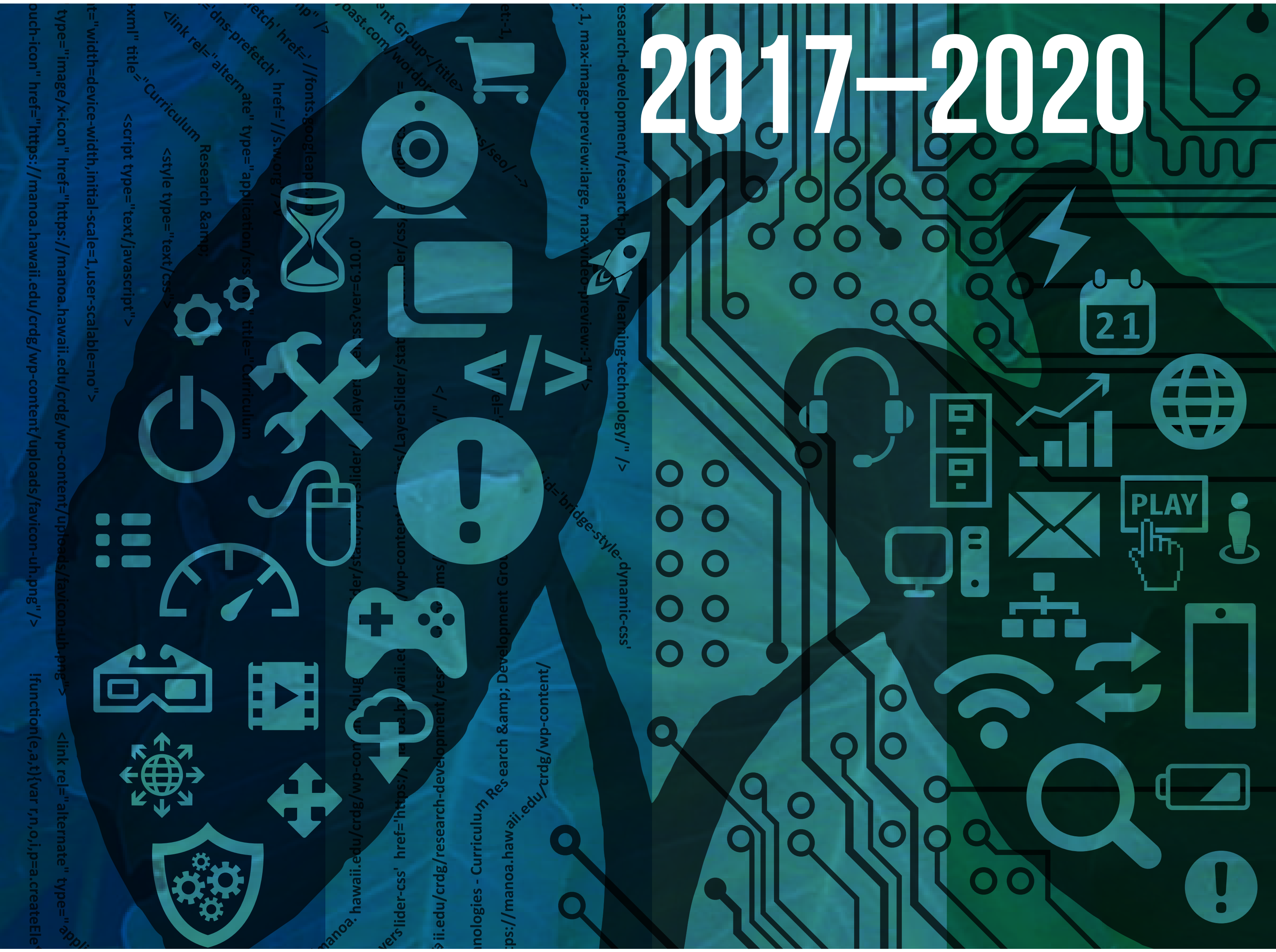
# CATCHING UP TO MOVE FORWARD:

## A Computer Science Education Landscape Report of Hawaiʻi Public Schools




Prepared by CRDG of the College of Education of the University of Hawaiʻi at Mānoa
June 30, 2020 Thanh Truc T. Nguyen and Minara Mordecai

# CATCHING UP TO MOVE FORWARD:
## A Computer Science Education Landscape Report of Hawaiʻi Public Schools, 2017–2020

Authors: Thanh Trúc T. Nguyễn and Minara Mordecai



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Design by the Curriculum Research & Development Group

Barbara J. Dougherty, Director
Lori Ward, Managing Editor

Curriculum Research & Development Group
College of Education, University of Hawaiʻi at Mānoa
1776 University Avenue, Castle Memorial Hall 132
Honolulu, HI 96822
crdg@hawaii.edu 808-956-4969
http://www.hawaii.edu/crdg

CRDG is an organized research unit in the College of Education at the University of Hawaiʻi Mānoa that contributes to the body of professional knowledge and practice in teaching and learning, curriculum development, program dissemination and implementation, evaluation and assessment, and school improvement. CRDG conducts research and creates, evaluates, disseminates, and supports educational programs that serve students, teachers, parents, and other educators in grades PreK–20.

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## A Computer Science Education Landscape Report

## of

## Hawaiʻi Public Schools

## 2017–2020

Thanh Trúc T. Nguyễn
Minara Mordecai

June 2020

CRDG
CURRICULUM RESEARCH & DEVELOPMENT GROUP
COLLEGE OF EDUCATION
UNIVERSITY OF HAWAIʻI AT MĀNOA

# TABLE OF CONTENTS

# TABLE OF CONTENTS

# LIST OF FIGURES AND TABLES

## List of Appendices



## List of Tables

## List of Figures

# EXECUTIVE SUMMARY

**"No other subject will open as many doors in the 21st Century, regardless of a student's ultimate field of study or occupation, as computer science."**

*- Running on Empty: The Failure to Teach K–12 Computer Science in the Digital Age, 2010*

This report is a computer science education landscape report and presents results of a study conducted by the Curriculum Research & Development Group in the College of Education at the University of Hawai‘i at Mānoa on behalf of the Hawai‘i Department of Education in 2020. The purpose of the report is to examine the landscape of public school K–12 computer science education in Hawai‘i, particularly after the passing of Act 51 (HRS 302A-323).[1]

Results here are based on analysis of data from the Hawai‘i State Department of Education (HIDOE) and national data systems; data from a HIDOE survey of 492 K–12 educators and administrators; and 5 follow-up sets of interviews with educators, administrators, industry partners, and the state computer science education team. Key findings include the following

- a rapid increase of computer science activities between 2017 and 2020;
- a total 33 public high schools and 11 combination schools offering computer science courses, which is 100% of high schools;
- an increase of 89.6% for AP CS Principles and 28.7% for AP CS A from SY 2017–18 to SY 2018–19 exam takers;
- an increase from 6.8% to 22.7% of Title I schools that offered AP CS courses from SY 2017–18 to SY 2019–20;
- a need for a process of feedback and support for computer science education activities;
- a high percentage of schools using programs like Code.org and Scratch;
- minimal to no change in the proportion of participation by girls, Native Hawaiian students, and other underrepresented minorities in formal course enrollment;
- an increase in girls' participation in AP CS exam taking, but not in the overall proportion of AP CS course enrollment;

- an increase in the presence of computer science opportunities in Title I schools;
- a tension of time needed to implement computer science education and other initiatives;
- a lack of incorporation of elements of the HĀ framework; and
- a high number of ESSA highly-qualified teachers, but a low number of teachers licensed in computer science.

The intent of the authors is to provide

- a comparison of Hawaiʻi to national computer science education trends;
- a description of the current K–12 computer science opportunities in Hawaiʻi public schools;
- a broad report of the research results from survey, interview, and document data; and
- a set of recommendations for addressing the local issues that this data uncovers.

Recommendations include

- maintaining continuity and sustainability of CS Initiatives;
- creating additional subsidies for AP examinations;
- establishing common language around computer science education;
- developing pathways toward computer science college majors and careers;
- creating effective supports for teachers;
- rethinking traditional teaching models; and
- committing to equity and access.

**"In the new economy, computer science isn't an optional skill, it's a basic skill."**

*- President Barack Obama, 2016*

**“Computer science (CS) has profoundly changed the ways that we learn, work, and play. The ubiquity of computing puts a premium on ensuring students’ competencies as generators, not just users, of digital resources.”**

*- State of the States Landscape Report, 2017*

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# INTRODUCTION

## ABOUT THIS REPORT

Computer science education in Hawai‘i experienced significant shifts between 2017 and 2020, during which standards were adopted, teacher licensure was established, courses were redesignated as computer science, a new national AP course appeared, legislative action and bills were passed, and an entire conference dedicated to computer science was offered. This report is a computer science education landscape report and presents results of a study conducted by the Curriculum Research & Development Group in the College of Education at the University of Hawai‘i at Mānoa on behalf of the Hawai‘i Department of Education (HIDOE) in 2020. The purpose of the report is to examine the landscape of K–12 computer science education in Hawai‘i, particularly after the passing of Act 51 (HRS 302A-323). The act required that the HIDOE develop and implement a statewide computer science curricula plan for public school students in kindergarten through twelfth grade that may include design thinking as part of the curricula and, beginning with the 2021–2022 school year, ensure that each public high school offers at least one computer science course during each school year. Results here are based on analysis of data from the HIDOE and national data systems; data from a HIDOE survey of 492 K–12 educators and administrators; and 5 follow-up sets of interviews with educators, administrators, industry partners, and the state computer science education team. Research was approved by the Institutional Research Board of the University of Hawai‘i (see Appendix 1). A full list of data sources is available in Appendix 2.

**CS in K–12 schools need long term attention and follow-up efforts.**

This report is released during one of the most challenging times in modern history, within a pandemic when people are relying more than ever on the affordances and innovations stemming from computer science that allow for online communication, creativity, commerce, collaboration, and more. Via online mechanisms, people are attending school, ordering groceries for delivery, connecting with family and friends, working out jointly, attending business meetings, visiting with their doctors and physicians, and reconnecting with hobbies. Software engineers and scientists are developing new simulations and models to track and share valuable information to the research community as well as to the public. Small and big businesses alike are redesigning websites and engaging with programmers to develop new algorithms for online business. Many physicians are using telehealth systems for the first time and new health professionals are being trained using simulations developed under social distancing guidance. Cybersecurity, systems, and network engineers are quickly developing new approaches to store, send, and secure data systems. The problem solving around strengthening infrastructure of internet access is of high priority for low income areas and engages all aspects of computer science education, from hardware and software development to the societal implications of equity and access.

**Computer science (CS) is "the study of computers and algorithmic processes, including their principles, their hardware and software designs, their application, and their impact on society" (Tucker et al., 2003, p. 6).**

# WHAT IS COMPUTER SCIENCE?

Computer science (CS) is "the study of computers and algorithmic processes, including their principles, their hardware and software designs, their application, and their impact on society" (Tucker et al., 2003, p. 6). This particular definition served as the basis for the first K–12 Computer Science Framework (2016) and has not changed dramatically for over 17 years. The 2003 report from Tucker et al. recommended a curriculum model within a four-level framework, and the framework contained about four half-year courses, many of which they suggested could be integrated as modules into science and mathematics curriculum units. Tucker et al. cautioned that school districts needed to balance how to integrate computer science with many other priorities, as well as time and budget constraints. They concluded that computer science in K–12 schools needed long-term attention and that many follow-up efforts would be needed to sustain the momentum they hoped their report would generate.

In pursuing the expansion of computer science education, Hawai'i adopted the definition[2] offered by Tucker et al. in 2003. These are some of the other definitions offered:

*Dictionary.com*

The science that deals with the theory and methods of processing information in digital computers, the design of computer hardware and software, and the applications of computers.

*Encyclopedia Brittanica*

Computer science, the study of computers and computing, including their theoretical and algorithmic foundations, hardware and software, and their uses for processing information. The discipline of computer science includes the study of algorithms and data structures, computer and network design, modeling data and information processes, and artificial intelligence. Computer science draws some of its foundations from mathematics and engineering and therefore incorporates techniques from areas such as queueing theory, probability and statistics, and electronic circuit design.

*TechTerms*

Computer science is the study of computers and computing concepts. It includes both hardware and software, as well as networking and the Internet. The hardware aspect of computer science overlaps with electrical engineering. It covers the basic design of computers and the way they work.

Computer science is sometimes described as it relates to the profession of a computer scientist. The Association of Computing Machinery (ACM) defines the work of computer scientists as falling into three major categories: a) designing and building software; b) developing effective ways to solve computing problems, such as storing information in databases, sending data over networks or providing new approaches to security problems; and c) devising new and better ways of using computers and addressing particular challenges in areas such as robotics, computer vision, or digital forensics.[3] ACM further describes four career paths for those who study computer science. The career paths connected strongly to computer science are 1) devising new ways to use computers and 2) developing effective ways to solve computing problems. The career paths that start in computer science but have stronger presence in other majors are 3) designing and implementing software and 4) planning and managing organizational technology infrastructure. Those other majors are software engineering, information technology, and information systems.

Though computer science was well established in collegiate levels, ACM recognized that K–12 education was not keeping pace. In 2003, and updated in 2006, ACM proposed a *A Model Curriculum for K–12* that they envisioned would help K–12 school systems integrate computer science fluency and competency throughout their curricula (Tucker et al., 2003, 2006). However, the progress was slow moving. In 2010, ACM took part in developing the groundbreaking report, *Running on Empty: The Failure to Teach K–12 Computer Science in the Digital Age* (Wilson et al., 2010), developed in partnership with the Computer Science Teachers Association (CSTA).

In the report *Running on Empty*, the authors declared that "federal, state, and local government policies underpinning the K–12 education system are deeply confused, conflicted, or inadequate to teach engaging computer science as an academic subject" (Wilson et al., 2010, p. 6). The statement was controversial, but one that lit a fire under many state governments and many school systems to undertake a change. For the report, the ACM and CSTA researchers sought to determine the extent to which computer science education was incorporated into state education standards, and to what extent states allowed computer science courses to count as a graduation credit in a required subject. What the authors found was a nation that was focused on skills but not grounded in standards; that two-thirds of the country had few or no computer science standards; that only nine states recognized computer science as meeting a graduation core requirement as a science or math course; that no state recognized computer science as a graduation requirement in itself; and that there was "deep and widespread confusion within the states as to what should constitute and how to differentiate technology education, literacy and fluency; information technology education; and computer science as an academic subject" (p. 9).

That report was followed a few years later in 2016 by the *K–12 Computer Science Framework*, steered by the ACM, Code.org, CSTA, the Cyber Innovation Center, and the National Math and Science Initiative. The *K–12 Computer Science Framework* was "designed to inform standards and curriculum, professional development, and the implementation of computer science pathways. The framework promotes a vision in which all students critically engage in computer science issues; approach problems in innovative ways; and create computational artifacts with a practical, personal, or societal intent" (2016, pp. 1–2). The concepts and practices of the framework are seen in Figure 1.

## Figure 1. The Concepts and Practices of the K–12 Computer Science Framework

**The Concepts and Practices of the K–12 Computer Science Framework**

| Core Concepts | Core Practices |
| --- | --- |
| 1. Computing Systems | 1. Fostering an Inclusive Computing Culture |
| 2. Networks and the Internet | 2. Collaborating Around Computing |
| 3. Data and Analysis | 3. Recognizing and Defining Computational Problems |
| 4. Algorithms and Programming | 4. Developing and Using Abstractions |
| 5. Impacts of Computing | 5. Creating Computational Artifacts |
| | 6. Testing and Refining Computational Artifacts |
| | 7. Communicating About Computing |

*Note.* Image from K–12 Computer Science Framework, https://k12cs.org/

As authors of the *K–12 Computer Science Framework* caution, understanding what computer science is carries as much importance as understanding what it is not. Computer science is not the everyday use of computers and computer applications, such as internet searching, spreadsheets and word processing, or making a slide presentation. It is also not creating videos and curating a social media presence. Computer science builds on computer literacy, educational technology, digital citizenship, and information technology. Their differences and relationship with computer science as described within the K–12 Computer Science Framework are described below:

- **Computer literacy** refers to the general use of computers and programs (i.e., computer applications) such as productivity software. Previously mentioned examples include performing an Internet search and creating a digital presentation.
- **Educational technology** applies computer literacy to school subjects. For example, students in an English class can use a web-based application to collaboratively create, edit, and store an essay online.
- **Digital citizenship** refers to the appropriate and responsible use of technology, such as choosing an appropriate password and keeping it secure.
- **Information technology** often overlaps with computer science but is mainly focused on industrial applications of computer science, such as installing and operating software rather than creating it. Information technology professionals often have a background in computer science.

- *K–12 Computer Science Framework* (2016)

Technological innovation thrives in a constant state of change, and computer science lives right in the middle of that continual flux. Admittedly, some of the confusion around what computer science is and conversations about what should constitute computer science are reflected in that flux. Institutions with renowned computer science departments name their own programs of study using a permutation of engineering, mathematics, and computer science. The majority of these college programs are recognized as computer and information sciences. However, many are in programs that also include engineering and mathematics. The Massachusetts Institute of Technology and University of California-Berkeley, for example, house computer science in their Department of Electrical Engineering and Computer Science. Stanford has a Computer Science Department within a School of Engineering. Carnegie Mellon has an entire School of Computer Science whereas Harvard has a School of Engineering and Applied Sciences. The University of Hawaiʻi at Mānoa, the flagship campus of the public post-secondary system in Hawaiʻi, has a Department of Information and Computer Sciences within a College of Natural Sciences. Of the other two public, four-year campuses, University of Hawaiʻi-West Oʻahu has a cybersecurity program and the University of Hawaiʻi at Hilo has a computer science program in a College of Natural and Health Sciences.

# HISTORY OF COMPUTER SCIENCE EDUCATION IN HAWAIʻI

As the only state in the nation whose local educational agency and state educational agency are the same, the Hawaiʻi Department of Education (HIDOE) comprises 257 public schools and 37 charter schools, 55 of which are military-impacted schools. Educating about 180,000 students and employing about 13,000 teachers, the system has 174 elementary schools, 42 middle schools, 34 high schools, and 44 combination schools.[4] The U.S. Department of Education reports that in the 2017–18 school year (SY), 84.4% of Hawaiʻi's school population, or 180,837 students were served in Hawaiʻi public schools with the remaining 33,274 students in private schools as seen in Table 1. About 6.6% of the student population is served in public charter schools as seen in Table 2. In SY 2019–20, 181 schools were designated as Title I[5] schools. The school system is divided into 15 complex areas that are regional groupings of two to four complexes. A complex is a high school and its feeder schools.

In Hawaiʻi, the conversation around computer science has had grass roots attention via teacher organizations like the CSTA Hawaiʻi chapter and the Hawaiʻi Society for Technology in Education, as well as a significant program of professional development by Code.org with support from STEMWorks Hawaiʻi. Other local non-profit and industry partners include Apple Education, Oceanit, Dell Technologies, Microsoft, HawaiiKidsCAN, Purple Maiʻa, Computational Thinkers, and PC Gamerz. Colleges and universities in Hawaiʻi are also strong supporters.

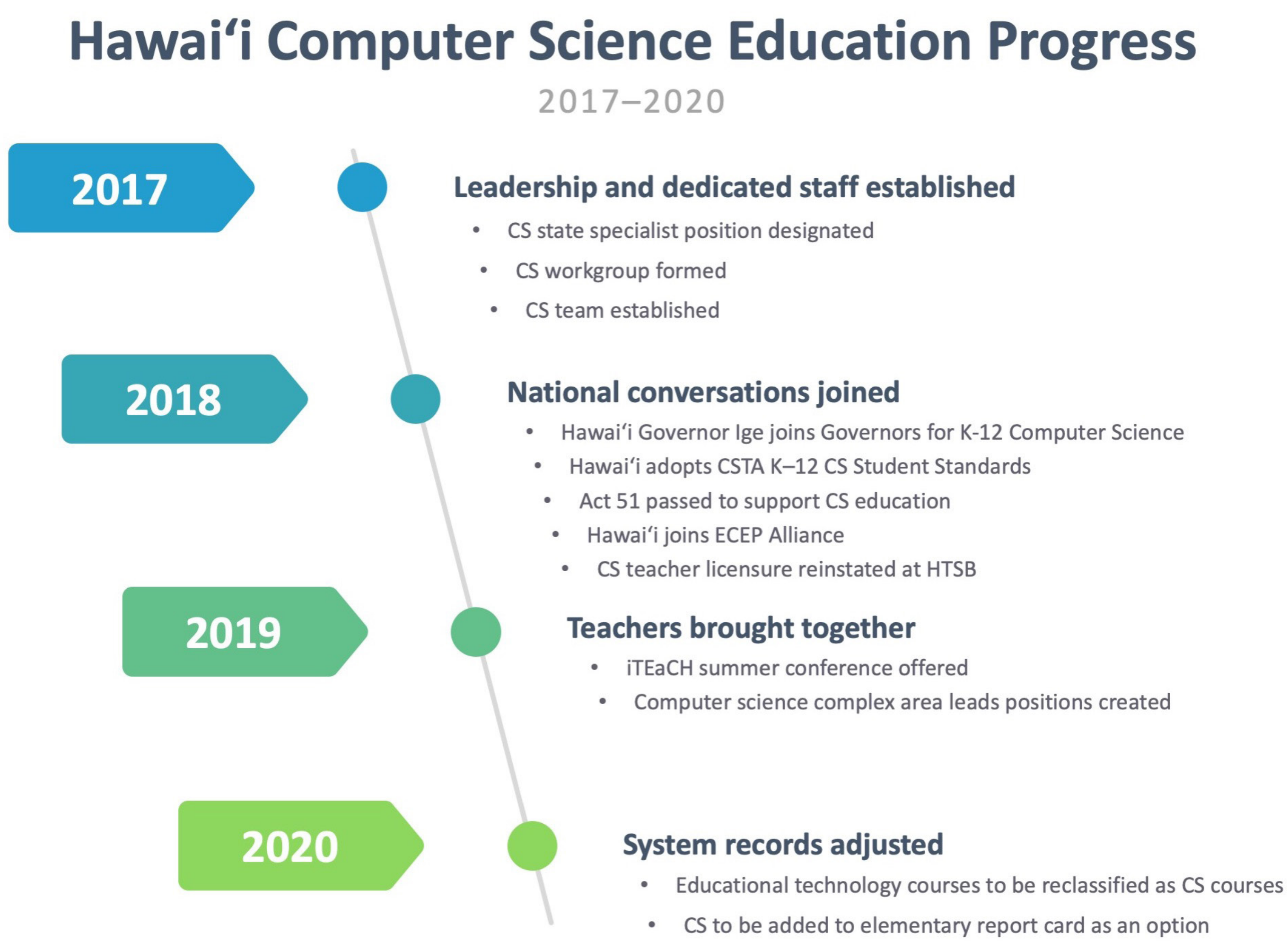
Prior to 2017, the presence of computer science in Hawaiʻi schools had been largely as Advanced Placement Computer Science A or AB, courses that students completed to take an exam for college credit. AP courses have been taken in Hawaiʻi since 1960, but AP computer science was not available until 1984. Since about 2017, the Hawaiʻi public schools system has embarked on a series of changes to increase the opportunities in computer science for both students and teachers. As seen in Figure 2, leadership and dedicated staff were established, national conversations were joined, teachers were brought together, and system records were adjusted. These actions were supported primarily by a computer science team consisting of two educational specialists and one resource teacher. The team was formerly in educational technology, then learning technology, then computer science. Approached to assist with distinguishing CS from science, technology, engineering and mathematics (STEM), this team has both inherited grass-roots efforts around CS as well as responded to local and national calls to action.

## Table 1. Students and Teachers in Hawai'i, SY 2017–18

| Public School | | | Private School | | |
|---|---|---|---|---|---|
| # students | FTE teachers | # of schools | # students | FTE teachers | # of schools |
| 180,837 | 11,653.47 | 294 | 33,274 | 2,890.60 | 108 |
| 84.4% | 80.1% | 73.1% | 15.5% | 19.9% | 26.9% |

Data Source: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Private School Universe Survey (PSS)", 2017-18 ; "Public Elementary/Secondary School Universe Survey", 2017-18 v.1a; "State Nonfiscal Public Elementary/Secondary Education Survey", 2017-18 v.1a.
FTE = Full-time equivalent
Percentages are rounded.

## Figure 2. Hawai'i Computer Science Education Progress Timeline



## Table 2. Student Enrollment in Hawai'i, SY 2019–20

| Public Schools | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Regular Education | | | | | | | | Special Education | | | |
| | K-5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | K–6 | 7–8 | 9–12 | Total | % |
| # | 71,784 | 12,008 | 11,677 | 11,206 | 12,504 | 11,325 | 10,420 | 9,571 | 8,392 | 2,774 | 5,793 | 167,454 | 93.3 |

| Public Charter Schools | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Regular Education | | | | | | | | Special Education | | | | |
| | K-5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | K–6 | 7–8 | 9–12 | Total | % |
| # | 5,535 | 1,213 | 987 | 972 | 637 | 601 | 503 | 428 | 504 | 237 | 260 | 11,877 | 6.6 |

*Note. Data Source: Hawai'i Department of Education SY 19–20 Enrollment Data*
*Percentages are rounded.*

Hawai'i began to join the national conversations in CS education in 2018 by becoming part of the Governors for K–12 Computer Science organization, establishing a Computer Science Teachers Association Hawai'i chapter, and joining the Expanding Computing Education Pathways alliance. Locally, the Hawai'i Teacher Standards Board reinstated computer science as its own field for teacher licensure, essentially distinguishing it from within career and technical education pathways. Of note is that Hawai'i Governor David Ige signed into law Act 51 on June 21, 2018, (House Bill 2607 HD1 SD2 CD1, 2018) with two mandates, enacted with the opening statement "The legislature finds that the importance of computer science cannot be overstated." Most importantly, Hawai'i formally adopted the Computer Science Teachers Association (CSTA) K–12 Computer Science Student Standards.[6] However, there was still confusion as to what computer science was, so a large effort was undertaken to plan for a computer science conference. This conference, called the Innovative Teachers Engage and Collaborate - Hawai'i (iTEaCH), was offered in the summer of 2019 and attended by 400+ educators. The attendees could select from 37 different sessions. The 218 participants who completed the evaluation indicated that they could better explain what computer science is and gained more ideas and strategies for incorporating computer science (Nguyen, 2019).

As a follow up to the iTEaCH conference, the OCID Computer Science Program partnered with CSforALL to offer a one-day Strategic CSforALL Resource & Implementation Planning Tool (SCRIPT).[7] On August 6, 2019, a memo was issued to complex area superintendents inviting each to participate and send a representative to the training. The complex area representatives who attended the September 2019 training included resource teachers, school renewal specialists, educational specialists, and classroom teachers. Since not all complex areas had opted to continue with SCRIPT and may have had other CS implementation plans formulated, follow-up meetings were renamed "Complex Area CS Team Meetings" rather than SCRIPT training. It was from these meetings that complex area CS leads were identified. A CS lead is a designated individual from each complex area who operates as a liaison between the multilevel leadership teams at

HIDOE. CS leads also serve as resources for individual schools and attend and provide CS training. The HIDOE continues to support complex areas that are implementing computer science programs whether they have chosen to use school design, SCRIPT, or a combination of the two implementation strategies. School design[8] is described in the HIDOE as "the purposeful design of schools to ensure that every student is highly engaged in a rigorous, creative and innovative academic curriculum, in their learning environment, and in powerful applied learning practices aligned to college and careers" (HIDOE, 2017). For example, the Leilehua Complex utilized the school design implementation strategy, whereas the Kauai Complex used the SCRIPT training with their school design for CS that the computer science team helped to facilitate.

During several CS team meetings, the OCID CS team shared that the enrollment in computer science courses had increased greatly between SY 17–18 and SY 19–20 (B. Tanaka, personal communication, October 18, 2019). However, most of the computer science courses were categorized under the educational technology or multidisciplinary. Furthermore, there were also courses that focused on computer science-related careers categorized under the career and technical education program pathways. Beginning in SY 2020–21, the educational technology courses will be redesignated as computer science courses, a move that was formalized in November 2019. Also, as stated in the memo, AP Computer Science would be redesignated as computer science instead of as multidisciplinary and CS would be added to the elementary school report card as a content option for the Additional Content Area section of the report cards (see Appendix 3). For the remainder of this report, two types of computer science courses will be discussed. They are the computer science (CS) courses and the career and technical education computer science-related (CTE CS-related) courses.

This landscape report, completed in 2020 on behalf of the HIDOE, may become an element added to the timeline above. The report can be viewed as one of the recommended elements of a five-step process that states can undertake towards a state-level computer science education reform.

# NATIONAL TRENDS IN COMPUTER SCIENCE EDUCATION

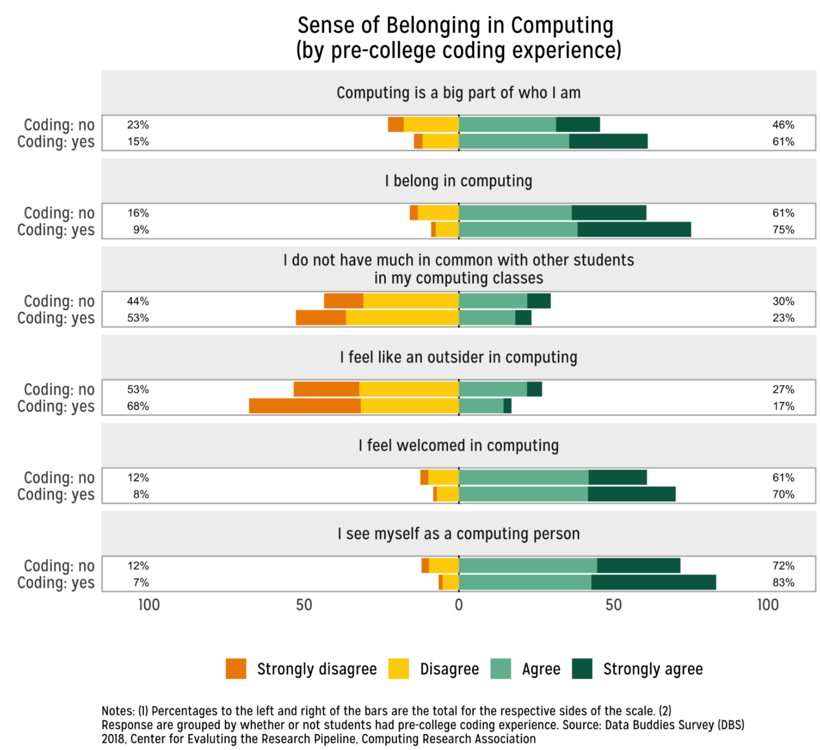
## CS EDUCATION AND ACADEMIC RESEARCH

Computer science is often grouped within science, technology, engineering, and mathematics, or STEM, and other hard sciences. Research has shown that in CS, like in STEM, women and students of color have been traditionally excluded (Landivar, 2013; National Academies of Sciences, Engineering, and Medicine, 2016; Smith et al., 2018). Harris et al. (2020) found that underrepresented students are more likely to underperform in undergraduate STEM courses even when academic ability and preparation would suggest otherwise. They further hypothesized that underrepresented students - women, underrepresented minorities,[9] and the socioeconomically disadvantaged - have greater sensitivity linked to their own belief in their ability to succeed (low self-efficacy) and to the cognitive demands of negative stereotypes about their gender or race (stereotype threat). To address these issues, interventions that reinforce a student's feelings of integrity and self-worth (Jordt et al., 2017), active learning (Theobald et al., 2020), and pairing students (Denner et al., 2005; Werner et al., 2004) may help to reduce the achievement gaps. In addition, paying attention to social cues that promote a sense of dignity, community, and kindness within the learning environment, described as macro and micro kindness cues that affirm social inclusion (Estrada et al., 2018) can be incorporated into programs of study.

**A major problematic area is that "coding" is often incorrectly perceived to *be* computer science.**

Throughout research about computer science, a major problematic area is that "coding" is often incorrectly perceived to be synonymous with computer science. Instead, coding is best described as a part of CS, much like anesthesiology training can be part of medical education. However, coding does remain a proven gateway to increase interest in computing among young people. A recent survey conducted among 5,000 undergraduate students in

### Figure 3. Sense of Belonging in Computing




*Note.* Data and image source: Tamer, 2020, https://cra.org/crn/2020/01/higher-sense-of-belonging/

computing across the U.S. has found that engagement with coding in K–12 can have long-term benefits for students who pursue CS fields in college. Students who have had experience with coding before college reported an increased sense of belonging in computing and connection with classmates (Tamer, 2020) (Figure 3). Because sense of belonging is tied closely to women's persistence in STEM (Lewis et al., 2017), and underrepresented first generation college students in computing majors have shown a positive correlation between academic success and the degree to which they felt welcome (Stout, 2016), early exposure to coding can be influential in closing the participation gaps in computing.

Across the nation, computer science is now recognized in 49 states as a math or science equivalent for graduation, and 35 states have adopted computer science standards. Organizations like the CSTA and Code.org have grown in membership; CSTA released K–12 standards for computer science that has guided and been incorporated into the CS standards of numerous states; Code.org released nine policy recommendations and has provided a monitoring mechanism that updates with each policy change; the Governors for K–12 Computer Science was established in 2016 with an eye on CS-rigorous courses, funding, and standards and has 17 members as of 2020.

## JOBS AND OCCUPATIONS

As mentioned previously, STEM is the larger category into which computer occupations fall. In 2015, computing occupations were projected to be 76% of newly created STEM jobs between 2014–2024 according to the U.S. Bureau of Labor Statistics (BLS) (Figure 4). Fayer, Lacey, and Watson (2017) reported that there were nearly 8.6 million STEM jobs in 2015, representing 6.2% of U.S. employment. In the most recent report, the BLS now projects STEM occupations between 2018 and 2028 to grow from 9.7 million to 10.5 million jobs, representing another increase of 858,000 positions.[10] Nationwide, Fayer et al. additionally reported that seven out of the ten largest STEM occupations were computer related, and most of the largest STEM occupations were related to computers and information systems. Applications software developers was the largest STEM occupation with nearly 750,000 jobs. Computer user support specialists and computer systems analysts each accounted for over a half a million jobs. States that added the largest numbers of STEM jobs between 2009 and 2015 included California (160,950), Texas (102,190), New York (42,980), and Michigan (41,100).

In comparison, the 2016 employment data in Hawai'i show that there were 29,438 STEM occupations, which represented 4.1% of total employment,[11] of which computer-related occupations were 31.5%. Between 2016 and 2026, STEM occupations in Hawai'i are projected to grow 3.7 percent to 31,965 jobs.

### Figure 4. STEM Job Projections, 2014–2024

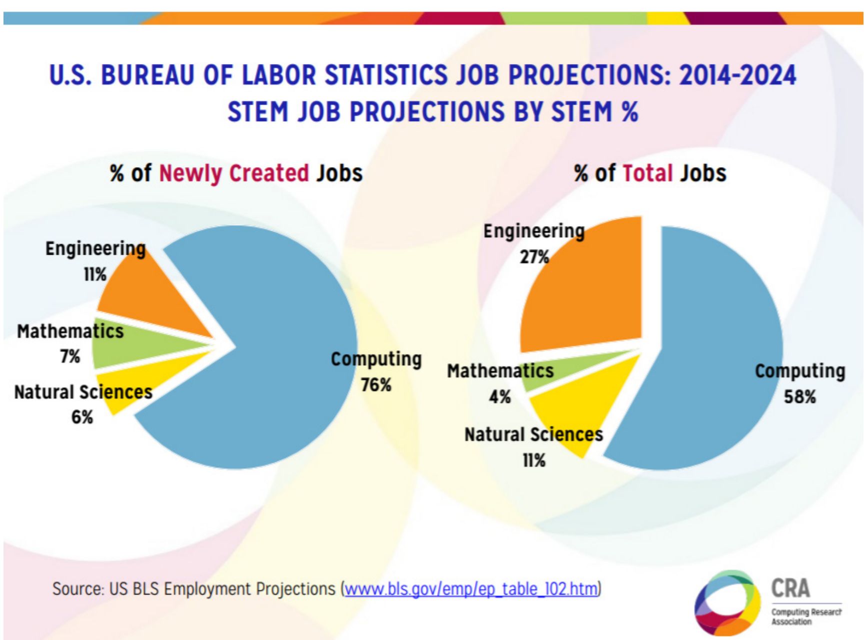



Image Source: Computing Research Association, 2017[48]

Some of the growing industries in the computing sector include hybrid and multi-cloud development, cloud security, artificial intelligence capabilities, and edge computing (Linthicum, n.d.). Other projections suggest an increased investment on the Internet of Things (IoT), big data management, and cybersecurity.

## Types of Jobs

Throughout the U.S., STEM occupations had above-average growth between 2008 and 2018. Over 99% of STEM occupations typically require some type of postsecondary education for entry, compared with 36% of overall employment. Occupations like software developers and engineers typically require a bachelor's degree for entry. STEM jobs accounted for more than half of employment in five industries. The largest STEM occupations in computing include computer systems analysts (167,830), systems software developers (130,630), computer user support specialists (125,440), and computer programmers (117,720). Computer and information systems managers, who plan, direct, or coordinate information technology activities, made up nearly 74,000 jobs. Some of the fastest growing STEM occupations are in computer systems design and related services. The rapid growth projected for these occupations is due in large part to the projected growth for the computing industry of 23%. However, computer programmers are projected to decline in this industry from 2014 to 2024 due to the ongoing trend of outsourcing the work to firms located overseas to cut costs.

In the most recent 2019 data from the US Bureau of Labor Statistics (BLS), computer and mathematical occupations was considered a major occupational group. Computers could also be found in three other major occupational groups—management, architecture and engineering, and educational instruction and library. Computers appear in three different employment sectors in the North American Industry Classification System (NAICS). Those sectors are as follows:

- Sector 31, 32, and 33 - Manufacturing
    - NAICS 334000 Computer and electronic product manufacturing
        - Computer and peripheral equipment manufacturing
- Sector 54 - Professional, Scientific, and Technical Services
    - NAICS 541500 Computer systems design and related services
- Sector 61 - Educational Services
    - NAICS 611400 Business schools and computer and management training

Computer occupations from BLS include computer systems analysts, information security analysts, computer and information research scientists, computer network support specialists, computer user support specialists, computer network architects, network and computer systems administrators, database administrators and architects, computer programmers, software developers, software quality assurance analysts and testers, and web developers and digital interface designers. Wages for most of these occupations are above the national average.

**Mean annual income in Hawai'i**
**$53,469 - All**
**$85,769 - Computer Occupational Groups**

A detailed comparison of computer science-related occupations across the US and Hawai'i is provided in Table 3. Looking at Hawai'i's employment statistics from May 2019, there were 635,500 people employed and the mean annual income was $53,469. The three major computer occupational groups combined had 11,940 positions and a mean annual income of $85,769 as seen in Table 4. According to a Hawai'i P–20 Partnerships for Education report, STEM graduates in technology from the University of Hawai'i were most likely to be found working in Hawai'i in the five years after graduation.[12] In the Hawai'i Career Explorer website,[13] three of the top five STEM occupations are computer occupations.

## Table 3. U.S. and Hawai'i Computer Science-Related Occupations, May 2019

| Occupation code | Occupation title | Level | Where | Employ-ment | Median hourly wage | Mean hourly wage | Annual mean wage |
|---|---|---|---|---|---|---|---|
| 00-0000 | All Occupations | total | US | 146,875,480 | $19.14 | $25.72 | $53,490 |
| | | total | HI | 635,500 | $21.35 | $26.41 | $54,930 |
| 11-3021 | Computer and Information Systems Managers | detail | US | 433,960 | $70.37 | $75.19 | $156,390 |
| | | detail | HI | 990 | $58.37 | $61.27 | $127,450 |
| 15-0000 | Computer and Mathematical Occupations | major | US | 4,552,880 | $42.47 | $45.08 | $93,760 |
| | | major | HI | 10,890 | $38.00 | $39.32 | $81,790 |
| 15-1210 | Computer and Information Analysts | broad | US | 714,640 | $44.40 | $46.91 | $97,570 |
| | | | HI | 2,120 | | | |
| 15-1211 | Computer Systems Analysts | detail | US | 589,060 | $43.71 | $46.23 | $96,160 |
| | | detail | HI | 1,780 | $36.83 | $38.29 | $79,650 |
| 15-1212 | Information Security Analysts | detail | US | 125,570 | $47.95 | $50.10 | $104,210 |
| | | detail | HI | 340 | $43.32 | $50.44 | $104,910 |
| 15-1221 | Computer and Information Research Scientists | detail | US | 30,780 | $59.06 | $61.28 | $127,460 |
| | | detail | HI | 80 | * | * | * |
| 15-1230 | Computer Support Specialists | broad | US | 832,750 | $26.33 | $28.51 | $59,290 |
| | | | HI | N | | | |
| 15-1231 | Computer Network Support Specialists | detail | US | 185,430 | $30.51 | $33.10 | $68,860 |
| | | detail | HI | 840 | $30.29 | $31.10 | $64,700 |
| 15-1232 | Computer User Support Spe-cialists | detail | US | 647,330 | $25.13 | $27.19 | $56,550 |
| | | detail | HI | 1,150 | $23.21 | $24.33 | $50,610 |
| 15-1240 | Database and Network Ad-ministrators and Architects | broad | US | 632,330 | $43.94 | $46.33 | $96,380 |
| | | | HI | N | | | |
| 15-1241 | Computer Network Architects | detail | US | 152,420 | $54.18 | $55.34 | $115,110 |
| | | detail | HI | 420 | $46.25 | $46.53 | $96,790 |

| Occupation code | Occupation title | Level | Where | Employ-ment | Median hourly wage | Mean hourly wage | Annual mean wage |
|---|---|---|---|---|---|---|---|
| 15-1244 | Network and Computer Systems Administrators | detail | US | 354,450 | $40.15 | $42.51 | $88,410 |
| | | detail | HI | 1,260 | $38.96 | $39.65 | $82,460 |
| 15-1245 | Database Administrators and Architects | detail | US | 125,460 | $45.07 | $46.21 | $96,110 |
| | | detail | HI | 310 | $45.22 | $45.19 | $93,990 |
| 15-1250 | Software and Web Developers, Programmers, and Testers | broad | US | 1,754,750 | $49.20 | $51.44 | $106,980 |
| | | | HI | N | | | |
| 15-1251 | Computer Programmers | detail | US | 199,540 | $41.61 | $44.53 | $92,610 |
| | | detail | HI | 470 | $40.67 | $38.17 | $79,390 |
| 15-1256 | Software Developers and Software Quality Assurance Analysts and Testers | detail | US | 1,406,870 | $51.69 | $53.66 | $111,620 |
| | | detail | HI | 1,880 | $43.67 | $47.87 | $99,570 |
| 15-1257 | Web Developers and Digital Interface Designers | detail | US | 148,340 | $35.46 | $39.60 | $82,370 |
| | | detail | HI | 300 | $30.11 | $30.52 | $63,480 |
| 15-1299 | Computer Occupations, All Other | detail | US | 393,160 | $42.57 | $44.43 | $92,410 |
| | | detail | HI | 1,700 | $43.76 | $40.78 | $84,820 |
| 15-2000 | Mathematical Science Occupations | minor | US | 194,460 | $43.47 | $46.59 | $96,900 |
| | | | HI | N | | | |
| 15-2011 | Actuaries | detail | US | 22,260 | $52.09 | $58.16 | $120,970 |
| | | | HI | N | | | |
| 15-2021 | Mathematicians | detail | US | 2,630 | $50.50 | $51.57 | $107,280 |
| | | | HI | N | | | |
| 15-2031 | Operations Research Analysts | detail | US | 99,680 | $40.78 | $43.56 | $90,600 |
| | | detail | HI | 150 | $45.18 | $45.20 | $94,010 |
| 15-2041 | Statisticians | detail | US | 39,090 | $43.83 | $46.00 | $95,680 |
| | | detail | HI | 170 | $33.36 | $35.44 | $73,710 |

| Occupation code | Occupation title | Level | Where | Employ-ment | Median hourly wage | Mean hourly wage | Annual mean wage |
|---|---|---|---|---|---|---|---|
| 15-2098 | Data Scientists and Mathematical Science Occupations, All Other | detail | US | 30,810 | $45.33 | $48.35 | $100,560 |
| | | | HI | N | | | |
| 17-2061 | Computer Hardware Engineers | detail | US | 67,880 | $56.36 | $59.15 | $123,030 |
| | | detail | HI | 60 | $55.98 | $57.80 | $120,220 |
| 17-2072 | Electronics Engineers, Except Computer | detail | US | 128,800 | $50.76 | $52.99 | $110,210 |
| | | detail | HI | 450 | $49.59 | $48.86 | $101,620 |
| 25-1020 | Math and Computer Science Teachers, Postsecondary | broad | US | 82,940 | ** | ** | $90,970 |
| | | | HI | N | | | |
| 25-1021 | Computer Science Teachers, Postsecondary | detail | US | 31,800 | ** | ** | $98,430 |
| | | detail | HI | 120 | ** | ** | $102,340 |
| 49-2011 | Computer, Automated Teller, and Office Machine Repairers | detail | US | 98,260 | $19.01 | $20.23 | $42,070 |
| | | detail | HI | 450 | $17.38 | $19.65 | $40,860 |
| 51-9160 | Computer Numerically Controlled Tool Operators and Programmers | broad | US | 177,270 | $20.68 | $21.90 | $45,560 |
| | | | HI | N | | | |
| 51-9161 | Computer Numerically Controlled Tool Operators | detail | US | 151,700 | $19.81 | $20.75 | $43,170 |
| | | | HI | N | | | |
| 51-9162 | Computer Numerically Controlled Tool Programmers | detail | US | 25,570 | $27.14 | $28.72 | $59,730 |
| | | | HI | N | | | |

*Note:* * - data not reported
** - data not reported because are not annual
N - None in Hawaiʻi
The occupations in the BLS Standard Occupational Classification and Coding Structure are classified at four levels of aggregation to suit the needs of various data users: major group, minor group, broad occupation, and detailed occupation. Each lower level of detail identifies a more specific group of occupations. The 23 major groups are divided into 98 minor groups, 459 broad occupations, and 867 detailed occupations. Major groups are broken into minor groups, which, in turn, are divided into broad occupations. Broad occupations are then divided into one or more detailed occupations
Data Source: US Bureau of Labor Statistics May 2019 National Occupational Employment and Wage Estimates, United States, https://www.bls.gov/oes/current/oes_nat.htm; US Bureau of Labor Statistics May 2019 Hawaii Occupational Employment and Wage Estimates, United States,https://www.bls.gov/oes/current/oes_hi.htm

## Table 4. Occupations in Hawai‘i, May 2019

| Occupation (SOC code) | Employment(1) | Hourly mean wage | Annual mean wage(2) | Annual median wage(2) |
|---|---|---|---|---|
| All Occupations (000000) | 635,500 | $26.41 | $54,930 | $44,400 |
| Computer and Information Systems Managers (113021) | 990 | $61.27 | $127,450 | $121,420 |
| Computer and Mathematical Occupations (150000) | 10,890 | $39.32 | $81,790 | $79,040 |
| Computer Hardware Engineers (172061) | 60 | $57.80 | $120,220 | $116,430 |
| Total CS | 11,940 | $41.23 | $85,769 | |

(1) Estimates for detailed occupations do not sum to the totals because the totals include occupations not shown separately. Estimates do not include self-employed workers.
(2) Annual wages have been calculated by multiplying the corresponding hourly wage by 2,080 hours.
SOC code: Standard Occupational Classification code -- see http://www.bls.gov/soc/home.htm
Date extracted: April 10, 2020

# DEGREE PROGRAMS

Computer science as a discipline emerged in the early 1960s (Appianing & Eck, 2015; Hanson et al., 2000; Werner et al., 2004) with conferences that engendered conversations around the nature of computer science what the new discipline should include, and whether universities should offer CS programs (Gupta, 2007). One of earliest curriculum efforts in computer science from Atchison et al. (1968) of the Association of Computing Machinery presented a classification system with over 22 courses. Topics included algorithms, programming languages, debugging and verification, application, data representation, symbolic coding, computer systems and organization, and logic design, among others (Atchison et al., 1968; Austing et al., 1979). There was a heavy emphasis on mathematics and logic. In the first census on aptitudes in 1960, Project TALENT, computer science was not yet a career field, but was mentioned only in relation to computers doing input and output runs and analysts allowing analysis tapes to run (Flanagan, 1960). The report attempted to understand 1960s youth in areas like mathematical readiness for college calculus or mechanical aptitude to become a garage mechanic. In recent years, computer science is often discussed within the science, technology, engineering, and mathematics (STEM) disciplines. In 2016–17, 376,825 STEM degrees were awarded in the United States (see Table 5).

