State Department of Education (DOE) does not currently offer CS teacher certifications. Furthermore, no state-approved teacher preparation programs in Hawaii specialize in CS, meaning CS teachers have been trained in other states, or in other content areas.[3]

The Hawaii DOE, however, has recognized the increasing demand for CS courses, and established a workgroup in September 2017 to meet with key stakeholders and identify strategies to improve access to CS in K-12 education. This group aims to adopt statewide standards for CS coursework which are aligned to national efforts, develop curricular resources and promote educator professional development.[4]

In December 2017, Gov. David Ige officially joined the GovsForCS Partnership, a group of bipartisan governors who are dedicated to expanding access to K-12 CS education, signalling his support for CS education initiatives.[5]

* Science, technology, engineering and math

Number of schools offering computer science

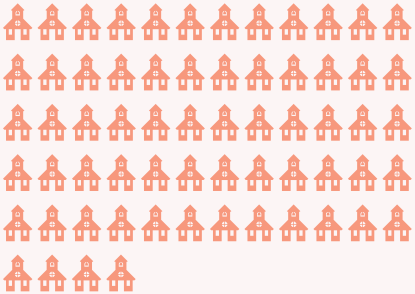
Courses like *Computer Programming* and *Introduction to Computer Science* are offered at Hawaii public high schools, though no information is publicly available about how many schools offer these courses or how many students enroll.

According to a 2016 survey conducted by Gallup, only 40 percent of principals nationwide reported having at least one dedicated CS course.[6] If this holds true for Hawaii, then K-12 students could only find a CS course in 102 schools[7] for the 2017–18 school year.[8]

ESTIMATED NUMBER OF HAWAII PUBLIC SCHOOLS OFFERING CS COURSES, TRADITIONAL PUBLIC SCHOOLS, 2017–18

Total Traditional Public Schools

256



Estimated Schools Offering CS

102

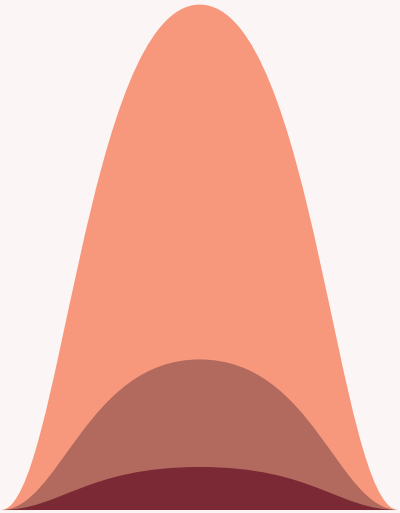
Note: : Estimates determined by applying Gallup poll results to DOE data. **Source:** Google & Gallup, Inc. Report, 2016; Hawaii DOE.

In addition to general CS courses, high school students can pursue Advanced Placement (AP) courses in CS to prepare for careers or postsecondary degrees in both STEM and non-STEM fields. Despite increased demand for these courses nationwide, just 14 traditional public high schools in Hawaii offer one of the two AP courses in CS (*Computer Science A* or *Computer Science Principles*).[9–10]

Just four of these schools received Title 1 funding in 2017–18*, suggesting a shortage of courses available to low-income students.[11] By increasing access to these rigorous courses—especially among underrepresented communities—Hawaii would increase the number of valuable opportunities for students to discover the CS field. This would also bring Hawaii closer to eliminating the gender- and ethnicity-based inequities seen across the CS workforce.

* Title I provides financial assistance to schools with high percentages of children from low-income families

NUMBER OF TRADITIONAL PUBLIC HIGH SCHOOLS OFFERING AP CS COURSES BY TITLE 1 FUNDING STATUS, 2017–18



Among 47 traditional public high schools, 14 are offering AP CS. 4 of these 14 schools received Title I funding in 2017–18.

Note: Does not include the Hawaii DOE e-School or public charter schools. **Source:** Hawaii DOE.