Computer science programs now number in the hundreds at institutions of higher education, and graduates of these programs have likely entered into the workforce. Data USA (2020) identified as 2.06 million CS workers in the 2018 workforce. The Data USA site also indicated that the CS workforce was projected to grow by 4.78%, based on data from the Census Bureau. Computer systems design is the industry that employs the most computer science graduates (22.5%). This is followed by colleges and universities (4.36%), consulting services (3.38%), banking (3.24%), insurance carriers (3.05%), K–12 schools (2.79%), hospitals (2.5%), and financial investment services (2.15%). The U.S. Department of Education reported 71,420 bachelor’s degrees and 46,555 master’s degrees awarded in computer and information sciences in 2017 as seen in Table 6.

## Table 5. Number and Percentage Distribution of Science, Technology, Engineering, and Mathematics (STEM) Degrees/Certificates Conferred by Postsecondary Institutions, by Race/ Ethnicity, Level of Degree/Certificate, and Gender of Student, 2016–17

| Number of STEM degrees/certificates conferred to U.S. citizens, permanent residents, and nonresident aliens | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Gender and degree | Total | White | Black | Hispanic | Asian/Pacific Islander | | | American Indian/ Alaska Native | Two or more races | Non-resident alien |
| | | | | | Total | Asian | Pacific Islander | | | |
| "Total, all levels of degrees/certificates | | | | | | | | | | |
| Total | 704,580 | 367,087 | 49,846 | 74,438 | 71,618 | 70,312 | 1,306 | 3,240 | 20,493 | 117,858 |
| Male | 478,601 | 256,733 | 30,896 | 50,055 | 44,486 | 43,571 | 915 | 2,180 | 12,979 | 81,272 |
| Female | 225,979 | 110,354 | 18,950 | 24,383 | 27,132 | 26,741 | 391 | 1,060 | 7,514 | 36,586 |
| Bachelors | | | | | | | | | | |
| Total | 376,825 | 221,607 | 24,428 | 40,387 | 48,041 | 47,377 | 664 | 1,328 | 13,389 | 27,645 |
| Male | 242,262 | 146,812 | 13,430 | 25,141 | 28,840 | 28,408 | 432 | 827 | 8,103 | 19,109 |
| Female | 134,563 | 74,795 | 10,998 | 15,246 | 19,201 | 18,969 | 232 | 501 | 5,286 | 8,536 |
| Masters | | | | | | | | | | |
| Total | 139,312 | 40,990 | 5,459 | 5,670 | 10,836 | 10,715 | 121 | 235 | 2,096 | 74,026 |
| Male | 93,767 | 27,836 | 3,163 | 3,714 | 6,815 | 6,737 | 78 | 150 | 1,310 | 50,779 |
| Female | 45,545 | 13,154 | 2,296 | 1,956 | 4,021 | 3,978 | 43 | 85 | 786 | 23,247 |
| Doctoral | | | | | | | | | | |
| Total | 28,544 | 11,653 | 720 | 1,123 | 2,110 | 2,092 | 18 | 56 | 461 | 12,421 |
| Male | 18,892 | 7,514 | 377 | 669 | 1,255 | 1,245 | 10 | 35 | 273 | 8,769 |
| Female | 9,652 | 4,139 | 343 | 454 | 855 | 847 | 8 | 21 | 188 | 3,652 |

Data Source: Bureau of Labor Statistics. Table 318.45. Number and percentage distribution of science, technology, engineering, and mathematics (STEM) degrees/certificates conferred by postsecondary institutions, by race/ethnicity, level of degree/certificate, and sex of student: 2008-09 through 2016-17, Table generated April 14, 2020, https://nces.ed.gov/programs/digest/d18/tables/dt18_318.45.asp

## Table 6. Computer Sciences Degrees Conferred by Postsecondary Institutions, 2014–2017

| State or jurisdiction | 2014–2015 | | 2015–2016 | | 2016–2017 | |
|---|---|---|---|---|---|---|
| | Bachelor's | Master's | Bachelor's | Master's | Bachelor's | Master's |
| United States | 59,581 | 31,474 | 64,405 | 40,128 | 71,420 | 46,555 |
| California | 5,398 | 2,498 | 5,976 | 3,487 | 7,188 | 4,008 |
| New York | 3,968 | 3,326 | 4,685 | 3,955 | 5,450 | 4,496 |
| Pennsylvania | 3,125 | 1,828 | 3,231 | 1,929 | 3,851 | 1,996 |
| Texas | 3,053 | 2,839 | 3,347 | 3,975 | 3,743 | 3,839 |
| Florida | 3,258 | 1,083 | 3,613 | 1,294 | 3,712 | 1,542 |
| Maryland | 2,988 | 2,187 | 3,147 | 2,177 | 3,478 | 2,375 |
| Illinois | 2,496 | 2,486 | 2,782 | 3,366 | 2,867 | 3,848 |
| Virginia | 2,573 | 968 | 2,588 | 1,471 | 2,654 | 1,735 |
| Massachusetts | 2,000 | 1,432 | 2,254 | 1,686 | 2,644 | 1,869 |
| ... | | | | | | |
| Delaware | 196 | 214 | 201 | 297 | 197 | 234 |
| Nevada | 162 | 28 | 213 | 73 | 191 | 61 |
| New Mexico | 195 | 81 | 189 | 108 | 187 | 103 |
| Hawai‘i | 213 | 68 | 178 | 39 | 178 | 24 |
| North Dakota | 120 | 17 | 139 | 27 | 163 | 31 |
| Maine | 121 | 11 | 118 | 9 | 126 | 18 |
| U.S. Service Academies | 123 | 0 | 138 | 0 | 114 | 0 |
| Montana | 75 | 21 | 100 | 12 | 99 | 17 |
| Wyoming | 25 | 11 | 32 | 2 | 42 | 8 |
| Alaska | 33 | 4 | 26 | 2 | 33 | 4 |
| Guam | 15 | 0 | 15 | 0 | 10 | 0 |
| U.S. Virgin Islands | 4 | 0 | 9 | 0 | 9 | 0 |

*Note:* Data are sorted from most to least bachelor's degrees awarded in 2016–2017. Middle 30 ranked states are not shown. Data are for postsecondary institutions participating in Title IV federal financial aid programs This table includes only those jurisdictions with 4-year institutions.
Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Fall 2015, Fall 2016, Fall 2017, Completions component Table 319.30 Bachelor's degrees conferred by postsecondary institutions, by field of study and state or jurisdiction and Table 319.40 Master's degrees conferred by postsecondary institutions, by field of study and state or jurisdiction

Throughout the U.S. in 2016–17, there were 71,420 bachelor's degrees and 46,555 master's degrees awarded. Computer science represented 3.65% and 5.79% of that total respectively. Across the ten major fields of study,[14] computer science has the least graduates; the largest is in business (381,353, 19.5%). The states with the highest number of graduates were California with 7,188 (3.39%) and New York 5,450 (3.90%), but the states with the highest percentage of computer science bachelor's degrees awarded were Maryland (10.18%) and Utah (6.88%).

# COMPUTING AND THE HAWAIʻI ECONOMY

Following national trends, Hawaiʻi has steadily recognized the importance of the tech sector to its economy as computing jobs have risen to be the number one source of all new wages in the U.S.; computing jobs are projected to be 58% of all new jobs in STEM by 2024 (Figure 4). Hawaiʻi, between May 2009 and May 2015, added 2,380 STEM jobs, a STEM employment growth of 9.8%. STEM jobs make up 5.0%, or 22,630, of jobs in urban Honolulu (Fayer et al., 2017).

## 2016–17 in Hawaiʻi

**178 bachelor's and 24 master's degrees in CS awarded**

**Hawaiʻi ranked 32nd in U.S. states in percentage of CS degrees awarded**

To keep up with the demand of the industry's growth, the tech industry will require a sizable number of well-trained Hawaiʻi residents who are equipped for the computing jobs of tomorrow. In 2005, the alarm was raised on Hawaiʻi not having enough computer science engineers and high-tech professionals.[15] In 2017, Hawaiʻi tech industry professionals continued to express that there may not be enough residents who can lead the tech industry in innovation, and the few who are trained in computer science and engineering tend to leave the Islands for more lucrative and innovative companies on the mainland.[16] A similar sentiment was made by our industry partners interviewed for this report, who estimated there were about 1,500 unfilled computer science jobs in Hawaiʻi. This catch-22 scenario has left a critical gap between the demands of the industry and the availability of a trained workforce.

In a review of the most recent data from 2016–17, 178 bachelor's and 24 master's degrees in computer science were awarded in Hawaiʻi post-secondary schools. The percentage of computer science degrees awarded in Hawaiʻi was 2.61% and 1.38% of bachelor's and master's degrees respectively, which was lower than the national average.[17] Hawaiʻi was the sixth lowest in number of graduates earning computer science bachelor's degrees; states with lower numbers were Alaska, Wyoming, Montana, Maine, and North Dakota. By percentage of bachelor's degrees awarded, Hawaiʻi ranked 32nd.

Before even attending college, of concern is that the number of Hawaiʻi students who take the AP exams and send their scores to mainland universities and colleges is increasing at a higher rate than to local Hawaiʻi universities and colleges. Between 2018 and 2019, there was a decrease of 7.5% of all AP exam scores from Hawaiʻi being sent to local postsecondary institutions and an increase of 18.9% to mainland institutions. As seen in Table 7, the difference for AP CS exams was more pronounced, with a decrease of 47.9% being sent to local postsecondary institutions and an increase of 62.2% to mainland institutions. Students increasingly sending scores outside of Hawaiʻi suggests more students with CS aptitude are applying to mainland institutions, which may result in a smaller set of students who earn CS degrees in Hawaiʻi (Table 8) and remain in Hawaiʻi to contribute to our society, economy, and industrial growth. Some of the increase to U.S. mainland institutions might be influenced by a 2014 bill in California where the University of California and California State University systems redesigned their admissions to allow computer science to satisfy advanced mathematics requirements for undergraduate admissions.

Because of the urgency to fill the existing gap, Hawaiʻi legislative, community, and business leaders recognize the need to prioritize STEM education, which includes computer science. Students who have a strong foundation in STEM and computer science are essential to Hawaiʻi's future economic stability. Recognizing the need to diversify the state's economy beyond tourism has prompted lawmakers to invest funding and resources in computer science education (Act 51). Maui Economic Development Board's (MEDB) proactive commitment to development of the tech industry has led to Maui County being a leader in computing initiatives, including 32 STEM programs.[18] MEDB was also instrumental in the development of Maui High Performance Computing Center, Maui Research and Technology Park, Maui Research and Technology Center, and Women in Technology (WIT). STEMworks was launched by WIT in 2018 and became Code.org's regional partner in Hawaiʻi.

## Table 7. AP CS Reports from Hawaiʻi Designated for In- or Out-of-State Colleges, 2017–2019

| | CS A | | | CS Principles | | | CS A and Principles | | |
|---|---|---|---|---|---|---|---|---|---|
| | In State | Out of State | Total | In State | Out of State | Total | In State | Out of State | Total |
| 2017 | 14 | 30 | 44 | 23 | 78 | 101 | 37 | 108 | 145 |
| 2018 | 48 | 43 | 91 | 48 | 105 | 153 | 96 | 148 | 244 |
| % change | 242.86% | 43.33% | 106.82% | 108.70% | 34.62% | 51.49% | 159.46% | 37.04% | 68.28% |
| 2019 | 39 | 70 | 109 | 11 | 170 | 181 | 50 | 240 | 290 |
| % change | -18.75% | 62.79% | 19.78% | -77.08% | 61.90% | 18.30% | -47.92% | 62.16% | 18.85% |

Data Source: AP College Board, table created June 15, 2020, https://apcentral.collegeboard.org/about-ap/ap-data-research

# ACT 51: LEGISLATIVE MANDATE TO IMPLEMENT CS IN PUBLIC SCHOOLS

As described previously, in 2018 the Hawaiʻi legislature passed Act 51 (HB 2607), creating two major mandates for developing a statewide computer science program in Hawaiʻi. The two mandates were to (1) develop and implement a statewide computer science curriculum plan for public school students in kindergarten through twelfth grade that may include design thinking as part of the curriculum; and (2) beginning with the 2021–2022 school year, ensure that each public high school offers at least one computer science course during each school year [L 2018, c 51, pt of §2]. Furthermore, $500,000 was allocated from state general funds for fiscal year 2018–19 to the HIDOE to develop a computer science curriculum plan, offer computer science classes, and contract for teacher development programs. The funding allocated for Act 51 was dispersed during fiscal year 2018–19.[19]

Act 51 went into effect on July 1, 2018, and it pushed the conversation about CS education to the forefront with a unified message that computer science education is a "matter of statewide concern." In its official legislative report, the state recognized that "computer science has the potential to drive job growth and innovation throughout the economy." The language of the Act also identified that although Hawaiʻi had thousands of open computing jobs with higher than average salary, only 155 Hawaiʻi college students graduated with a CS degree in 2014 and only 14 public schools offered AP Computer Science courses in SY 2015–16. The number of high schools that offer AP CS has since increased to 22 high schools, excluding e-school offerings.

## Table 8. Computer Science Degrees Awarded in Hawaiʻi Higher Education Institutions, 2009 and 2018

| | 2018 CIS | | | | | | 2009 CIS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NH or PI | | | Grand total | | | Asian, NH, or PI | | | | | |
| Institution Name | Total | Men | Women | All | Men | Women | Total | Men | Women | All | Men | Women |
| Argosy University-Hawaiʻi | 3 | 2 | 1 | 4 | 3 | 1 | | | | | | |
| Brigham Young University-Hawaiʻi | 2 | 1 | 1 | 36 | 29 | 7 | 5 | 5 | 0 | 30 | 26 | 4 |
| Chaminade University of Honolulu | 1 | 1 | 0 | 2 | 2 | 0 | 8 | 3 | 5 | 9 | 4 | 5 |
| Hawaiʻi Community College | 0 | 0 | 0 | 6 | 5 | 1 | 3 | 1 | 2 | 6 | 4 | 2 |
| Hawaiʻi Pacific University | 0 | 0 | 0 | 44 | 36 | 8 | 22 | 15 | 7 | 83 | 68 | 15 |
| Honolulu Community College | 1 | 0 | 1 | 48 | 42 | 6 | 9 | 9 | 0 | 10 | 10 | 0 |
| Kapiʻolani Community College | 0 | 0 | 0 | 22 | 17 | 5 | 12 | 9 | 3 | 16 | 13 | 3 |
| Leeward Community College | 1 | 0 | 1 | 49 | 27 | 22 | 5 | 5 | 0 | 6 | 6 | 0 |
| University of Hawaiʻi at Hilo | 1 | 1 | 0 | 16 | 13 | 3 | 1 | 1 | 0 | 13 | 10 | 3 |
| University of Hawaiʻi at Mānoa | 1 | 1 | 0 | 89 | 74 | 15 | 35 | 27 | 8 | 43 | 34 | 9 |
| University of Phoenix-Hawaiʻi | 4 | 3 | 1 | 59 | 54 | 5 | 6 | 4 | 2 | 29 | 24 | 5 |

*Note.* NH = Native Hawaiian, PI = Pacific Islander; CIS = Computer Information Sciences
Data source: USDOE IPEDS, Table generated June 26, 2020

Historical analysis of Act 51 reveals that the bill, as it was originally proposed, urged that CS be allowed to meet core graduation requirements, stating that HIDOE "permit students attempting to graduate from public high schools to fulfil some math and science requirements through the satisfactory completion of computer science coursework" and "requiring the University of Hawai'i to permit applicants to fulfill certain admission requirements by demonstrating the satisfactory completion of high school computer science coursework."[20] These two provisions were not included in the final text of the Act; however, they reflect an acknowledgement that the University of Hawai'i, the major public university system in Hawai'i with 10 campuses across the state, plays an important role in increasing CS participation among public school students. These provisions also represent a growing agreement among educators that availability does not always lead to participation (Martin et al., 2015). Growing access will need to be accompanied by an incentive to participate. For example, in 2014, CA passed SB 1200, which called on the University of California and California State University systems "to develop guidelines for high school computer science courses that would satisfy advanced math subject matter requirements for undergraduate admissions."[21]

To meet the mandates of Act 51, the state legislature provided HIDOE with dedicated funding with the requirement that the $500,000 be encumbered by the end of the 2018–19 fiscal year. Funding provided by Act 51 was expended as follows:

- $142,480 (28%) = CS Innovation Grants that focused on K–8 efforts to prepare students for high school CS courses[22]
    - 'Aiea Complex Area: Learning a Little BIT of Science
    - Nānākuli High and Intermediate: Data Driven Instructional Cycle (DDIC) framework
    - Waiākea Elementary and Intermediate: WES and WIS Collaborating for 21st Century Success
- Approx. $77,000 (15%) = Professional development sessions provided by Apple: Learn to Code, Oceanit, Computational Thinkers, and CodeHS
- iTEaCH conference, June 2019
- Restricted funds

# INDUSTRY AND NON-PROFIT PARTNERS

A number of nonprofit organizations and industry professionals, both local and national, have participated in discussions of the articulation and implementation of the state's goals towards broadening participation in computer science. Some have offered training opportunities for teachers while others have provided internship experiences for students. While the list below is not exhaustive, it provides a fair assessment of influential HIDOE community partners who possess the expertise or resources to aid in future CS education efforts.

## Expanding Computing Education Pathways (ECEP)

ECEP Alliance is a multi-state collaborative effort between educational agencies whose mission is to promote state-level policies and systemic changes in improving the quality of computing education and broadening participation. ECEP's initiatives are based on the NSF-funded Broadening Participation in Computing (BPC) project. ECEP currently supports 23 member states and territories, including Hawaiʻi, which joined ECEP in 2018. Website: https://ecepalliance.org/

## CSforALL

In 2016 President Obama allocated $20 million to support Computer Science for All (CSforALL) Researcher Practitioner Partnerships to develop a strategic framework for integration of computer science and computational thinking in K–12 education. CSforALL consortium was formed to serve as a local support for schools and districts in advancing CS education. It is a nonprofit member organization of diverse stakeholders with over 500 members, including the HIDOE. CSforALL employs local expert educators to conduct teacher professional development training in Hawaiʻi.[49] Website: https://www.csforall.org/

## CSTA Hawaiʻi Chapter

### CSTA Hawaiʻi Chapter

Computer Science Teachers Association (CSTA) Hawaiʻi is a local chapter of the national CSTA organization. Led by CS teachers both in public and private schools, the organization strives to further the mission of CSTA and offer professional development opportunities for CS teachers in Hawaiʻi. Website: https://hawaii.csteachers.org/

## AP College Board

Since 1955, the Advanced Placement Program has enabled millions of students to take college-level courses and earn college credit, advanced placement, or both while still in high school. The AP College Board is a mission-driven not-for-profit organization that connects students to college success. They describe themselves as a dynamic, member-led, mission-driven not-for-profit organization governed by an elected Board of Trustees with guidance from three national assemblies and six regional assemblies. More than 6,000 two- and four-year colleges, universities, secondary schools and districts, higher education systems, and other nonprofit organizations compose the College Board. Website: https://apcentral.collegeboard.org/

## STEMWorks

STEMWorks describes itself as an innovative, impactful, and relevant approach to Science, Technology, Engineering and Math (STEM) education, the flagship program of Maui Economic Development Board's (MEDB) Women in Technology project. On its website, STEMworks is described as a STEM service-learning initiative designed to build critical thinkers and solution creators through project-based, service-oriented student learning. As a regional partner for Code.org, STEMWorks coordinates and conducts summer and year-long professional development sessions for CS teachers. The Professional Learning program caters primarily to middle and high school teachers in grades 6–12, but also provides some training in CS fundamentals for elementary school teachers. The sessions are conducted by Code.org facilitators. CSTA approved the Code.org curriculum for elementary and middle schools. Website: https://www.stemworkshawaii.org/

## CSP4Hawaii

Maui College is currently completing a 3-year program that supports the deployment of AP CSP courses statewide through teacher professional development. The project is supported by a $1 million grant from NSF (STEM+C program, NSF Award #1738824) from October 2017 to September 2020. In its first two years the program conducted training workshops for 36 Hawai'i high school teachers. Its ultimate goal is to train 60 teachers across 30 HIDOE high schools to teach the AP CSP course. Website: http://maui.hawaii.edu/csp4hi/

# INDUSTRY AND NON-PROFIT PARTNERS

## Code.org

Code.org® is a nonprofit dedicated to expanding access to computer science in schools and increasing participation by women and underrepresented youth. Their vision is that every student in every school has the opportunity to learn computer science, just like biology, chemistry or algebra. Code.org describes itself as providing the leading curriculum for K–12 computer science in the largest school districts in the United States, and they also organize the annual Hour of Code campaign which has engaged more than 15% of all students in the world. Code.org provides professional learning for teachers in CS Fundamentals (K-5), Exploring Computer Science or Computer Science Discoveries, and Computer Science Principles. Website: https://code.org/

## Maui Educational Consortium

UH Maui College is a member of the CSforAll consortium and has collaborated with Maui County K–12 schools and community agencies to "build community capability to improve computer science education student learning and achievement, and work to connect students to a wealth of UHMC learning resources." This collaborative effort is geared toward middle school students in grades 6–8. Website: https://www.csforall.org/members/university_of_hawaii_maui_college/

## Girls Who Code

Girls Who Code is a national non-profit organization and does not have a formal local chapter. They state that they are on a mission to close the gender gap in technology and to change the image of what a programmer looks like and does. They are driven by the fact that in 1995, 37% of computer scientists were women but decreased to 24% in 2017 and projected to be 22% in 2022. With recognition that the biggest drop off of girls in computer science is between the ages of 13 and 17, Girls Who Code offers in-person programming including their Summer Immersion Program, Clubs, and College Loops. Website: https://girlswhocode.com/

## Hawai‘i Society for Technology in Education (HSTE)

HSTE is an affiliate member of the International Society for Technology in Education (ISTE), a nonprofit professional organization with a focus on technology assisted learning worldwide. HSTE operates as a member organization providing curriculum resources, networking opportunities, training seminars, and general community support to its members, many of whom are HIDOE teachers. Website: http://www.hste.org/

## Oceanit Research Foundation

The Oceanit Research Foundation is an organization focused on positively impacting the community through lifelong learning, innovative curriculum, community outreach, and STEM missions that benefit all students. Their primary initiative is SURF, or Social Utilization of Resources for the Future, which aims to empower organizations and communities around Hawai'i—and the world—to apply disruptive innovation mindsets to public education and lifelong learning. SURF encompasses three core programs: Altino Coding, Aloha AI, and Design Thinking.

In working with educators, Oceanit hopes that those who learn from SURF workshops become advocates for seeding Design Thinking, Computer Science, and Artificial Intelligence superpowers in the students of tomorrow. They believe that educators will lead the charge to empower students to pursue new disciplines never before taught in Hawai'i schools and that these educators and collaborators will create the next generation, who in turn will launch and lead the future economy. Website: https://www.oceanitfoundation.org/

## HawaiiKidsCAN

HawaiiKidsCAN advocates for the success of every Hawai‘i student, from pre-K through college and career. They aim to improve policy to help all students thrive and share promising practices and stories to demonstrate that all kids CAN succeed. HawaiiKidsCAN has made computer science a campaign priority, and developed a research report, State of Computer Science Education in Hawaii 2018.
Website: https://hawaiikidscan.org/

# INDUSTRY AND NON-PROFIT PARTNERS

## More Partners and Supporters

In addition to all ten campuses of the University of Hawai‘i system, other partners in computer science education conversations during the SY 2019–20 are listed below.

Air Force Association Hawai‘i
American Savings Bank
CyberPatriot
Apple, Inc.
Bytemarks Cafe and Hawaii Open Data
Computational Thinkers
CTE Office of the State Director
Dell Technologies
DevLeague
eWorld Enterprise Solutions
Extreme Networks
Google Education
Hawai‘i Association of Independent Schools
Hawai‘i High School Athletic Association
Hawai‘i P–20
Hawai‘i State Legislature
HE‘E Coalition
Hawai‘i Pacific University CS
‘Iolani School
Mānoa Academy
Microsoft Hawai‘i
Mid-Pacific Institute
National Security Agency Central Security Service
NCWIT Hawai‘i Affiliate
Network 2000
Office of the Governor
PCG Enterprises (PC Gamerz)
Punahou School
Purple Mai'a
SecondWave Technologies
St. Andrew’s Schools
State of Hawai‘i - Office of Enterprise Technology Services

# DATA COLLECTION

## INDUSTRY AND NON-PROFIT FOCUS GROUPS

Three one-hour focus group interviews were conducted with industry and non-profit partners to better understand some of their thinking and to hear their perspectives on computer science education in Hawai'i. Thirty-three industry and non-profit partners participated in the discussions. Five guiding questions were posed to the groups: 1) What are your needs as our industry partners? 2) What are the major barriers to or supports for schools being able to teach computer science? 3) What are the major supports available or not available in our state? 4) What would you like to see or not see in our state? 5) Do you have any concerns about the direction of computer science in our state? Four major themes emerged across the three discussions.

### Students developing transferable skills was important.

The first major theme was that **students developing transferable skills was more important** to the industry and non-profit discussion participants than students learning specialized knowledge in computer science. During discussions, most participants shared that they did not have formal degrees in computer science, but have learned their way into it by being creative and collaborative. People skills, teamwork, and problem-solving skills were more valued by their leadership than any particular computer science knowledge. In some cases, they clarified that specific computer science knowledge can be learned and refined while on the job. By extension, some industry participants indicated that they were slightly alarmed by the push for students to earn associate degrees a few months immediately out of high school. Two industry partners stated that they would prefer a student attend college for a few years to gain more experience; they would not hire a student out of high school. They indicated that in addition to transferable skills, the ability to self manage multiple projects were likely not developed yet in high school. Computer science knowledge, they maintained, should grow and evolve beyond high school.

### Students should be exposed to computer science ideas at an early age.

But even with transferable skills being more important to the focus group participants, a second major theme that emerged was the **importance of exposure to computer science ideas at an early age.** They made the point that instilling that curiosity early was important—that curiosity could lead to continued exploration as adolescents had meaningful experiences like internships in upper grades. They pointed back to their own non-computer science degrees and said that their knack for problem solving and being creative are what led them to careers in computer science. Many recounted stories of their youth and the importance of teachers nurturing their curiosity.

### Teachers were struggling and need support.

With teachers being so important to student learning, teacher knowledge of computer science was also quickly identified as a major barrier, which is the third theme. Participants recognized that **teachers were struggling and need support.** Teacher knowledge and understanding of computer science was characterized as sometimes "fuzzy at best" by one participant. Participants did agree that all teachers with whom they have interacted have been great partners. However, even if teachers had great enthusiasm, participants noted that misinformation is still wrong information. Most teachers did not have computer science exposure or training, so to expect them to carry forward a state vision for computer science was unreasonable. If they could, the industry participants shared that they would want to partner with teachers to provide the content knowledge while the teachers provided the pedagogy. In that partnership, they would share more about artificial intelligence, big data, and conversations around ethics. They cautioned that computer science is a changing field with many jobs not yet in existence. So, having a teacher keep up with all the changes was difficult.

**Computer-science oriented students are leaving Hawai'i.**

The last theme was an **alarming concern for computer science-oriented students leaving Hawai'i**. During all three discussions, participants stated that there were about 1,500 jobs in CS or CS-related fields but only 160 college graduates in CS in Hawai'i. Students who excelled were being recruited by mainland companies and enticed with larger salaries. Industry participants talked about their disappointment when they work with students, only to have those students receive offers to California, for example, and seeming like the students are not getting counseled more to stay in Hawai'i instead. They are happy that students are recognized for their potential and are recruited, but they are cognizant that it means that a bright mind is leaving Hawai'i. Industry partners connected students leaving to an economics argument. If there are about 1,500 jobs open, and the beginning salary is about $65,000, that means a loss of $15 million in taxes that the state cannot collect from $95 million payroll. The participants considered it both an intellectual loss for Hawai'i as well as an economic one.

Overall, the sentiment by the industry and non-profit partners who participated in the discussions is that they want to help the schools since the product of the schools is the workforce they employ. But, they emphasized that it is not enough to increase the numbers of computer science courses in schools. There is a need to address the confusion around computer science first before greatly increasing its presence in schools.

# COMPUTER SCIENCE SURVEY

In Spring of 2020, HIDOE, in partnership with CRDG, conducted a district wide survey (CS survey) in preparation for the landscape report. To collect the data from the different complex areas, the survey was divided into 15 identical online forms—one for each complex area—and distributed to complex area CS leads to share with their respective school administrators, teachers, and curriculum coordinators. The questions varied depending on the professional role of the respondent. Complex area superintendents were asked to approve distribution to individual schools, which resulted in diverse methods and timing of the survey release. The surveys and questions were created by the HIDOE CS team, while the data analysis was conducted by the CRDG team. All data collection efforts were approved by the Institutional Research Board of the University of Hawai'i (see Appendix 1).

Overall, there were 492 responses to the survey from 186 schools, which represents 72.7% of all HIDOE schools. Among the respondents, 243 were teachers, 149 were school administrators, and 100 were curriculum or technology coordinators. The majority of the respondents were employed at the elementary school level (76%), and correspondingly, most of the teacher responses (80%) in the survey represent grades 1–5. At the time of the survey distribution, HIDOE did not yet have ACCN course codes at the elementary school level. The elementary CS course data in this report is therefore incomplete, and as such, the data may be skewed in its underrepresentation of CS at the elementary level. Detailed data on survey participation across all complex areas can be found in Table 9.

## Table 9. CS Survey Participation

| | Respondent Type | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Complex Area | # of Responses | # of Schools Responding | # of Schools In Complex Area | % of Schools Represented in the Survey | Number of Enrolled Students | Curriculum Coordinator or Other Teacher Support | School Administrator | Teacher |
| ʻAiea-Moanalua-Radford | 23 | 16 | 22 | 72.73% | 14,287 | 5 | 6 | 12 |
| Baldwin-Kekaulike-Maui | 81 | 16 | 20 | 80.00% | 15,946 | 12 | 13 | 56 |
| Campbell-Kapolei | 59 | 15 | 17 | 88.24% | 17,299 | 14 | 8 | 37 |
| Castle-Kahuku | 7 | 6 | 16 | 37.50% | 7,847 | 3 | 2 | 2 |
| Farrington-Kaiser-Kalani | 37 | 25 | 25 | 100.00% | 15,587 | 1 | 31 | 5 |
| Hāna-Lahainaluna-Lānaʻi- Molokaʻi | 21 | 11 | 11 | 100.00% | 5,105 | 3 | 12 | 6 |
| Hilo-Waiākea | 15 | 9 | 13 | 69.23% | 7,893 | 1 | 9 | 5 |
| Honokaʻa-Kealakehe-Kohala-Konawaena | 10 | 6 | 19 | 31.58% | 10,061 | 1 | 6 | 3 |
| Kailua-Kalāheo | 11 | 10 | 14 | 71.43% | 6,310 | 10 | | 1 |
| Kaimukī-McKinley-Roosevelt | 75 | 28 | 28 | 100.00% | 14,103 | 29 | 27 | 19 |
| Kapaʻa-Kauaʻi-Waimea | 7 | 7 | 16 | 43.75% | 9,289 | 1 | 2 | 4 |
| Kaʻu-Keaʻau-Pāhoa | 6 | 4 | 9 | 44.44% | 5,457 | 2 | 3 | 1 |
| Leilehua-Mililani-Waialua | 8 | 7 | 20 | 35.00% | 16,347 | 2 | 3 | 3 |
| Nānākuli-Waianae | 21 | 9 | 9 | 100.00% | 7,286 | | 9 | 12 |
| Pearl City-Waipahu | 111 | 17 | 17 | 100.00% | 14,637 | 16 | 18 | 77 |
| Total | 492 | 186 | 256 | 75.39% | 167,454 | 100 | 149 | 243 |

# COMPUTER SCIENCE IN THE HAWAIʻI PUBLIC SCHOOL SYSTEM

As described previously, Hawaiʻi Department of Education experienced a growth in computer science education activities between 2017 and 2020. In the HIDOE 2030 Promise Plan, computer science is even identified as one of five strategies that schools can use to guide their school design.[23] Following is a description of CS education activities and perceptions of those activities that emerged from the online survey.

## CONCEPTS FROM ADOPTED CS STANDARDS

In May of 2018, the Hawaiʻi Board of Education unanimously voted to adopt the K–12 Computer Science Teachers Association (CSTA) Standards. The CS leads for each complex area have received information about the standards for dissemination to all schools in their respectives complex areas.

Developed by a consortium of CS educators, the CSTA standards identify "a set of learning objectives designed to provide the foundation for a complete computer science curriculum and its implementation at the K–12 level."[24] CSTA standards emphasize the importance of early introduction of computer science at the elementary school level, integration of CS into the STEM curriculum, and increasing availability of rigorous CS courses for diverse learners. The standards identify five core concepts that must be addressed in all foundational CS courses:

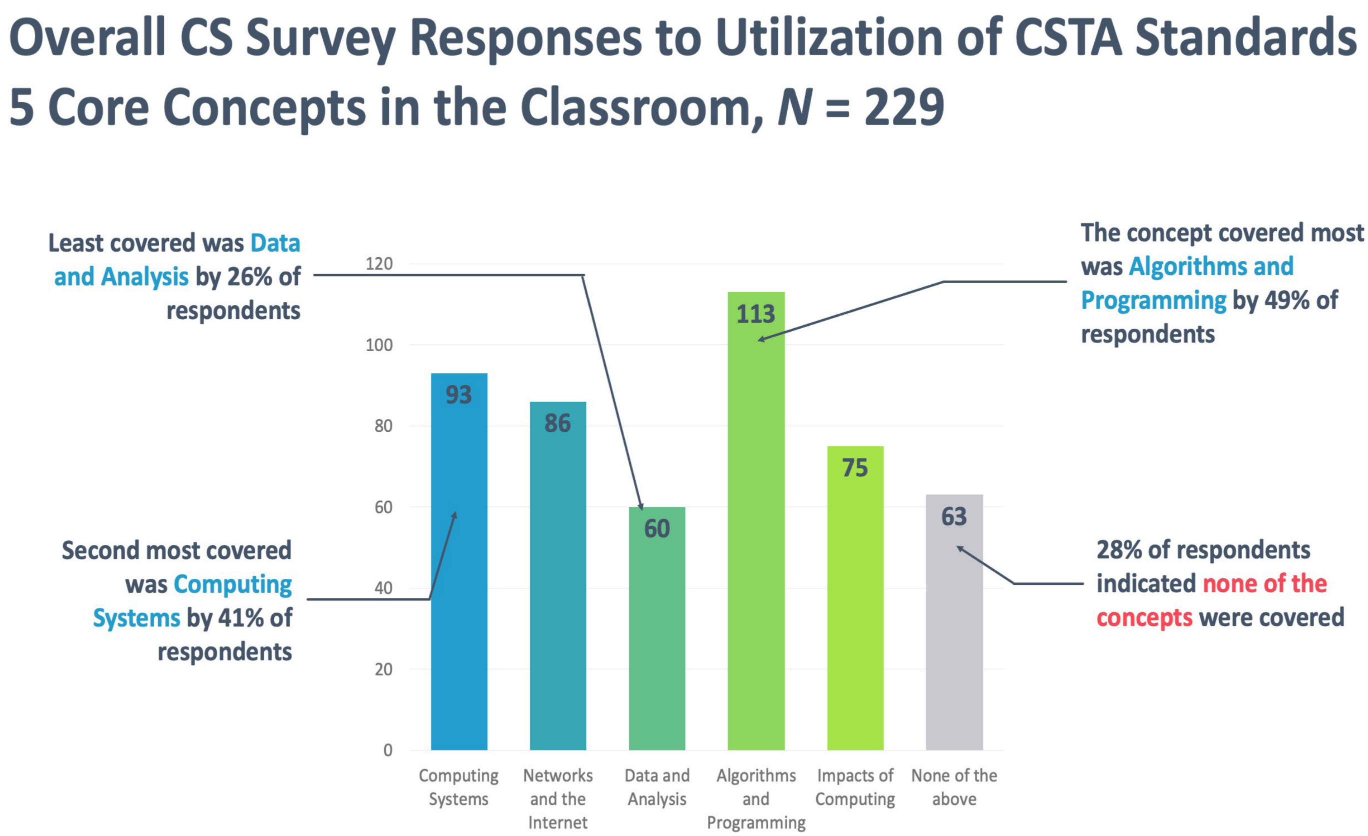
- Computing Systems
- Networks and the Internet
- Data and Analysis
- Algorithms and Programming
- Impacts of Computing

Following in Figure 5 is a snapshot report of the entire state based on the CS survey results. Snapshot reports of each complex area, based also on the CS survey results, can be found in Appendix 4.

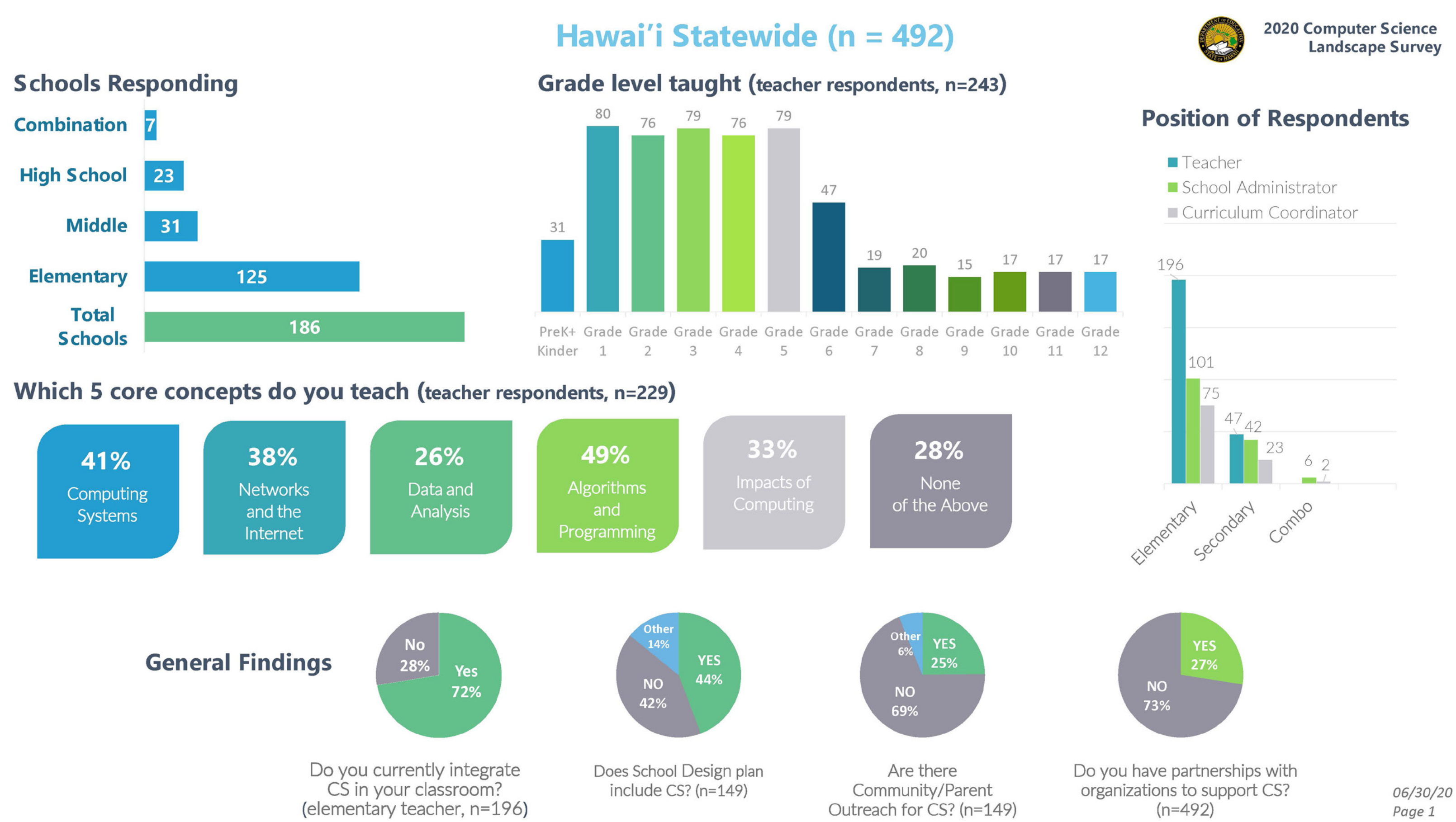
When asked in the CS survey which of the five core concepts the teachers taught in the classroom, the most commonly taught concept was "Algorithms and Programming" (49%), and the least commonly taught was "Data and Analysis" (26%) (Figure 6). The emphasis on algorithms and programming corresponds to the heavy leaning of professional development on coding-focused providers.

A full set of responses by complex areas to the survey about utilization of the five core concepts can be found in Table 10.

## Figure 6. CS Survey Responses to Utilization of CSTA Standards 5 Core Concepts



# Figure 5. CS Survey Statewide Snapshot Report



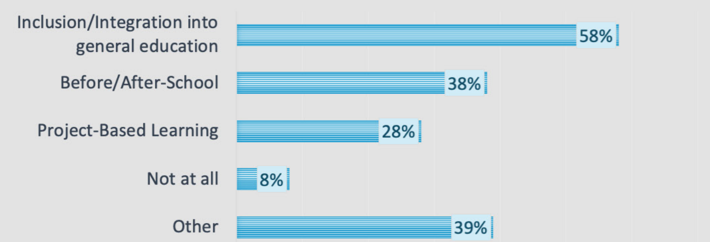
# Hawai'i Statewide (*N* = 492)

**Number of schools**
(excluding charter)
**256**

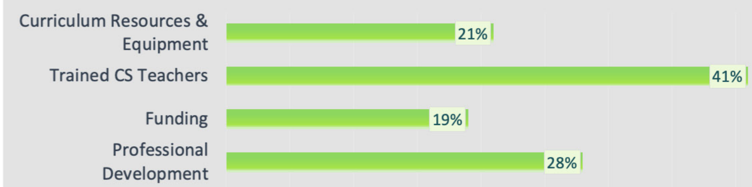
**Percentage of schools represented in the survey**
**72.66%**

**Students enrolled in CS-designated courses (SY19-20)**
**10,377**

## How is CS education offered at your school? (n=244)

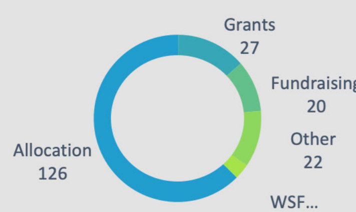



## In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=492)

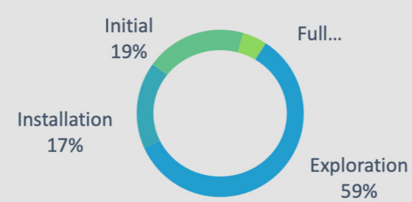



*top 4 selections

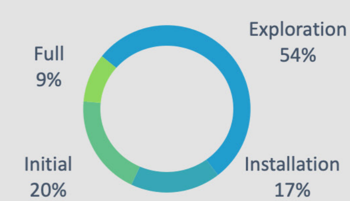
## How is CS funded?
(n=149; check all that apply)




## Implementation for School Design Phase (n=149)




## Implementation for Equity and Access Phase (n=149)

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*Page 2*

## Table 10. CS Survey Responses to Utilization of 5 Core CSTA Concepts in the Classroom by Complex Area

| | Number of responses | Computing Systems | | Networks and the Internet | | Data and Analysis | | Algorithms and Programming | | Impacts of Computing | | None of the above | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Complex Area | | # | % | # | % | # | % | # | % | # | % | # | % |
| ʻAiea-Moanalua-Radford | 11 | 9 | 82% | 10 | 91% | 5 | 45% | 8 | 73% | 9 | 82% | 0 | 0% |
| Baldwin-Kekaulike-Maui | 54 | 17 | 31% | 20 | 37% | 19 | 35% | 20 | 37% | 14 | 26% | 18 | 33% |
| Campbell-Kapolei | 33 | 16 | 48% | 6 | 18% | 4 | 12% | 18 | 55% | 8 | 24% | 5 | 15% |
| Castle-Kahuku | 2 | 1 | 50% | 1 | 50% | 1 | 50% | 2 | 100% | 1 | 50% | 0 | 0% |
| Farrington-Kaiser-Kalani | 4 | 2 | 50% | 2 | 50% | 1 | 25% | 3 | 75% | 1 | 25% | 1 | 25% |
| Hāna-Lahainaluna-Lānaʻi- Molokaʻi | 6 | 3 | 50% | 2 | 33% | 3 | 50% | 3 | 50% | 2 | 33% | 3 | 50% |
| Hilo-Waiākea | 5 | 4 | 80% | 5 | 100% | 5 | 100% | 4 | 80% | 4 | 80% | 0 | 0% |
| Honokaʻa-Kealakehe-Kohala-Konawaena | 3 | 0 | 0% | 1 | 33% | 0 | 0% | 2 | 67% | 1 | 33% | 0 | 0% |
| Kailua-Kalāheo | 1 | 0 | 0% | 0 | 0% | 0 | 0% | 1 | 100% | 1 | 100% | 0 | 0% |
| Kaimukī-McKinley-Roosevelt | 16 | 11 | 69% | 10 | 63% | 6 | 38% | 13 | 81% | 8 | 50% | 2 | 13% |
| Kapaʻa-Kauaʻi-Waimea | 4 | 2 | 50% | 2 | 50% | 3 | 75% | 2 | 50% | 2 | 50% | 1 | 25% |
| Kaʻu-Keaʻau-Pāhoa | 1 | 1 | 100% | 1 | 100% | 1 | 100% | 1 | 100% | 1 | 100% | 0 | 0% |
| Leilehua-Mililani-Waialua | 3 | 2 | 67% | 1 | 33% | 0 | 0% | 3 | 100% | 1 | 33% | 0 | 0% |
| Nānākuli-Waianae | 12 | 3 | 25% | 2 | 17% | 2 | 17% | 3 | 25% | 3 | 25% | 6 | 50% |
| Pearl City-Waipahu | 74 | 22 | 30% | 23 | 31% | 10 | 14% | 30 | 41% | 19 | 26% | 27 | 36% |
| Total | 229 | 93 | | 86 | | 60 | | 113 | | 75 | | 63 | |

# CURRICULUM

From the survey, respondents indicated that they overwhelmingly rely on non-HIDOE curriculum to teach CS, and for the most part, the selected teaching tools are coding-focused. To the question "What curriculum resources/providers are utilized at your school to support computer science education?", the top 10 most frequently reported are in Table 11.

## Table 11. CS Survey Responses to CS Curriculum Used in Schools

| Curriculum | # of Responses | Curriculum Description |
|---|---|---|
| Code.org | 247 | Multigrade curricula designed by Code.org, a nonprofit organization, whose aim is to broaden participation in programming and computer science among K–12 students |
| Hour of Code | 166 | Sponsored by Code.org, a 1-hour group coding activity available for free online to encourage students to learn programming |
| Robotics | 157 | Hardware and software kits for development of programmable robots, such as LEGO Mindstorm |
| Scratch | 107 | Free educational website and a programming language that allows students to create online projects using coding prompts |
| Khan Academy | 73 | Free online tutorials on diverse K–12 subjects including computer science |
| Makey Makey | 67 | An "Invention Kit for Everyone," an electronic tool and toy that allows users to connect "everyday" objects to computer programs |
| Dash and Dot Robots | 62 | Mobile robots and proprietary software designed to help students learn coding using the Blockly programming app |
| Project Lead the Way | 62 | Curricula designed by a nonprofit organization for K–12 STEM education |
| Common Sense Media | 62* | Digital citizenship curriculum that teaches safe and responsible technology use |
| Girls Who Code | 41 | After school clubs aimed at increasing girls' participation in computer science through activities that focus on coding. |

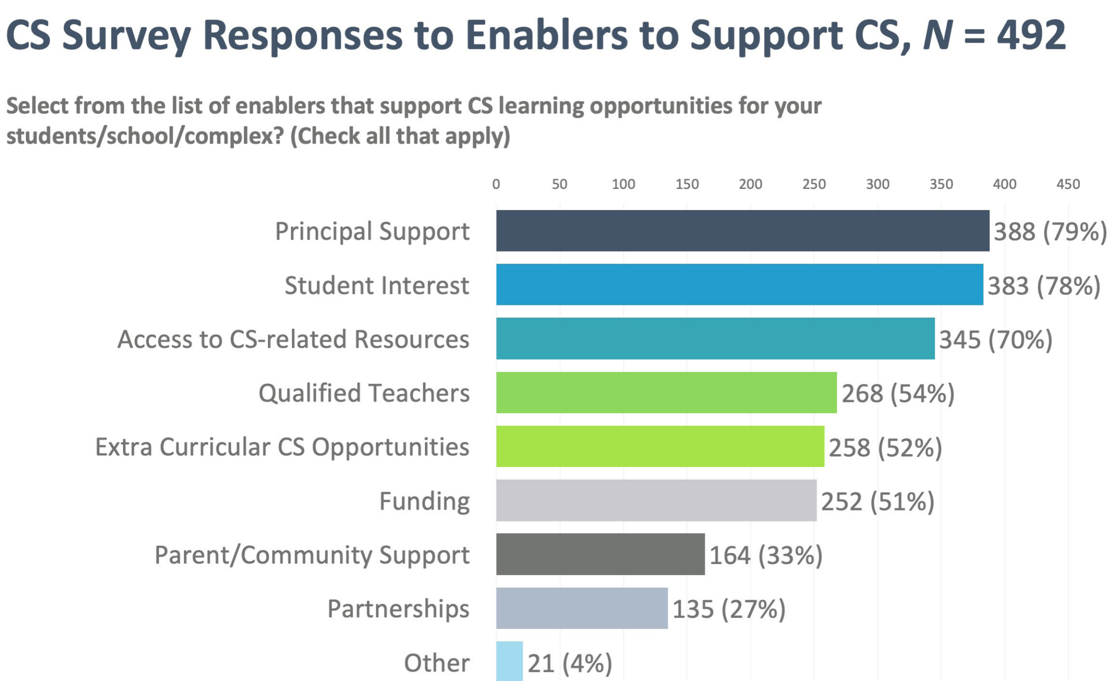
*Note.* *Common Sense has three areas--Common Sense Education, Common Sense Media, and Common Sense Kids Action.

# SUPPORTS AND ENABLERS TO CS EDUCATION

The top enabler that supports computer science education was "principal support," which was selected by 79% of the survey respondents. Without principals and school leadership, respondents indicated that students would likely not have after-school or club activities exposing them to computer science, and teachers would not receive professional development. Also high on the list of supports and enablers was student interest, selected by 78% of respondents.

Engendering student interest at an early age was shared both in written responses as well as during discussion as critical not only to discussing computer science as a possible career, but also to seeing the connections that computer science has to all aspects of society and a range of careers. Other enablers to support CS can be seen in Figure 7.

### Figure 7. CS Survey Responses to Enablers that Support CS Learning Opportunities for Students, Schools, and Complexes




# TEACHERS

According to the data shared by HIDOE, public schools in SY 2019–20 had 170 teachers teaching computer science-designated and CTE computer science-related courses across all levels of K–12 education. Seventy-seven teachers are female and 93 were male, as seen in Table 12. Of the 170 teachers, 68 teachers taught computer science-designated courses across all levels of K–12 education. Teachers were closely divided along self-reported gender with 32 female and 36 male teachers as seen in Table 12. However, when analyzed by teaching licenses approved for CS courses, male teachers outnumbered female teachers in CS licensure (8 to 4), science licensure (25 to 7), engineering licensure (8 to 1), and CTE licensure (36 to 20).

The Hawai'i Teacher Standards Board (HTSB) added a CS licensing field to its list of subject areas in 2018. In addition, HIDOE has created a crosswalk rubric for CS courses to identify approved cross-disciplinary licensure. As of SY 2019–20, teachers could instruct non-AP CS courses if they held one of the following licenses:

- License 1, ESSA Subject Area - Computer Science
- License 2 (License other content equivalency) - STEM; Math; Science
- License 3 (License other content equivalency) - CTE - A&C; CTE - IET
- ESSA Hawai'i Qualified (EHQ) Certificate Content Equivalency - Computer Science; STEM; Ed Tech; Math; Science

## Table 12. HIDOE Teachers in CS Courses in SY 2019–20

| Teachers and License Type | Total | Female | Male |
|---|---|---|---|
| Number of teachers teaching any CS course | 170 | 77 | 93 |
| Number of teachers teaching CS designated-courses | 68 | 32 | 36 |
| CS teachers with ESSA HQ secondary designation | 62 | 30 | 32 |
| CS teachers licensed in CS | 12 | 4 | 8 |
| CS teachers licensed in mathematics | 39 | 19 | 20 |
| CS teachers licensed in science | 32 | 7 | 25 |
| CS teachers licensed in STEM | 53 | 27 | 26 |
| CS teachers licensed in engineering | 5 | 1 | 8 |
| CS teachers licensed in CTE | 56 | 20 | 36 |
| CS teachers without ESSA HQ designation | 55 | 31 | 24 |
| CS teachers without primary or secondary crosswalk licenses | 14 | 4 | 10 |

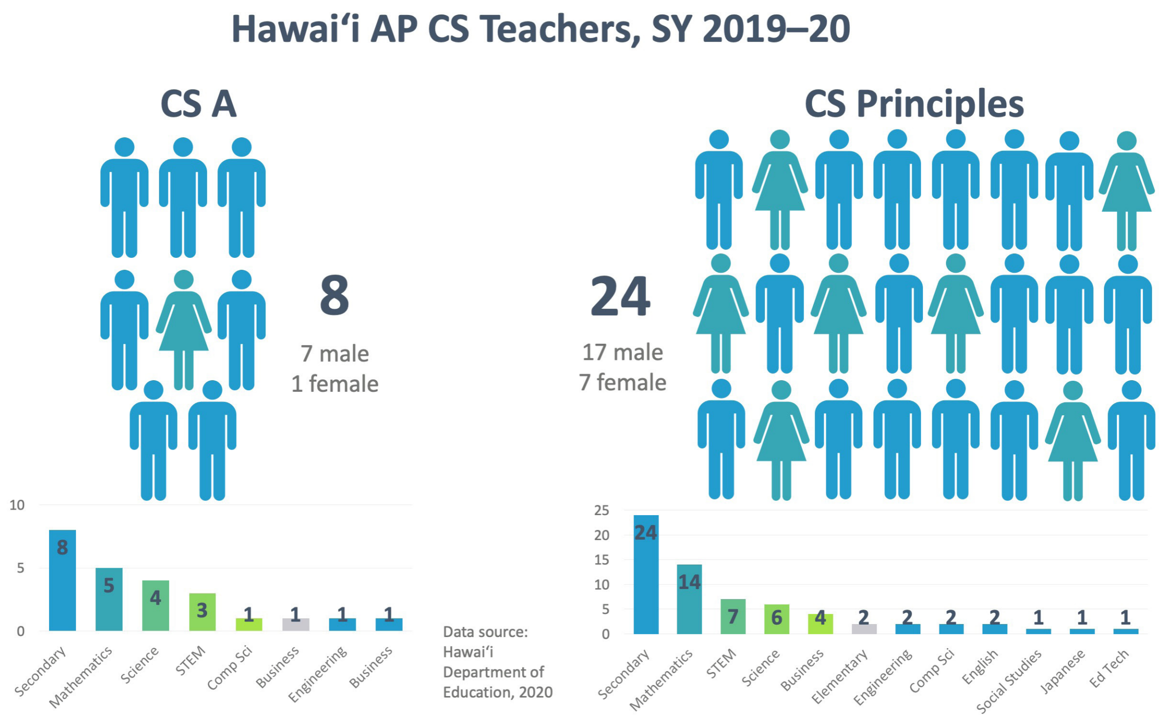
Data Source: HIDOE Office of Talent Management

In SY 2019–20, AP CS courses were listed as "Multidisciplinary." AP CS A can be taught by teachers who possess a license in mathematics, science, or STEM and an ESSA designation of highly qualified in computer science, mathematics, science, STEM, or educational technology. All 8 teachers of the 8 AP CS A classes held qualified designations in their content area for grades 6–12; one of the teachers was also highly qualified in computer science and one other teacher held an advanced license in computer science.

AP CS Principles was included in the HIDOE curriculum beginning SY 2016–17. AP CS Principles can be taught by a teacher who possesses a secondary teaching license without restrictions. All 24 teachers of the 24 AP CS Principles courses possessed a secondary teaching license and held ESSA highly qualified designations in their content area (see Figure 8). The requirements of who can teach will not change in SY 2020-21 when AP CS courses become part of the CS subject area. Professional development sessions on AP CS Principles have been offered to teachers at the annual AP summer institute since 2016. The summer institute will be hosted by Hawai'i Pacific University in summer 2020 online. CTE CS courses can be taught by a teacher who possesses the appropriate CTE license.

Of note is that across all 68 teachers in SY 2019–20 who taught computer science-designated courses analyzed in this report, 60 did not possess a CS license. With CTE computer science-related courses included, 152 of the 170 teachers did not possess a CS license. In the Hawai'i public school system, teachers who possess content area licenses in mathematics, science, STEM are approved to teach computer science courses. For some courses, a license in engineering, business, and art are approved also.[25] The number of teachers licensed in CS may change in the next few months if teachers who complete the Maui College AP CS Principles training opt to add CS to their current teaching licenses.

## Figure 8. Hawaiʻi AP Computer Science Teachers, SY 2019–20




At the time of this report, the Department has not adopted teaching standards for CS, but the CSTA teaching standards were shared with the CS leads to raise awareness among teachers.

# PROFESSIONAL DEVELOPMENT

A joint report from Google and Gallup in 2016 indicated that 63% of the K–12 principals and 74% of superintendents who do not have CS in their school or district say a reason they do not offer CS is the lack of teachers available at their school with the necessary skills to teach it.[26] The lack of teachers available to teach CS had already been previously identified by the HIDOE. In the HIDOE CS Survey, questions related to teachers' professional development (PD) were asked both of teacher and of administrator respondents. Teachers were asked "What type of PD incentives do you prefer?" and the school administrators were asked "What type of PD incentives do your teachers prefer?" Majority of the teachers indicated a preference for stipend PD (55%), while school administrators selected for-credit PD as their preferred response (76%).

**Teachers preferred PD training with a focus on pedagogy and standards rather than content.**

Over 75% of teachers selected "Face-to-Face instruction" as the preferred method of PD. This was the top selection for the group. Other popular responses were "Hybrid Face-to-Face and Online" (37%) and "Online Asynchronous

Self-Paced" (33%). The least preferred method was "Online Facilitated" (14%). For 20% of the respondents, the method of PD instruction did not matter. However, we would be remiss in not acknowledging that some of the responses were recorded before the outbreak of COVID-19 and will need to be revisited in light of social distancing recommendations.

The survey participants were also asked to select CS-related PD topics they would be interested in learning. Out of 18 proposed topics, the most popular responses were "General CS Instructional Strategies" (55%) and "K–12 CS Standards" (52%), followed by "Instructional Strategies for Integrating CS into other subject areas" (46%) and "*K–12 CS Framework*" (43%). The least preferred topics were "Data Science" (16%) and "Databases" (8%). The survey results revealed that the **teachers preferred PD training with a focus on pedagogy and standards rather than content.** The complete table of preferred topics can be found in Table 13.

Because of the funding available for professional development through Act 51, a large number of teachers registered for PD in SY 2018–19. Many of the sessions were administered by nonprofit and for profit vendors such as Code.org, Oceanit, and Apple Learn to Code, among others. The number of CS-related PD sessions and registered teachers for the past three years is represented in Table 14.

## Table 13. CS Survey Responses to Preferred Professional Development Topics

| PD Topic | # of Responses | % |
|---|---|---|
| General CS Instructional Strategies | 133 | 55% |
| K–12 CS Standards | 126 | 52% |
| Instructional Strategies for Integrating CS into other subject areas | 112 | 46% |
| K–12 CS Framework | 104 | 43% |
| Robotics | 83 | 34% |
| Programming | 82 | 34% |
| CS Instructional Strategies for ELL Students | 72 | 30% |
| CS Instructional Strategies for SpEd Students | 70 | 29% |
| Project-Based Learning and CS | 69 | 28% |
| Digital Citizenship | 67 | 28% |
| CS Instructional Strategies for Gifted and Talented Students | 64 | 26% |
| Unplugged CS Instructional Strategies | 64 | 26% |
| ISTE Computational Thinking Competencies | 63 | 26% |
| Drones | 53 | 22% |
| Cybersecurity | 50 | 21% |
| Artificial Intelligence (AI) | 48 | 20% |
| Networking | 42 | 17% |
| Data Science | 39 | 16% |
| Databases | 20 | 8% |

**Table 14. HIDOE Teacher Registration for HIDOE-Sponsored Professional Development Sessions Related to Computer Science, 2017–20**

| | Sessions Offered | Teachers Registered |
|---|---|---|
| 2017–2018 | 23 | 501 |
| 2017–2018 | 33 | 1,099 |
| 2019–2020 | 30 | 257 |

Data Source: Computer Science Team of HIDOE Office of Curriculum and Instructional Design

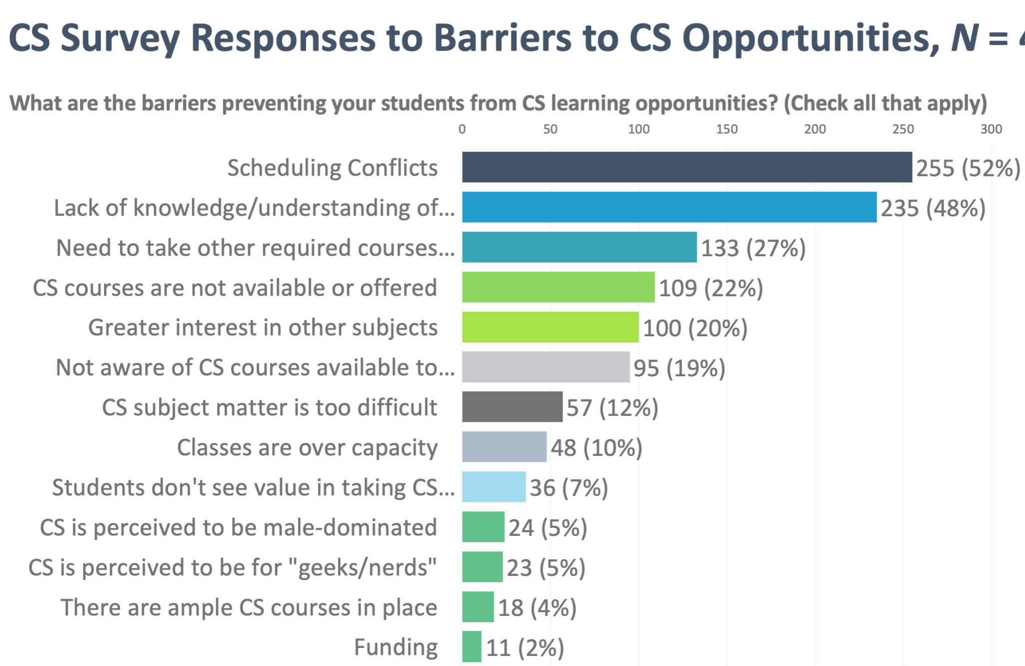
## PERCEPTIONS OF PRIORITIES AND BARRIERS

Two of the top priorities for CS education identified in the CS Survey are related to teachers and professional development. As seen in Table 15, 201 (40.6%) of respondents indicated that the training of teachers was a top priority and 137 (27.9%) respondents indicated professional development. Issues of what might be needed as topics in those PD sessions emerged from questions related to barriers as well as during discussions. As seen in Figure 9, more than half of the respondents ($n$ = 231, 51.8%) indicated that there is a lack of knowledge and understanding of what CS education is and why it is valuable, indicated by 235 (51.8%). Discussions of topics centered around three needs. First was the definition of computer science education. Though the state has adopted Tucker et al.'s (2003) definition, adding to the confusion was the redesignation of all educational technology courses as computer science; the K–12 Computer Science Frameworkeven had stated that topics like computer literacy, educational technology, digital citizenship, and information technology are only related to computer science and not computer science. Respondents sought clarity in terms of definition of computer science education and understanding its parameters. Sessions on the CS standards were identified as needed across several discussions. The second need for teachers was about curriculum, implementation, and assessments. Though the state has offered SCRIPT training and computer science is one of five recommended strategies in the promise plan, how to go about implementing those ideas is still vague. There are still no curriculum selection materials guides and therefore no assessments, except for AP computer science. Regardless of what curriculum might be selected, there are no current CS assessments conducted statewide. Schools and complex areas may be using the HIDOE School Design process to develop these components to meet their particular needs. Third, respondents identified a lack of coordinated efforts and expectations of implementation of CS. Respondents indicated that "a lot of CS is piecemeal at schools," which results in students receiving unequal exposure. The lack of coordination also leads to poor information about the cost of programs and their support and what needs to be requested in terms of funding. To address this concern, Complex Area CS teams have been established to address the support system logistics; their effectiveness has yet to be determined.

## Table 15. CS Survey Responses to Top Priority for CS Education

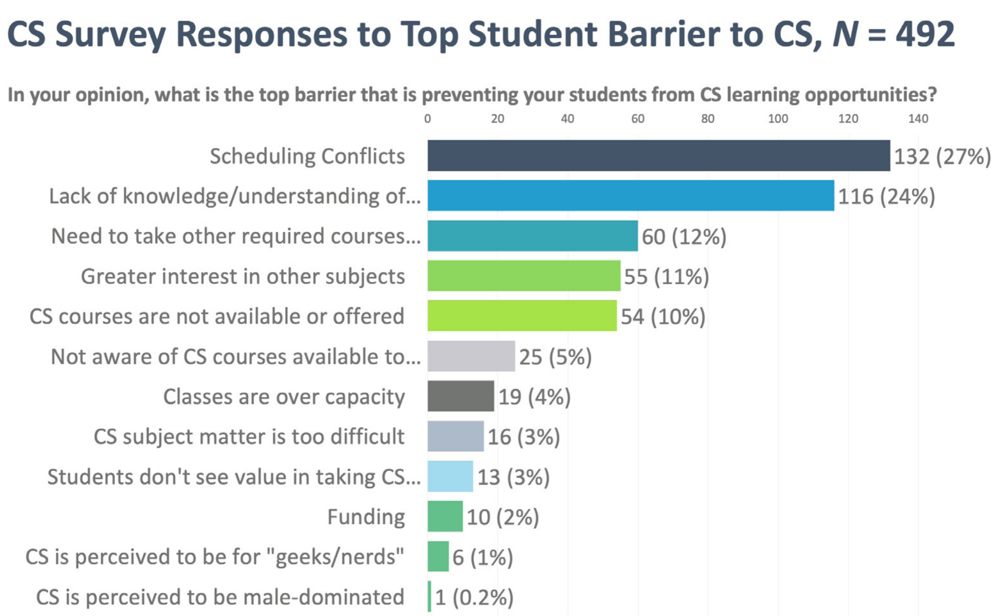
| In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school/complex? | | |
|---|---|---|
| **Priority Area** | **# of Responses** | **%** |
| Trained CS Teachers | 201 | 40.85% |
| Professional Development | 137 | 27.85% |
| Curriculum Resources/Equipment | 103 | 20.93% |
| Funding | 93 | 18.90% |
| Understanding K–12 CS Standards | 90 | 18.29% |
| School Design for CS Process | 87 | 17.68% |
| Infrastructure - Network/Devices | 37 | 7.52% |

## Figure 9. CS Survey Responses to Barriers in CS Opportunities



When it came to students, the most identified barrier to student access to learning opportunities was scheduling conflicts and the second most was lack of knowledge or understanding of computer science education. Discussion around these two areas had to do with courses scheduled at the same time as other required courses or at the same time as other interest areas. Aside from scheduling conflicts, the discussion centered around students not understanding how CS relates to career choices outside of a computer science career. Teacher respondents shared that students need to hear more about jobs outside of CS that require CS knowledge as well as stronger connections to society above and beyond social media use. In Figure 10, the top barriers to student CS learning as selected by respondents remained as scheduling conflicts and lack of knowledge and awareness.

## Figure 10. CS Survey Responses to Top Student Barrier




# COURSES

**CS designated and CTE CS related**

Computer science courses in the Hawai'i Department of Education are designated in two ways. The first is via an official change announced on November 14, 2019 of the Authorized Course and Code Number (ACCN) category formerly "educational technology" to be replaced by "computer science" effective SY 2020–21.[27] The second is from career and technical education (CTE) courses[28] in which some courses are CS related. These CTE courses have the ACCN category of CTE. For the purposes of this report, the two types of courses are described as “CS designated” and “CTE CS related,” respectively.

There are currently nine CS-designated courses offered by HIDOE categorized under "educational technology" content area (Table 16). In the same November 2019 memo where the HIDOE announced "educational technology" changing to "computer science," AP CS courses will also be recategorized from "multidisciplinary" to "computer science." Furthermore, during the same school year "computer science" will be added as a content option on the elementary school report cards. The ACCN numbers and teacher licensure requirements for the existing CS courses will remain the same.

## Table 16. HIDOE Educational Technology and Multidisciplinary Courses in SY 2019–20 Scheduled to Become Computer Science Courses in SY 2020–21

| | SY 2019–2020 | | | |
|---|---|---|---|---|
| ACCN | Course Title | School Type | # of Schools | # of Teachers |
| ECS9500 | AP Computer Science A | H, E-S | 7 | 8 |
| ECS9800 | AP Computer Science Principles | H, C, E-S | 21 | 24 |
| ECS9900 | Directed Study in Computer Science | H, C | 5 | 5 |
| EMS0600 | Introduction to Computer Literacy | M | 1 | 1 |
| EXS0100 | Introduction to Computer Science A | M, C, E-S | 13 | 20 |
| EXS0110 | Introduction to Computer Science B | M, C | 9 | 12 |
| EXS1200 | Computer Literacy | H | 5 | 9 |
| EXS1400 | Computer Science A | H, C, E-S | 13 | 14 |
| EXS1500 | Computer Science B | H, C, E-S | 13 | 13 |
| EXS1600 | Computer Programming - Javascript | | 0 | |
| EXS1700 | Computer Programming - Python | | 0 | |

*Note.* High school (H), E-school (E-S), Middle School (MS); Combination School (C)

Additionally, CTE CS-related courses were identified from within the career and technical education categories, particularly from the arts and communication pathway, the industrial and engineering technology pathway, and the business pathway. In the Office of the State Director Career and Technical Education handbook, there are six pathways, three of which are considered CS-related pathways.

- Express Yourself in **Arts and Communication**. Develop an analytical eye for the art and media that infuse the world around you. The Arts and Communication Pathway focuses on connecting formal structures of artistic expression to audience perspectives in careers spanning fashion and technology; digital media; and the visual, performing, and written arts.
- Build the Future in **Industrial and Engineering Technology**. Interested in designing, engineering, developing, and building solutions to address society's problems and needs? Solve problems, connect people and places, and make the world run in the diverse career opportunities available in the Industrial and Engineering Technology Pathway.
- Lead the Way in the World of **Business**. Why answer to the chief executive officer, when you can be one? Business is the foundation for all industries. The diversity of skills and concepts such as technology, finance, customer service, marketing, organizational behavior, and management learned in the Business Pathway applies to careers in all of the pathways.

Within each pathway are clusters and within each cluster are occupational examples. In a word analysis of the handbook, the word *computer* appeared in two pathways. Industrial and Engineering Technology had an electronic and computer systems cluster naming one occupation with computer in the name—computer engineer. Within Business was a cluster of management information systems naming six occupations with computer in the name—computer and information systems manager, computer hardware engineer, computer programmer, computer support specialist, computer systems analyst, networks and computer systems administrator. Furthermore, the Industrial and Engineering Technology pathways identifies five programs of study—computer networking, cybersecurity, A+ certification, Cisco certification, and computer technician—each with core, cluster, and concentration courses, all of which require Algebra I.

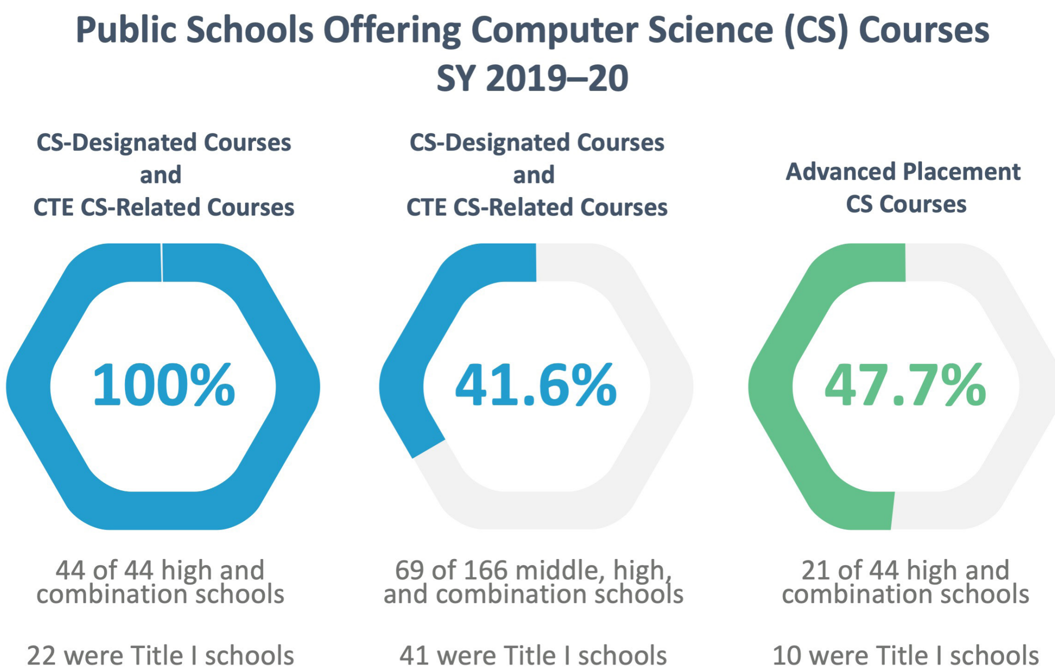
In the Career and Technical Education Annual 2018–2019 report,[29] two concentrations might be perceived as related to computer science. Those two concentrations are information technology and STEM, which reported 84 students (73 male and 11 female) and 358 students (292 male and 66 female) secondary students respectively enrolled. A secondary student was defined as a 12th grade student who had completed the requirements for her or his selected state certificated CTE program of study. Of note is that the female enrollment was lower than the males in each of those fields. CTE students often use the Hawaiʻi Career Explorer[30] to explore jobs based on their interests, skills, and abilities. Students can see quickly high demand occupations, high demand STEM occupations, as well as high earning occupations. Full list of courses and corresponding ACCNs analyzed in this report are represented in Table 17.

100% of high schools offered at least one computer science-designated or CTE computer science-related course in 2019–20. The statewide HIDOE data revealed that a total of 43 of 166 middle, high, and combination schools offered CS-designated courses in SY 2019–20. These include 23 standalone high schools, 8 combination schools, 11 middle schools, and an online E-School open to students across the state. A total of 63 of 166 middle, high, and combination schools offered CTE CS-related courses in SY 2019–20. These include 33 standalone high schools, 11 combination schools, 26 middle schools, and an online E-School open to students across the state. In total 69 of 166 middle, high, and combination schools offered CS courses in SY 2019–20. Several schools offer multiple CS courses in the same school. 19 of 33 high schools and 2 of the 11 combination schools offer AP CS. A comparison of CS offerings can be seen in Figure 11. Of the exam takers of AP CS, 134 or 27.1% of the students were from 13 different Title I schools.

**100% of high schools offered at least one computer science-designated or CTE computer science-related course in 2019–20.**

Twenty-two high and combination schools were designated as Title I schools in SY 2019–20. It is also important to note that elementary schools may be offering CS experiences that are not counted here. Elementary schools will be adding an optional CS designation on their report cards in SY 2020–21, which may allow for better accounting in the future.

## Figure 11. Public Schools Offering Computer Science Courses in SY 2019–20



## Table 17. Computer Science-Designated and CTE Computer Science-Related Courses in SY 2019–2020

| ACCN Content Area | ACCN | Course Title | # of Schools | Begin Grade |
|---|---|---|---|---|
| Multidisciplinary | ECS9500 | AP Computer Science A* | 11 | 9 |
| Multidisciplinary | ECS9800 | AP Computer Science Principles* | 23 | 9 |
| Educational Technology | ECS9900 | Directed Study in Computer Science | 7 | 9 |
| Educational Technology | EMS0600 | Introduction to Computer Literacy | 2 | 6 |
| Educational Technology | EXS0100 | Introduction to Computer Science A* | 10 | 6 |
| Educational Technology | EXS0110 | Introduction to Computer Science B | 8 | 6 |
| Educational Technology | EXS1200 | Computer Literacy | 8 | 9 |
| Educational Technology | EXS1300 | Introduction to Computer Science | 2 | 9 |
| Educational Technology | EXS1400 | Computer Science A | 12 | 9 |

| End Grade | Description |
|---|---|
| 12 | This course prepares high school students for the Advanced Placement (AP) Computer Science/ AB Examination and is aimed at helping students develop the ability to design and implement computer-based solutions to problems in several application areas; design and select appropriate algorithms and data structures to solve problems; code fluently in a well-structured fashion using an accepted high-level language, e.g., Java; and to identify the major components of a computer system (hardware and software), their relationship to one another, and the roles of these components within the system. Students recognize the ethical and social implications of computer use. AP Computer Science meets the requirements as set forth in the Advanced Placement Computer Science Program course description and is designed to give students the necessary information and skills to program in Java. In addition to the topics studied in Advanced Placement Computer Science A, the Computer Science AB course deals more formally with program verification and algorithm analysis. Can be delivered through E-School. |
| 12 | The AP Computer Science Principles course is designed to be equivalent to a first-semester introductory college computing course. The curriculum framework provides a detailed description of the course content. The key sections of this framework are described in the following text: -computational thinking practices (connecting computing, creating computational artifacts, abstracting, analyzing problems and artifacts, communicating, collaborating) -seven big ideas (creativity, abstraction, data and information, algorithms, programming, the internet, global impact) -learning objectives that integrate computational thinking practice or skill -essential knowledge statements |
| 12 | This course allows highly motivated students to identify a project of interest and to plan a constructive mode of learning to accomplish specific objectives. Such a project shall be designed under the guidance of a computer science teacher, and may also include the guidance of a community computer professional. The student must have earlier demonstrated the motivation and ability to engage in independent study in other related courses and must have the approval of the computer science teacher and/or counselor. May be repeated for credit. |
| 6 | This course is designed to introduce students to the fundamental 21st century computer literacy skills. Students will learn and apply the basic digital technologies to help them attain General Learner Outcome 6 in their various content area courses. |
| 8 | This course introduces students to computer programming concepts and skills. As much as possible, these concepts and skills will be taught in learning activities that take place in problem-solving context. |
| 8 | This course will cover the more advanced computer science concepts and skills. Students will have opportunities to apply them in a problem-solving context. Computer science concepts covered may include programming, networking, and/or cybersecurity. Students will have opportunities to learn and apply computational problem-solving skills. |
| 12 | This course is designed to introduce students to the fundamental 21st century computer literacy and digital citizenship skills. Students will learn and apply the basic digital technologies to help them attain General Learner Outcome 6 in their various content area courses. |
| 12 | The Introduction to Computer Science course is a first year computer science course which gives students the opportunity to explore several important topics of computing using their own ideas and creativity to develop an interest in computer science that will foster further endeavors in the field. |
| 12 | This hands-on course introduces students to computer science concepts and skills. Computer science concepts covered include programming, networking, and cybersecurity. Students will have opportunities to learn and apply computational problem-solving skills. |

| ACCN Content Area | ACCN | Course Title | # of Schools | Begin Grade |
|---|---|---|---|---|
| Educational Technology | EXS1500 | Computer Science B | 11 | 9 |
| Educational Technology | EXS1600 | Computer Programming - Javascript | | 9 |
| Educational Technology | EXS1700 | Computer Programming - Python | | 9 |
| Career & Technical Education | TAN2110 | Web Design | 6 | 9 |
| Career & Technical Education | TAN2311 | Gaming | 7 | 9 |
| Career & Technical Education | TAN2312 | Gaming A | 3 | 9 |
| Career & Technical Education | TAN2313 | Gaming B | 2 | 9 |
| Career & Technical Education | TAU2210 | Digital Media Technology | 40 | 9 |
| Career & Technical Education | TAU2211 | Digital Media Technology A | 4 | 9 |
| Career & Technical Education | TAU2212 | Digital Media Technology B | 5 | 9 |
| Career & Technical Education | TBU3411 | Database Control And Functions | | 9 |

| End Grade | Description |
|---|---|
| 12 | In this hands-on course, students will learn more advanced computer science concepts and skills. Computer science concepts covered include programming, networking and cybersecurity. Students will have opportunities to lean and apply computational problem-solving skills. |
| 12 | The course teaches the foundations of computer science and basic programming, with an emphasis on helping students develop logical thinking and problem solving skills. Once students complete the course, they will be able to program in JavaScript. |
| 12 | The course teaches the foundations of computer science and basic programming, with an emphasis on helping students develop logical thinking and problem solving skills. Once students complete the course, they will be able to program in Python. |
| 12 | The purpose of this course is to provide students with a foundation in web design through the evaluation of design principles in web design and creation of web design projects. Legal and ethical aspects of website design, workplace safety and societal impact of the internet and websites are concepts that will be taught in this course. Recommended Prerequisite: Completion of TAC2010 Arts and Communication Career Pathway Core and TAU2210 Digital Med Tech |
| 12 | The purpose of this course is to provide students with a foundation in the principles of interactive entertainment media and design. This will include a study of the gaming industry and gaming as a media form. Emphasis will be placed on designs and products that meet specific goals or criteria. Recommended Prerequisite: Completion of TAC2010 Arts and Communication Career Pathway Core and TAU2210 Digital Med Tech. |
| 12 | Only the year course for this ACCN should be used for scheduling students. This semester number is assigned to the year course and is to be used to award/record credit given to students unable to complete the entire year. Refer to the year course description for this ACCN. |
| 12 | Only the year course for this ACCN should be used for scheduling students. This semester number is assigned to the year course and is to be used to award/record credit given to students unable to complete the entire year. Refer to the year course description for this ACCN. |
| 12 | This course is designed to equip students with the necessary skills to support and enhance their use of digital media technologies. Topics will include the creation of media content, its communicative abilities, the production process, and legal concerns. Recommended prerequisite: Completion of TAC2010 Arts and Communication Career Pathway Core. |
| 12 | Only the year course for this ACCN should be used for scheduling students. This semester number is assigned to the year course and is to be used to award/record credit given to students unable to complete the entire year. Refer to the year course description for this ACCN. |
| 12 | Only the year course for this ACCN should be used for scheduling students. This semester number is assigned to the year course and is to be used to award/record credit given to students unable to complete the entire year. Refer to the year course description for this ACCN. |
| 12 | "This semester course follows Database Fundamentals and introduces SQL (Select statement; Data definition, manipulation, and control languages, Transaction control) and basic PL/SQL blocks, functions, cursors, records, tables, and exceptions. Course final will include an introduction to SQL and PL/SQL Certification exam. Students will also build personal portfolios and improve interview skills. The four (4) courses —TBU3410, TBU3411, TBU3412, and TBU3413— comprise a two-year program of studies which lead to preparation for the Oracle database programming certification examination. |

| ACCN Content Area | ACCN | Course Title | # of Schools | Begin Grade |
|---|---|---|---|---|
| Career & Technical Education | TIN5320 | Design Technology 2 | 20 | 9 |
| Career & Technical Education | TIN5512 | A+ Certification 3:Operating Systems (C) | 5 | 9 |
| Career & Technical Education | TIN5513 | A+ Certification 4:Internship (D) | 5 | 9 |
| Career & Technical Education | TIN5520 | Cyber Security | 9 | 9 |
| Career & Technical Education | TIN5716 | Wide Area Networks And Networking Architectures | 2 | 9 |
| Career & Technical Education | TIU5310 | Design Technology 1 | | 9 |
| Career & Technical Education | TIU5510 | A+ Certification 1:Intro To Computer Sem Sys (A) | 7 | 9 |
| Career & Technical Education | TIU5511 | A+ Certification 2:Intro To Computer Sem Sys (B) | 7 | 9 |
| Career & Technical Education | TIU5610 | Computer Electronics | 5 | 9 |
| Career & Technical Education | TIU5612 | Computer Electronics B | 1 | 9 |

| End Grade | Description |
|---|---|
| 12 | This course organizes learning experiences, which emphasizes theory, use of computer aided design, and laboratory work as related to designing, and translating data or specifications. Planning, preparing, and interpreting mechanical, architectural, structural, electronics, topographical, and designs and schematics are included. Instruction is designed to provide experiences with computer aided design and other industry standard tools to create solutions to real-world problems. Recommended prerequisite: Completion of TIC5010 IET Career Pathway Core and TIU5310 Design Technology 1. |
| 12 | A+ Certification 3: Introduction to Computer Semester Systems (Course C) |
| 12 | A+ Certification 4: Introduction to Computer Semester Systems (Course D) |
| 12 | Network Security builds upon the knowledge learned from the IET Core and Network and LAN Fundamentals and has students apply that knowledge into securing system networks. Through this course, students will identify vulnerabilities and attack mechanisms to a network on various platforms and use intrusion detection systems and other methods to mitigate security risks. Emphasis will be placed on the application of skills in detection and the utilization of strategies to combat identified threats. Prerequisite: Completion of TIC5010 IET Career Pathway Core and TIU5713 Network Fundamentals and LAN. |
| 12 | This course provides knowledge and skills needed to build LANs: what physical cables are used, how these cables are connected together and how hardware platforms attach to LANs. Students will also learn about network operating system (NOS) software and applications that run on LANs. Recommended Prerequisite: Completion of TIU5713 Networking Fundamentals and LAN. |
| 12 | This course provides classroom learning experiences that are found in drafting technology. Learning activities include: design, spatial visualization and techniques, sketching and use of digital tools, shape and size description, auxiliaries, rotation, pictorial drawings, computer aided design, and the creation of two dimensional and three dimensional models for problem solution. Recommended Prerequisite: Completion of TIC5010 IET Career Pathway Core. |
| 12 | A+ Certification A Introduction discusses the history of computer systems, the hardware content of a computer and their mechanics for constructing computer systems. The topics covered will include safety, basic electronics, power supply, chipsets, motherboards, Pentium processors, and USB Standards. An internship program will be recommended for students. The four (4) coursesTIU5510, TIU5511, TIN5512, and TIN5513—comprise a two-year program of studies which leads to A+ Certification, a recognized computer industry certification that certifies the competency of beginning computer service technicians. |
| 12 | A+ Certification B introduces the computer operating systems. The topics covered will include MS-DOS and Windows operating systems (covering past and current versions, e.g., 3.11, 97, and 98), beginning Internet Explorer and other web browsers, basic networking, and troubleshooting. An internship program will be recommended for students. Recommended Prerequisite: Completion of TIN5510 A+ Certification 1: Introduction to Computer Systems (Course A) |
| 12 | This course is an exploratory course in the principles of computers and their applications in our technological society. Instructional units include circuit fundamentals, basic number systems, introduction to digital and analog computers and their uses, and electronic controls and devices. Recommended Prerequisite: Completion of TIC5010 IET Career Pathway Core. |
| 12 | Only the year course for this ACCN should be used for scheduling students. This semester number is assigned to the year course and is to be used to award/record credit given to students unable to complete the entire year. Refer to the year course description for this ACCN. |

| ACCN Content Area | ACCN | Course Title | # of Schools | Begin Grade |
|---|---|---|---|---|
| Career & Technical Education | TIU5713 | Networking Fundamentals And Local Area Networks | 8 | 9 |
| Career & Technical Education | TIU6100 | Information Technology I | 6 | 9 |
| Career & Technical Education | TMG0410 | Introduction To Technology Education | 18 | 7 |
| Career & Technical Education | TMG0500 | Career And Technical - Computer Literacy (Qtr) | 4 | 7 |
| Career & Technical Education | TMG0501 | Career And Technical- Computer Literacy (Sem) | 16 | 7 |
| Career & Technical Education | TMG0502 | Career And Technical - Computer Literacy (Yr) | 4 | 7 |
| Off-campus Course | ZMR1500 | Running Start: Introduction To Computer Science I | 1 | 11 |
| Off-campus Course | ZTI1050 | Running Start: Intro To Computing Skills | 1 | 9 |
| Off-campus Course | ZTI1105 | Running Start: Introduction To Programming | 1 | 9 |