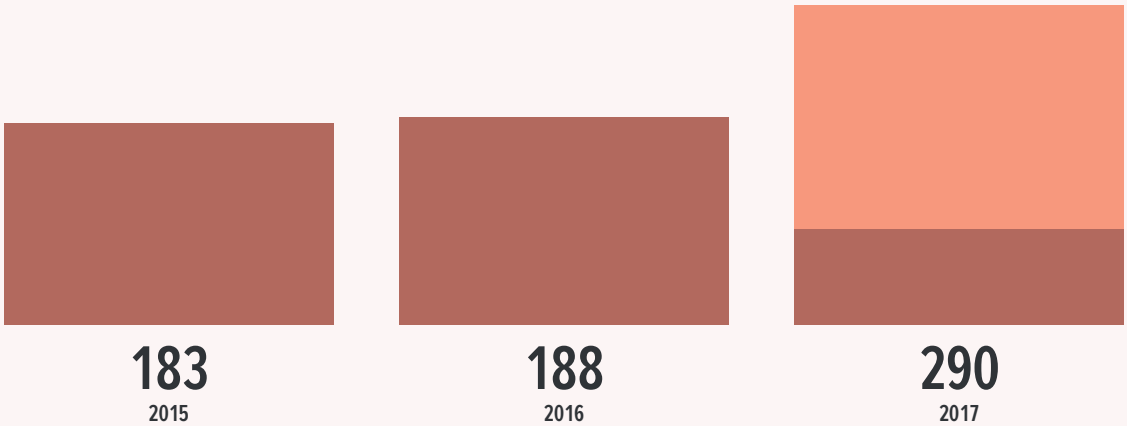
Number of students taking computer science

Hawaii students have shown increased interest in CS and math jobs, and college majors, since 2012. That year, only 7 percent of Hawaii ACT test takers were interested in CS and math. This figure has grown steadily to 11 percent in 2016.[12] Providing access to CS courses in K-12 education can increase this interest further and provide additional opportunities for students to learn the skills needed to perform well in these fields.

Yet participation in Hawaii on the AP CS exams remains low. Just 290 AP CS exams were administered across the state in 2017, less than two percent of all AP exams taken in Hawaii that year. This represents a substantial 54 percent increase in exam participation from 2016, largely due to the introduction of the AP Computer Science Principles exam.[13]

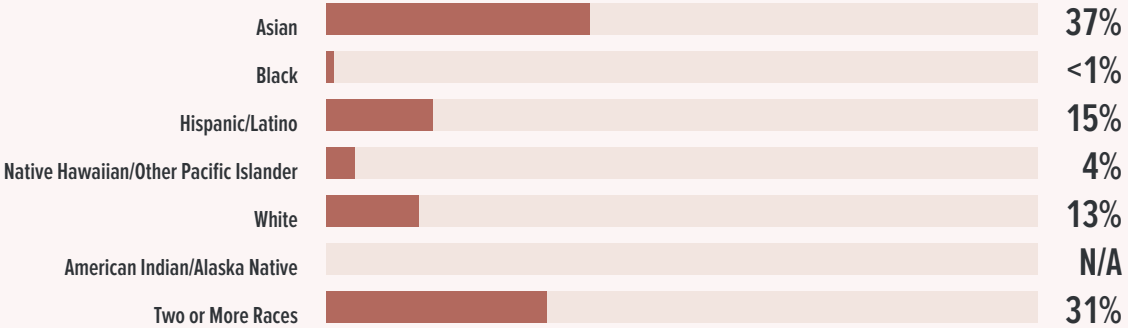
Of the 290 AP CS test takers in 2017, only 32 percent were female and only 4 percent—just 12 students statewide—identified as Native Hawaiian/Pacific Islander, highlighting the demographic gaps in K-12 CS enrollment. Despite this inequity, female test takers performed almost identically to male test takers, achieving the same median score on the AP CS A exam and a median score just 0.03 points lower on the new AP CS Principles (CS P) exam.[14]