*Note*. *Also offered by E-School, which is not included in the school count.
Courses with semester or quarter designations are not listed unless students were enrolled in SY 2019–20.
Data source: ACCN Crosswalk and ACCN Content Course Descriptions, Hawaiʻi Department of Education

| End Grade | Description |
|---|---|
| 12 | This course provides skills and knowledge on how WANs are built: what technologies are used, and how systems are configured to maintain and troubleshoot WANs. Students will also learn about networking architectures and how they are integrated into corporate computing environments. Recommended Prerequisite: Completion of TIC5010 IET Career Pathway Core. |
| 12 | Course Description: This course is designed to provide students will basic knowledge and skills integral to informational technology careers. Cyber fundamentals of networking, coding and security, and their connection to technological systems are emphasized. Contexts for learning include the interrelationship between basic cyber fundamentals and the conditions necessary to monitor, maintain, analyze and defend systems. Pre-requisite: Completion of TIC5010 IET Core |
| 8 | This course is an introductory study of industry and technology. Learning experiences involve activities in one or more of the following systems of technology: communication, construction, manufacturing, transportation, and biotechnology and provide opportunities for creativity, problem solving, and cooperative/collaborative learning. |
| 8 | This course is for those students who either have not had enough prior experience with using computers to be considered computer literate, or for those who wish to extend their knowledge of the basics of computer literacy. Emphasis on this course shall be on careers that involve information access, information processing, information management, and communication of information. |
| 8 | This course is for those students who either have not had enough prior experience with using computers to be considered computer literate, or for those who wish to extend their knowledge of the basics of computer literacy. Emphasis on this course shall be on careers that involve information access, information processing, information management, and communication of information. |
| 8 | This course is for those students who either have not had enough prior experience with using computers to be considered computer literate, or for those who wish to extend their knowledge of the basics of computer literacy. Emphasis on this course shall be on careers that involve information access, information processing, information management, and communication of information. |
| 12 | "** Reference specific Community College within the University of Hawaii system for information on this course.**<br>Running Start: University of Hawaii - Hilo, CS150-Intro to Computer Science I<br>Intended for Computer Science majors and all others interested in the first course in programming. An overview of the fundamentals of computer science emphasizing problem solving,algorithm development, implementation, and debugging/testing using an object-oriented programming language. |
| 12 | |
| 12 | |

The 44 public high schools and combination schools that offered at least one CS or CTE CS course in SY 2019–20 are below. They are listed with their school code designation. The Title I schools are indicated with an asterisk (*).

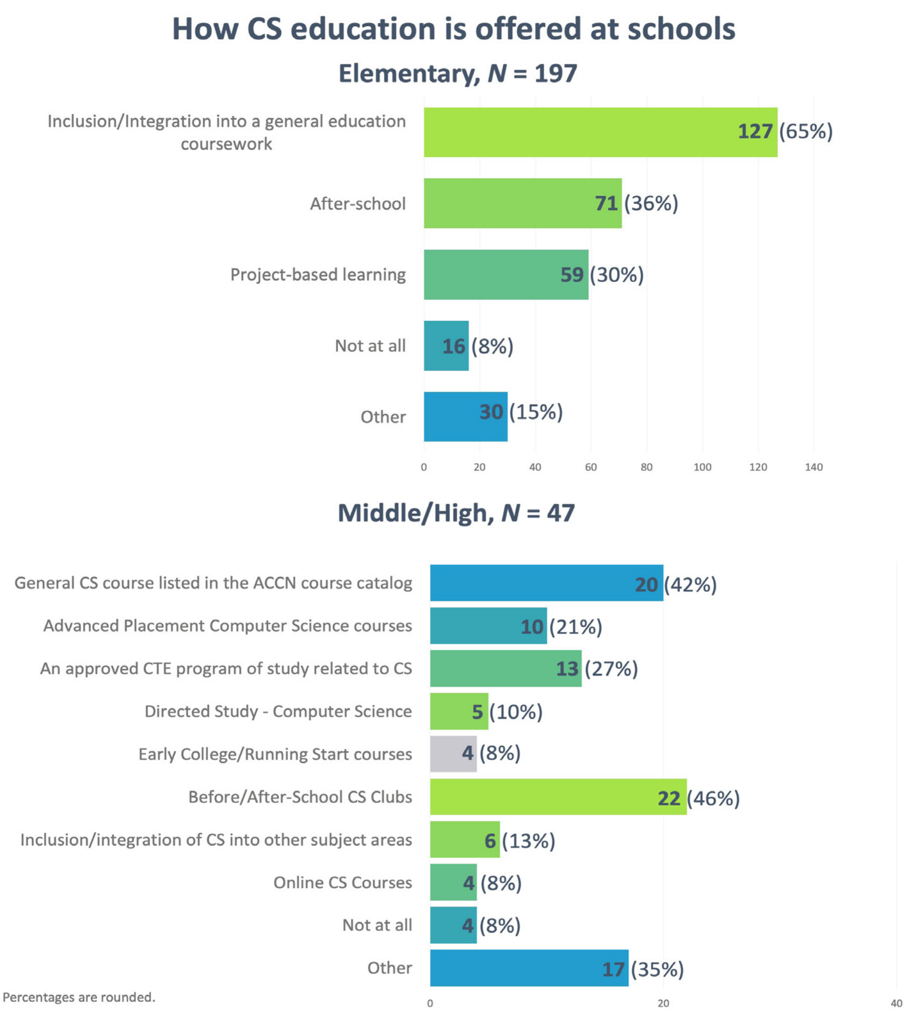
ʻAiea High (202)*
Ãnuenue School (103)*
Baldwin High (400)
Campbell High (252)
Castle High (301)
Farrington High (106)*
Hana High & Elem (402)*
Hawaiʻi School for the Deaf and Blind (470)*
Hilo HIgh (355)*
Honokaʻa High & Inter (360)*
Kahuku High & Inter (331)
Kailua High (308)
Kaimukī High (115)*
Kaiser High (154)
Kalāheo High (312)
Kalani High (119)
Kapaʻa High (455)
Kapolei High (292)
Kaʻu High & Pahala Elem (368)*
Kauaʻi High (456)
Keaʻau High (354)*
Kealakehe High (392)*
Kekaulike High (435)
Kohala High (373)*
Konawaena High (374)*
Lahainaluna High (414)
Lanai High & Elem (415)
Leilehua High (214)*
Maui High (418)
McKinley High (138)*
Mililani High (216)
Moanalua High (218)
Molokaʻi High (421)*
Nānākuli High & Inter (263)*
Olomana School (475)*
Pahoa High & Inter (383)*
Pearl City High (266)
Radford High (224)
Roosevelt High (146)
Waiākea High (389)
Waialua High & Inter (232)
Waiʻanae High (272)*
Waimea High (462)*
Waipahu High (277)*

*Charter Schools*
Ka Waihona O Ka Naʻauao (545)*
Kamaile Academy (275)*
Kamalani Academy (553)*
Hawaiʻi Academy of Arts & Sciences (561)
Kapolei Charter (555)
Ke Kula O Niʻihau Kekaha (556)*
Laupāhoehoe Community (377)*
Malama Honua (550)*
West Hawaiʻi Explorations (399)

A full listing of courses and enrolled students can be seen in Table 18. Table 19 is a listing of courses and enrollment by complex area. At the time of this report preparation, elementary schools had no CS-designated subject area or courses. Beginning in SY 2020–21, data can be gathered from elementary schools that choose to add computer science as a content option on report cards.[31] Accordingly, there is no standardized data that was available for a comprehensive assessment of student understanding. However, in preparation of this report, a survey was sent out to all 15 complex areas to gain a baseline understanding of the status of computer science integrated education at every school level.

To supplement statewide enrollment data, the CS Survey asked teacher respondents how CS education was offered at their schools. Following is data from the public school survey, which does not include charter schools. Out of 244 K–12 teachers who responded, the majority reported offering CS education as "inclusion/integration into a general education coursework" (58%) followed by "before/after school" activities (38%), as referenced in the statewide snapshot report. For middle and high school teachers, specifically, the primary delivery of CS education was "before/after-school CS clubs" (46%) and "general CS courses" (42%). In the "Other" category, the teachers listed academy pathways; during tech resource class; Project Lead the Way; during lunch via design challenge activities, among others. A summary of responses to this question can be found in Figure 12.

## Figure 12. CS Survey Responses to How CS Education is Offered at Schools




*Note.* Percentages are rounded.

## Table 18. Course Enrollment by Course from 2017–2018 to 2019–2020

| | 2017–2018 | | | 2018–2019 | | | 2019–2020 | | | All |
|---|---|---|---|---|---|---|---|---|---|---|
| Course ACCN and Name | F | M | Total | F | M | Total | F | M | Total | Total |
| ECS9500 AP CMPTR SCI AB | 36 | 110 | 146 | 44 | 87 | 131 | 29 | 70 | 99 | 376 |
| ECS9500 AP COMPUTER SCIENCE A | 5 | 10 | 15 | 9 | 38 | 47 | 8 | 27 | 35 | 97 |
| ECS9600 AP COMPUTER SCIENCE A A | 2 | | 2 | | | | | | | 2 |
| ECS9800 AP COMPUTER SCIENCE PRNCPLS | 76 | 167 | 243 | 125 | 306 | 431 | 231 | 467 | 698 | 1372 |
| ECS9820 AP COMPUTER SCIENCE PRNCPLS B | | | | | 1 | 1 | | | | 1 |
| ECS9900 DIR STDY-CMPTR SCI | 8 | 24 | 32 | 12 | 54 | 66 | 12 | 40 | 52 | 150 |
| EMS0600 EXPLOR CMPTR GR 6 | 216 | 205 | 421 | 123 | 123 | 246 | 121 | 125 | 246 | 913 |
| EXS0100 INTRO COMPUTER SCI A | 319 | 367 | 686 | 355 | 400 | 755 | 379 | 458 | 837 | 2278 |
| EXS0100 INTRO COMPUTING GR 6-8 | 717 | 954 | 1671 | 557 | 691 | 1248 | 365 | 501 | 866 | 3785 |
| EXS0110 INTRO COMPUTER SCI B | 4 | 4 | 8 | 20 | 44 | 64 | 309 | 426 | 735 | 807 |
| EXS0110 INTRO PROG GR 6-8 | 223 | 340 | 563 | 35 | 64 | 99 | 75 | 120 | 195 | 857 |
| EXS1200 COMPUTER LITERACY | 77 | 143 | 220 | 36 | 51 | 87 | 124 | 187 | 311 | 618 |
| EXS1200 COMPUTING-TOOLS INFO AGE | 17 | 31 | 48 | 173 | 331 | 504 | 49 | 73 | 122 | 674 |
| EXS1400 CMPTR PROG A | 54 | 205 | 259 | 52 | 181 | 233 | 36 | 155 | 191 | 683 |
| EXS1400 COMPUTER SCIENCE A | | | | 27 | 104 | 131 | 48 | 177 | 225 | 356 |
| EXS1500 CMPTR PROG B | 50 | 203 | 253 | 34 | 142 | 176 | 32 | 137 | 169 | 598 |
| EXS1500 COMPUTER SCIENCE B | | | | 37 | 129 | 166 | 32 | 152 | 184 | 350 |
| TAN2110 WEB DESIGN | 12 | 20 | 32 | 13 | 27 | 40 | 18 | 42 | 60 | 132 |
| TAN2311 GAMING | 17 | 73 | 90 | 9 | 42 | 51 | 19 | 113 | 132 | 273 |
| TAN2312 GAMING A | 1 | 4 | 5 | 1 | | 1 | | | | 6 |
| TAN2313 GAMING B | | | | 1 | | 1 | 2 | | 2 | 3 |
| TAU2210 DIGITAL MEDIA TECH | 581 | 698 | 1279 | 569 | 718 | 1287 | 654 | 716 | 1370 | 3936 |
| TAU2211 DIGITAL MEDIA TECH A | 2 | 3 | 5 | 4 | | 4 | 5 | 5 | 10 | 19 |

| | 2017–2018 | | | 2018–2019 | | | 2019–2020 | | | All |
|---|---|---|---|---|---|---|---|---|---|---|
| **Course ACCN and Name** | **F** | **M** | **Total** | **F** | **M** | **Total** | **F** | **M** | **Total** | **Total** |
| TAU2212 DIGITAL MEDIA TECH B | 4 | 3 | 7 | 3 | 1 | 4 | 3 | 2 | 5 | 16 |
| TIN5320 DESIGN TECHNOLOGY 2 | 35 | 161 | 196 | 41 | 147 | 188 | 47 | 200 | 247 | 631 |
| TIN5512 A+CERT 3-OPERATING SYS C | 9 | 83 | 92 | 8 | 58 | 66 | 2 | 62 | 64 | 222 |
| TIN5513 A+CERT 4-INTERNSHIP D | 8 | 79 | 87 | 8 | 57 | 65 | 3 | 62 | 65 | 217 |
| TIN5520 CYBER SECURITY | 4 | 22 | 26 | 6 | 47 | 53 | 23 | 100 | 123 | 202 |
| TIN5716 WAN / NETWK ARCHITECTURE | 4 | 16 | 20 | 3 | 13 | 16 | 1 | 17 | 18 | 54 |
| TIU5510 A+CERT 1-INTRO CMPTR SYS A | 21 | 173 | 194 | 8 | 97 | 105 | 10 | 117 | 127 | 426 |
| TIU5511 A+CERT 2-INTRO CMPTR SYS B | 20 | 167 | 187 | 8 | 94 | 102 | 9 | 116 | 125 | 414 |
| TIU5610 CMPTR ELECTRN | 4 | 8 | 12 | 14 | 54 | 68 | 3 | 26 | 29 | 109 |
| TIU5612 CMP ELEC B | | | | | 1 | 1 | | | | 1 |
| TIU5713 NETWK FUND / LAN | 13 | 54 | 67 | 7 | 51 | 58 | 31 | 149 | 180 | 305 |
| TIU6100 INFORMATION TECH 1 | 5 | 29 | 34 | 25 | 62 | 87 | 16 | 57 | 73 | 194 |
| TMG0410 INTRO TECH ED | 977 | 1683 | 2660 | 881 | 1585 | 2466 | 647 | 1237 | 1884 | 7010 |
| TMG0500 CAREER /TECH-CMPTR LIT QTR | 203 | 251 | 454 | 121 | 145 | 266 | 127 | 150 | 277 | 997 |
| TMG0501 CAREER /TECH-CMPTR LIT SEM | 1152 | 1347 | 2499 | 1209 | 1486 | 2695 | 1209 | 1438 | 2647 | 7841 |
| TMG0502 CAREER /TECH-CMPTR LIT YR | 30 | 51 | 81 | 34 | 38 | 72 | 27 | 36 | 63 | 216 |
| ZMR1500 CS150/ICS111 | | | | | | | | 2 | 2 | 2 |
| ZTI1050 ICS 105 | 7 | | 7 | | | | | | | 7 |
| ZTI1105 ICS 110 | 7 | 7 | 14 | | | | | | | 14 |
| Grand Total | 4920 | 7695 | 12615 | 4612 | 7469 | 12081 | 4706 | 7762 | 12468 | 37164 |
| +/- | | | | -6.26% | -2.94% | -4.23% | 2.04% | 3.92% | 3.20% | |
| Female to male ratio | 1:1.56 | | | 1:1.62 | | | 1:1.65 | | | |
| % | 39.00% | 61.00% | | 38.18% | 61.82% | | 37.74% | 62.26% | | |

Data Source: Hawai'i Department of Education

## Table 19. Course Enrollment by Complex Area from 2017–2018 to 2019–2020

| | 2017–2018 | | | |
|---|---|---|---|---|
| **Complex area (CA) and Course information** | **F** | **M** | **Total in CS** | **Total in CA** |
| **'Aiea-Moanalua-Radford** | 321 | 467 | 788 | |
| ECS9500 AP CMPTR SCI AB | 13 | 39 | 52 | |
| ECS9800 AP COMPUTER SCIENCE PRNCPLS | | | | |
| ECS9900 DIR STDY-CMPTR SCI | | | | |
| EXS0100 INTRO COMPUTER SCI A | 151 | 174 | 325 | |
| EXS1400 COMPUTER SCIENCE A | | | | |
| EXS1500 COMPUTER SCIENCE B | | | | |
| TAN2110 WEB DESIGN | 6 | 9 | 15 | |
| TAN2311 GAMING | 2 | 15 | 17 | |
| TAU2210 DIGITAL MEDIA TECH | 44 | 58 | 102 | |
| TIN5320 DESIGN TECHNOLOGY 2 | | 1 | 1 | |
| TMG0410 INTRO TECH ED | 105 | 171 | 276 | |
| TMG0501 CAREER /TECH-CMPTR LIT SEM | | | | |
| | | | | |
| **Baldwin-Kekaulike-Maui** | 567 | 687 | 1254 | |
| ECS9500 AP COMPUTER SCIENCE A | 5 | 10 | 15 | |
| ECS9800 AP COMPUTER SCIENCE PRNCPLS | 4 | 12 | 16 | |
| EXS0110 INTRO COMPUTER SCI B | | | | |
| EXS0110 INTRO PROG GR 6-8 | | | | |
| EXS1400 COMPUTER SCIENCE A | | | | |
| EXS1500 COMPUTER SCIENCE B | | | | |
| TAN2110 WEB DESIGN | 2 | 6 | 8 | |
| TAU2210 DIGITAL MEDIA TECH | 71 | 80 | 151 | |
| TIN5320 DESIGN TECHNOLOGY 2 | 1 | 13 | 14 | |

| 2018–2019 | | | | 2019–2020 | | | | All |
|---|---|---|---|---|---|---|---|---|
| F | M | Total in CS | Total in CA | F | M | Total in CS | Total in CA | Grand Total |
| 371 | 623 | 994 | | 271 | 499 | 770 | 14287 | 2552 |
| 12 | 31 | 43 | | 9 | 38 | 47 | | 142 |
| 1 | 10 | 11 | | 14 | 15 | 29 | | 40 |
| 3 | 1 | 4 | | 1 | 7 | 8 | | 12 |
| 173 | 192 | 365 | | | | | | 690 |
| 9 | 54 | 63 | | 13 | 61 | 74 | | 137 |
| 10 | 55 | 65 | | 10 | 56 | 66 | | 131 |
| 11 | 18 | 29 | | 8 | 16 | 24 | | 68 |
| 2 | 12 | 14 | | 1 | 9 | 10 | | 41 |
| 36 | 54 | 90 | | 42 | 45 | 87 | | 279 |
| | | | | | | | | 1 |
| 114 | 196 | 310 | | 144 | 176 | 320 | | 906 |
| | | | | 29 | 76 | 105 | | 105 |
| | | | | | | | | |
| 647 | 773 | 1420 | | 662 | 837 | 1499 | 15946 | 4173 |
| 6 | 12 | 18 | | 5 | 10 | 15 | | 48 |
| 7 | 17 | 24 | | 29 | 53 | 82 | | 122 |
| | | | | 22 | 27 | 49 | | 49 |
| | | | | 26 | 22 | 48 | | 48 |
| 4 | 11 | 15 | | 3 | 13 | 16 | | 31 |
| 5 | 10 | 15 | | 1 | 11 | 12 | | 27 |
| | 3 | 3 | | | 3 | 3 | | 14 |
| 61 | 74 | 135 | | 72 | 101 | 173 | | 459 |
| 4 | 15 | 19 | | 4 | 16 | 20 | | 53 |

| Complex area (CA) and Course information | 2017–2018 | | | |
|---|---|---|---|---|
| | F | M | Total in CS | Total in CA |
| TIN5512 A+CERT 3-OPERATING SYS C | | 4 | 4 | |
| TIN5513 A+CERT 4-INTERNSHIP D | | 4 | 4 | |
| TIU5510 A+CERT 1-INTRO CMPTR SYS A | | 7 | 7 | |
| TIU5511 A+CERT 2-INTRO CMPTR SYS B | | 7 | 7 | |
| TIU6100 INFORMATION TECH 1 | | | | |
| TMG0410 INTRO TECH ED | 48 | 69 | 117 | |
| TMG0501 CAREER /TECH-CMPTR LIT SEM | 436 | 475 | 911 | |
| | | | | |
| **CA OCISS*** | 2 | 1 | 3 | |
| ECS9500 AP CMPTR SCI AB | | 1 | 1 | |
| ECS9600 AP COMPUTER SCIENCE A A | 2 | | 2 | |
| ECS9800 AP COMPUTER SCIENCE PRNCPLS | | | | |
| EXS0100 INTRO COMPUTER SCI A | | | | |
| | | | | |
| **Campbell-Kapolei** | 331 | 686 | 1017 | |
| ECS9500 AP CMPTR SCI AB | 8 | 24 | 32 | |
| ECS9500 AP COMPUTER SCIENCE A | | | | |
| ECS9800 AP COMPUTER SCIENCE PRNCPLS | 46 | 73 | 119 | |
| ECS9820 AP COMPUTER SCIENCE PRNCPLS B | | | | |
| EXS1200 COMPUTER LITERACY | 16 | 34 | 50 | |
| EXS1200 COMPUTING-TOOLS INFO AGE | 17 | 31 | 48 | |
| EXS1400 CMPTR PROG A | 4 | 33 | 37 | |
| EXS1400 COMPUTER SCIENCE A | | | | |
| EXS1500 CMPTR PROG B | 4 | 33 | 37 | |
| EXS1500 COMPUTER SCIENCE B | | | | |

| 2018–2019 | | | | 2019–2020 | | | | All |
|---|---|---|---|---|---|---|---|---|
| F | M | Total in CS | Total in CA | F | M | Total in CS | Total in CA | Grand Total |
| | 1 | 1 | | | 10 | 10 | | 15 |
| | 1 | 1 | | | 9 | 9 | | 14 |
| | 13 | 13 | | 2 | 18 | 20 | | 40 |
| | 13 | 13 | | 2 | 18 | 20 | | 40 |
| | 9 | 9 | | | | | | 9 |
| 88 | 123 | 211 | | 58 | 73 | 131 | | 459 |
| 472 | 471 | 943 | | 438 | 453 | 891 | | 2745 |
| | | | | | | | | |
| 18 | 19 | 37 | | 12 | 14 | 26 | | 66 |
| 2 | 7 | 9 | | 5 | 6 | 11 | | 21 |
| | | | | | | | | 2 |
| 5 | 3 | 8 | | 6 | 6 | 12 | | 20 |
| 11 | 9 | 20 | | 1 | 2 | 3 | | 23 |
| | | | | | | | | |
| 371 | 906 | 1277 | | 324 | 841 | 1165 | 17299 | 3459 |
| 10 | 15 | 25 | | 8 | 15 | 23 | | 80 |
| | | | | 1 | 8 | 9 | | 9 |
| 31 | 98 | 129 | | 41 | 119 | 160 | | 408 |
| | 1 | 1 | | | | | | 1 |
| | | | | 68 | 114 | 182 | | 232 |
| 129 | 250 | 379 | | | | | | 427 |
| 8 | 50 | 58 | | 9 | 30 | 39 | | 134 |
| | | | | 6 | 11 | 17 | | 17 |
| 8 | 51 | 59 | | 10 | 32 | 42 | | 138 |
| | | | | 6 | 9 | 15 | | 15 |

| Complex area (CA) and Course information | 2017–2018 | | | |
|---|---|---|---|---|
| | F | M | Total in CS | Total in CA |
| TAN2110 WEB DESIGN | 2 | 3 | 5 | |
| TAU2210 DIGITAL MEDIA TECH | 56 | 74 | 130 | |
| TIN5320 DESIGN TECHNOLOGY 2 | 10 | 29 | 39 | |
| TIN5512 A+CERT 3-OPERATING SYS C | 3 | 24 | 27 | |
| TIN5513 A+CERT 4-INTERNSHIP D | 3 | 22 | 25 | |
| TIN5520 CYBER SECURITY | 4 | 16 | 20 | |
| TIU5510 A+CERT 1-INTRO CMPTR SYS A | 2 | 33 | 35 | |
| TIU5511 A+CERT 2-INTRO CMPTR SYS B | 2 | 30 | 32 | |
| TMG0410 INTRO TECH ED | 71 | 101 | 172 | |
| TMG0501 CAREER /TECH-CMPTR LIT SEM | 83 | 126 | 209 | |
| | | | | |
| **Castle-Kahuku** | 180 | 271 | 451 | |
| ECS9500 AP CMPTR SCI AB | 11 | 34 | 45 | |
| ECS9800 AP COMPUTER SCIENCE PRNCPLS | | | | |
| EXS1200 COMPUTER LITERACY | 9 | 27 | 36 | |
| EXS1400 CMPTR PROG A | 8 | 22 | 30 | |
| EXS1400 COMPUTER SCIENCE A | | | | |
| EXS1500 CMPTR PROG B | 8 | 21 | 29 | |
| EXS1500 COMPUTER SCIENCE B | | | | |
| TAN2311 GAMING | 3 | 28 | 31 | |
| TAN2312 GAMING A | 1 | | 1 | |
| TAU2210 DIGITAL MEDIA TECH | 8 | 19 | 27 | |
| TIU5610 CMPTR ELECTRN | | | | |
| TMG0501 CAREER /TECH-CMPTR LIT SEM | 132 | 120 | 252 | |
| | | | | |

| 2018–2019 | | | | 2019–2020 | | | | All |
|---|---|---|---|---|---|---|---|---|
| F | M | Total in CS | Total in CA | F | M | Total in CS | Total in CA | Grand Total |
| 2 | 2 | 4 | | | 4 | 4 | | 13 |
| 67 | 109 | 176 | | 76 | 94 | 170 | | 476 |
| 6 | 23 | 29 | | 5 | 36 | 41 | | 109 |
| 2 | 19 | 21 | | 1 | 28 | 29 | | 77 |
| 2 | 18 | 20 | | 1 | 29 | 30 | | 75 |
| 5 | 18 | 23 | | 2 | 29 | 31 | | 74 |
| 2 | 23 | 25 | | 1 | 34 | 35 | | 95 |
| 2 | 22 | 24 | | 1 | 33 | 34 | | 90 |
| 45 | 118 | 163 | | 40 | 100 | 140 | | 475 |
| 52 | 89 | 141 | | 48 | 116 | 164 | | 514 |
| | | | | | | | | |
| 61 | 103 | 164 | | 71 | 129 | 200 | 7847 | 815 |
| 14 | 14 | 28 | | | 1 | 1 | | 74 |
| | | | | 29 | 24 | 53 | | 53 |
| 23 | 35 | 58 | | | | | | 94 |
| | | | | | | | | 30 |
| 8 | 18 | 26 | | 17 | 41 | 58 | | 84 |
| | | | | | | | | 29 |
| 7 | 18 | 25 | | 7 | 30 | 37 | | 62 |
| 3 | 9 | 12 | | 2 | 5 | 7 | | 50 |
| | | | | | | | | 1 |
| 6 | 9 | 15 | | 15 | 19 | 34 | | 76 |
| | | | | 1 | 9 | 10 | | 10 |
| | | | | | | | | 252 |
| | | | | | | | | |

| Complex area (CA) and Course information | 2017–2018 | | | |
|---|---|---|---|---|
| | F | M | Total in CS | Total in CA |
| **Farrington-Kaiser-Kalani** | 248 | 414 | 662 | |
| ECS9500 AP CMPTR SCI AB | 4 | 12 | 16 | |
| ECS9500 AP COMPUTER SCIENCE A | | | | |
| ECS9800 AP COMPUTER SCIENCE PRNCPLS | | | | |
| EXS0100 INTRO COMPUTER SCI A | | | | |
| EXS0110 INTRO COMPUTER SCI B | | | | |
| EXS0110 INTRO PROG GR 6-8 | | | | |
| EXS1200 COMPUTER LITERACY | | | | |
| EXS1400 CMPTR PROG A | 7 | 46 | 53 | |
| EXS1400 COMPUTER SCIENCE A | | | | |
| EXS1500 CMPTR PROG B | 7 | 45 | 52 | |
| EXS1500 COMPUTER SCIENCE B | | | | |
| TAU2210 DIGITAL MEDIA TECH | 73 | 94 | 167 | |
| TAU2211 DIGITAL MEDIA TECH A | | | | |
| TIN5320 DESIGN TECHNOLOGY 2 | 7 | 40 | 47 | |
| TMG0501 CAREER /TECH-CMPTR LIT SEM | 150 | 177 | 327 | |
| | | | | |
| **Hāna-Lahainaluna-Lānaʻi- Molokaʻi** | 311 | 359 | 670 | |
| ECS9800 AP COMPUTER SCIENCE PRNCPLS | | | | |
| EXS1200 COMPUTER LITERACY | | | | |
| EXS1400 COMPUTER SCIENCE A | | | | |
| EXS1500 COMPUTER SCIENCE B | | | | |
| TAN2311 GAMING | | | | |
| TAN2312 GAMING A | | | | |
| TAN2313 GAMING B | | | | |

| 2018–2019 | | | | 2019–2020 | | | | All |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| F | M | Total in CS | Total in CA | F | M | Total in CS | Total in CA | Grand Total |
| 247 | 495 | 742 | | 296 | 549 | 845 | 15587 | 2249 |
| 2 | 14 | 16 | | | | | | 32 |
| 3 | 25 | 28 | | | | | | 28 |
| | | | | 14 | 81 | 95 | | 95 |
| 8 | 12 | 20 | | 7 | 6 | 13 | | 33 |
| 4 | 8 | 12 | | | | | | 12 |
| | | | | 2 | 5 | 7 | | 7 |
| 2 | 5 | 7 | | | | | | 7 |
| 11 | 47 | 58 | | 10 | 61 | 71 | | 182 |
| 1 | 3 | 4 | | | | | | 4 |
| 11 | 47 | 58 | | 9 | 54 | 63 | | 173 |
| | 1 | 1 | | | | | | 1 |
| 49 | 77 | 126 | | 58 | 90 | 148 | | 441 |
| | | | | | 1 | 1 | | 1 |
| 17 | 51 | 68 | | 9 | 64 | 73 | | 188 |
| 139 | 205 | 344 | | 187 | 187 | 374 | | 1045 |
| | | | | | | | | |
| 171 | 242 | 413 | | 175 | 279 | 454 | 5105 | 1537 |
| 1 | 1 | 2 | | 5 | 17 | 22 | | 24 |
| 11 | 11 | 22 | | 47 | 50 | 97 | | 119 |
| | | | | 1 | 5 | 6 | | 6 |
| | | | | 1 | 3 | 4 | | 4 |
| 3 | 4 | 7 | | | | | | 7 |
| 1 | | 1 | | | | | | 1 |
| 1 | | 1 | | | | | | 1 |

| Complex area (CA) and Course information | 2017–2018 | | | |
|---|---|---|---|---|
| | F | M | Total in CS | Total in CA |
| TAU2210 DIGITAL MEDIA TECH | 58 | 59 | 117 | |
| TAU2211 DIGITAL MEDIA TECH A | | | | |
| TAU2212 DIGITAL MEDIA TECH B | 2 | 1 | 3 | |
| TIN5320 DESIGN TECHNOLOGY 2 | 2 | 10 | 12 | |
| TIU5610 CMPTR ELECTRN | | | | |
| TIU5612 CMP ELEC B | | | | |
| TIU5713 NETWK FUND / LAN | | | | |
| TMG0410 INTRO TECH ED | 191 | 231 | 422 | |
| TMG0501 CAREER /TECH-CMPTR LIT SEM | 58 | 58 | 116 | |
| | | | | |
| **Hilo-Waiākea** | 264 | 339 | 603 | |
| EXS0100 INTRO COMPUTER SCI A | | | | |
| EXS0100 INTRO COMPUTING GR 6-8 | | | | |
| EXS0110 INTRO COMPUTER SCI B | | | | |
| TAU2210 DIGITAL MEDIA TECH | 13 | 16 | 29 | |
| TIN5320 DESIGN TECHNOLOGY 2 | 1 | 13 | 14 | |
| TIN5520 CYBER SECURITY | | | | |
| TIU5610 CMPTR ELECTRN | 4 | 8 | 12 | |
| TIU5713 NETWK FUND / LAN | 8 | 9 | 17 | |
| TIU6100 INFORMATION TECH 1 | | | | |
| TMG0410 INTRO TECH ED | 13 | 4 | 17 | |
| TMG0501 CAREER /TECH-CMPTR LIT SEM | 225 | 289 | 514 | |
| ZMR1500 CS150/ICS111 | | | | |
| | | | | |

| 2018–2019 | | | | 2019–2020 | | | | All |
|---|---|---|---|---|---|---|---|---|
| F | M | Total in CS | Total in CA | F | M | Total in CS | Total in CA | Grand Total |
| 50 | 37 | 87 | | 35 | 37 | 72 | | 276 |
| 2 | | 2 | | | | | | 2 |
| | | | | | | | | 3 |
| 2 | 5 | 7 | | 10 | 15 | 25 | | 44 |
| 2 | 7 | 9 | | | | | | 9 |
| | 1 | 1 | | | | | | 1 |
| | | | | 3 | 14 | 17 | | 17 |
| 98 | 176 | 274 | | 73 | 138 | 211 | | 907 |
| | | | | | | | | 116 |
| | | | | | | | | |
| 278 | 336 | 614 | | 277 | 307 | 584 | 7893 | 1801 |
| 27 | 24 | 51 | | 13 | 11 | 24 | | 75 |
| 7 | 8 | 15 | | | | | | 15 |
| 7 | 8 | 15 | | | | | | 15 |
| 16 | 11 | 27 | | 15 | 10 | 25 | | 81 |
| 2 | 11 | 13 | | 1 | 16 | 17 | | 44 |
| | | | | 2 | 3 | 5 | | 5 |
| 1 | 18 | 19 | | 2 | 17 | 19 | | 50 |
| | | | | 4 | 9 | 13 | | 30 |
| 4 | 12 | 16 | | | | | | 16 |
| 30 | | 30 | | 10 | | 10 | | 57 |
| 184 | 244 | 428 | | 230 | 239 | 469 | | 1411 |
| | | | | | 2 | 2 | | 2 |
| | | | | | | | | |

| | 2017–2018 | | | |
|---|---|---|---|---|
| **Complex area (CA) and Course information** | **F** | **M** | **Total in CS** | **Total in CA** |
| **Honokaʻa-Kealakehe-Kohala-Konawaena** | 449 | 617 | 1066 | |
| ECS9500 AP CMPTR SCI AB | | | | |
| ECS9800 AP COMPUTER SCIENCE PRNCPLS | 8 | 31 | 39 | |
| ECS9900 DIR STDY-CMPTR SCI | | | | |
| EMS0600 EXPLOR CMPTR GR 6 | 109 | 127 | 236 | |
| EXS0100 INTRO COMPUTER SCI A | 120 | 129 | 249 | |
| EXS0100 INTRO COMPUTING GR 6-8 | 57 | 81 | 138 | |
| EXS0110 INTRO COMPUTER SCI B | | | | |
| EXS0110 INTRO PROG GR 6-8 | 6 | 3 | 9 | |
| EXS1200 COMPUTER LITERACY | | | | |
| EXS1400 CMPTR PROG A | 1 | 7 | 8 | |
| EXS1500 CMPTR PROG B | 1 | 6 | 7 | |
| TAN2110 WEB DESIGN | | | | |
| TAN2312 GAMING A | | 4 | 4 | |
| TAU2210 DIGITAL MEDIA TECH | 14 | 20 | 34 | |
| TIN5320 DESIGN TECHNOLOGY 2 | | 4 | 4 | |
| TMG0410 INTRO TECH ED | 76 | 123 | 199 | |
| TMG0500 CAREER /TECH-CMPTR LIT QTR | 36 | 50 | 86 | |
| TMG0501 CAREER /TECH-CMPTR LIT SEM | 21 | 32 | 53 | |
| | | | | |
| **Kailua-Kalāheo** | 68 | 110 | 178 | |
| EXS0100 INTRO COMPUTING GR 6-8 | 21 | 46 | 67 | |
| EXS1200 COMPUTER LITERACY | | | | |
| TAN2311 GAMING | | | | |
| TAU2210 DIGITAL MEDIA TECH | 23 | 38 | 61 | |

| 2018–2019 | | | | 2019–2020 | | | | All |
|---|---|---|---|---|---|---|---|---|
| F | M | Total in CS | Total in CA | F | M | Total in CS | Total in CA | Grand Total |
| 554 | 712 | 1266 | | 599 | 716 | 1315 | 10061 | 3647 |
| 4 | 6 | 10 | | 7 | 10 | 17 | | 27 |
| 20 | 47 | 67 | | 11 | 33 | 44 | | 150 |
| | | | | 4 | 2 | 6 | | 6 |
| 123 | 123 | 246 | | 121 | 125 | 246 | | 728 |
| 122 | 124 | 246 | | 130 | 150 | 280 | | 775 |
| 49 | 46 | 95 | | 34 | 33 | 67 | | 300 |
| 5 | 20 | 25 | | 29 | 47 | 76 | | 101 |
| | | | | | | | | 9 |
| | | | | 8 | 23 | 31 | | 31 |
| | 2 | 2 | | 1 | 10 | 11 | | 21 |
| | 2 | 2 | | | 3 | 3 | | 12 |
| 15 | 10 | 25 | | 6 | 8 | 14 | | 39 |
| | | | | | | | | 4 |
| 33 | 41 | 74 | | 66 | 49 | 115 | | 223 |
| | 3 | 3 | | | 6 | 6 | | 13 |
| 75 | 131 | 206 | | 61 | 88 | 149 | | 554 |
| 77 | 80 | 157 | | 79 | 81 | 160 | | 403 |
| 31 | 77 | 108 | | 42 | 48 | 90 | | 251 |
| | | | | | | | | |
| 28 | 27 | 55 | | 25 | 45 | 70 | 6310 | 303 |
| | | | | | | | | 67 |
| | | | | 1 | | 1 | | 1 |
| | | | | 3 | 10 | 13 | | 13 |
| 25 | 27 | 52 | | 15 | 29 | 44 | | 157 |

| Complex area (CA) and Course information | 2017–2018 | | | |
|---|---|---|---|---|
| | F | M | Total in CS | Total in CA |
| TAU2211 DIGITAL MEDIA TECH A | 2 | 3 | 5 | |
| TAU2212 DIGITAL MEDIA TECH B | 2 | 2 | 4 | |
| TMG0410 INTRO TECH ED | 13 | 21 | 34 | |
| ZTI1050 ICS 105 | 7 | | 7 | |
| | | | | |
| **Kaimukī-McKinley-Roosevelt** | 338 | 521 | 859 | |
| ECS9800 AP COMPUTER SCIENCE PRNCPLS | | | | |
| ECS9900 DIR STDY-CMPTR SCI | | | | |
| EMS0600 EXPLOR CMPTR GR 6 | 107 | 78 | 185 | |
| EXS0100 INTRO COMPUTER SCI A | | 7 | 7 | |
| EXS0100 INTRO COMPUTING GR 6-8 | 28 | 56 | 84 | |
| EXS0110 INTRO COMPUTER SCI B | 4 | 4 | 8 | |
| EXS0110 INTRO PROG GR 6-8 | 30 | 57 | 87 | |
| EXS1400 CMPTR PROG A | 10 | 18 | 28 | |
| EXS1500 CMPTR PROG B | 5 | 15 | 20 | |
| TAN2311 GAMING | 3 | 10 | 13 | |
| TAU2210 DIGITAL MEDIA TECH | 38 | 39 | 77 | |
| TAU2212 DIGITAL MEDIA TECH B | | | | |
| TIU5510 A+CERT 1-INTRO CMPTR SYS A | 3 | 15 | 18 | |
| TIU5511 A+CERT 2-INTRO CMPTR SYS B | 2 | 12 | 14 | |
| TIU6100 INFORMATION TECH 1 | 5 | 28 | 33 | |
| TMG0410 INTRO TECH ED | 56 | 105 | 161 | |
| TMG0500 CAREER /TECH-CMPTR LIT QTR | 34 | 64 | 98 | |
| TMG0502 CAREER /TECH-CMPTR LIT YR | 6 | 6 | 12 | |
| ZTI1105 ICS 110 | 7 | 7 | 14 | |

| 2018–2019 | | | | 2019–2020 | | | | All |
|---|---|---|---|---|---|---|---|---|
| F | M | Total in CS | Total in CA | F | M | Total in CS | Total in CA | Grand Total |
| 2 | | 2 | | 4 | 4 | 8 | | 15 |
| 1 | | 1 | | 2 | 2 | 4 | | 9 |
| | | | | | | | | 34 |
| | | | | | | | | 7 |
| | | | | | | | | |
| 253 | 418 | 671 | | 254 | 399 | 653 | 14103 | 2183 |
| 25 | 27 | 52 | | 24 | 38 | 62 | | 114 |
| 1 | 1 | 2 | | | | | | 2 |
| | | | | | | | | 185 |
| 14 | 39 | 53 | | 2 | 6 | 8 | | 68 |
| 50 | 84 | 134 | | 52 | 62 | 114 | | 332 |
| 4 | 8 | 12 | | 2 | 6 | 8 | | 28 |
| 33 | 56 | 89 | | 42 | 78 | 120 | | 296 |
| 7 | 21 | 28 | | 7 | 16 | 23 | | 79 |
| 6 | 17 | 23 | | 4 | 10 | 14 | | 57 |
| | 2 | 2 | | | | | | 15 |
| 44 | 65 | 109 | | 52 | 79 | 131 | | 317 |
| 2 | | 2 | | 1 | | 1 | | 3 |
| | | | | | | | | 18 |
| | | | | | | | | 14 |
| 15 | 29 | 44 | | 10 | 25 | 35 | | 112 |
| | | | | | | | | 161 |
| 44 | 65 | 109 | | 48 | 69 | 117 | | 324 |
| 8 | 4 | 12 | | 10 | 10 | 20 | | 44 |
| | | | | | | | | 14 |

| Complex area (CA) and Course information | 2017–2018 | | | |
|---|---|---|---|---|
| | F | M | Total in CS | Total in CA |
| **Kapa‘a-Kaua‘i-Waimea** | 576 | 832 | 1408 | |
| ECS9800 AP COMPUTER SCIENCE PRNCPLS | 3 | 3 | 6 | |
| ECS9900 DIR STDY-CMPTR SCI | | | | |
| EXS0100 INTRO COMPUTING GR 6-8 | 167 | 225 | 392 | |
| EXS0110 INTRO PROG GR 6-8 | 184 | 265 | 449 | |
| EXS1400 CMPTR PROG A | 13 | 3 | 16 | |
| EXS1500 CMPTR PROG B | 13 | 3 | 16 | |
| TAN2110 WEB DESIGN | 2 | 2 | 4 | |
| TAN2311 GAMING | | 14 | 14 | |
| TAN2313 GAMING B | | | | |
| TAU2210 DIGITAL MEDIA TECH | 26 | 42 | 68 | |
| TIN5320 DESIGN TECHNOLOGY 2 | 4 | 9 | 13 | |
| TIU5510 A+CERT 1-INTRO CMPTR SYS A | 1 | 12 | 13 | |
| TIU5511 A+CERT 2-INTRO CMPTR SYS B | 1 | 12 | 13 | |
| TMG0410 INTRO TECH ED | 115 | 172 | 287 | |
| TMG0501 CAREER /TECH-CMPTR LIT SEM | 47 | 70 | 117 | |
| | | | | |
| **Ka‘u-Kea‘au-Pāhoa** | 180 | 282 | 462 | |
| ECS9500 AP COMPUTER SCIENCE A | | | | |
| ECS9800 AP COMPUTER SCIENCE PRNCPLS | | | | |
| ECS9900 DIR STDY-CMPTR SCI | 2 | 9 | 11 | |
| EXS0100 INTRO COMPUTER SCI A | 48 | 57 | 105 | |
| EXS1400 CMPTR PROG A | 10 | 52 | 62 | |
| EXS1400 COMPUTER SCIENCE A | | | | |
| EXS1500 CMPTR PROG B | 11 | 56 | 67 | |

| 2018–2019 | | | | 2019–2020 | | | | All |
|---|---|---|---|---|---|---|---|---|
| F | M | Total in CS | Total in CA | F | M | Total in CS | Total in CA | Grand Total |
| 570 | 827 | 1397 | | 313 | 720 | 1033 | 9289 | 3838 |
| 6 | 39 | 45 | | 6 | 16 | 22 | | 73 |
| | | | | | 1 | 1 | | 1 |
| 179 | 198 | 377 | | 131 | 208 | 339 | | 1108 |
| | | | | | | | | 449 |
| 9 | 25 | 34 | | 9 | 38 | 47 | | 97 |
| 9 | 25 | 34 | | 9 | 38 | 47 | | 97 |
| | 4 | 4 | | 4 | 11 | 15 | | 23 |
| 1 | 15 | 16 | | 13 | 89 | 102 | | 132 |
| | | | | 2 | | 2 | | 2 |
| 27 | 53 | 80 | | 16 | 27 | 43 | | 191 |
| | 6 | 6 | | 2 | 6 | 8 | | 27 |
| | | | | | | | | 13 |
| | | | | | | | | 13 |
| 173 | 213 | 386 | | 43 | 106 | 149 | | 822 |
| 166 | 249 | 415 | | 78 | 180 | 258 | | 790 |
| | | | | | | | | |
| 121 | 187 | 308 | | 140 | 176 | 316 | 5457 | 1086 |
| | 1 | 1 | | | | | | 1 |
| 4 | 9 | 13 | | 18 | 20 | 38 | | 51 |
| 3 | 18 | 21 | | 5 | 17 | 22 | | 54 |
| | | | | | | | | 105 |
| 17 | 36 | 53 | | | | | | 115 |
| | | | | 8 | 21 | 29 | | 29 |
| | | | | | | | | 67 |

| Complex area (CA) and Course information | 2017–2018 | | | |
|---|---|---|---|---|
| | F | M | Total in CS | Total in CA |
| EXS1500 COMPUTER SCIENCE B | | | | |
| TAN2311 GAMING | 9 | 6 | 15 | |
| TAU2210 DIGITAL MEDIA TECH | 36 | 26 | 62 | |
| TAU2211 DIGITAL MEDIA TECH A | | | | |
| TIN5320 DESIGN TECHNOLOGY 2 | | 4 | 4 | |
| TIN5520 CYBER SECURITY | | | | |
| TMG0410 INTRO TECH ED | 63 | 72 | 135 | |
| TMG0502 CAREER /TECH-CMPTR LIT YR | 1 | | 1 | |
| | | | | |
| **Leilehua-Mililani-Waialua** | 697 | 1324 | 2021 | |
| ECS9500 AP COMPUTER SCIENCE A | | | | |
| ECS9800 AP COMPUTER SCIENCE PRNCPLS | 15 | 48 | 63 | |
| ECS9900 DIR STDY-CMPTR SCI | 4 | 8 | 12 | |
| EXS0100 INTRO COMPUTING GR 6-8 | 332 | 374 | 706 | |
| EXS0110 INTRO COMPUTER SCI B | | | | |
| EXS1400 COMPUTER SCIENCE A | | | | |
| EXS1500 COMPUTER SCIENCE B | | | | |
| TAU2210 DIGITAL MEDIA TECH | 50 | 53 | 103 | |
| TIN5320 DESIGN TECHNOLOGY 2 | 3 | 24 | 27 | |
| TIN5512 A+CERT 3-OPERATING SYS C | 4 | 40 | 44 | |
| TIN5513 A+CERT 4-INTERNSHIP D | 3 | 40 | 43 | |
| TIN5520 CYBER SECURITY | | | | |
| TIN5716 WAN / NETWK ARCHITECTURE | 3 | 12 | 15 | |
| TIU5510 A+CERT 1-INTRO CMPTR SYS A | 8 | 56 | 64 | |
| TIU5511 A+CERT 2-INTRO CMPTR SYS B | 8 | 56 | 64 | |

| 2018–2019 | | | | 2019–2020 | | | | All |
|---|---|---|---|---|---|---|---|---|
| F | M | Total in CS | Total in CA | F | M | Total in CS | Total in CA | Grand Total |
| 10 | 27 | 37 | | 7 | 20 | 27 | | 64 |
| | | | | | | | | 15 |
| 36 | 33 | 69 | | 38 | 19 | 57 | | 188 |
| | | | | 1 | | 1 | | 1 |
| 3 | | 3 | | 2 | 4 | 6 | | 13 |
| | | | | 12 | 17 | 29 | | 29 |
| 48 | 63 | 111 | | 49 | 58 | 107 | | 353 |
| | | | | | | | | 1 |
| | | | | | | | | |
| 575 | 1135 | 1710 | | 593 | 1200 | 1793 | 16347 | 5524 |
| | | | | 2 | 9 | 11 | | 11 |
| 25 | 54 | 79 | | 29 | 36 | 65 | | 207 |
| 5 | 34 | 39 | | 2 | 13 | 15 | | 66 |
| 157 | 147 | 304 | | 125 | 155 | 280 | | 1290 |
| | | | | 36 | 75 | 111 | | 111 |
| 3 | 5 | 8 | | | 25 | 25 | | 33 |
| 3 | 5 | 8 | | | 23 | 23 | | 31 |
| 33 | 43 | 76 | | 37 | 28 | 65 | | 244 |
| 4 | 18 | 22 | | 5 | 15 | 20 | | 69 |
| 5 | 28 | 33 | | 1 | 20 | 21 | | 98 |
| 5 | 28 | 33 | | 2 | 20 | 22 | | 98 |
| | 22 | 22 | | 4 | 28 | 32 | | 54 |
| 1 | 8 | 9 | | 1 | 12 | 13 | | 37 |
| 6 | 51 | 57 | | 6 | 54 | 60 | | 181 |
| 6 | 49 | 55 | | 5 | 54 | 59 | | 178 |

| | 2017–2018 | | | |
|---|---|---|---|---|
| Complex area (CA) and Course information | F | M | Total in CS | Total in CA |
| TIU5610 CMPTR ELECTRN | | | | |
| TIU5713 NETWK FUND / LAN | 3 | 36 | 39 | |
| TIU6100 INFORMATION TECH 1 | | 1 | 1 | |
| TMG0410 INTRO TECH ED | 108 | 395 | 503 | |
| TMG0500 CAREER /TECH-CMPTR LIT QTR | 133 | 137 | 270 | |
| TMG0501 CAREER /TECH-CMPTR LIT SEM | | | | |
| TMG0502 CAREER /TECH-CMPTR LIT YR | 23 | 44 | 67 | |
| | | | | |
| **Nānākuli-Waianae** | 234 | 295 | 529 | |
| EXS0100 INTRO COMPUTER SCI A | | | | |
| EXS0100 INTRO COMPUTING GR 6-8 | 96 | 113 | 209 | |
| EXS0110 INTRO COMPUTER SCI B | | | | |
| TAU2210 DIGITAL MEDIA TECH | 56 | 58 | 114 | |
| TMG0410 INTRO TECH ED | 82 | 124 | 206 | |
| | | | | |
| **Pearl City-Waipahu** | 150 | 482 | 632 | |
| ECS9800 AP COMPUTER SCIENCE PRNCPLS | | | | |
| ECS9900 DIR STDY-CMPTR SCI | 2 | 7 | 9 | |
| EXS0100 INTRO COMPUTING GR 6-8 | 16 | 59 | 75 | |
| EXS0110 INTRO PROG GR 6-8 | 3 | 15 | 18 | |
| EXS1200 COMPUTER LITERACY | 52 | 82 | 134 | |
| EXS1200 COMPUTING-TOOLS INFO AGE | | | | |
| EXS1400 CMPTR PROG A | 1 | 24 | 25 | |
| EXS1400 COMPUTER SCIENCE A | | | | |
| EXS1500 CMPTR PROG B | 1 | 24 | 25 | |

| 2018–2019 | | | | 2019–2020 | | | | All |
|---|---|---|---|---|---|---|---|---|
| F | M | Total in CS | Total in CA | F | M | Total in CS | Total in CA | Grand Total |
| 1 | 4 | 5 | | | | | | 5 |
| 5 | 42 | 47 | | 14 | 64 | 78 | | 164 |
| | | | | | | | | 1 |
| 125 | 416 | 541 | | 150 | 404 | 554 | | 1598 |
| | | | | | | | | 270 |
| 165 | 151 | 316 | | 157 | 139 | 296 | | 612 |
| 26 | 30 | 56 | | 17 | 26 | 43 | | 166 |
| | | | | | | | | |
| 186 | 252 | 438 | | 501 | 622 | 1123 | 7286 | 2090 |
| | | | | 226 | 283 | 509 | | 509 |
| 85 | 154 | 239 | | | | | | 448 |
| | | | | 220 | 271 | 491 | | 491 |
| 33 | 30 | 63 | | 45 | 23 | 68 | | 245 |
| 68 | 68 | 136 | | 10 | 45 | 55 | | 397 |
| | | | | | | | | |
| 176 | 424 | 600 | | 193 | 429 | 622 | 14637 | 1854 |
| | 1 | 1 | | 5 | 9 | 14 | | 15 |
| | | | | | | | | 9 |
| 30 | 54 | 84 | | 23 | 43 | 66 | | 225 |
| 2 | 8 | 10 | | 5 | 15 | 20 | | 48 |
| | | | | | | | | 134 |
| 44 | 81 | 125 | | 49 | 73 | 122 | | 247 |
| | | | | | | | | 25 |
| 2 | 13 | 15 | | | | | | 15 |
| | | | | | | | | 25 |

| Complex area (CA) and Course information | 2017–2018 | | | |
|---|---|---|---|---|
| | F | M | Total in CS | Total in CA |
| EXS1500 COMPUTER SCIENCE B | | | | |
| TAU2210 DIGITAL MEDIA TECH | 15 | 22 | 37 | |
| TAU2212 DIGITAL MEDIA TECH B | | | | |
| TIN5320 DESIGN TECHNOLOGY 2 | 7 | 14 | 21 | |
| TIN5512 A+CERT 3-OPERATING SYS C | 2 | 15 | 17 | |
| TIN5513 A+CERT 4-INTERNSHIP D | 2 | 13 | 15 | |
| TIN5520 CYBER SECURITY | | 6 | 6 | |
| TIN5716 WAN / NETWK ARCHITECTURE | 1 | 4 | 5 | |
| TIU5510 A+CERT 1-INTRO CMPTR SYS A | 7 | 50 | 57 | |
| TIU5511 A+CERT 2-INTRO CMPTR SYS B | 7 | 50 | 57 | |
| TIU5610 CMPTR ELECTRN | | | | |
| TIU5713 NETWK FUND / LAN | 2 | 9 | 11 | |
| TIU6100 INFORMATION TECH 1 | | | | |
| TMG0410 INTRO TECH ED | 32 | 87 | 119 | |
| TMG0502 CAREER /TECH-CMPTR LIT YR | | 1 | 1 | |
| | | | | |
| Total | 4916 | 7687 | 12603 | |

*Note.* * CA OCISS are courses offered as E-School
Some courses listed are semester courses; some students took one semester course, then the second. Total numbers are of enrollment, not of the number of unique students.
Data Source: HIDOE Data Analysis and Governance Branch, table created June 16, 2020

| 2018–2019 | | | | 2019–2020 | | | | All |
|---|---|---|---|---|---|---|---|---|
| F | M | Total in CS | Total in CA | F | M | Total in CS | Total in CA | Grand Total |
| 2 | 13 | 15 | | | | | | 15 |
| 53 | 55 | 108 | | 72 | 66 | 138 | | 283 |
| | 1 | 1 | | | | | | 1 |
| 3 | 15 | 18 | | 9 | 22 | 31 | | 70 |
| 1 | 10 | 11 | | | 4 | 4 | | 32 |
| 1 | 10 | 11 | | | 4 | 4 | | 30 |
| 1 | 7 | 8 | | 3 | 23 | 26 | | 40 |
| 2 | 5 | 7 | | | 5 | 5 | | 17 |
| | 10 | 10 | | 1 | 11 | 12 | | 79 |
| | 10 | 10 | | 1 | 11 | 12 | | 79 |
| 10 | 25 | 35 | | | | | | 35 |
| 2 | 9 | 11 | | 10 | 62 | 72 | | 94 |
| 6 | 12 | 18 | | 6 | 32 | 38 | | 56 |
| 17 | 81 | 98 | | 9 | 49 | 58 | | 275 |
| | 4 | 4 | | | | | | 5 |
| | | | | | | | | |
| 4627 | 7479 | 12106 | | 4706 | 7762 | 12468 | | 37177 |

HIDOE CS courses do not have prerequisites, although it is recommended that the students enroll in Algebra I before commencing AP CS courses. In addition, the College Board, which develops and administers the AP curriculum, recommends that students take Introduction to CS before enrolling in AP computer science A.

As such, efforts to increase statewide participation in CS must take into consideration the availability, access to, and incentives for students to participate in foundational and preparatory courses such as Algebra I.

### E-School

As a distance delivery learning model, E-School provides an opportunity for all high school students to enroll in a CS course regardless of whether the course is offered at the home school. These courses are available to charter school students as well. E-School courses are generally asynchronous, meaning the students may log in and complete assignments any time, and are led by state-certified teachers. However, E-School CS courses will not meet the Act 51 mandate of offering CS at every high school even if the availability of online courses exceeds the enrollment demands. During SY 2020–21 E-School will offer six computer science courses for high school students and two computer science courses for middle school students.[32]

### Advanced Placement Courses

Educational standards typically differ from state to state, thus presenting challenges to assessment of CS performance on a national scale. However, the College Board's Advanced Placement (AP) program offers a brief, albeit incomplete, glimpse into standardized comparison of the nation's achievements in CS education. AP CS curricula and examinations are standardized for all students across the country, allowing for comparison of Hawai'i students' performance against the national trends.

**AP Computer Science Principles focuses on creative development, data, algorithms and programming, computer systems and networks, and the impact of computing.**

AP courses, in general, are academically advanced, with many colleges offering college-level credit for a qualifying AP exam score. After a rigorous semester or year-long AP course, students may take the standardized examination in the selected subject area. However, students may also take the exam without enrolling in the course, or they may complete the course without participating in the exam. Each AP exam costs $94, with some subsidies available for low-income students that can reduce the cost to $53. Additionally, states may set aside 3% of their fiscal year 2019 Title I funds to provide grants to school districts for direct student services, which include covering AP exam fees. In addition, districts and schools can use Title I, Part A funds to cover AP exam fees for low-income students under certain conditions. In Hawai'i, the HIDOE reports that it has subsidized AP exams for low-income students at all HIDOE schools, bringing the cost to $12. HIDOE has also subsidized AP exams for all students at Title I and Community Eligibility Provision schools;[33] in SY 2018–19 and 2019–20, the program included 52 regular schools and 15 charter schools. In total, 37 schools received AP exam subsidies for their students; charter schools were not subsidized because state general funds were used.

Across the nation, the College Board offered AP Computer Science A in Pascal for the 1984–1998 exams, in C++ for 1999–2003, and in Java since 2004. AP Computer Science AB was discontinued in 2008 due to low numbers of exam takers. The AP Computer Science Principles (AP CSP) exam launched in SY 2016–17 and has more than doubled in participation nationwide since.[34] AP CSP is intended as a general, broad introduction to CS focusing not only on content but also on a "a way of thinking" in computational terms. The recently revised framework for AP CSP will focus on five major themes throughout the course: creative development, data, algorithms and programming, computer systems and networks, and the impact of computing.[35] The five areas are aligned with introductory CS college courses and will go into effect starting in SY 2020-21. AP CSP course is fitting for students who wish to understand the big picture of computing and to pursue majors that utilize computer science, such as physics, information science, and economics. AP CSA, on the other hand, is focused specifically on programming in Java language and is ideal for students who aim to study and work in computer science fields, such as software engineering and web development.

AP exams are taken almost exclusively by high school students, with the majority of takers in 11th and 12th grades. In 2019, AP CSP saw a national 33% increase in exam takers from the previous year.[36] In Hawai'i this increase was 57.0% for CSP and 28.7% for CSA from SY 2017–18 to SY 2018–19. The national mean scores were 3.26 for CSA and 3.11 for CSP. Hawai'i students performed slightly lower on CSP (2.86) and significantly lower on CSA examination (2.89) as compared to the national average.[37] These figures do not include charter schools.[38]

The most recently available data, from 2019, show that across the U.S., 69,685 students took AP CSA exams and 96,105 students took AP CSP exams. The large majority (60–75%) of students who take the exam are in grades 11 and 12. The large majority (67–75%) of AP CS exam takers are also male. Of all the AP CS exam takers, about 70% pass the exam with a score of 3 or higher. A summary of students demographics in 2019 can be seen in Table 20.

## Table 20. Demographic Details of Students Who Took the AP CS Exams Across the U.S. in 2019

| | 9th | 10th | 11th | 12th | Other | M | F | Schools | Colleges |
|---|---|---|---|---|---|---|---|---|---|
| AP CSA | 1,619 | 13,265 | 25,139 | 28,401 | 1,261 | 52,574 | 17,111 | 5,567 | 1,661 |
| AP CSP | 10,813 | 24,773 | 28,455 | 30436 | 1,628 | 64,647 | 31,458 | 5,189 | 2,199 |

*Note:* CSP = Computer Science Principles.
Data Source: AP College Board, Available at https://apstudents.collegeboard.org/

Every year Hawai'i students have an opportunity to take two CS AP exams offered by the College Board: AP Computer Science Principles (AP CSP) and AP Computer Science A (AP CSA). There were a total of 9,903 exam takers for all AP exams in Hawai'i in 2018 and 9,887 exam takers for all AP exams in Hawai'i in 2019. Of that total, 65.9% of exam takers were from public school in 2018 and 70.1% in 2019. Hawai'i students who took AP CS exams in 2019 is represented in Table 21.

## Table 21. AP CS Exams Taken by Hawai‘i Students by Title I High School Status, 2017–2019

| School Name | Title I School | 2017–2018 | 2018–2019 | Total |
|---|---|---|---|---|
| ‘Aiea High School | yes | | 11 | 11 |
| Baldwin High School | | 1 | | 1 |
| Campbell High School | | 78 | 87 | 165 |
| Castle High School | | 17 | 23 | 40 |
| Hilo High School | yes | | 3 | 3 |
| Honoka‘a High & Inter School | yes | | 1 | 1 |
| Kaiser High School | | | 26 | 26 |
| Kalāheo High School | | | 2 | 2 |
| Kalani High School | | 16 | 14 | 30 |
| Kapa‘a High School | | 6 | 14 | 20 |
| Kapolei High School | | 29 | 29 | 58 |
| Kaua‘i High School | | | 19 | 19 |
| Kea‘au High School | yes | | 14 | 14 |
| Kealakehe High School | yes | 20 | 29 | 49 |
| Kekaulike High School | | 14 | 25 | 39 |
| Kohala High School | yes | | 1 | 1 |
| Konawaena High School | yes | 9 | 17 | 26 |
| Leilehua High School | yes | 6 | 5 | 11 |
| Maui High School | | 12 | 12 | 24 |
| McKinley High School | yes | | 47 | 47 |
| Mililani High School | | 23 | 51 | 74 |
| Moanalua High School | | 47 | 41 | 88 |
| Moloka‘i High School | yes | | 2 | 2 |
| Radford High School | | | 1 | 1 |
| Waiākea High School* | yes | | 1 | 1 |

| School Name | Title I School | 2017–2018 | 2018–2019 | Total |
|---|---|---|---|---|
| Waialua High & Inter School | | 15 | 12 | 27 |
| Waipahu High School | yes | | 2 | 2 |
| Total from Title I schools | | 35 | 134 | 169 |
| Total from non Title I schools | | 258 | 355 | 613 |
| Total students | | 293 | 489 | 782 |
| % of students from non-Title I schools | | 88.05% | 72.60% | 78.39% |
| "% students from Title I high schools | | 11.95% | 27.40% | 21.61% |

*Note*. *Waiakea High School was a Title I school in SY 2018-19, but not SY 2017–18
Data Source: HIDOE Data Governance and Analysis Branch. Table created June 16, 2020

Between SY 2017–18 and 2018–19, the number of Title I high schools that offered an AP CS course increased from 3 (6.8%) to 7 (15.9%), which represented 12% and 27% of the exam takers across the state in AP Computer Science. In SY 2019–20, the number of Title I high schools increased to 10 (22.7%) that offered AP CS courses. And, though Act 51 has mandated that some form of computer science education be offered at all high schools beginning SY 2021-22, it is still unclear if any of those new courses will be AP courses. Hawai'i AP CS exam score summary can be seen in Table 22 with school summary information in Table 23.

## Table 22. Hawai'i AP Computer Science Exam Scores, 2018–2019

| | All Exam Takers | Mean Score[a] | Male Exam Takers (%) | Female Exam Takers (%) | Native Hawaiian or PI[b] | Mean Score for Native Hawaiian or PI | Public School Exam Takers | Mean Score for Public School Exam Takers |
|---|---|---|---|---|---|---|---|---|
| 2017 AP CSA | 88 | 2 | 62 (70%) | 26 (30%) | 8 | 1.13 | 29 | 2 |
| 2017 AP CSP | 202 | 3.34 | 136 (67%) | 66 (33%) | 4 | * | 100 | 3 |
| 2018 AP CSA | 132 | 2.44 | 100 (76%) | 32 (24%) | 1 | * | 101 | 2.42 |
| 2018 AP CSP | 325 | 3.07 | 225 (67%) | 100 (33%) | 8 | 2.25 | 200 | 2.68 |
| 2019 AP CSA | 155 | 2.62 | 111 (72%) | 44 (28%) | 1 | * | 130 | 2.49 |
| 2019 AP CSP | 511 | 3 | 352 (69%) | 159 (31%) | 19 | 2.16 | 337 | 2.65 |

*Note*. NH = Native Hawaiian, PI = Pacific Islander. * Frequency distributions and mean scores not reported when <5 exam takers in a field.
[a] AP Exams are graded on a 1-5 scale.
[b] This figure does not include students who reported "two or more races."
Data Source: AP College Board

## Table 23. Type of AP Computer Science Exam by School in SY 2017–18 and SY 2018–19

| | 2017–2018 | | | 2018–2019 | | | |
|---|---|---|---|---|---|---|---|
| School Name | CS A | CS P | All | CS A | CS P | All | Total |
| ʻAiea High School | | | | | 11 | 11 | 11 |
| Baldwin High School | 1 | | 1 | | | | 1 |
| Campbell High School | 25 | 53 | 78 | 16 | 71 | 87 | 165 |
| Castle High School | | 17 | 17 | | 23 | 23 | 40 |
| Hilo High School | | | | 1 | 2 | 3 | 3 |
| Honokaʻa High & Inter School | | | | | 1 | 1 | 1 |
| Kaiser High School | | | | 26 | | 26 | 26 |
| Kalāheo High School | | | | 1 | 1 | 2 | 2 |
| Kalani High School | 16 | | 16 | 14 | | 14 | 30 |
| Kapaʻa High School | | 6 | 6 | | 14 | 14 | 20 |
| Kapolei High School | | 29 | 29 | | 29 | 29 | 58 |
| Kauaʻi High School | | | | | 19 | 19 | 19 |
| Keaʻau High School | | | | 1 | 13 | 14 | 14 |
| Kealakehe High School | | 20 | 20 | 8 | 21 | 29 | 49 |
| Kekaulike High School | | 14 | 14 | 11 | 14 | 25 | 39 |
| Kohala High School | | | | | 1 | 1 | 1 |
| Konawaena High School | | 9 | 9 | 1 | 16 | 17 | 26 |
| Leilehua High School | | 6 | 6 | | 5 | 5 | 11 |
| Maui High School | 12 | | 12 | 5 | 7 | 12 | 24 |
| McKinley High School | | | | 1 | 46 | 47 | 47 |
| Mililani High School | | 23 | 23 | 1 | 50 | 51 | 74 |
| Moanalua High School | 47 | | 47 | 41 | | 41 | 88 |
| Molokaʻi High School | | | | | 2 | 2 | 2 |
| Radford High School | | | | | 1 | 1 | 1 |

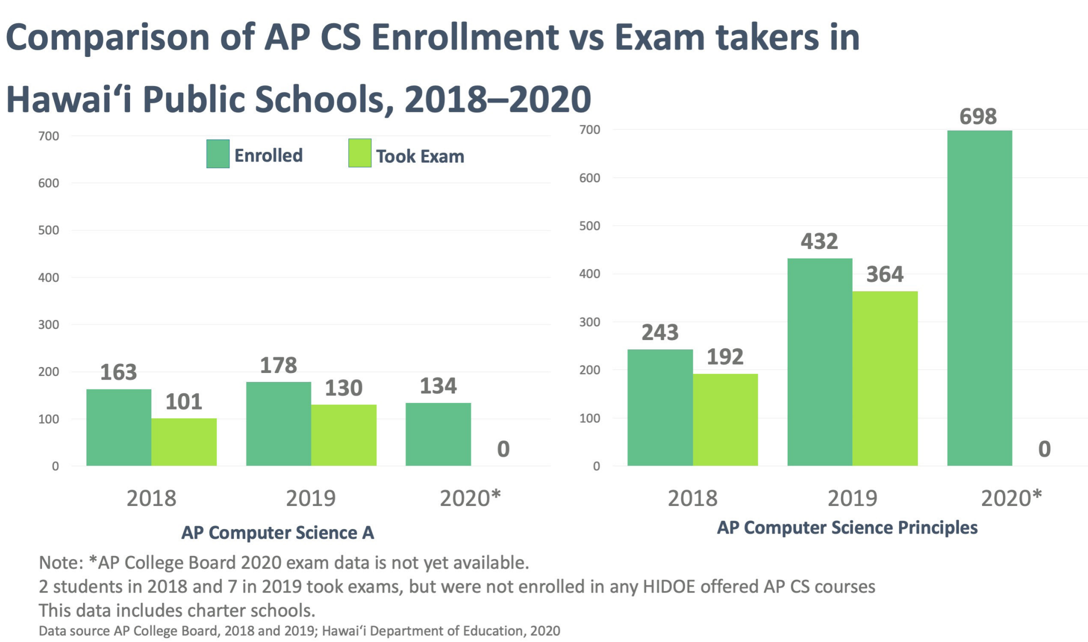
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Waiākea High School | | | | 1 | | 1 | 1 |
| Waialua High & Inter School | | 15 | 15 | | 12 | 12 | 27 |
| Waipahu High School | | | | 1 | 1 | 2 | 2 |
| Total | 101 | 192 | 293 | 129 | 360 | 489 | 782 |
| Change | | | | 27.7% | 87.5% | 66.9% | |

*Notes:* [a] CS Principles is shortened to CS P.
Data Source: Data Governance and Analysis Branch, Hawai'i Department of Education, Table created June 16, 2020

AP data suggests a disparity among public school students both in participation and performance. While HIDOE students represent 84% of the Hawaiʻi student population, only 65% of the exam takers were reported to be in public school (HIDOE, 2017). Similarly, public school students performed below the reported mean score in both CSA and CSP. Disproportionate number of exam takers were male with, 72% in CSA and 69% in CSP. Overall, the number of public school students who took CS AP exams are lower than for the more traditional subjects. Among approximately 46,000 high school students at HIDOE, approximately 1% took CS-related AP exams in 2019. In comparison, 3.8% took AP English Language & Composition, 2.7% took AP Psychology, and 2% took AP Calculus exams.

Additionally analysis between the enrollment data from the HIDOE and the test taking data from the AP College Board reveal that less students took the exam than were enrolled as seen in Figure 13. In 2018, 62% of enrollees took the exam for AP CS A and 73.0% for AP CS Principles. In 2019, 79% of enrollees took the exam for AP CS A and 84.0% for AP CS Principles. Data were not yet available for 2020 at the time of this report.

## Figure 13. Comparison of AP CS Enrollment vs Exam takers in Hawaiʻi Public Schools, 2018–2020



# STUDENT ENROLLMENT AND PARTICIPATION

The number of students enrolled in computer science-designated and CTE computer related-courses has increased since 2017 as seen in Table 24. There are more males than females in almost every course except for ones that are mandatory across all middle schoolers and specialized elective courses. There was a slight increase in the gap between the proportion of females to males between SY 2018–19 and SY 2019–20.

## Table 24. Number of Unique Student Counts in a Computer Science-Designated or CTE Computer Science-Related Course, 2017–2020

| | 2017–2018 | | | 2018–2019 | | | 2019–2020 | | |
|---|---|---|---|---|---|---|---|---|---|
| Complex Area | F | M | Total | F | M | Total | F | M | Total |
| ʻAiea-Moanalua-Radford | 321 | 461 | 782 | 359 | 555 | 914 | 260 | 431 | 691 |
| Baldwin-Kekaulike-Maui | 557 | 659 | 1216 | 625 | 721 | 1346 | 646 | 772 | 1418 |
| Campbell-Kapolei | 280 | 488 | 768 | 299 | 633 | 932 | 284 | 616 | 900 |
| Castle-Kahuku | 171 | 243 | 414 | 54 | 83 | 137 | 61 | 89 | 150 |
| Farrington-Kaiser-Kalani | 234 | 360 | 594 | 220 | 421 | 641 | 278 | 461 | 739 |
| Hāna-Lahainaluna-Lānaʻi-Molokaʻi | 267 | 288 | 555 | 169 | 243 | 412 | 170 | 262 | 432 |
| Hilo-Waiākea | 254 | 330 | 584 | 247 | 323 | 570 | 274 | 306 | 580 |
| Honokaʻa-Kealakehe-Kohala-Konawaena | 440 | 601 | 1041 | 526 | 676 | 1202 | 586 | 688 | 1274 |
| Kailua-Kalāheo | 64 | 107 | 171 | 25 | 28 | 53 | 24 | 42 | 66 |
| Kaimukī-McKinley-Roosevelt | 303 | 429 | 732 | 226 | 374 | 600 | 232 | 356 | 588 |
| Kapaʻa-Kauaʻi-Waimea | 372 | 501 | 873 | 367 | 521 | 888 | 223 | 497 | 720 |
| Kaʻu-Keaʻau-Pāhoa | 168 | 220 | 388 | 110 | 152 | 262 | 124 | 144 | 268 |
| Leilehua-Mililani-Waialua | 524 | 862 | 1386 | 477 | 784 | 1261 | 492 | 836 | 1328 |
| Nānākuli-Waianae | 183 | 223 | 406 | 138 | 215 | 353 | 303 | 388 | 691 |
| Pearl City-Waipahu | 118 | 306 | 424 | 154 | 324 | 478 | 181 | 351 | 532 |
| Grand Total | 4256 | 6078 | 10334 | 3996 | 6053 | 10049 | 4138 | 6239 | 10377 |
| -/+ | | | | -6.10% | -0.40% | -2.80% | 0.036 | 0.031 | 0.033 |
| F:M ratio | 1.43 | | | 1.51 | | | 1.51 | | |

*Note.* Data Source: Hawaiʻi Department of Education, Electronic Student Information System (eSIS), Retrieved June 10, 2020.

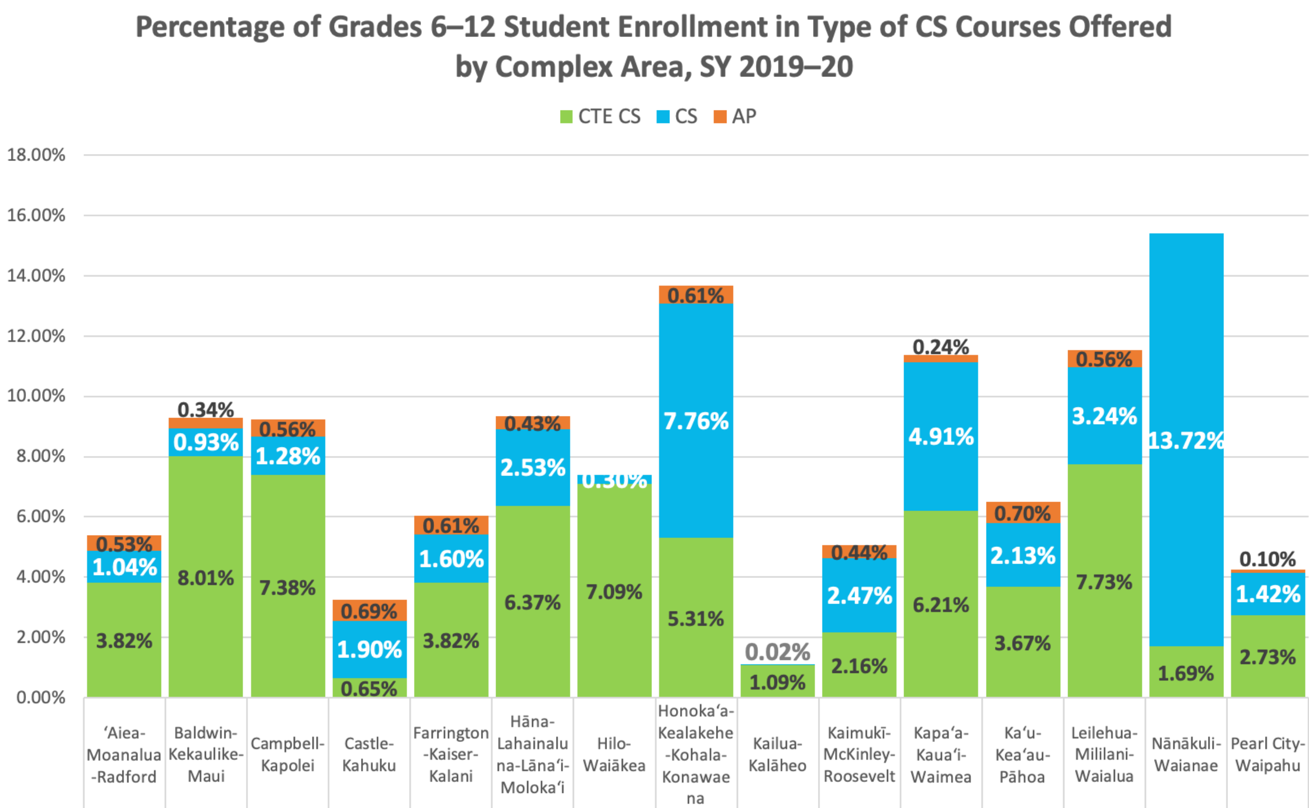
As seen in Table 25, about 14% of students in grades 6–12 are taking some form of CS course in SY 2019–20. About 60% of those students are taking CTE CS-related courses. Percentages of grades 6–12 student enrollment in the different types of CS courses offered by complex areas in SY 2019–20 is seen in Figure 14. Estimates were not available for elementary students.

## Table 25. Hawai'i Public School CS Participation, 2017–2020

| | 2017–2018 | 2018–2019 | 2019–2020 |
|---|---|---|---|
| # K–12 schools | 256 | 256 | 256 |
| # K–12 students | 168,095 | 168,152 | 167,454 |
| # Schools with Gr. 6–12[a] | 169 | 169 | 166 |
| # Students in Gr. 6–12[b] | 86,810 | 87,715 | 88,477 |
| # K–12 schools offering CS | 70 | 70 | 69 |
| # Schools with Gr. 6–12 offering CS | 70 | 70 | 69 |
| # Gr. 6–12 students in CS | 12,615 | 12,106 | 12,468 |
| # Gr. 6–12 students in CS-designated courses | 4,567 | 4,385 | 4,965 |
| # Gr. 6–12 students in CTE CS-related courses | 8,048 | 7,721 | 7,503 |
| # Gr. 6–12 unique students in CS courses | 10,337 | 10,049 | 10,377 |
| % K–12 schools offering CS | 27.34% | 27.34% | 26.95% |
| % Schools with Gr. 6–12 offering CS | 41.42% | 41.42% | 41.57% |
| % Gr. 6–12 students in CS | 14.53% | 13.80% | 14.09% |
| % Gr. 6–12 students in CS-designated courses | 5.26% | 5.00% | 5.61% |
| % Gr. 6–12 students in CTE CS-related courses | 9.27% | 8.80% | 8.48% |
| % Gr. 6–12 unique students in CS courses | 11.91% | 11.46% | 11.73% |

*Notes*. Elementary schools would not have designated CS courses until SY 2020–21. Public charter school students were not included in these counts.
[a]Elementary schools with grade 6 students were also included in these counts. In SY 2019–20, three elementary schools transitioned to not having grade 6 students. Enrollment numbers include students who may have been enrolled in two courses in the same school year.
[b]Enrollment numbers for grade 6 were estimated by taking reported numbers for SPED K–6 and dividing by 7 then rounding up before adding to the total counts.
Data source: DOE Enrollment 2017–18, 2018–19, 2019–20, Hawai'i Department of Education

## Figure 14. Percentage of Grades 6–12 Student Enrollment in Type of CS Courses Offered by Complex Area, SY 2019–20




| | ʻAiea-Moanalua-Radford | Baldwin-Kekaulike-Maui | Campbell-Kapolei | Castle-Kahuku | Farrington-Kaiser-Kalani | Hāna-Lahainaluna-Lānaʻi-Molokaʻi | Hilo-Waiākea | Honokaʻa-Kealakehe-Kohala-Konawaena | Kailua-Kalāheo | Kaimukī-McKinley-Roosevelt | Kapaʻa-Kauaʻi-Waimea | Kaʻu-Keaʻau-Pāhoa | Leilehua-Mililani-Waialua | Nānākuli-Waianae | Pearl City-Waipahu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AP | 0.53% | 0.34% | 0.56% | 0.69% | 0.61% | 0.43% | 0.00% | 0.61% | 0.00% | 0.44% | 0.24% | 0.70% | 0.56% | 0.00% | 0.10% |
| CS | 1.04% | 0.93% | 1.28% | 1.90% | 1.60% | 2.53% | 0.30% | 7.76% | 0.02% | 2.47% | 4.91% | 2.13% | 3.24% | 13.72% | 1.42% |
| CTE CS | 3.82% | 8.01% | 7.38% | 0.65% | 3.82% | 6.37% | 7.09% | 5.31% | 1.09% | 2.16% | 6.21% | 3.67% | 7.73% | 1.69% | 2.73% |

The complex areas with the highest counts of students in CS courses were in Leilehua-Mililani-Waialua (*n* = 1,793), Baldwin-Kekaulike-Maui (*n* = 1,499), and Honokaʻa-Kealakehe-Kohala-Konawaena (*n* = 1,315). Looking at the percentage of students enrolled, the Nanakuli Nānākuli-Waianae complex area had 15.42% of their students in CS courses, followed by the Honokaʻa-Kealakehe-Kohala-Konawaena complex area with 13.07% and Kapaʻa-Kauaʻi-Waimea complex area with 11.12%.

# EQUITY AND ACCESS

As many studies have shown and as cautioned in the *K–12 CS Framework*, equity is more than just whether classes are available. Though this report could not determine differences in student outcomes except for AP courses, the report instead looked at access as a starting point. Efforts towards understanding learning strategies and teaching, the choice and use of curriculum, student recruitment and retention initiatives, and school and classroom culture in support of diverse learners should be included in future landscape reports. Data from the HIDOE were analyzed to determine the participation of students based on designations of gender, ethnic, special education, low socioeconomic, and English language learner (ELL) status. These types of demographic data were not available for elementary school students since there were not yet CS courses at the elementary level in SY 2019–20; new course codes for elementary will begin in

SY 2020–21. However, information about computer science experiences that have had a focus on equity are described in the next section. Data for middle and high school students in CS courses were analyzed based on enrollment data provided by the Hawaiʻi Department of Education and exam data from the AP College Board.

## Elementary schools

At the elementary school level, student data were not available. Data were also not available for specific computer science courses or opportunities,[39] though some such as Hour of Code, Scratch, Lego Robotics, Makey Makey, Dash and Dot Robots, Common Sense Media were identified in the CS survey, as seen in Table 11. In particular, reported Code.org elementary activities as well as program information from STEMworks (Code.org) and Girls Who Code show moderate to high activity in coding opportunities related to computer science at the elementary school level, particularly as they engage with female students. Elementary school programs through Purple Maiʻa and Oceanit are very local community oriented. About half of these programs were not part of the HIDOE system, but rather, were offered by industry and community partners as extra-curricular experiences outside the HIDOE system. Many were supported by the HIDOE. Some of these programs are described below.

Code.org reports that their curriculum is used in 44% of elementary schools, 33% of middle schools, and 33% of high schools in Hawaiʻi, where there are four Code.org facilitators.[40] Over 100 schools in Hawaiʻi have hosted Hour of Code events, short interactive activities to introduce students to coding. Code.org additionally reports that of students who have been in their programs, 51% attend high needs schools, 22% are in rural schools, 45% are female students, and 53% are underrepresented minority students (Black/African American, Hispanic/Latino, American Indian, or Hawaiian). Lastly, Code.org reports that it and its regional partner(s) STEMworks, through 4 facilitators, have provided professional learning in Hawaiʻi for 1,031 teachers in CS Fundamentals (K-5), 55 teachers in Exploring Computer Science or Computer Science Discoveries, and 21 teachers in Computer Science Principles.