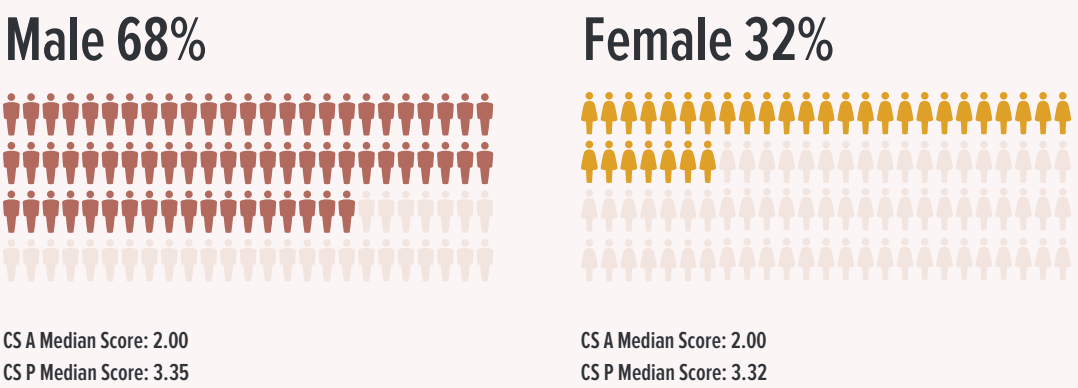
GROWTH IN AP CS EXAM PARTICIPATION IN HAWAII, 2015–2017



Source: College Board.

AP CS TEST TAKERS BY RACE/ETHNICITY AND GENDER, 2017





Note: Percentages may not add to 100 due to rounding. **Source:** 2017 College Board AP Program Participation and Performance State Report.

Though there has been a 70 percent increase in female AP CS test takers from 2016, and a whopping 557 percent increase from 2007, the rate still pales in comparison to male participation.[15] Early exposure to CS can play a significant role in addressing this disparity, and could ultimately eliminate the gender gap in CS that translates from the classroom to the workforce. In 2015, only 25 percent of computing occupations were held by women across the country.[16]

After participating in a hands-on introduction to coding through an *Hour of Code* event, female students are 10 percent more likely to say they like CS.[17] Encouraging women to enroll in AP CS courses in high school can increase the likelihood that they will go on to major in CS in college, an important step in reducing the gender gap that exists in higher education CS enrollment.[18] Nationally in 2015–16, less than 19 percent of Bachelor's degrees in computer and information sciences were conferred to women, along with 31 percent of Master's degrees and 20 percent of Doctoral degrees in this field.[19]

Preparation of computer science teachers

More educators are needed to meet the growing demand for CS courses in Hawaii. Nationwide, only 75 new educators completed their pre-service teacher preparation in CS in 2016—and none of these teachers were prepared in Hawaii.[20] This stands in stark contrast with the 12,528 teachers who were prepared in mathematics and 11,917 who were prepared in science across the country that year.[21]

Addressing this teacher shortage is paramount to increasing access to high-quality CS courses in our state. Nationally, a majority of K-12 principals and superintendents (63 percent and 74 percent, respectively) who do not offer a CS course in their school or district point to a lack of qualified teachers available to teach these classes.[22]

High salaries in the CS workforce make it especially difficult for schools to compete for qualified applicants. One way to overcome the high cost of hiring CS practitioners is to train existing teachers in these areas.

Through in-service professional development, teachers can gain the knowledge to effectively teach CS and open a world of opportunity to our students. The professional development program UTeach, out of the University of Texas, and Google's CS4HS have both recently partnered with the University of Hawaii to provide in-service training for Hawaii high school teachers from all fields.[23] Professional development programs from Code.org, as well as Hawaii-based Oceanit and DevLeague, can also prepare existing teachers on CS education at all levels.[24]

Impact on student achievement

Introducing students to CS does not have to wait until high school. In addition to technical knowledge, the skills taught in CS courses can help students across a range of other school subjects.[25] For instance, Momilani Elementary School in Waimalu offers a Tech Lab for students beginning in third grade. Through problem-solving and game-based learning, students are taught math, science and language arts.[26]

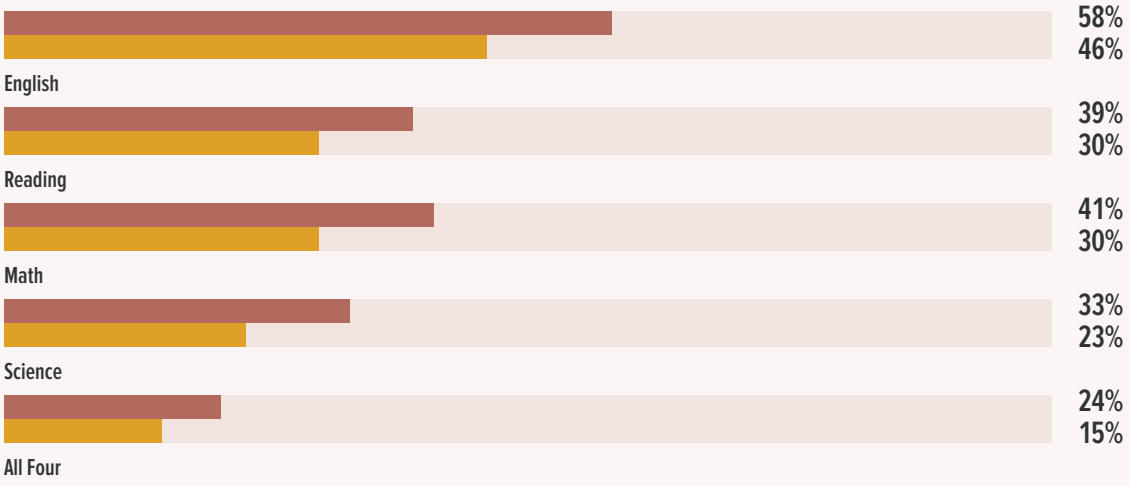
Stevenson Middle School in Honolulu is home to STEM teacher Patricia Morgan, who received a $100,000 grant to establish an "Invention Imaginarium." The Imaginarium aims to provide students with experience in coding, 3-D printing and computer-aided design.[27] Nonprofit organizations like Purple Maia are also expanding CS experiences in K-8 with culturally-focused workshops and classes for underrepresented students.[28]

Student performance on ACT examinations

Though comprehensive data is lacking, results from the 2016 ACT exam in Hawaii suggest that CS skills could help students excel in other academic areas. Test takers who expressed interest in CS jobs and majors also met the ACT college- and career-readiness benchmarks at higher rates than the state average.

This difference was particularly pronounced in English, where 58 percent of students interested in CS met the benchmark compared to the state average of 46 percent. In reading, 39 percent of students interested in CS met the benchmark compared to 30 percent among all Hawaii test takers. Forty-one percent of test takers interested in CS met the math benchmark, compared to the state average of 30 percent. In science, 33 percent of CS-interested test takers met the benchmark, compared to 23 percent of all Hawaii test takers.[29–30]

PERCENT OF HAWAII TEST TAKERS MEETING ACT COLLEGE AND CAREER READINESS BENCHMARKS BY INTEREST IN CS/MATH, 2016



Source: ACT Research Publications, 2016.