As shared earlier, the Girls Who Code website lists publicly 38 clubs. They are located on the islands of Kauaʻi, Maui, Oʻahu, and Hawaiʻi. Seventeen of the publicly listed clubs are associated with public schools. There is also one college loop, which is associated with the University of Hawaiʻi at Mānoa. As reported to the HIDOE CS team by the Girls Who Code Senior Manager of Community Partnerships & Outreach however, there were actually 50 public school clubs in SY 2019–20 with 193 participants;[41] the participant count was based on the number of students who registered for an account online associated with their school club. In some schools, especially in younger grades, the teacher facilitators have students share accounts or do the activities “unplugged” or offline. Therefore, the CS team estimates that the number of students who participated was more than 193.

Purple Maiʻa provides coding, computer science, and technology exploration programming at Hālau ʻĪnana, a Native Hawaiian innovation and collaboration space located in Mōʻiliʻili on the island of Oʻahu. They share that kumu (teachers) are Native Hawaiian or local people, many are parents, and all have CS knowledge and are passionate about sharing this knowledge to positively affect students’ lives. Their program, Tech Squidz, is a youth technology after school program where they explore art and computer science at Hālua ʻĪnana. They additionally offer Ahupua’a Minecraft, Haku JavaScript, and Summer Moʻolelo & Gaming Institute and run coding and computer science classes at select schools and youth organizations around the islands. Classes are either after school or elective, and they are free to students (funded by private grants and contracts).

To address equity of access, one of Oceanit’s strategies is to train teachers. Since 2017, Oceanit has trained over 550 teachers from almost 200 schools in Hawaiʻi using Altino. Oceanit also has an Altino PDE3 course for educators approved by the Hawaiʻi Department of Education from which educators can earn 3 credits. The course covers coding as well as lesson plan development to incorporate coding into any subject areas, such as history, social studies, English, art, and even PE as described by Oceanit. They have hosted ten design thinking workshops in Hawaiʻi, some at elementary schools, and brought their augmented reality sandbox to elementary, middle, and high schools. Oceanit's goal is to reach 5,000 teachers, thereby potentially reaching all Hawaiʻi students.

### Middle and High School

A summary of data of the percentages of student enrollment based on designations of gender, special education,[42] low socioeconomic, and English language learner (ELL) status is seen in Table 26. At the middle and high school level in SY 2019–20, 69 schools offer CS courses across all 15 complex areas.

## Table 26. Counts and Percentages of Male and Female, Special Education, Low Income, and English Language Learning (ELL) Student Enrollment in CS Courses by Complex Area, SY 2019–20

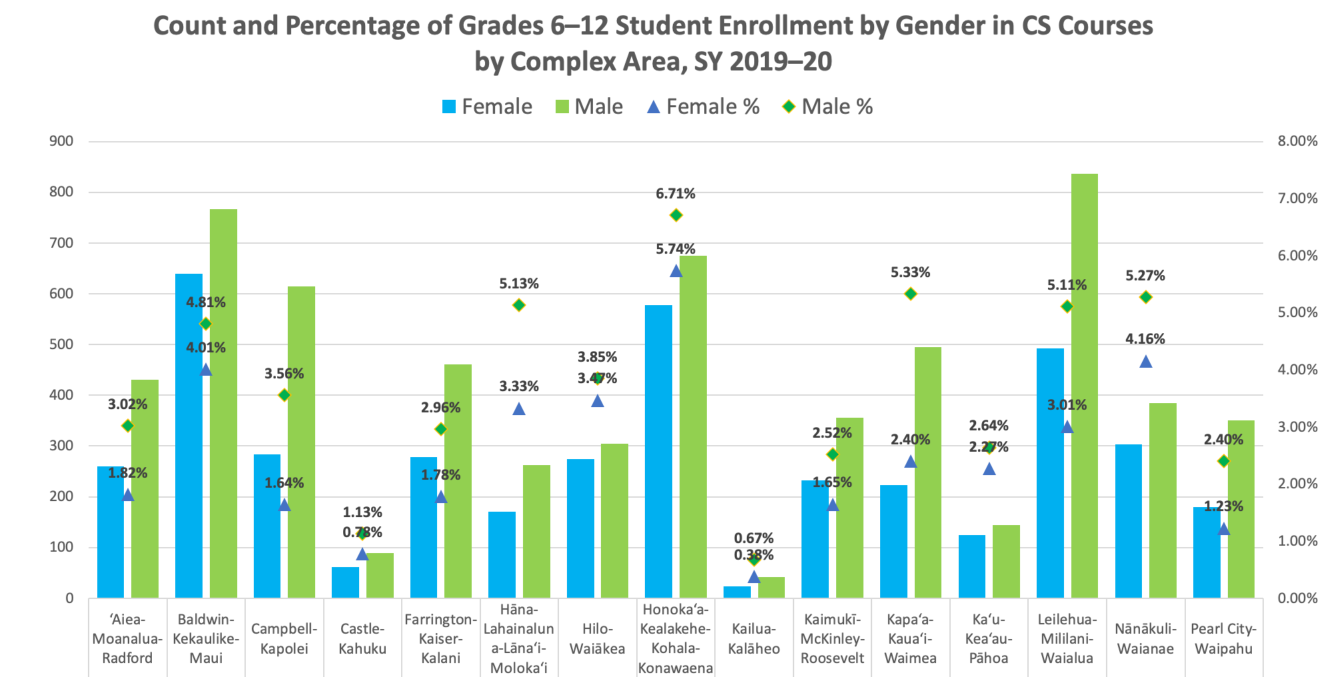
| Complex Area Enrollment Counts | Female | Male | IDEA | ELL | Low SES | CTE CS | CS | AP | All CS | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| ʻAiea-Moanalua-Radford | 260 | 431 | 57 | 32 | 240 | 546 | 148 | 76 | 691 | 14,287 |
| Baldwin-Kekaulike-Maui | 646 | 772 | 136 | 37 | 638 | 1,277 | 149 | 54 | 1,418 | 15,946 |
| Campbell-Kapolei | 284 | 616 | 79 | 22 | 263 | 1,277 | 222 | 97 | 900 | 17,299 |
| Castle-Kahuku | 61 | 89 | 17 | 1 | 50 | 51 | 149 | 54 | 150 | 7,847 |
| Farrington-Kaiser-Kalani | 278 | 461 | 60 | 60 | 201 | 596 | 249 | 95 | 739 | 15,587 |
| Hāna-Lahainaluna-Lānaʻi- Molokaʻi | 170 | 262 | 48 | 7 | 190 | 325 | 129 | 22 | 432 | 5,105 |
| Hilo-Waiākea | 274 | 306 | 66 | 25 | 334 | 560 | 24 | 0 | 580 | 7,893 |
| Honokaʻa-Kealakehe-Kohala-Konawaena | 586 | 688 | 102 | 179 | 757 | 534 | 781 | 61 | 1,274 | 10,061 |
| Kailua-Kalāheo | 24 | 42 | 8 |  | 22 | 69 | 1 | 0 | 66 | 6,310 |
| Kaimukī-McKinley-Roosevelt | 232 | 356 | 62 | 103 | 325 | 304 | 349 | 62 | 588 | 14,103 |
| Kapaʻa-Kauaʻi-Waimea | 223 | 497 | 68 | 29 | 310 | 577 | 456 | 22 | 720 | 9,289 |
| Kaʻu-Keaʻau-Pāhoa | 124 | 144 | 21 | 13 | 134 | 200 | 116 | 38 | 268 | 5,457 |
| Leilehua-Mililani-Waialua | 492 | 836 | 154 | 82 | 541 | 1,263 | 530 | 91 | 1,328 | 16,347 |

| Complex Area Enrollment Counts | Female | Male | IDEA | ELL | Low SES | CTE CS | CS | AP | All CS | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Nānākuli-Waianae | 303 | 388 | 135 | 32 | 368 | 123 | 1,000 | 0 | 691 | 7,286 |
| Pearl City-Waipahu | 181 | 351 | 55 | 40 | 199 | 400 | 208 | 14 | 532 | 14,637 |
| Total | 4,138 | 6,239 | 1,068 | 662 | 4,572 | 8,102 | 4,511 | 686 | 10,377 | 167,454 |
| **Complex Area Enrollment Percentages** | **Female** | **Male** | **IDEA** | **ELL** | **Low SES** | **CTE CS** | **CS** | **AP** | **All** | **Total** |
| ʻAiea-Moanalua-Radford | 1.82% | 3.02% | 0.40% | 0.22% | 1.68% | 3.82% | 1.04% | 0.53% | 4.84% | 100% |
| Baldwin-Kekaulike-Maui | 4.01% | 4.81% | 0.85% | 0.23% | 4.00% | 8.01% | 0.93% | 0.34% | 8.89% | 100% |
| Campbell-Kapolei | 1.64% | 3.56% | 0.46% | 0.13% | 1.52% | 7.38% | 1.28% | 0.56% | 5.20% | 100% |
| Castle-Kahuku | 0.78% | 1.13% | 0.22% | 0.01% | 0.64% | 0.65% | 1.90% | 0.69% | 1.91% | 100% |
| Farrington-Kaiser-Kalani | 1.78% | 2.96% | 0.38% | 0.38% | 1.29% | 3.82% | 1.60% | 0.61% | 4.74% | 100% |
| Hāna-Lahainaluna-Lānaʻi- Molokaʻi | 3.33% | 5.13% | 0.94% | 0.14% | 3.72% | 6.37% | 2.53% | 0.43% | 8.46% | 100% |
| Hilo-Waiākea | 3.47% | 3.85% | 0.84% | 0.32% | 4.23% | 7.09% | 0.30% | 0.00% | 7.35% | 100% |
| Honokaʻa-Kealakehe-Kohala-Konawaena | 5.74% | 6.71% | 1.01% | 1.78% | 7.52% | 5.31% | 7.76% | 0.61% | 12.66% | 100% |
| Kailua-Kalāheo | 0.38% | 0.67% | 0.13% | 0.00% | 0.35% | 1.09% | 0.02% | 0.00% | 1.05% | 100% |
| Kaimukī-McKinley-Roosevelt | 1.65% | 2.52% | 0.44% | 0.73% | 2.30% | 2.16% | 2.47% | 0.44% | 4.17% | 100% |
| Kapaʻa-Kauaʻi-Waimea | 2.40% | 5.33% | 0.73% | 0.31% | 3.34% | 6.21% | 4.91% | 0.24% | 7.75% | 100% |
| Kaʻu-Keaʻau-Pāhoa | 2.27% | 2.64% | 0.38% | 0.24% | 2.46% | 3.67% | 2.13% | 0.70% | 4.91% | 100% |
| Leilehua-Mililani-Waialua | 3.01% | 5.11% | 0.94% | 0.50% | 3.31% | 7.73% | 3.24% | 0.56% | 8.12% | 100% |
| Nānākuli-Waianae | 4.16% | 5.27% | 1.85% | 0.44% | 5.05% | 1.69% | 13.72% | 0.00% | 9.48% | 100% |
| Pearl City-Waipahu | 1.23% | 2.40% | 0.38% | 0.27% | 1.36% | 2.73% | 1.42% | 0.10% | 3.63% | 100% |
| Total | 2.47% | 3.73% | 0.64% | 0.40% | 2.73% | 4.84% | 2.69% | 0.41% | 6.20% | 100% |

*Note:* Counts for gender, special education, low socioeconomics, and English language learners were controlled for multiple courses in the single academic year. CS courses are complete enrollment counts; a student taking two CS courses was counted in both courses.
Data Source: Hawaiʻi Department of Education eSIS, 2020. Table generated June 20, 2020

At the schools, a gap in participation between female and male students can be seen in courses that are not required. In every complex area, the percentage of female students enrolled in CS courses were lower than that of males, as seen in Figure 15. The complex area with the closest proportion of participation of males and females students was in the Kailua-Kalāheo complex area that had a 0.29% difference, then the Castle-Kahuku complex area that had a 0.36% difference, the Kaʻu-Keaʻau-Pāhoa complex area at 0.37%, and then Hilo-Waiākea with a 0.38% difference. The complex area with the largest difference in proportion of participation of male and female students was in the Kapaʻa-Kauaʻi-Waimea complex area that had a 2.93% difference and the Leilehua-Mililani-Waialua complex area with a 2.10% difference. Across all public schools, there was a difference of 1.25% or 2,090 students.

## Figure 15. Count and Percentage of Grades 6–12 Student Enrollment by Gender in CS Courses by Complex Area, SY 2019–20




| | ʻAiea-Moanalua-Radford | Baldwin-Kekaulike-Maui | Campbell-Kapolei | Castle-Kahuku | Farrington-Kaiser-Kalani | Hāna-Lahainaluna-Lānaʻi-Molokaʻi | Hilo-Waiākea | Honokaʻa-Kealakehe-Kohala-Konawaena | Kailua-Kalāheo | Kaimukī-McKinley-Roosevelt | Kapaʻa-Kauaʻi-Waimea | Kaʻu-Keaʻau-Pāhoa | Leilehua-Mililani-Waialua | Nānākuli-Waianae | Pearl City-Waipahu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Female | 260 | 639 | 284 | 61 | 278 | 170 | 274 | 578 | 24 | 232 | 223 | 124 | 492 | 303 | 180 |
| Male | 431 | 767 | 615 | 89 | 461 | 262 | 304 | 675 | 42 | 356 | 495 | 144 | 836 | 384 | 351 |
| Female % | 1.82% | 4.01% | 1.64% | 0.78% | 1.78% | 3.33% | 3.47% | 5.74% | 0.38% | 1.65% | 2.40% | 2.27% | 3.01% | 4.16% | 1.23% |
| Male % | 3.02% | 4.81% | 3.56% | 1.13% | 2.96% | 5.13% | 3.85% | 6.71% | 0.67% | 2.52% | 5.33% | 2.64% | 5.11% | 5.27% | 2.40% |

*Note:* Percentages were calculated based on the total student enrollment counts of the complex area. Student counts were controlled for multiple courses in a single year.

Looking at the courses shown earlier in Table 18, there were two CS courses across 69 schools in SY 2019–20 which there were more females than males. Those courses were Gaming B (TAN2313) where both students enrolled were female students and Digital Media Technology B (TAU2212) where there were 5 female and 3 male students. The other 34 offered courses had more males than females by an average of 62 males for every 38 females.

Demographic data were available for students in AP CS courses. According to records from the HIDOE, between 2017 and 2020, 1,848 students from Hawaiʻi took the AP CSA or AP CS Principles course. Looking at SY 2019–20, the majority of the students were Asian (52.6%) and male (67.9%), as seen in Table 27 and Figure 16. Unlike in national statistics, where

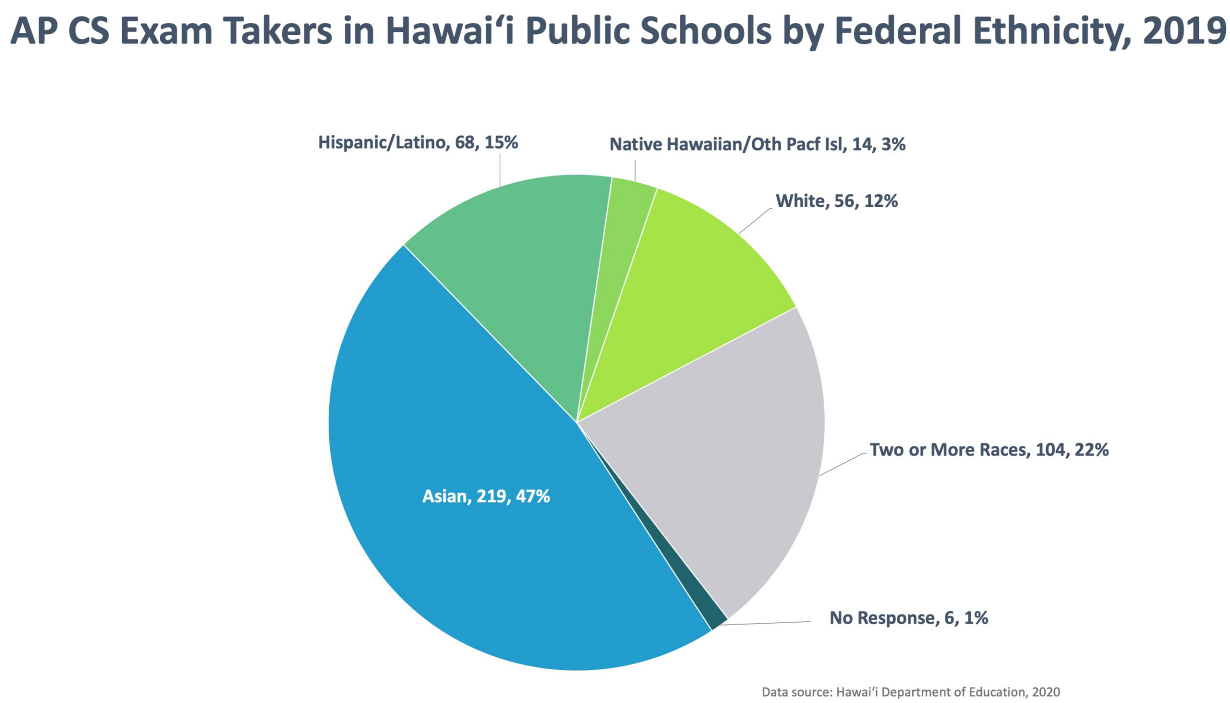
White students were the majority of AP CS exam takers, Hawai'i's largest group of test takers were Asian (47%). More specifically, the three largest Asian groups were Filipino (25%), Japanese (13%), and Chinese (11%), as seen in Figure 17. In the three most recent school years, the number of females taking the AP CS courses has increased by about 50% each school year, surpassing the growth of males taking the courses in SY 2019–20, where the increase by males was 30.6%. However, across all three school years, the ratio of females to males is still skewed towards males, 1:2.41 in SY 2017–18 to 1:2.10 in SY 2019–20 as seen in Figures 18 and 19.

## Table 27. Ethnicity of Students Taking the AP CS Courses in Hawai'i by Federal Designations, 2017–2020

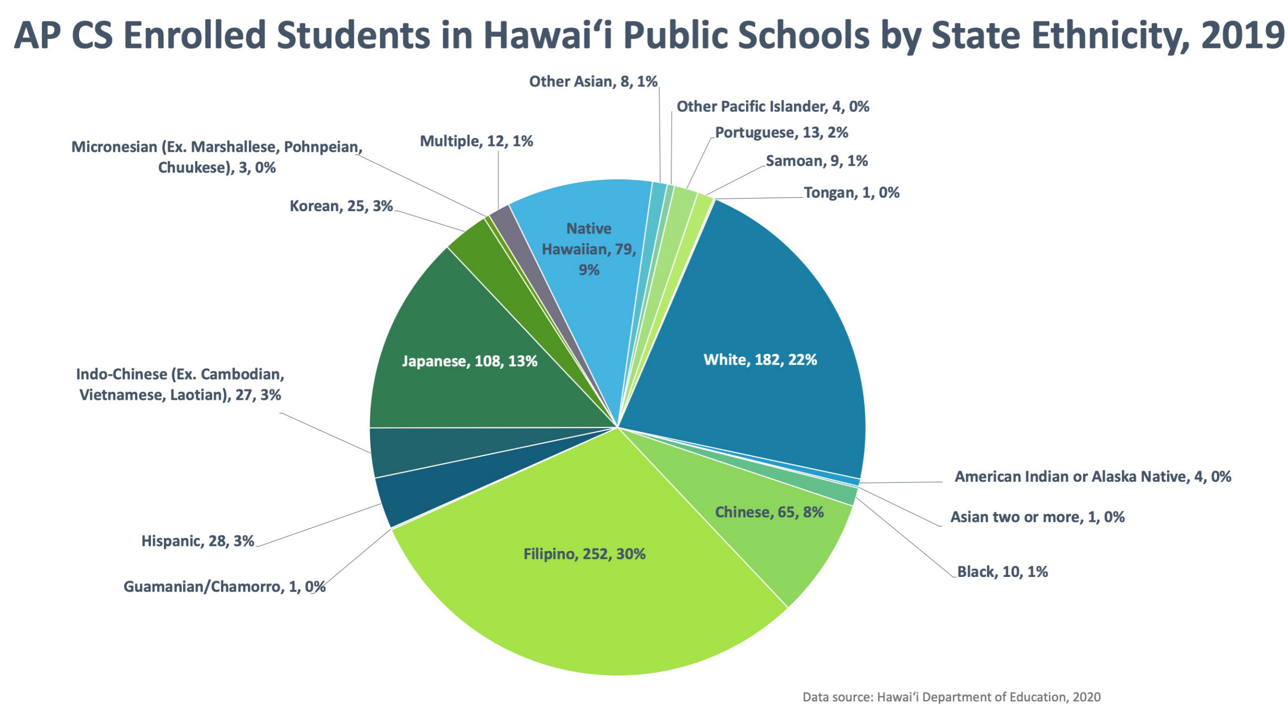
| | 2017–2018 | | | 2018–2019 | | | 2019–2020 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Ethnicity, Federal | F | M | Total | F | M | Total | F | M | Total | Grand Total |
| American Indian or Alaska Native | 1 | 3 | 4 | | 3 | 3 | | 1 | 1 | 8 |
| Asian | 71 | 149 | 220 | 92 | 216 | 308 | 153 | 285 | 438 | 966 |
| Black | 3 | 6 | 9 | 1 | 8 | 9 | 2 | 3 | 5 | 23 |
| Hispanic | 4 | 18 | 22 | 14 | 28 | 42 | 14 | 48 | 62 | 126 |
| Multiple | 5 | 25 | 30 | 17 | 37 | 54 | 21 | 61 | 82 | 166 |
| Pacific Islander | 16 | 24 | 40 | 30 | 45 | 75 | 35 | 57 | 92 | 207 |
| White | 19 | 62 | 81 | 24 | 95 | 119 | 43 | 109 | 152 | 352 |
| Total | 119 | 287 | 406 | 178 | 432 | 610 | 268 | 564 | 832 | 1848 |
| +/- | | | | 0.496 | 0.502 | 50.20% | 0.506 | 0.306 | 36.40% | |
| F:M ratio | 1:2.41 | | | 1:2.42 | | | 1:2.10 | | | |

Data Source: Hawai'i Department of Education, Electronic Student Information System (eSIS), Retrieved June 10, 2020.

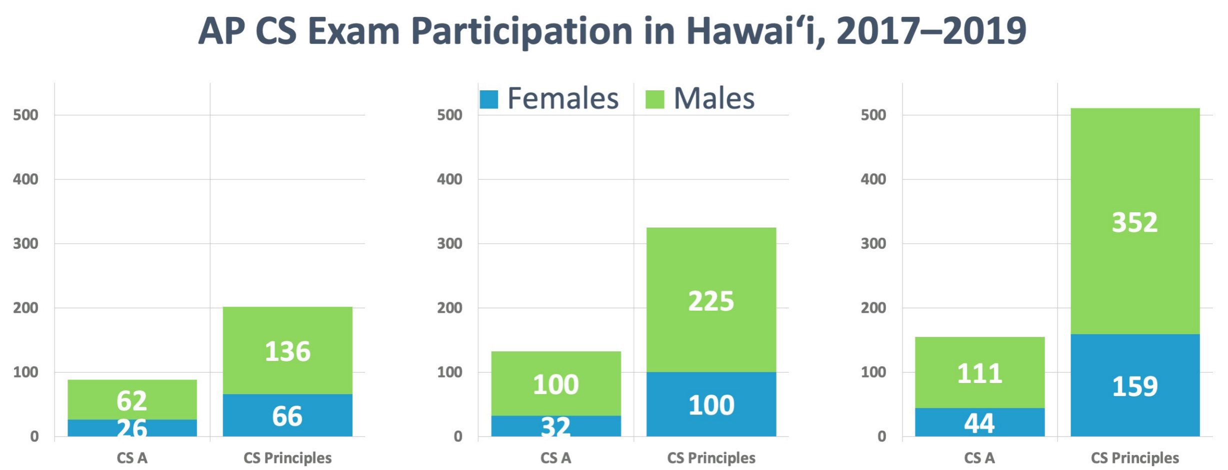
## Figure 16. Hawai‘i AP Exam Takers in 2019 by Federal Ethnicity Designations




## Figure 17. Hawai‘i AP Exam Takers in 2019 by State Designations



## Figure 18. AP CS Exam Participation in Hawai‘i, 2017–2019




**2017**

- 44% of exam takers were from public schools.
- 30% of CS A exam takers were female.
- 33% of CS Principles exam takers were female.
- There were 12 Native Hawaiian or Pacific Islander exam takers.

**2018**

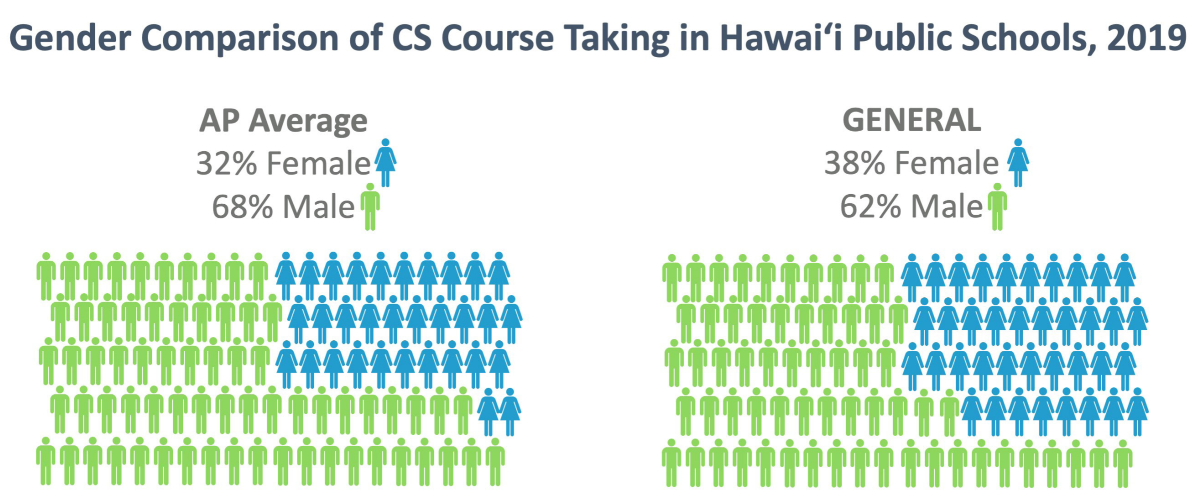
- 65% of exam takers were from public schools.
- 24% of CS A exam takers were female.
- 33% of CS Principles exam takers were female.
- There were 9 Native Hawaiian or Pacific Islander exam takers.

**2019**

- 70% of exam takers were from public schools.
- 28% of CS A exam takers were female.
- 31% of CS Principles exam takers were female.
- There were 20 Native Hawaiian or Pacific Islander exam takers.

Data source: AP College Board, 2017, 2018, 2019

## Figure 19. Gender Comparison of CS Course Enrollment in Hawai‘i Public Schools in SY 2019–20




**AP CS A**

- SY 2017–18: 26% females, 43
- SY 2018–19: 30% females, 53
- SY 2019–20: 28% females, 37

**AP CS Principles**

- SY 2017–18: 31% females, 76
- SY 2018–19: 29% females, 125
- SY 2019–20: 33% females, 231

**General CS**

- SY 2017–18: 39% females, 4932
- SY 2018–19: 39% females, 4669
- SY 2019–20: 38% females, 4761

Data source: Hawai‘i Department of Education, 2020

Looking at the Hawai'i ethnicity data in Table 28, the largest group of AP CS test-taking students across all three school years are Filipino (29.17%), followed by White (22.46%),[43] and Japanese (13.26%). Native Hawaiian students represent 10.0% of exam takers.

## Table 28. Ethnicity of Students Taking the AP CS Exams in Hawai'i by State Designations , 2017–2020

| | 2017–2018 | | | 2018–2019 | | | 2019–2020 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Ethnicity, Hawai'i State** | **F** | **M** | **Total** | **F** | **M** | **Total** | **F** | **M** | **Total** |
| American Indian or Alaska Native | 1 | 3 | 4 | | 6 | 6 | 1 | 3 | 4 |
| Asian two or more | 1 | | 1 | 1 | | 1 | | 1 | 1 |
| Black | 3 | 9 | 12 | 1 | 12 | 13 | 2 | 8 | 10 |
| Chinese | 9 | 14 | 23 | 18 | 39 | 57 | 28 | 37 | 65 |
| Filipino | 46 | 79 | 125 | 50 | 112 | 162 | 75 | 177 | 252 |
| Guamanian/Chamorro | | | | 1 | 2 | 3 | | 1 | 1 |
| Hispanic | 1 | 9 | 10 | 4 | 15 | 19 | 6 | 22 | 28 |
| Indo-Chinese (Ex. Cambodian, Vietnamese, Laotian) | 2 | 5 | 7 | 8 | 12 | 20 | 12 | 15 | 27 |
| Japanese | 14 | 55 | 69 | 20 | 48 | 68 | 41 | 67 | 108 |
| Korean | 2 | 9 | 11 | 5 | 19 | 24 | 7 | 18 | 25 |
| Micronesian (Ex. Marshallese, Pohnpeian, Chuukese) | | | | 3 | 1 | 4 | 2 | 1 | 3 |
| Multiple | 1 | 1 | 2 | 3 | 6 | 9 | 1 | 11 | 12 |
| Native Hawaiian | 14 | 22 | 36 | 27 | 43 | 70 | 28 | 51 | 79 |
| Other Asian | 1 | 2 | 3 | 1 | 1 | 2 | 3 | 5 | 8 |
| Other Pacific Islander | 1 | | 1 | 1 | | 1 | 2 | 2 | 4 |
| Portuguese | 3 | 2 | 5 | 2 | 5 | 7 | 3 | 10 | 13 |
| Samoan | 1 | 2 | 3 | 1 | 3 | 4 | 6 | 3 | 9 |
| Tongan | | | | 1 | | 1 | | 1 | 1 |
| White | 19 | 75 | 94 | 31 | 108 | 139 | 51 | 131 | 182 |
| Total | 119 | 287 | 406 | 178 | 432 | 610 | 268 | 564 | 832 |
| +/- | | | | 49.6% | 50.5% | 50.2% | 50.6% | 30.6% | 36.4% |
| Female to male ratio | 1:2.41 | | | 1:2.43 | | | 1:2.10 | | |

Data Source: HIDOE Data Governance and Analysis Branch, table created June 16, 2020

With a lens on females, the number of public school female students who took AP computer science exams increased from 76 to 141 from SY 2017–18 to 2018–19, as seen in Table 29. However, a comparison to males shows that for every 5 males, there were 2 females who took the exams in both school years. Across all computer science participation, the proportion of females has not increased. In SY 2017–18, there were 64 girls for every 100 boys. In SY 2019-20, that number has decreased slightly and is 60 girls for every 100 boys in a CS-designated or CTE CS-related course. Participation numbers were not available for out-of-school programs.

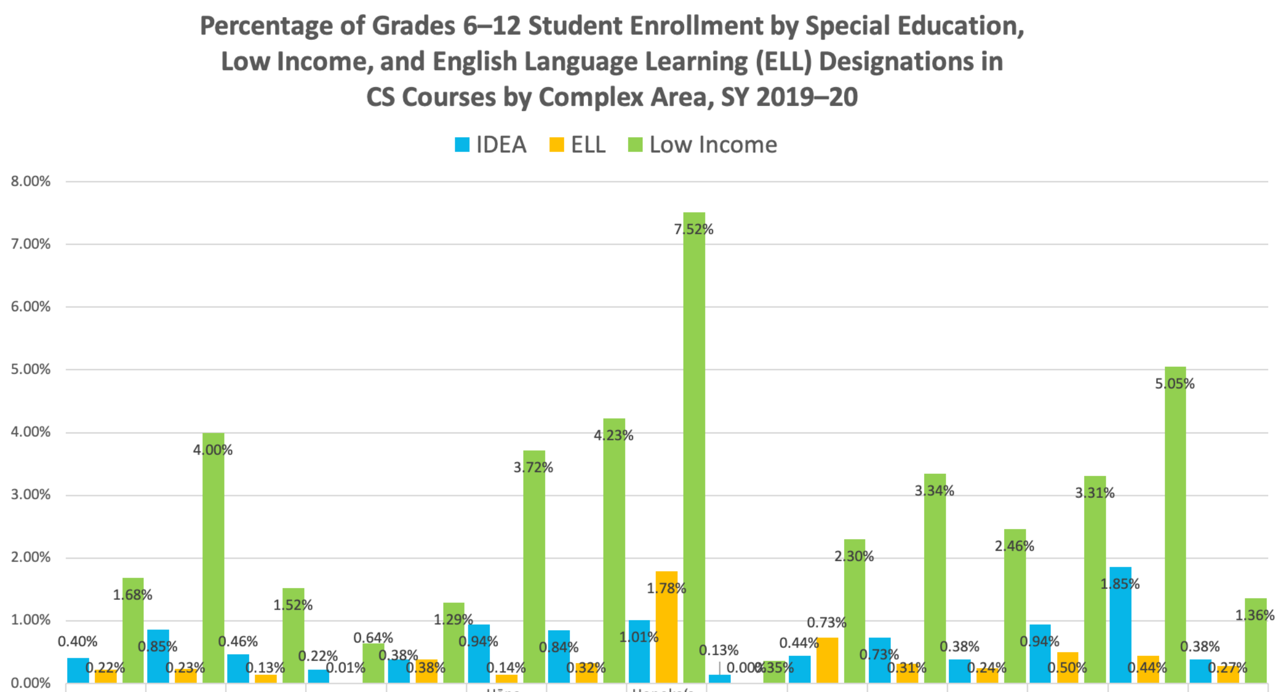
## Table 29. AP Exam Scores in Hawaiʻi Public Schools by Hawaiʻi Gender, 2017–2019

| | 2017–2018 | | | 2018–2019 | | |
|---|---|---|---|---|---|---|
| Score | F | M | Total | F | M | Total |
| 1 | 26 | 48 | 74 | 38 | 87 | 125 |
| 2 | 15 | 47 | 62 | 34 | 83 | 117 |
| 3 | 20 | 66 | 86 | 41 | 102 | 143 |
| 4 | 8 | 37 | 45 | 19 | 48 | 67 |
| 5 | 7 | 17 | 24 | 9 | 26 | 35 |
| Total | 76 | 215 | 291 | 141 | 346 | 487 |
| Mean | 2.41 | 2.67 | | 2.48 | 2.55 | |

Data source: HIDOE Data Governance and Analysis Branch, table created June 16, 2020

Furthermore, the AP courses offered through E-School addresses part of the equity of access concern for remote areas or schools where only a few students want to take AP CS and there may not be qualified teachers to offer the high-level courses. However, a student taking AP CS via E-School does not fulfill the legislative Act 51 requirement that their school has offered a computer science course. As seen in Figure 20, the Honokaʻa-Kealakehe-Kohala-Konawaena, Nānākuli-Waianae, Hilo-Waiākea, Baldwin-Kekaulike-Maui, and Hāna-Lahainaluna-Lānaʻi-Molokaʻi complex areas had higher enrollment in percentage of students in the low socioeconomic designation more so than other complex areas. On average, 0.64% of the enrolled CS students were special education students, 0.39% were English language learners, and 2.72% were low socioeconomic students.

## Figure 20. Percentage of Grades 6–12 Student Enrollment by Special Education, Low Income, and English Language Learning (ELL) Designations in CS Courses by Complex Area, SY 2019–20




| | ʻAiea-Moanalua-Radford | Baldwin-Kekaulike-Maui | Campbell-Kapolei | Castle-Kahuku | Farrington-Kaiser-Kalani | Hāna-Lahainaluna-Lānaʻi-Molokaʻi | Hilo-Waiākea | Honokaʻa-Kealakehe-Kohala-Konawaena | Kailua-Kalāheo | Kaimukī-McKinley-Roosevelt | Kapaʻa-Kauaʻi-Waimea | Kaʻu-Keaʻau-Pāhoa | Leilehua-Mililani-Waialua | Nānākuli-Waianae | Pearl City-Waipahu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IDEA | 0.40% | 0.85% | 0.46% | 0.22% | 0.38% | 0.94% | 0.84% | 1.01% | 0.13% | 0.44% | 0.73% | 0.38% | 0.94% | 1.85% | 0.38% |
| ELL | 0.22% | 0.23% | 0.13% | 0.01% | 0.38% | 0.14% | 0.32% | 1.78% | 0.00% | 0.73% | 0.31% | 0.24% | 0.50% | 0.44% | 0.27% |
| Low Income | 1.68% | 4.00% | 1.52% | 0.64% | 1.29% | 3.72% | 4.23% | 7.52% | 0.35% | 2.30% | 3.34% | 2.46% | 3.31% | 5.05% | 1.36% |

*Note:* Percentages were calculated based on the total student enrollment counts of the complex area. Student counts were controlled for multiple courses in a single year.

Beyond demographic representations, another area that is valued in Hawai'i as expressed by CS survey respondents and industry and non-profit partner organizations in discussions is a commitment to local cultural context. Nā Hopena Aʻo (HĀ) is the HIDOE's department-wide framework to develop the skills, behaviors, and dispositions that are reminiscent of Hawaiʻi's unique context and to honor the qualities and values of the indigenous language and culture of Hawaiʻi.[44] HĀ was identified as needing a stronger presence in the CS endeavors. There were some teachers who shared that they have tried to incorporate HĀ into CS, but they would appreciate more guidance. Organizations like Purple Maiʻa support Hawaiian values and strategies that are culturally grounded and teach coding and computer science through after school and elective classes to Native Hawaiian students, low-income youth, and others who are underrepresented in tech. Oceanit looks to empower organizations and communities around Hawai'i and looks beyonds computer science courses to assist with lesson plan development to incorporate coding into subject areas like history, social studies, English language arts, arts, and physical education. An annotated bibliography of equity and access literature for computer science and related fields can be found in Appendix 5.

# PROMISING TRENDS

## MEETING THE GOALS OF ACT 51

The goal of having every high school in Hawai‘i offer at least one CS course is well under way. 100% of high schools offered at least one computer science-designated or CTE computer science-related course in SY 2019–20. In SY 2019–20, 23 high schools and 8 combination schools offered CS-designated courses, and 33 high schools and 11 combination schools offered CTE CS-related courses. Additionally, 11 middle schools offered CS-designated courses and 26 middle schools offered CTE CS-related courses. Several schools offered multiple CS courses in the same school. 19 high schools and 2 combination schools offered AP CS.

## PERSONNEL

In 2019 HIDOE asked each complex area to designate an employee to serve as a CS lead for the complex area. In this role, 15 CS leads contribute their experience and expertise to serve as a resource for individual schools, attend and provide training, and operate as a liaison between the multilevel leadership teams at HIDOE. Many of the CS Leads are resource teachers.
HIDOE also designated a CS Education Specialist who is one of three members of the CS team at the state level.

## INNOVATION GRANTS

Part of the Act 51 funds were used to sponsor three innovative projects in diverse and high-need school areas. As part of HIDOE Innovation Grant program, there were three CS innovation grants in 2019:

- ‘Aiea Complex: Learning a Little "Bit" of Computer Science
  - Proposal to design an Articulated Computer Science Program Structure; focused on developing a vertical alignment driven by the needs of the ‘Aiea Complex that includes involvement of teachers, parents, community and students
- Nānākuli High & Intermediate: Data Driven Instructional Cycle Framework
  - With goals to restructure DDIC framework domains: standards, assessments, data analysis and instruction to better map the computer science curriculum for our students towards improving achievement levels
- Waiākea K-8 Consortium: Collaborating for 21st Century Success
  - Aimed to create collaborative partnerships to improve teacher understanding and integration of technology in the classroom to meet the scope and sequence of the K–8 Computer Science Framework and prepare its students with 21st century skills

The funds had to be encumbered by July 2019. Information on the development and success of these three projects after one year of implementation was not available for this report.

Furthermore, using the same funding source, four rural high schools and their feeder schools received professional development from Oceanit and Code HS. The high schools included Hana, Kohala, Moloka‘i, and Waimea.

# ITEACH CONFERENCE

In June 2019, HIDOE organized iTEaCH, a statewide one-day conference with 561 participants in attendance with the goal of promoting and developing sustainable CS education in Hawaiʻi. The conference was partially funded by money allocated in Act 51. With 403 public school teachers and personnel in attendance, the conference focused on teacher-led sessions that covered a wide range of CS-related topics and skill levels. A post conference survey revealed three key benefits and positive takeaways for teachers: impact of teacher-led sessions; networking opportunities across complex areas; and greater understanding of computer science.

# CODE.ORG'S NINE POLICY RECOMMENDATIONS

Code.org introduced a plan for sustainable statewide implementation of CS using 9 policy recommendations. In their 2019 State of Computer Science Education report, Code.org, CSTA, and ECEP identified that the more policies were adopted, the more computer science was offered in high schools. Hawaiʻi Department of Education has been actively engaged in reaching these goals. In Hawaiʻi, Code.org identified two major policy areas that are not being addressed. The first is the lack of computer science learning programs at institutions of higher education for teachers rather than for computer science majors. The second is that the institutions of higher education do not accept computer science as a core admissions requirement. Code.org's belief is that the shortage of computer science programs in K–12 schools is tied to a computer science teacher shortage since there is no computer science teacher program. Code.org also believes that Hawaiʻi students may be discouraged from taking computer science since their local university does not consider it core to admissions in the same way that in English, mathematics, or science are. At the elementary level, one of the biggest challenges is the lack of prepared teachers (Code.org, 2017; Hawaii Kids Can, 2018), which may be tied to the misperception of computer science as being difficult. Hawaiʻi's progress as it relates to the nine policy recommendations is presented in Table 30.

## Table 30. Implementation of Code.org Nine CS Policy Recommendations

| Policy | Hawai'i Implementation | # of States with Statewide Implementation |
|---|---|---|
| Create a state plan for K–12 CS education | YES - HIDOE has created a state plan for expanding computer science access. | 16 |
| Define CS and establish CS standards | PARTIAL - The CSTA K–12 CS Standards were adopted in May 2018. The state has not adopted CS teaching standards or defined criteria for CS-designated courses or instructional materials selection criteria. | 35 |
| Allocate funding for CS teacher training and course support | YES - HB 2607 (2018) dedicated $500K to computer science teacher professional development in FY 2019. In 2019, the state budget increased the weighted per-pupil funding to schools by $3M, directing that schools use the funds to implement, among other subjects, computer science curriculum. | 29 |
| Implement certification pathways for CS teachers | YES - The state developed certification pathways for K–6, 6–12, and K–12 in computer science in 2018. | 40 |
| Create college programs offering CS to preservice teachers | NO. | 20 |
| Establish dedicated state CS positions | YES - HIDOE created a computer science specialist position under the Educational Technology office. | 27 |
| Require CS in all secondary schools | YES - Act 51 (2018) requires all public high schools to offer at least one computer science course by SY 2021–22. | 19 |
| Allow CS to satisfy a core HS graduation requirement | PARTIAL - AP CS course can count as the mathematics credit for the Honors or STEM diploma but not as a core requirement.[45] | 49 |
| Allow CS to satisfy college admissions requirement | NO | 20 |

# RECOMMENDATIONS

## MAINTAINING CONTINUITY AND SUSTAINABILITY OF CS INITIATIVES

Since 2017, the department has introduced a number of initiatives to broaden CS education, including the iTEaCH Conference, virtual sessions for teacher collaboration (supported by Chiefs for Change grant), complex area programs through innovation grants, and more. However, many of the excellent programs tend to run out of steam after the initial funding is spent or when the school experiences transition in school leadership. **Funding needs to be stable and support from leadership is critical.** While this issue is not unique to CS or education, the high attrition and transition rates in employment in individual schools contributes to derailment of CS initiatives. In the CS Survey, “principal support” was named as the number one enabler of CS learning opportunities by 388 respondents, which may signal the need for continued commitment by the school leadership. Going forward, **CS initiatives in the state should include a plan for sustainability as well as accountability**. Allocation of funds should be tied not only to spending but also to specific deliverables that can be maintained or built on beyond the life of the grant. The plan should also have short, medium, and long term goals that speak to efforts beyond establishment of courses, and identify the purposes and larger vision. That many schools were not able to fully utilize funding allocated to them to jump start CS efforts suggests that schools need more time to thoughtfully plan these efforts, so the timing of any award should be made with attention to school planning timelines. Data should be used to inform in meaningful ways, which may require developing new systems or refining existing ones. The HIDOE should **identify what data are needed, tying those data to needs so that they serve the particular goals within their overall plan** for broadening participation in K–12 CS education to include all students. Data should be shared with HIDOE leadership often so that adjustments and course corrections can be made. With that being said, the CS initiatives of the state need to clearly delineate between what seems like the two goals of making CS available to all students and increasing the number and diversity of students pursuing CS careers.