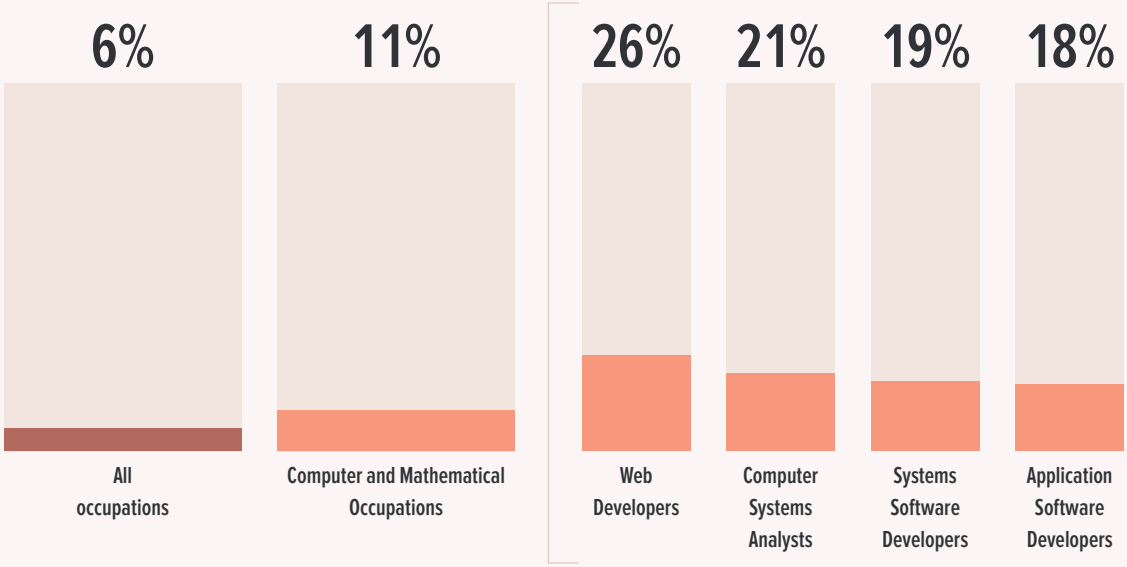
Computer and mathematical occupations growth

Knowledge of CS and other STEM topics is becoming more important—and more relevant to success—each day, as our diverse economy evolves. Between 2014 and 2024, for instance, CS-related occupations are projected to grow by almost 11 percent in Hawaii—faster than the six percent projected growth for all occupations in Hawaii over the same time.[31]

In particular, some of Hawaii's fastest-growing occupations between 2014 and 2024 will require CS experience, including web development (26 percent growth), computer systems analysis (21 percent growth), systems software development (19 percent growth) and application software development (18 percent growth).[32] In 2016, these and other computer and mathematical occupations carried a median hourly wage of $35.87 in Hawaii, nearly double the median hourly wage of $19.24 for all jobs that year.[33]

Students with CS skills can move into lucrative careers early on, with several high schoolers from Leilehua and Waipahu already gaining hands-on knowledge as work study interns with the National Security Agency.[34]

PROJECTED GROWTH IN EMPLOYMENT IN COMPUTER AND MATHEMATICAL OCCUPATIONS IN HAWAII, 2014–2024



Source: Hawaii Workforce Infonet.

Unfilled STEM jobs in Hawaii

Though inclusive of much more than just CS, STEM-related occupations generally represent a great opportunity for local workers to access high-paying and challenging careers in Hawaii. Across the state, the unemployment rate in STEM fields (1.3 percent between 2014–2017) is just over one-third the unemployment rate for non-STEM fields (3.6 percent).[35]

Job openings in Hawaii are difficult to fill, especially in the STEM workforce. In Honolulu, jobs requiring STEM skills and at least a Bachelor's degree take an average of nine days longer to fill than non-STEM jobs with the same education level.[36]

Next steps and policy proposals

Providing CS education in K-12 will introduce our students to skills and knowledge that will help them succeed in Hawaii's evolving economy. The Hawaii DOE understands the importance of this education, and is developing a comprehensive plan to bring CS opportunities to all K-12 students by 2022. With a team of state leaders, the DOE is conducting meetings with stakeholders to gather feedback on adopting CS standards, outlining a teacher certification process and increasing access to CS education.[37]

Though the Hawaii DOE has taken some early steps to expand CS in K-12 schools across the state, more can still be done. Specifically, Board of Education policy should allow computer science courses to count toward mandatory graduation credits for math or science. Doing so could have an immediate impact on CS participation.[38–39]

To help meet the increasing demand for K-12 CS teachers, Hawaii should also pass a bill that provides funding for high schools to offer computer science professional development to teachers. This is a critical step in increasing K-12 CS capacity while pre-service CS preparation programs are being developed for future educators.

ENDNOTES

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