# CONTINUING AND EXPANDING SUBSIDIES FOR AP EXAMINATIONS

Participant feedback from the iTEaCH conference as well the focus group interviews identified the cost of AP exams as a barrier factor. The cost of AP exams has gone up dramatically since 2017 when a provision in the Every Child Succeeds Act (ESSA) ended a federal grant program that subsidized the cost of AP and International Baccalaureate exams for students from low-income families.[46] Prior to 2017, federal and other subsidies typically brought down the cost of one AP exam to $5-15 for low income students. Currently, one AP exam will cost low income students $53 with subsidies. The College Board offers a $32 fee reduction. At $94 per exam, the cost of even one AP examination is prohibitive for many students in Hawai‘i.

Students who elect to take the AP exam must prioritize which subject areas they should focus on, and CS, as a secondary subject, will often give way to subjects that will fulfill general college requirements, such as calculus and language arts. As such, students who cannot afford the exam may forego enrollment in the course altogether even though the exam is not part of the class. It is important to recognize how economic disparity can lead to disparity in participation in CS. In SY 2018–19, the attrition rate from enrolled students to exam takers was 27% for AP CS A and 16% for AP CS Principles. Furthermore, the increased number of exam takers will provide a better assessment of how Hawai‘i students perform on CS AP courses compared to national data. In Hawai‘i, the HIDOE reports that it has subsidized AP exams for low-income students at all HIDOE schools, bringing the cost to $12. The **Department should continue to allocate funding to significantly subsidize AP exams for low-income and underrepresented students**.[47] Providing the subsidies information more clearly to families may increase the numbers of low-income and underrepresented students who choose to take AP courses. Currently, the AP webpage on the HIDOE website identifies only the AP College Board subsidy that reduces the fee to $53.

The Department might also **consider an incentive program of subsidies for students who intend to pursue higher education in Hawai‘i** given the concern that our CS and technology students are leaving Hawai‘i and the data that show AP CS students sending their scores to out-of-state more than in-state institutions of higher education.

# ESTABLISHING COMMON LANGUAGE AROUND COMPUTER SCIENCE EDUCATION

Lack of consensus as to what falls under the computer science umbrella continues to remain a barrier toward statewide implementation. HIDOE has adopted the CSTA standards but how to implement those standards have not communicated clearly. Additionally, the definition of CS is still confusing. This lack of clarity was cited by the CS leads; for example, 7 out of 12 respondents referenced lack of understanding of CS or CS concepts as a barrier. Among 492 educators who took the CS Survey, 116 (24%) selected "Lack of knowledge/understanding of what CS education is about" as the top barrier to CS learning opportunities, ranking it as the second most frequently cited barrier. **Reinforcing the statewide definition and establishing common language around computer science education** will advance the goals of HIDOE for several reasons. First, a common language provides a common place from which to establish goals, purposes, and strategies. Second, it allows for consistent reporting of progress for the purposes of Act 51 and subsequent CS-related objectives. Third, it supports a consistent way to identify which CTE courses are related to computer science. And last, the spirit of computer science for all means computer science is not limited only to CS courses. Common language around computer science education may better enable computer science concepts to be a part of all courses.

Part of defining computer science education as it relates to all subject areas and learners will require a **resolving of computer science education and career and technical education courses** in computer science. Collaboration and conversation between the CTE and CS communities will be needed to develop more robust and agile solutions for CS success for students, especially with the potential for 40 programs in 13 pathways in future years. Hawai'i Career Explorer, used in CTE programs, is a possible tool for all students to understand the relevance of computer science and career pathways. Conversations also need to occur with the HIDOE mathematics and science colleagues, from which computer science teachers are being drawn. While a time-intensive review was done to designate some CTE courses as computer science related, the process and criteria used to make those designations remain unclear. Mathematics, which already experiences a nationwide shortage of teachers at the secondary level and is no different in Hawai'i, seems to be the teachers that are most tapped to teach in computer science.

Better **defining the role of the computer science leads** for each complex area will be supported through establishing common position titles and descriptions.

Identified by the leads themselves as a slightly confusing role, more attention needs to be paid to these key individuals who are part of the efforts to systematically improve computer science opportunities across the state. Aligning their roles to the goals, purposes, and strategies is critical.

## DEVELOPING PATHWAYS TOWARD COMPUTER SCIENCE IN COLLEGE AND CAREER

The industry stakeholders repeatedly identified transferable skills, such as communication, leadership, initiative, and creativity, as essential to computing jobs. Several have commented that these skills will need to be developed during college through diverse hands-on engagement in CS-related projects. However, industry stakeholders also raised concerns about the reality of hiring a person into a computing job directly from high school, citing the need for more time to develop "people" skills that come partly with college experience and partly with work experience. **HIDOE should design an achievable, well-defined college and career pathway toward a CS degree in order to increase participation, engagement, and interest among high school students**. Currently, HIDOE students lack both incentives and substantial interest in CS as reported by the CS survey results. Educators identified some of the barriers that prevent CS learning opportunities as "Scheduling Conflicts" (27%), "Need to take other required courses rather than CS" (12%), and "Greater interest in other subjects" (11%). The CS leads also named "other priorities" taking precedence over computer science courses. From research, numerous studies also recommend providing opportunities beginning at elementary school to engender a stronger connection during the formative years to computer science as a possible college or career path.

Recognizing that the computer science education effort by the HIDOE is not only to increase the computer science-focused graduates, but to **expand awareness and recognition of computer science in all fields and disciplines**, the HIDOE should also support efforts to develop connections to other subjects. Local partners like Oceanit and Code.org have been successful in their efforts to assist Hawai'i teachers. Efforts like theirs can be used as models.

## CREATING EFFECTIVE SUPPORTS FOR TEACHERS

**Effective PD sessions should be targeted and developmentally appropriate**

**based on elementary and secondary level computer science standards**. Professional development remains one of the persistent issues in computer science education. As data from the CS survey revealed, most of the previously offered PD in CS was content specific, such as coding, whereas teacher interest is more in pedagogy and instructional strategies. The sessions were also driven by the availability and expertise of the outside vendors and partners rather than pedagogical, subject discipline, or instructional goals. Factors related to level of instruction, delivery format, assessment, and topic relevance must be considered during the planning stages, aiming to meet the needs of the teachers and their teaching objectives. **Of particular need is professional development around vetted instructional materials and a process by which school can select those instructional instructional materials.**

**PD should be designed to meet diverse teacher level experiences**. Each teacher arrives at CS with a diverse level of expertise, particularly as it is an emerging field. CS-related PD sessions need to clearly identify which PD sessions are appropriate for new CS teachers, and there needs to be a sufficient number of beginner, intermediate, and advanced sessions. Teachers have also indicated the need for communities of practice. One respondent noted, "The barriers to CS instruction do not involve lack of training as much as they involve lack of campus-based computing resources. The teaching networks for CS teachers are also very small, and for the most part male-dominated. As teachers we learn to work in teams, and if you're like me, you're the only one on campus who does what I do instructionally, so you have to seek connections through PD and social media to find other CS teachers."

At this time, teachers teaching computer science courses are not required to have a license specifically in computer science. Teaching of computer science courses have different licensure requirements depending on the type of AP CS course, the type of general CS course, or the CTE program that is related to CS. Comments from teachers indicate that they want licensure in one of the STEM fields to be considered adequate, which is demonstrated in the array of licenses that teachers who teach computer science possess. However, the 68 teachers who are teaching a CS course, 38 do not have a license in CS or in any of the STEM disciplines. If the state continues to have broad acceptance in licensure to teach CS, then teachers should at least have opportunities to learn about CS systematically themselves. **Adopting the CSTA teaching standards**, which would help in developing more aligned teacher learning opportunities, and **developing a CS teacher training program in local colleges or universities** are both recommended. University faculty in both CS and education departments might consider examining the CSTA teaching standards and working together to find innovative ways to restructure existing courses to fit the needs of future CS teachers. Additionally, educational technology, learning technology, STEM, and CTE coursework for teachers can be updated to include computer science.

Furthermore, incentivizing the pursuit and attainment of a computer science license is also recommended.

## RETHINKING TRADITIONAL TEACHING MODELS

Both teachers and industry stakeholders emphasized the importance of hands-on experimentation and "willingness to fail" among beginner students of CS. Project-Based Learning (PBL), brought up by many teachers in the CS survey, might be a possibility to explore for delivery of CS curriculum, which supports experiential learning. Project-based learning may also provide an avenue for discussion of Nā Hopena Aʻo (HĀ), the department-wide framework to honor the qualities and values of the indigenous language and culture of Hawaiʻi.

Furthermore, CS survey respondents identified the training of CS teachers (41%) as the top priority in providing equitable access in their schools or complex areas, with professional development (28%) second. However, there is a clear recognition of the urgency for CS learning opportunities that is hindered by the time it would require to train enough qualified teachers through traditional training methods. No other subject that is taught in schools has been so new and yet so important at the same time. **In meeting the economic and educational goals of the state, HIDOE should consider and assess innovative teaching models for CS**. Partnering with industry professionals should be explored and distance learning should be leveraged.

## COMMITTING TO EQUITY AND ACCESS

A commitment to equity and access begins with the presence of opportunities, but needs to be expanded to efforts to understand learning strategies and teaching, the choice and use of curriculum, student recruitment and retention initiatives, and school and classroom culture in support of diverse learners. More schools offering CS courses should be acknowledged as an achievement, but females and other underrepresented minorities continue to have low participation rates in computer science. Though 57% of Hawaiʻi's Title I schools now offer an AP computer science course, it is unclear if the number of Title I schools offering either AP CS courses increased in SY 2019–20 or what the intents are towards additional computer science courses by SY 2021–22.

In SY 2018–19, the number of female students who took AP computer science exams increased, but a comparison to male students shows that for every 100 male students, there were 40 female students who took the exams. Across all computer science participation, for every 100 male students, there were 60 female students, a decrease from SY 2017–2018 of 100 to 64. Though numbers were not available for out-of-school programs that may have more female students, **committing to systematic efforts across all schools should be made to establish early learning opportunities for female students and other underrepresented groups**. Studies have shown that students with limited or no exposure to CS in the earlier grades may be less inclined, or prepared, to take future CS courses. There are industry and community partners in Hawaiʻi who are willing to assist in those efforts, but the school system needs to develop a way in which those partnerships can happen effectively and efficiently.

Part of the equity and access conversation around computer science is about the role models to students. The most immediate role model are teachers themselves. Of the 68 CS teachers, the gender representation was rather even. However, when analyzed by teaching licenses approved for CS courses, male teachers outnumber female teachers in CS licenses (6 to 2), science licenses (24 to 7), engineering licenses (8 to 1), and CTE licenses (36 to 19). Ethnicity information was not available for teachers. Another important set of role models are the industry partners. Organizations like Expanding Computing Education Pathways, STEMWorks, Women in Technology, National Center for Women & Information Technology Hawaii Affiliate, Girls Who Code have specific missions and goals tied to broadening participation for girls and other underrepresented minorities.

Additionally, cultural and contextual efforts in computer science are not readily present. Though the HIDOE has department-wide framework like HĀ about developing local skills, behaviors and dispositions to honor the qualities and values of the indigenous language and culture of Hawaiʻi, these efforts seem individually based or support outside of the HIDOE through organizations like Purple Maiʻa and Oceanit. The HIDOE **should consider how to more explicitly frame HĀ in the computer science efforts.**

## SUMMARY

In this information age, computing skills are needed for both personal and professional success. The HIDOE has made progress towards increasing opportunities for the K–12 students by adopting CS standards, increasing courses available at schools, and becoming part of national efforts dedicated to broadening participation by all students. The partnership with local industry and non-profit organizations have enabled teachers and students to participate in coding-oriented learning experiences, but more expansion is needed into the five principles of computer science. Areas that still need attention for teachers are professional development beyond coding for teachers, a high quality CS instructional materials selection process, and more strategies for increasing the participation of girls and other underrepresented minorities, particularly our Hawaiian and Pacific Islander students. Though the last three years have shown a growth in numbers of courses and enrolled students, assessments around computer science are needed, which means data are needed to show effectiveness of those efforts. Those data need to be more than counts of enrollment and exposure events, but systematic within schools and meaningful to the learning. At the system level, funding is critical to continued efforts and leadership supports are key. As many educators indicated during development of this report, computer science has had the challenge of being viewed as one more thing among the myriad of other important initiatives in education. Attending to all of the suggested recommendations in this report is not possible in one or two school years, but will take time, commitment of the education community and partners, and continued support and vision from leadership. At this point, the Hawaiʻi public school system has caught up to having computer science in all high schools, a moderate presence in middle schools, and moderate exposure in elementary schools. Moving from counting to considering quality and context are urgent next steps. Hawaiʻi needs to move forward with systemic changes in schools that attend to the broader economic and social importance of a computer science-educated citizenry.

## Endnotes

1 See Act 51 Hawaiʻi Revised Statute [§302A-323] Computer science; curricula plan; public schools. https://www.capitol.hawaii.gov/session2018/bills/GM1151_.pdf

2 See Computer Science, HIDOE, http://www.hawaiipublicschools.org/TeachingAndLearning/StudentLearning/CSforHI/Pages/default.aspx

3 See Association for Computing Machinery, https://www.acm.org/binaries/content/assets/education/computing-disciplines.pdf

4 See HIDOE Media Kit, http://www.hawaiipublicschools.org/ConnectWithUs/MediaRoom/MediaKit/Pages/home.aspx

5 Title I, Part A (Title I) of the Elementary and Secondary Education Act, as amended by the Every Student Succeeds Act (ESEA) provides financial assistance to local educational agencies for children from low-income families to help ensure that all children meet challenging state academic standards, U.S. Department of Education, https://www2.ed.gov/programs/titleiparta/index.html

6 The CSTA K–12 Computer Science Standards, released in 2017, delineate a core set of learning objectives designed to provide the foundation for a complete computer science curriculum and its implementation at the K–12 level. https://www.csteachers.org/page/about-csta-s-k-12-nbsp-standards

7 See CSforALL SCRIPT Program, https://www.csforall.org/projects_and_programs/script/

8 In 2017, Superintendent Christina M. Kishimoto put forward three action strategies to advance the public school system's strategic work — school design, teacher collaboration, and student voice. HIDOE School Design, http://www.hawaiipublicschools.org/VisionForSuccess/AdvancingEducation/StrategicPlan/Pages/school-design.aspx

9 According to the National Science Foundation, underrepresented minorities are in three racial and ethnic groups—blacks, Hispanics, and American Indians or Alaska Natives, including Native Hawaiians or Other Pacific Islanders—and are underrepresented in science and engineering.

10 From Employment Projections program, U.S. Bureau of Labor Statistics, Table 1.11 Employment in STEM occupations, 2018 and projected 2028, dated April 15, 2020, https://www.bls.gov/emp/tables/stem-employment.htm

11 From the Top 20 Occupations in Hawaiʻi September 2018 report from the Research and Economic Analysis Division of the Department of Business, Economic Development and Tourism https://files.hawaii.gov/dbedt/economic/reports/Top20_Occupations_Hawaii_2018.pdf

12 See STEM Career Pathways within the Education Workforce Report, February 2019, http://www.p20hawaii.org/wp-content/uploads/2019/02/Education_to_Workforce_Report_Final.pdf

13 See Hawaiʻi Career Explorer website https://uhcc.hawaii.edu/career_explorer/

14 The National Center for Education Statistics identifies the ten major fields of studies as humanities, psychology, social sciences and history, natural sciences and mathematics, computer sciences, engineering, education, business, health professions and related programs, and other fields.

15 U.S. state of Hawaiʻi facing tech worker shortage, SIA workpermit.com, https://workpermit.com/news/us-state-hawaii-facing-tech-worker-shortage-20051129

16 Behind Hawaii's push to be a startup paradise, VentureBeat, https://venturebeat.com/2017/05/13/behind-hawaiis-push-to-be-a-startup-paradise/

17 National Center for Education Statistics Table 319.1 Degrees conferred by postsecondary institutions, by control of institution, level of degree, and state or jurisdiction: 2016-17

18 Wilkins reflects on first year at MEDB helm, The Maui News, https://www.mauinews.com/news/local-news/2018/08/wilkins-reflects-on-first-year-at-medb-helm/

19 Interview with HIDOE CS team, 2020

20 Legiscan, https://legiscan.com/HI/text/HB2607/id/1704380

21 California legislative information, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201320140SB1200

22 See presentation on June 13, 2019 at the HIDOE iTEaCH Conference: https://docs.google.com/presentation/d/1xgPjYALYJtZo1zB38ddiUwMXdtecwpXbqeeHETzvCvA/edit#slide=id.p

23 See 2030 Promise Plan and the School Design section, http://www.hawaiipublicschools.org/DOE%20Forms/Advancing%20Education/2030PromisePlan.pdf

24 See CSTA's K–12 Standards, https://www.csteachers.org/page/about-csta-s-k-12-nbsp-standards

25 HIDOE 2019-2020 ACCN Crosswalk (UPDTD 10-8-2019), https://hidoeotm.org/eq/docs1920/2019-2020ACCNCrosswalk%28UPDTD10-8-2019%29.pdf

26 Trends in the State of Computer Science in U.S. K–12 Schools 2016, https://services.google.com/fh/files/misc/trends-in-the-state-of-computer-science-report.pdf

27 Interview with HIDOE CS team, 2020

28 See Office of the State Director Career and Technical Education handbook http://www.hawaiipublicschools.org/DOE%20Forms/CTE/CTEhandbook.pdf

29 Career and Technical Education Annual Report, 2018–2019, https://www.hawaii.edu/cte/publications/CAR_Y2019.pdf

30 Hawaiʻi Career Explorer is an award-winning online modeling system that uses data from Economic Modeling Specialists Intl, Occupational Information Network, University of Hawai'i Operation Data System, Hawai'i P20, and the National Student Clearinghouse that allows students to explore industries, occupations, and careers in Hawaiʻi. https://uhcc.hawaii.edu/career_explorer/

31 Elementary schools do not have courses like in middle and high schools. Instead, elementary schools are organized as classes that cover different subject areas. Beginning SY 2020–21, elementary schools can add CS to their report card as a content option in the "Additional Content Area" section.

32 See HIDOE E-School course listing at https://hidoe.geniussis.com/PublicStudentCourseRegistration.aspx

33 The Community Eligibility Provision Pilot Program is an expansion of a U.S. Department of Agriculture program to allow all students at select campuses, charter schools to receive free meal service.

34 See article Participation in AP Computer Principles, https://www.collegeboard.org/releases/2019/participation-csp-nearly-doubles

35 See AP Computer Science Principles Curriculum Framework, AP 2020-21 CS principles conceptual framework

36 AP College Board, https://apcentral.collegeboard.org/about-ap/ap-data-research

37 AP College Board student score distribution, 2019

38 When including charter schools, the increase was 89.6% for CSP and 28.7% for CSA from SY 2017–18 to SY 2018–19, and the mean scores were 3.00 on and 2.62 on CSA.

39 Elementary school visitations, interviews, and observations could not be conducted due to the COVID-19 pandemic.

40 Code.org Advocacy Fact Sheet: Support K–12 Computer Science Education in Hawaii, https://code.org/advocacy/state-facts/HI.pdf

41 According to Girls Who Code, not all clubs are listed on their website for reasons of privacy and protection of students.

42 In accordance with the Individuals with Disabilities Education Act (IDEA), as amended in 2004, the Office of Special Education Programs (OSEP) requires public reporting of all data submitted under Section 618. These reports are used to ensure implementation of programs designed to improve results for children and youth with disabilities.

43 Many students whose ethnicity was reported as Hispanic or Multiple in the federal categories were reported as White in the Hawaiʻi state categories.

44 HIDOE's Nā Hopena A'o, http://www.hawaiipublicschools.org/TeachingAndLearning/StudentLearning/HawaiianEducation/Pages/HA.aspx

45 Per Code.org state tracking document, HI has implemented #8 policy recommendation. However, CS does not currently satisfy a core requirement at HIDOE.

46 Schools Grappling With Fee Hikes for AP Exams, Education Week, https://www.edweek.org/ew/articles/2017/01/18/schools-grappling-with-fee-hikes-for-ap.html

47 Advanced Placement in HIDOE, http://www.hawaiipublicschools.org/TeachingAndLearning/Testing/AdvancedPlacement/Pages/home.aspx

48 From Computing Research Association, https://cra.org/govaffairs/wp-content/uploads/sites/6/2017/03/CVD-Leavebehind-Materials-Feb-2017.pdf

49 See FACT SHEET: A Year of Action Supporting Computer Science for All, (2016), https://www.csforall.org/media-faq/; https://obamawhitehouse.archives.gov/the-press-office/2016/12/05/fact-sheet-year-action-supporting-computer-science-all).

## Appendix 1. Notice of Approval for Human Research, Exempt Study

University of Hawaiʻi Mānoa

Office of Research Compliance
Human Studies Program

| | |
|---|---|
| **DATE:** | March 24, 2020 |
| **TO:** | Nguyen, Thanh Truc, EdD, Curriculum Research & Development Group, University of Hawaii at Manoa |
| | Mordecai, Minara, JD, Curriculum Research & Development Group, University of Hawaii at Manoa |
| **FROM:** | Rivera, Victoria, Dir, Ofc of Rsch Compliance, Social&Behav Exempt |
| **PROTOCOL TITLE:** | Computer science landscape report, 2020 |
| **FUNDING SOURCE:** | Hawaii Department of Education |
| **PROTOCOL NUMBER:** | 2020-00173 |
| **APPROVAL DATE:** | March 24, 2020 |

**NOTICE OF APPROVAL FOR HUMAN RESEARCH**

This letter is your record of the Human Studies Program approval of this study as exempt.

On March 24, 2020, the University of Hawaii (UH) Human Studies Program approved this study as exempt from federal regulations pertaining to the protection of human research participants. The authority for the exemption applicable to your study is documented in the Code of Federal Regulations at 45 CFR 46.101(b) 2.

Exempt studies are subject to the ethical principles articulated in The Belmont Report, found at the OHRP Website www.hhs.gov/ohrp/humansubjects/guidance/belmont.html.

Exempt studies do not require regular continuing review by the Human Studies Program. However, if you propose to modify your study, you must receive approval from the Human Studies Program prior to implementing any changes. You can submit your proposed changes via the UH eProtocol application. The Human Studies Program may review the exempt status at that time and request an application for approval as non-exempt research.

In order to protect the confidentiality of research participants, we encourage you to destroy private information which can be linked to the identities of individuals as soon as it is reasonable to do so. Signed consent forms, as applicable to your study, should be maintained for at least the duration of your project.

This approval does not expire. However, please notify the Human Studies Program when your study is complete. Upon notification, we will close our files pertaining to your study.

If you have any questions relating to the protection of human research participants, please contact the Human Studies Program by phone at 956-5007 or email uhirb@hawaii.edu. We wish you success in carrying out your research project.

UH Human Studies Program, Office of Research Compliance
Office of the Vice President for Research and Innovation, University of Hawai'i, System
2425 Campus Road, Sinclair 10, Honolulu HI 96822
Phone: 808.956.5007 • Email: uhirb@hawaii.edu
https://www.hawaii.edu/researchcompliance/human-studies
An Equal Opportunity & Affirmative Action Institution

Association for the Accreditation of Human Research Protection Programs, Inc. — Full Accreditation

## Appendix 2. Data Sources

| Date | Type | Description | Number |
|---|---|---|---|
| May 22, 2020 | Interview | Interview with non-profit representative | 1 |
| May 19, 2020 | Focus Group | Discussion with HIDOE CS team | 4 |
| May 14, 2020 | Interview | Interview with CS complex area lead | 1 |
| May 5, 2020 | Interview | Interview with industry representative | 1 |
| May 12, 2020 | Focus Group | Discussion with CS stakeholder group | 9 |
| May 6, 2020 | Focus Group | Discussion with CS stakeholder group | 17 |
| Apr 17, 2020 | Focus Group | Discussion with CS stakeholder group | 6 |
| Apr 9, 2020 | Focus Group | Discussion with CS complex area leads | 13 |
| Spring 2020 | Online Survey | SY 19–20 computer science landscape survey | 492 |
| | | | |

| Data Source | Description |
|---|---|
| AP College Board | The College Board is a mission-driven not-for-profit organization that connects students to college success and opportunity. Founded in 1900, the College Board was created to expand access to higher education. |
| Bureau of Labor Statistics | U.S. Bureau of Labor Statistics. The Bureau of Labor Statistics measures labor market activity, working conditions, price changes, and productivity in the U.S. economy to support public and private decision making. |
| Expanding Computing Education Pathways (ECEP) Landscape Reports | Expanding Computing Education Pathways, or ECEP, recommends that states conduct a landscape report as the second step in the five-step state change model. Landscape reports accomplish a number of vital strategic tasks in a state initiating state change. |
| Governors for K–12 Computer Science website | The Governors' Partnership for K-–2 Computer Science is a group of bi-partisan state leaders committed to advancing policy and funding to expand access to, and increase equity in, K–12 computer science (CS) education. https://www.governorsforcs.org/state-profiles |
| Hawai'i Department of Business, Economic Development & Tourism | DBEDT's Research and Economic Analysis Division site serves as a repository of data related to commerce and the economy in Hawai'i, including census data, visitor statistics, forecasts and more. Managed by Hawai'i DBEDT: 808-586-2466. |

| | |
|---|---|
| Hawai‘i State Legislature | Hawai‘i State Legislature Document Repository |
| HIDOE Accountability System | Accountability System: Compiles scores from the state assessment (and alternate and Hawaiian language versions), student scores from quarterly assessments, and School Quality Survey results. |
| HIDOE Electronic Human Resources System (eHR) | Tracks teacher certification, payroll and personnel time & attendance. |
| HIDOE Electronic Student Information System (eSIS) | Includes student biographical data, attendance, elementary homeroom class lists, school master schedule, student and teacher schedules, grades/marks/report cards, enrollment, parent information, emergency contacts, diploma types available, projected graduation date, student credit accumulation, Career Technical Education progress, student health information, and homelessness. |
| HIDOE PDE3 | Accounts for staff professional development (courses taken and completed) along with teacher evaluation data. |
| Integrated Postsecondary Education Data System (IPEDS) | IPEDS is part of NCES. Data are submitted at the aggregated-level from postsecondary institutions and do not have student-level information. Institutions submit data through 12 interrelated survey components about general higher education topics for 3 reporting periods. |
| National Center for Education Statistics | NCES is the primary federal entity for collecting and analyzing data related to education in the U.S. and other nations. Includes state-specific data. |
| State of Hawai‘i, Hawai‘i Teacher Standards Board (HTSB) | The HTSB is the licensing body for all teachers in Hawai‘i. All Hawai‘i DOE and Charter School teachers, librarians, and counselors must have a license. If no licensed teacher is available, the school may hire an emergency hire teacher. There is a penalty for both the teacher and the administrator if a person is teaching without the proper license or permit. https://hawaiiteacherstandardsboard.org/content/permits-and-license-types/ |
| U.S. Census Bureau | Repository of census data collected on the population of the U.S. |

## Appendix 3. HIDOE Memo: November 14, 2019, Computer Science ACCN Course Category and Elementary Report Card Effective School Year 2020–2021

DAVID Y. IGE
GOVERNOR

DR. CHRISTINA M. KISHIMOTO
SUPERINTENDENT

**STATE OF HAWAI`I**
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI`I 96804

OFFICE OF CURRICULUM AND INSTRUCTIONAL DESIGN

November 14, 2019

TO: Principals (All)
Teachers (All)

FROM: Donna Lum Kagawa
Assistant Superintendent

SUBJECT: **Computer Science ACCN Course Category and Elementary Report Card Effective School Year 2020-2021**

In efforts to expand Computer Science across Pre K-12 public schools, the Office of Curriculum and Instructional Design (OCID) in collaboration with the Office of Information Technology Services will effectuate the following system updates for the School Year 2020-2021:

- Infinite Campus will replace the "Educational Technology" category with "Computer Science." However, the Fall 2020 registration will still show "Educational Technology" since registration will occur during the School Year 2019-2020.
- "Computer Science" will be added as a content option for the "Additional Content Area" section of the Elementary report cards.
- The following Advanced Placement Computer Science courses currently categorized under "Multidisciplinary" will be changed to "Computer Science".
    - ECS 9500 – AP Computer Science A
    - ECS 9800 – AP Computer Science Principles

The above changes will help promote the K-12 Computer Science standards adopted by the Board of Education in 2018. The changes *will not* affect any ACCN Course Codes for existing "Educational Technology" courses currently under the "Computer Science" ACCN Course Category. Additionally, Hawaii Qualified Teacher (HQT) requirements will remain the same along with the additional "Computer Science" Teacher licensing options.

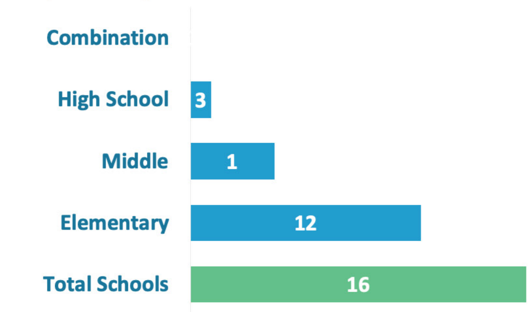
The OCID would like to thank the following stakeholders for their valuable feedback and support in these efforts:

- Computer Science Work and Stakeholders Group
- Statewide and Honolulu Registrars
- Secondary Principals Forum
- Complex Area Superintendent Leadership Group

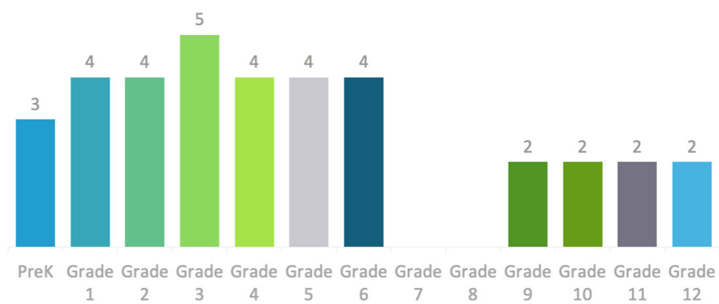
## Appendix 4. Complex Area Snapshot Reports from the CS Survey

# ‘Aiea-Moanalua-Radford Complex Area (*n* = 23)

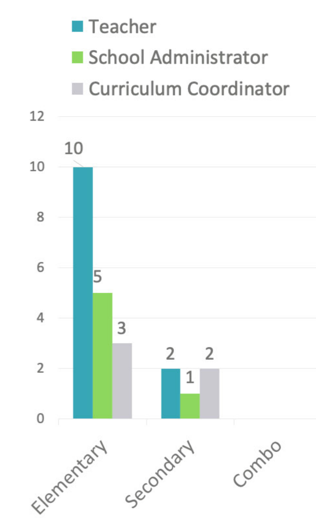
## Responses by school level




## Grade level taught (teacher respondents, n=12)




## Position of Respondents




## Which 5 core concepts do you teach (teacher respondents, n=11)

**82%** Computing Systems

**91%** Networks and the Internet

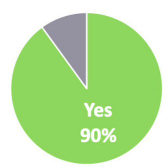
**45%** Data and Analysis

**73%** Algorithms and Programming

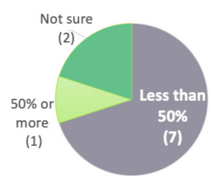
**82%** Impacts of Computing

**0** None of the Above

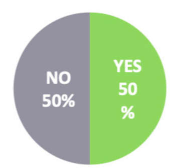
## General Findings



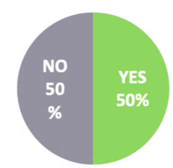

Do you currently integrate CS in your classroom? (n=10)



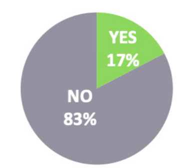

What percentage of time are your students learning about computer science? (n=9)




Does School Design plan include CS? (n=6)




Are there Community/Parent Outreach for CS? (n=6)




Do you have partnerships with organizations to support CS? (n=23)

05/13/20
Page 1

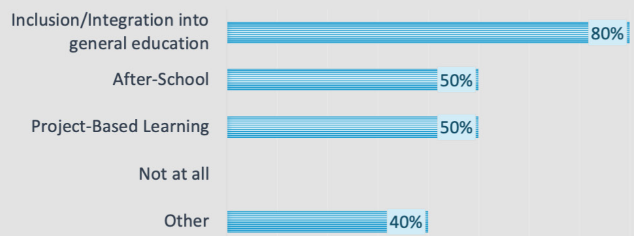
# ‘Aiea-Moanalua-Radford Complex Area ($n$ = 23)

Number of schools in complex area
**22**

Percentage of schools represented in the survey
**73%**

High school students enrolled in CS (est. SY19-20)
**218**

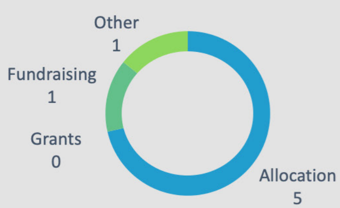
## How is CS Education offered at your school? (n=10)



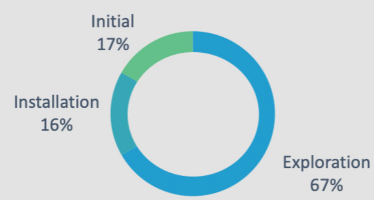

## In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=23)


*top 4 selections

## How is CS funded? (n=6)




## Implementation for School Design Phase (n=6)

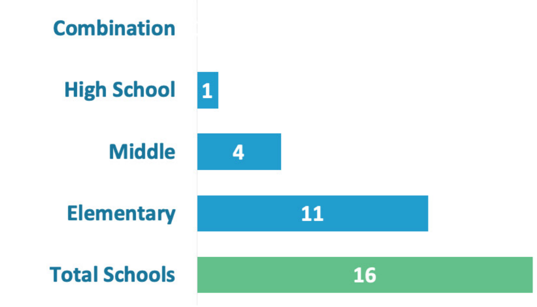



## Implementation for Equity and Access Phase (n=6)

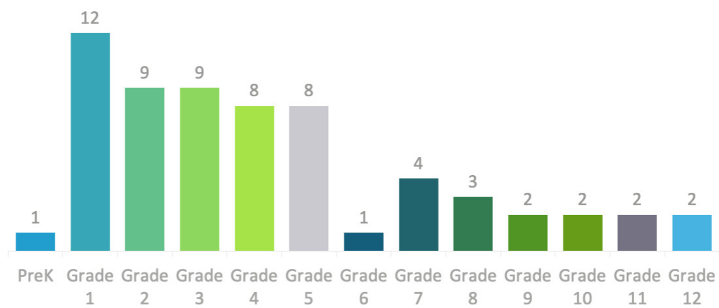

05/13/20
Page 2

# Baldwin-Kekaulike-Maui Complex Area (*n* = 81)

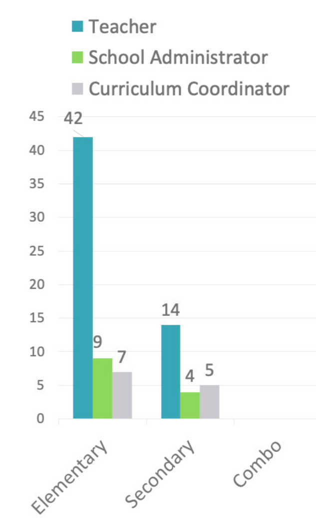
## Responses by school level




## Grade level taught (teacher respondents, n=52)




## Position of Respondents




## Which 5 core concepts do you teach (teacher respondents, n=54)

**31%** Computing Systems

**37%** Networks and the Internet

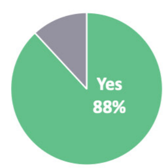
**35%** Data and Analysis

**37%** Algorithms and Programming

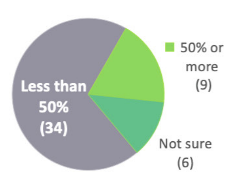
**26%** Impacts of Computing

**33%** None of the Above

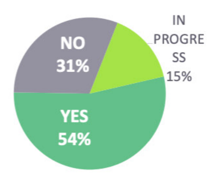
## General Findings



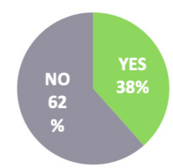

Do you currently integrate CS in your classroom? (n=42)



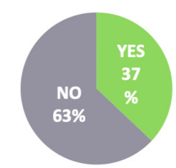

What percentage of time are your students learning about computer science? (n=49)




Does School Design plan include CS? (n=13)




Are there Community/Parent Outreach for CS? (n=13)




Do you have partnerships with organizations to support CS? (n=81)

*05/13/20*
*Page 1*

# Baldwin-Kekaulike-Maui Complex Area (*n* = 81)

**Number of schools in complex area**

**20**

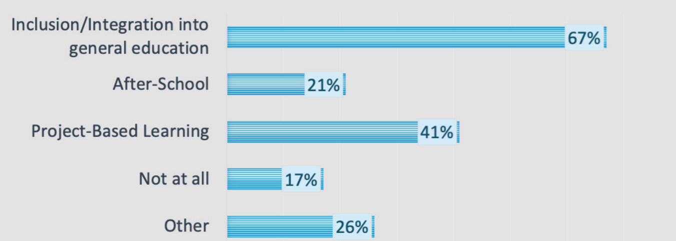
**Percentage of schools represented in the survey**

**80%**

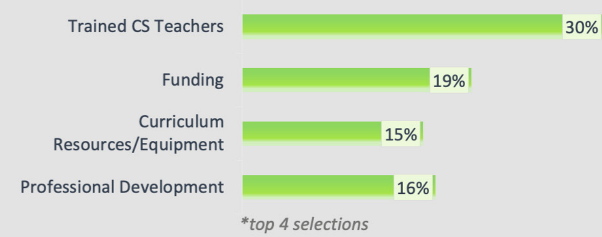
**High school students enrolled in CS (est. SY19-20)**

**157**

## How is CS Education offered at your school? (n=42)

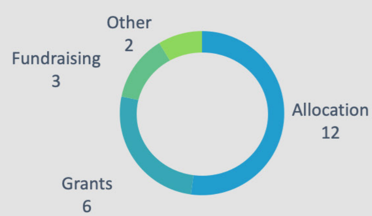



## In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=81)

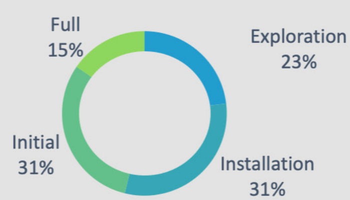



*top 4 selections

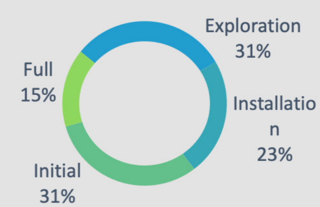
## How is CS funded? (n=13)




## Implementation for School Design Phase (n=13)




## Implementation for Equity and Access Phase (n=13)

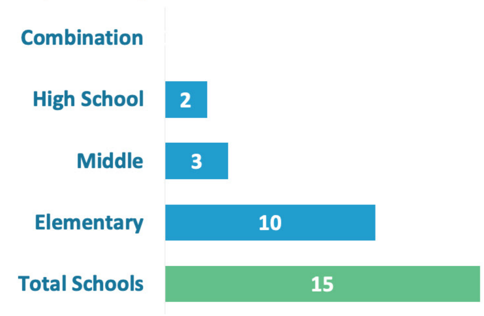



*05/13/20*
*Page 2*

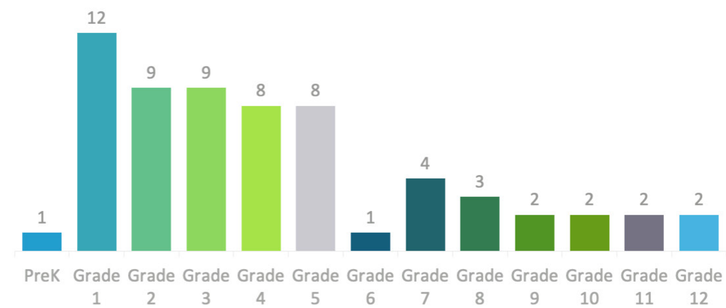
Preliminary report for
2020 Computer Science
Landscape Survey

# Campbell-Kapolei Complex Area ($n$ = 59)

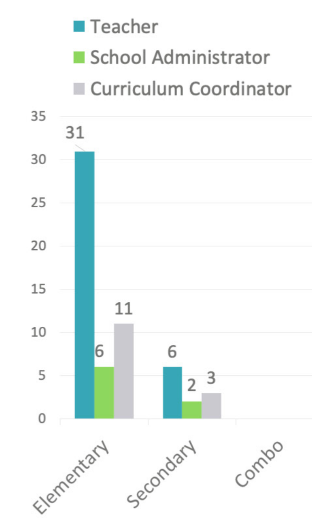
## Responses by school level




## Grade level taught (teacher respondents, n=19)



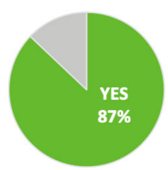

## Position of Respondents



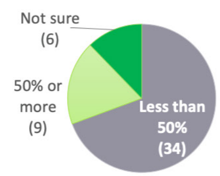

## Which 5 core concepts do you teach (teacher respondents, n=33)

- **48%** Computing Systems
- **18%** Networks and the Internet
- **12%** Data and Analysis
- **55%** Algorithms and Programming
- **24%** Impacts of Computing
- **15%** None of the Above

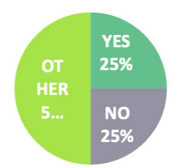
## General Findings



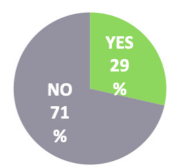

Do you currently integrate CS in your classroom? (n=31)



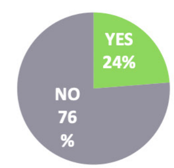

What percentage of time your students are learning about computer science? (n=16)




Does School Design plan include CS? (n=8)




Are there Community/Parent Outreach for CS? (n=8)




Do you have partnerships with organizations to support CS? (n=59)

*05/13/20*
*Page 1*

# Campbell-Kapolei Complex Area ($n$ = 59)

**Number of schools in complex area**

**17**

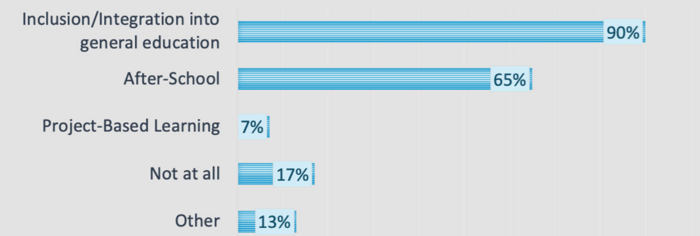
**Percentage of schools represented in the survey**

**88%**

**High school students enrolled in Comp. Sci. (est. SY19-20)**

**563**

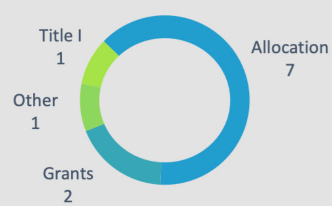
## How is CS Education offered at your school? (n=31)



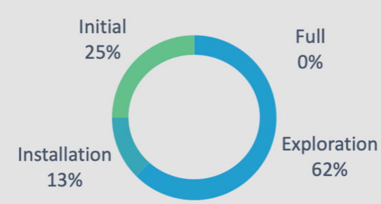

## In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=59)


**top 4 selections*

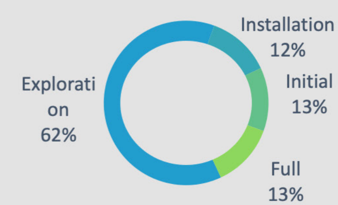
## How is CS funded? (n=8)




## Implementation for School Design Phase (n=8)



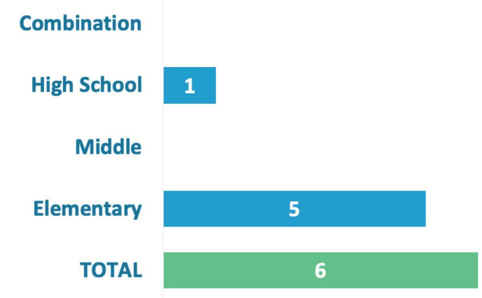

## Implementation for Equity and Access Phase (n=8)



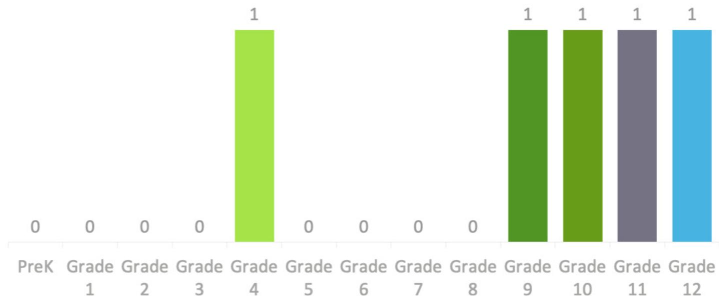

*05/13/20*
*Page 2*

# Castle-Kahuku Complex Area (*n* = 7)

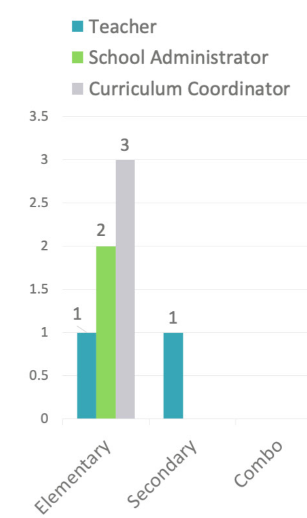
## Responses by school level




## Grade level taught (teacher respondents, n=2)



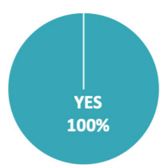

## Position of Respondents



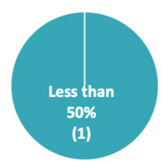

## Which 5 core concepts do you teach (teacher respondents, n=2)

| Computing Systems | Networks and the Internet | Data and Analysis | Algorithms and Programming | Impacts of Computing | None of the Above |
|---|---|---|---|---|---|
| 1 | 1 | 1 | 2 | 1 | 0 |

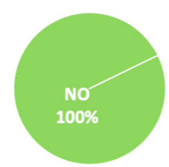
## General Findings



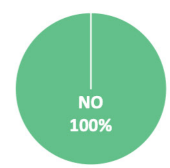

Do you currently integrate CS in your classroom? (n=1)



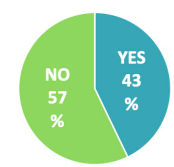

What percentage of time your students are learning about computer science? (n=1)




Does School Design plan include CS? (n=2)




Are there Community/Parent Outreach for CS? (n=2)




Do you have partnerships with organizations to support CS? (n=7)

*05/13/20*
*Page 1*

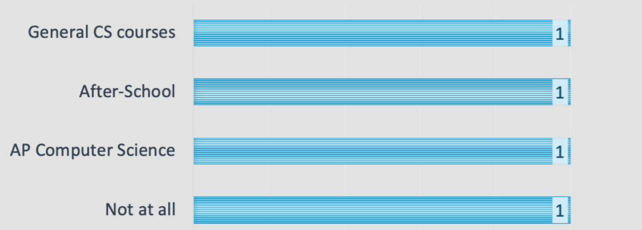
# Castle-Kahuku Complex Area (*n* = 7)

Number of Schools in complex area
**16**

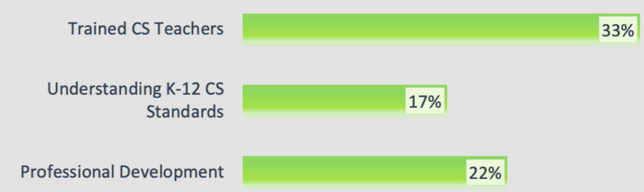
Percentage of schools represented in the survey
**38%**

High school students enrolled in CS (est. SY19-20)
**163**

### How is CS Education offered at your school? (n=2)




### In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=7)

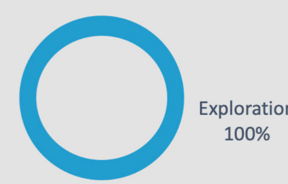



*top 3 selections

### How is CS funded? (n=2)


### Implementation for School Design Phase (n=2)


### Implementation for Equity and Access Phase (n=2)

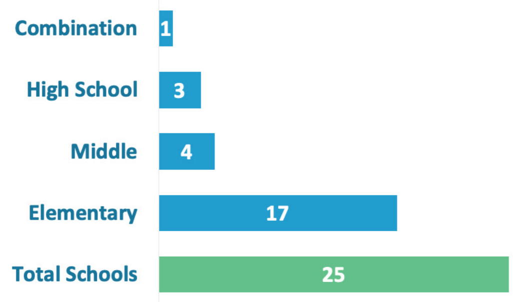



*05/13/20*
*Page 2*

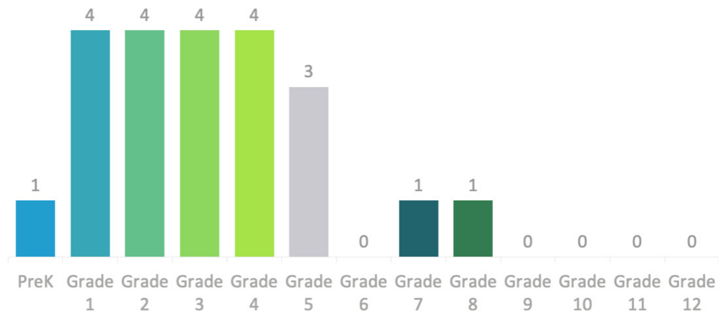
# Farrington-Kaiser-Kalani Complex Area (*n* = 37)

Preliminary report for
2020 Computer Science
Landscape Survey

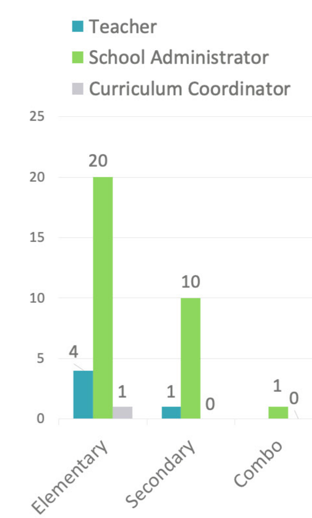
## Responses by school level




## Grade level taught (teacher respondents, n=5)



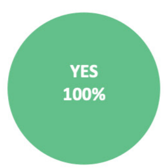

## Position of Respondents



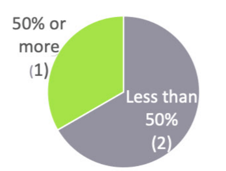

## Which 5 core concepts do you teach (teacher respondents, n=4)

| | | | | | |
|---|---|---|---|---|---|
| **2** Computing Systems | **2** Networks and the Internet | **1** Data and Analysis | **3** Algorithms and Programming | **1** Impacts of Computing | **1** None of the Above |

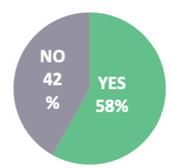
## General Findings



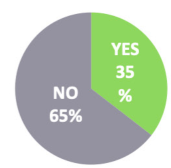

Do you currently integrate CS in your classroom?
(n=4)



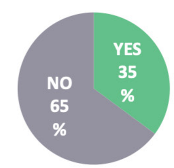

What percentage of time your students are learning about computer science?
(n=3)




Does School Design plan include CS? (n=31)




Are there Community/Parent Outreach for CS? (n=31)




Do you have partnerships with organizations to support CS? (n=37)

*05/13/20*
*Page 1*

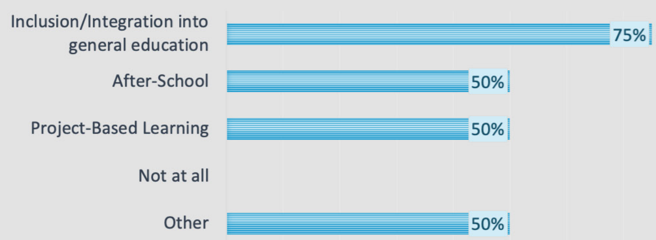
# Farrington-Kaiser-Kalani Complex Area ($n$ = 37)

**Number of Schools in complex area**
**25**

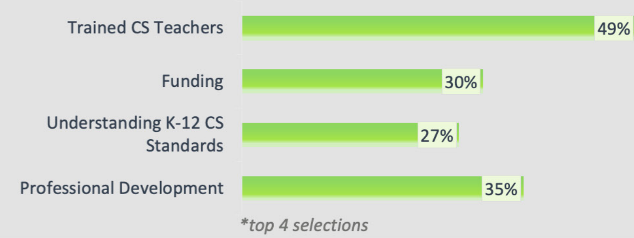
**Percentage of schools represented in the survey**
**100%**

**High school students enrolled in CS (est. SY19-20)**
**270**

**How is CS Education offered at your school? (n=4)**

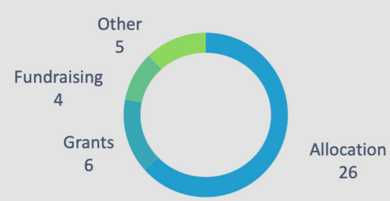



**In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=37)**

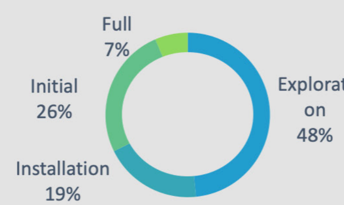



*top 4 selections

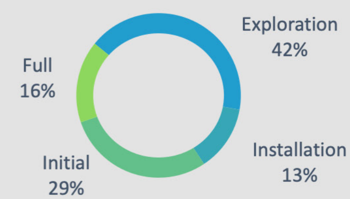
**How is CS funded?** (n=31)




**Implementation for School Design Phase** (n=31)




**Implementation for Equity and Access Phase** (n=31)

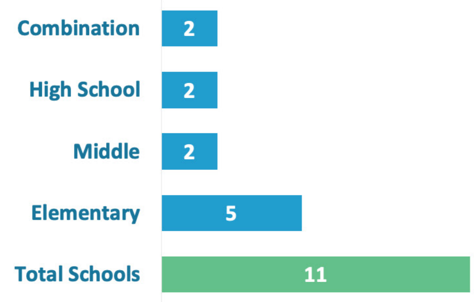



*05/13/20*
*Page 2*

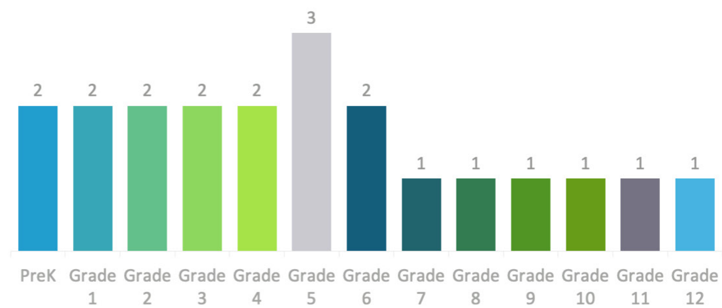
# Hāna-Lahainaluna-Lānaʻi-Molokaʻi Complex Area (*n* = 21)

Preliminary report for
2020 Computer Science
Landscape Survey

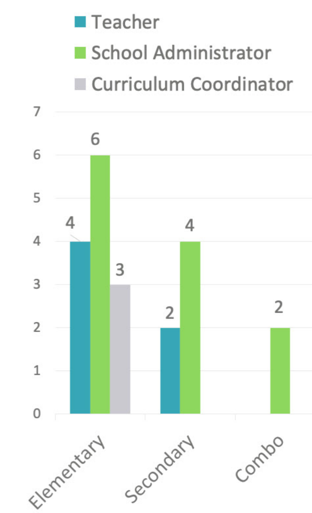
## Responses by school level




## Grade level taught (teacher respondents, n=5)



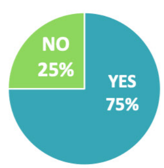

## Position of Respondents



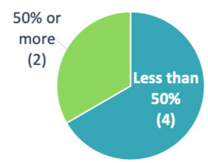

## Which 5 core concepts do you teach (teacher respondents, n=6)

- **50%** Computing Systems
- **33%** Networks and the Internet
- **50%** Data and Analysis
- **50%** Algorithms and Programming
- **33%** Impacts of Computing
- **50%** None of the Above

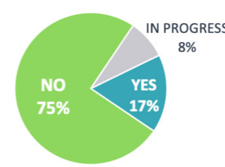
## General Findings



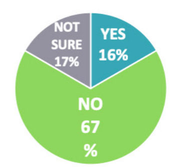

Do you currently integrate CS in your classroom? (n=4)



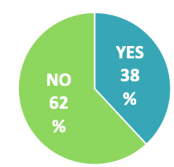

What percentage of time your students are learning about computer science? (n=6)




Does School Design plan include CS? (n=12)




Are there Community/Parent Outreach for CS? (n=12)




Do you have partnerships with organizations to support CS? (n=21)

*05/13/20*
*Page 1*

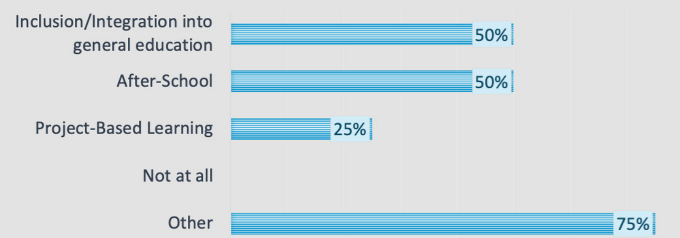
# Hāna-Lahainaluna-Lānaʻi-Molokaʻi Complex Area ($n$ = 21)

**Number of Schools in complex area**
**11**

**Percentage of schools represented in the survey**
**100%**

**High school students enrolled in CS (est. SY19-20)**
**137**

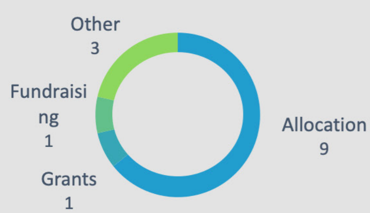
## How is CS Education offered at your school? (n=4)



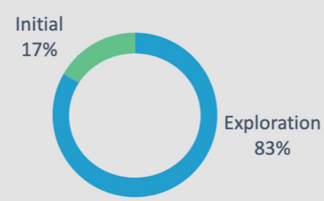

## In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=21)


*top 4 selections

## How is CS funded? (n=12)




## Implementation for School Design Phase (n=12)

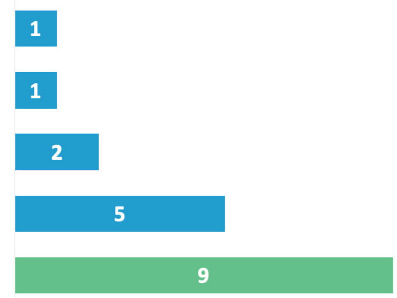



## Implementation for Equity and Access Phase (n=12)

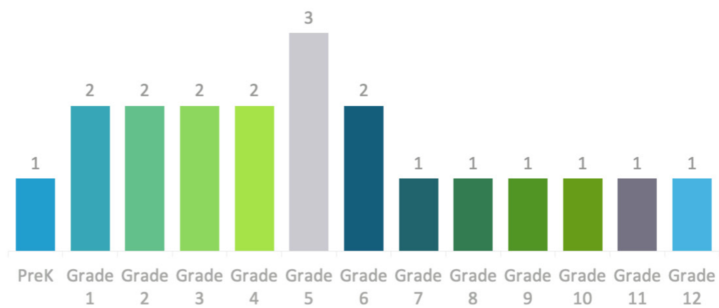

05/13/20
Page 2

# Hilo-Waiākea Complex Area ($n$ = 15)

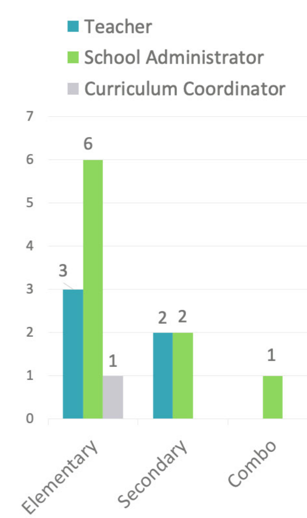
## Responses by school level




## Grade level taught (teacher respondents, n=5)




## Position of Respondents




## Which 5 core concepts do you teach (teacher respondents, n=5)

**4** Computing Systems

**5** Networks and the Internet

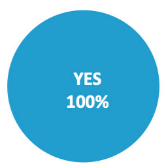
**5** Data and Analysis

**4** Algorithms and Programming

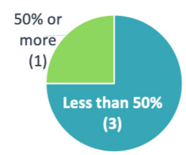
**4** Impacts of Computing

**0%** None of the Above

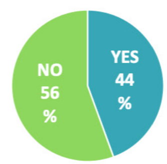
## General Findings



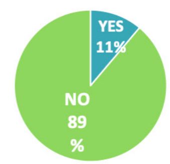

Do you currently integrate CS in your classroom? (n=3)



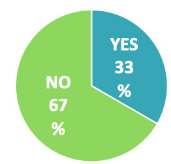

What percentage of time your students are learning about computer science? (n=4)




Does School Design plan include CS? (n=9)




Are there Community/Parent Outreach for CS? (n=9)




Do you have partnerships with organizations to support CS? (n=15)

*05/13/20*
*Page 1*

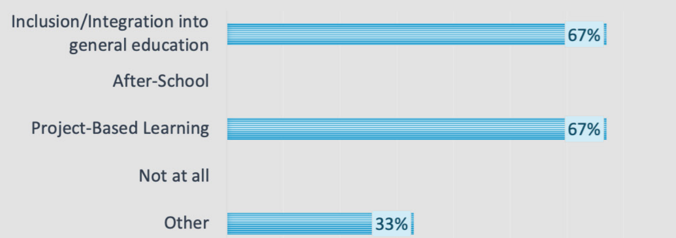
# Hilo-Waiākea Complex Area (*n* = 15)

**Number of Schools in complex area**
**13**

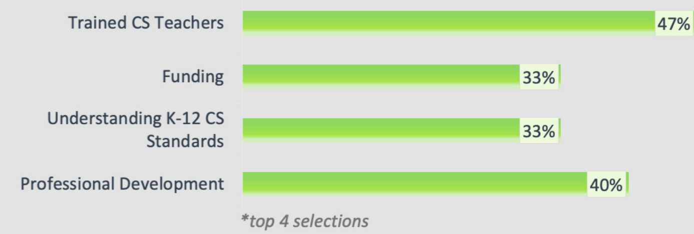
**Percentage of schools represented in the survey**
**69%**

**High school students enrolled in CS (est. SY19-20)**
**38**

### How is CS Education offered at your school? (n=3)

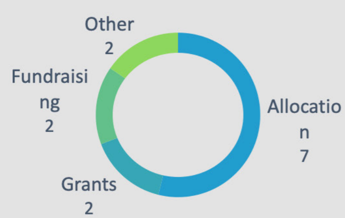



### In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=15)

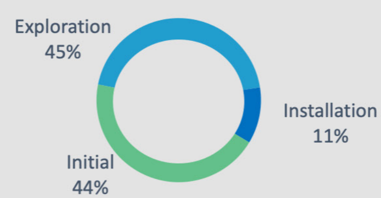



*top 4 selections

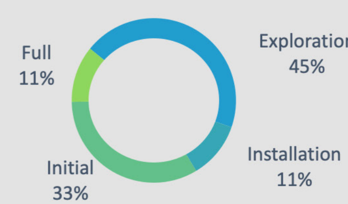
### How is CS funded? (n=9)




### Implementation for School Design Phase (n=9)




### Implementation for Equity and Access Phase (n=9)

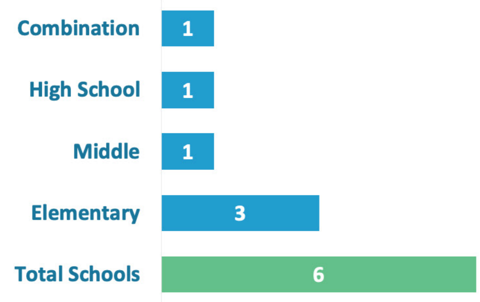



*05/13/20*
*Page 2*

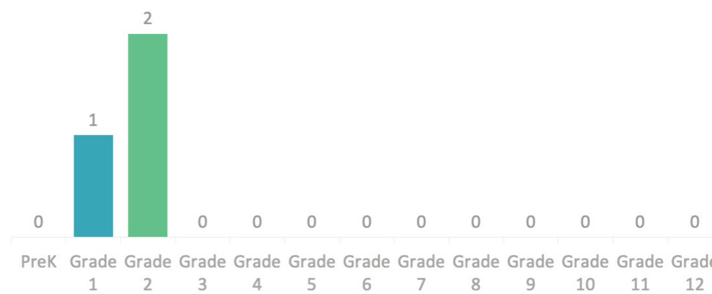
# Honoka'a-Kealakehe-Kohala-Konawaena Complex Area (*n* = 10)

Preliminary report for 2020 Computer Science Landscape Survey

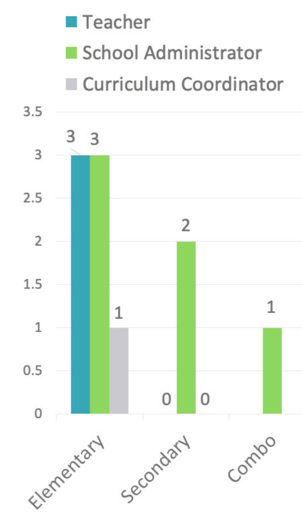
## Responses by school level




## Grade level taught (teacher respondents, n=3)



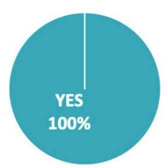

## Position of Respondents



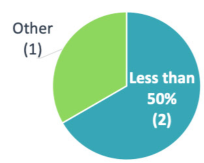

## Which 5 core concepts do you teach (teacher respondents, n=3)

- **0** Computing Systems
- **1** Networks and the Internet
- **0** Data and Analysis
- **2** Algorithms and Programming
- **1** Impacts of Computing
- **0** None of the Above

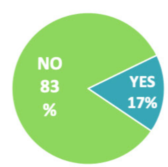
## General Findings



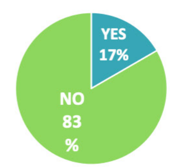

Do you currently integrate CS in your classroom? (n=3)



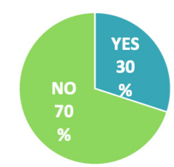

What percentage of time your students are learning about computer science? (n=3)




Does School Design plan include CS? (n=6)




Are there Community/Parent Outreach for CS? (n=6)




Do you have partnerships with organizations to support CS? (n=10)

*05/13/20*
*Page 1*

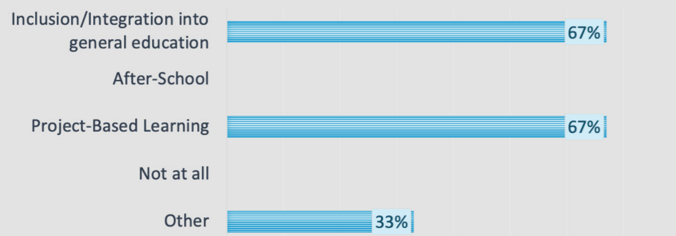
# Honokaʻa-Kealakehe-Kohala-Konawaena Complex Area ($n$ = 10)

**Number of Schools in complex area**
**19**

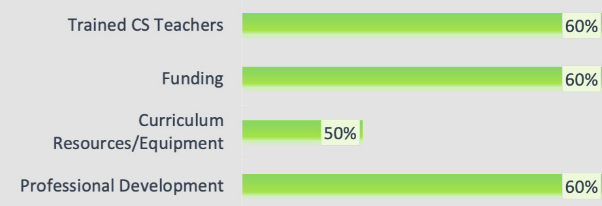
**Percentage of schools represented in the survey**
**32%**

**High school students enrolled in CS (est. SY19-20)**
**29**

### How is CS Education offered at your school? (n=3)

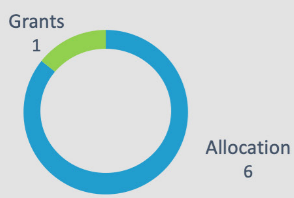



### In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=10)

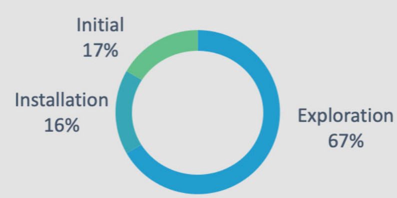



*top 4 selections

### How is CS funded? (n=6)




### Implementation for School Design Phase (n=6)

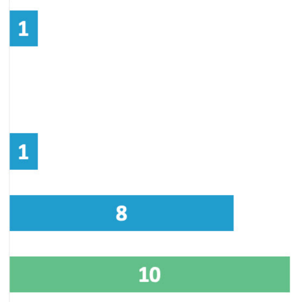



### Implementation for Equity and Access Phase (n=6)

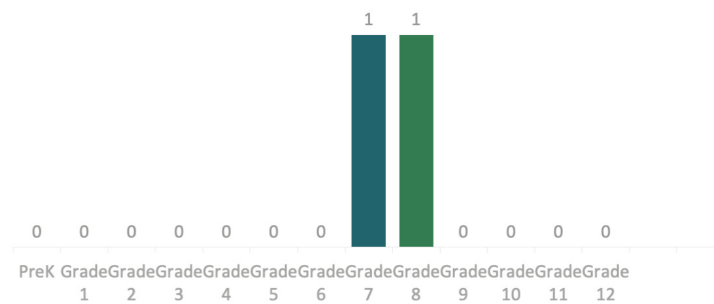

05/13/20
Page 2

# Kailua-Kalāheo Complex Area ($n$ = 11)

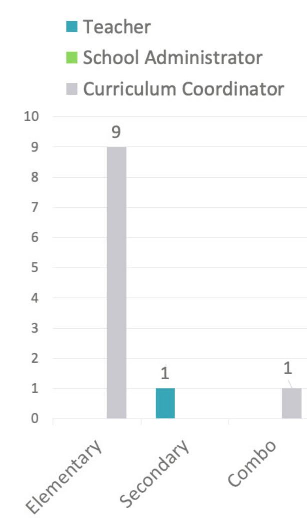
## Responses by school level




## Grade level taught (teacher respondents, n=1)



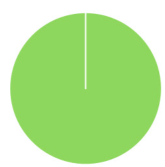

## Position of Respondents




## Which 5 core concepts do you teach (teacher respondents, n=1)

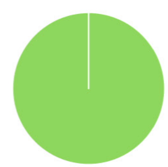
| Computing Systems | Networks and the Internet | Data and Analysis | Algorithms and Programming | Impacts of Computing | None of the Above |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 1 | 0 |

## General Findings

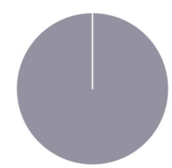


Do you currently integrate CS in your classroom? (n=0)

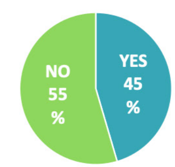

What percentage of time your students are learning about computer science? (n=1)



Does School Design plan include CS? (n=0)



Are there Community/Parent Outreach for CS? (n=0)




Do you have partnerships with organizations to support CS? (n=11)

*05/13/20*
*Page 1*

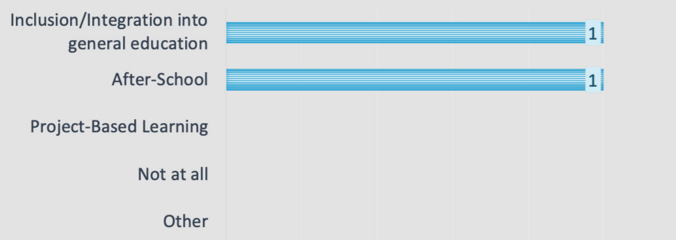
# Kailua-Kalāheo Complex Area ($n$ = 11)

Number of Schools in complex area
**14**

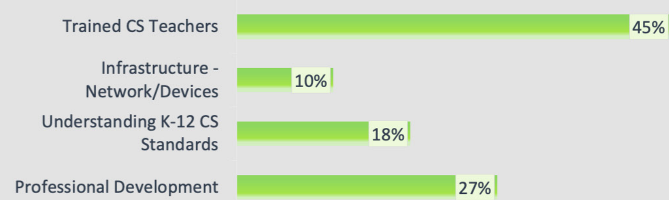
Percentage of schools represented in the survey
**71%**

High school students enrolled in CS (est. SY19-20)
**0**

## How is CS Education offered at your school? (n=1)




## In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=11)




*top 4 selections

## How is CS funded? (n=0)


## Implementation for School Design Phase (n=0)

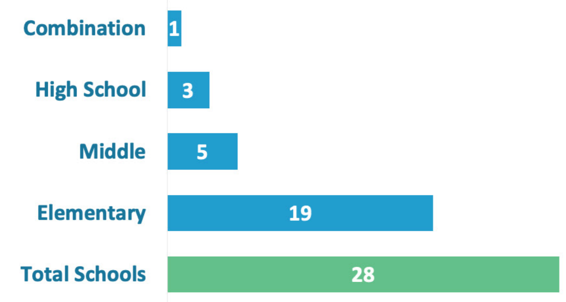

## Implementation for Equity and Access Phase (n=0)


05/13/20
Page 2

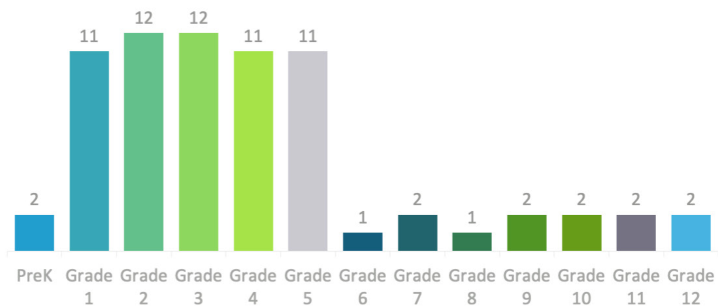
# Kaimukī-McKinley-Roosevelt Complex Area ($n$ = 75)

Preliminary report for
2020 Computer Science
Landscape Survey

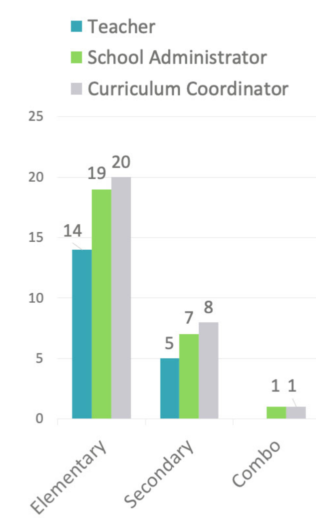
## Responses by school level




## Grade level taught (teacher respondents, n=19)




## Position of Respondents




## Which 5 core concepts do you teach (teacher respondents, n=16)

**69%** Computing Systems

**63%** Networks and the Internet

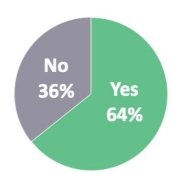
**38%** Data and Analysis

**81%** Algorithms and Programming

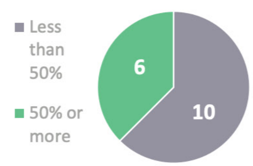
**50%** Impacts of Computing

**13%** None of the Above

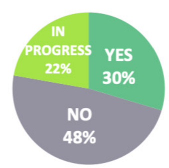
## General Findings



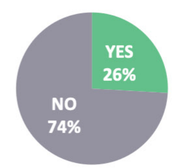

Do you currently integrate CS in your classroom? (n=14)



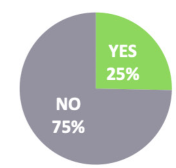

What percentage of time your students are learning about computer science? (n=16)




Does School Design plan include CS? (n=27)




Are there Community/Parent Outreach for CS? (n=27)




Do you have partnerships with organizations to support CS? (n=75)

*05/13/20*
*Page 1*

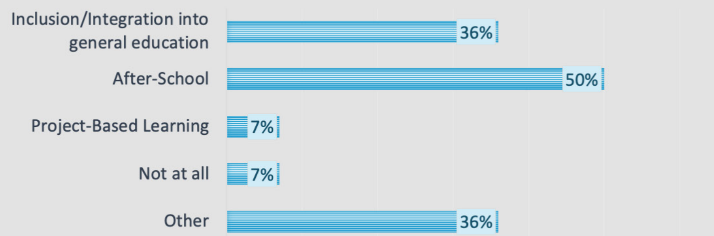
# Kaimukī-McKinley-Roosevelt Complex Area ($n$ = 75)

**Number of schools in complex area**
**28**

**Percentage of schools represented in the survey**
**100%**

**High school students enrolled in CS (est. SY19-20)**
**131**

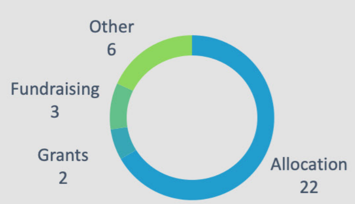
**How is CS Education offered at your school? (n=14)**



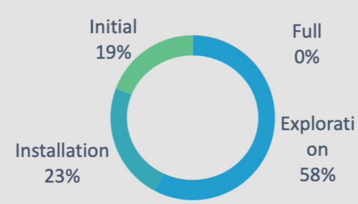

**In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=75)**


*top 4 selections

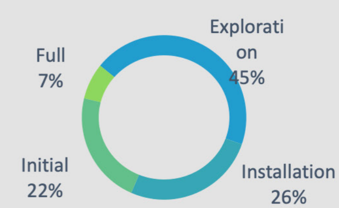
**How is CS funded? (n=27)**




**Implementation for School Design Phase (n=27)**



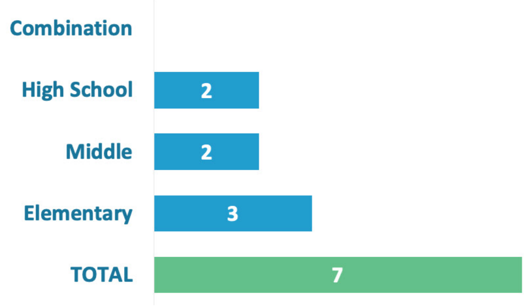

**Implementation for Equity and Access Phase (n=27)**



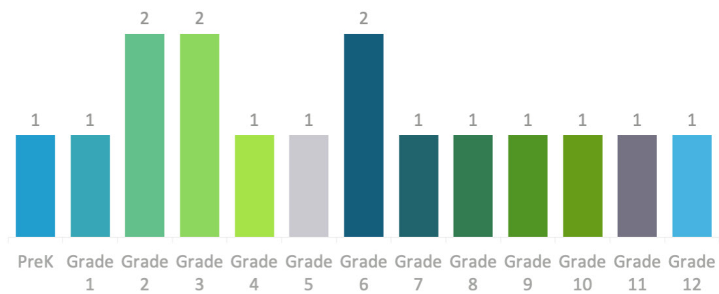

*05/13/20*
*Page 2*

# Kapaʻa-Kauaʻi-Waimea Complex Area ($n$ = 7)

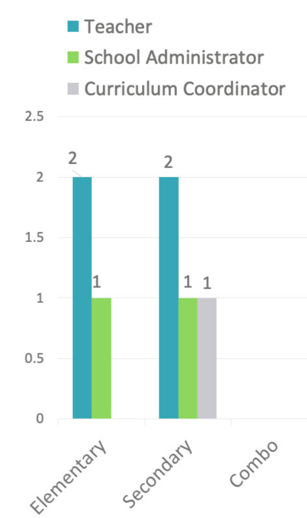
## Responses by school level




## Grade level taught (teacher respondents, n=4)



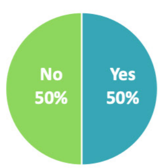

## Position of Respondents



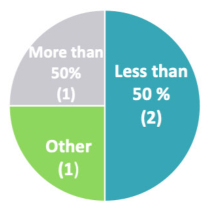

## Which 5 core concepts do you teach (teacher respondents, n=4)

| | | | | | |
|---|---|---|---|---|---|
| 2 Computing Systems | 2 Networks and the Internet | 3 Data and Analysis | 2 Algorithms and Programming | 2 Impacts of Computing | 1 None of the Above |

## General Findings



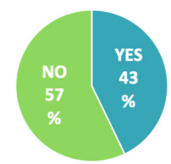

Do you currently integrate CS in your classroom? (n=2)




What percentage of time your students are learning about computer science? (n=4)


Does School Design plan include CS? (n=2)


Are there Community/Parent Outreach for CS? (n=2)




Do you have partnerships with organizations to support CS? (n=7)

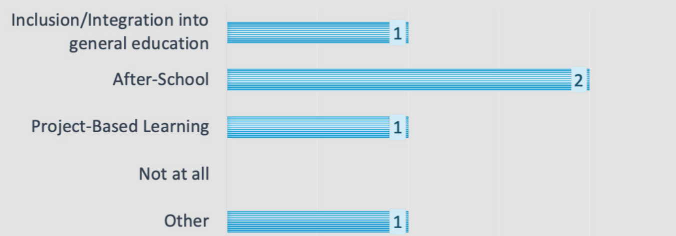
# Kapa‘a-Kaua‘i-Waimea Complex Area ($n = 7$)

**Number of Schools in complex area**
**16**

**Percentage of schools represented in the survey**
**44%**

**High school students enrolled in CS (est. SY19-20)**
**109**

## How is CS Education offered at your school? (n=2)



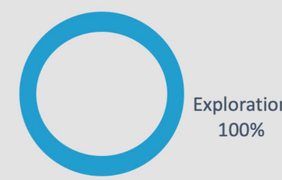

## In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=7)


*top 4 selections

## How is CS funded? (n=2)


## Implementation for School Design Phase (n=2)

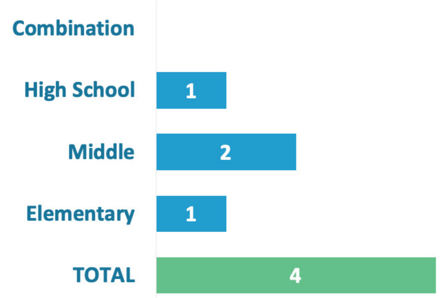

## Implementation for Equity and Access Phase (n=2)



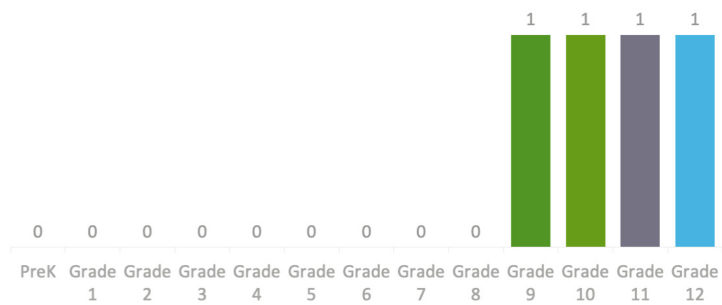

05/13/20
Page 2

# Kaʻu-Keaʻau-Pāhoa Complex Area ($n$ = 6)

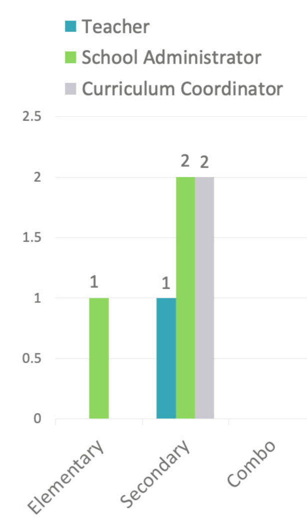
## Responses by school level




## Grade level taught (teacher respondents, n=1)



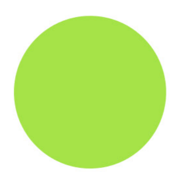

## Position of Respondents



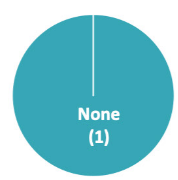

## Which 5 core concepts do you teach (teacher respondents, n=1)

- **1** Computing Systems
- **1** Networks and the Internet
- **1** Data and Analysis
- **1** Algorithms and Programming
- **1** Impacts of Computing
- **0** None of the Above

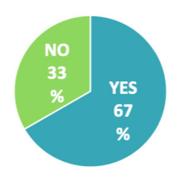
## General Findings



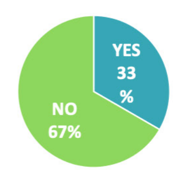
Do you currently integrate CS in your classroom? (n=0)



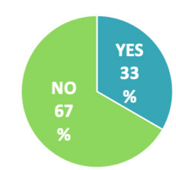

What percentage of time your students are learning about computer science? (n=1)




Does School Design plan include CS? (n=3)




Are there Community/Parent Outreach for CS? (n=3)




Do you have partnerships with organizations to support CS? (n=6)

# Ka‘u-Kea‘au-Pāhoa Complex Area (*n* = 6)

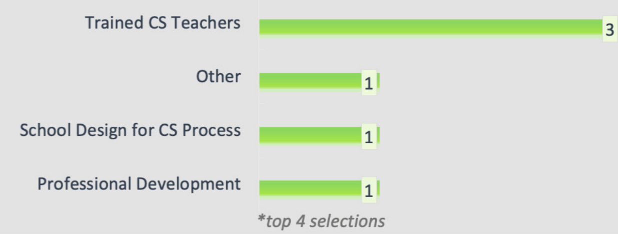
**Number of Schools in complex area**
**9**

**Percentage of schools represented in the survey**
**44%**

**High school students enrolled in CS (est. SY19-20)**
**141**

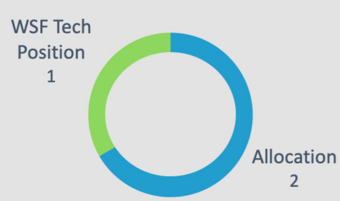
## How is CS Education offered at your school? (n=0)


## In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=6)




*top 4 selections

## How is CS funded? (n=3)




## Implementation for School Design Phase (n=3)

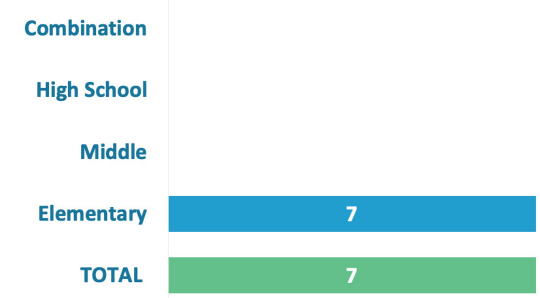

## Implementation for Equity and Access Phase (n=3)


*05/13/20*
*Page 2*

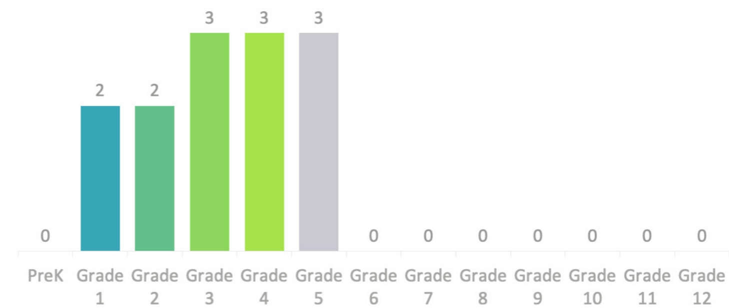
# Leilehua-Mililani-Waialua Complex Area ($n$ = 8)



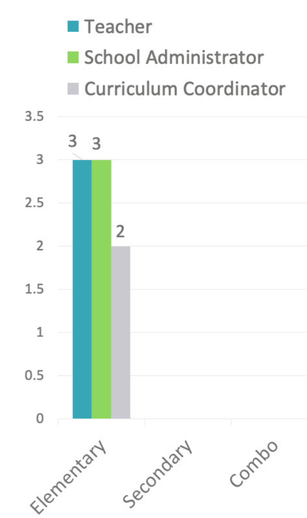
## Responses by school level




## Grade level taught (teacher respondents, n=3)



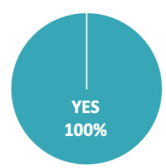

## Position of Respondents



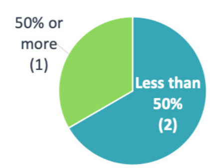

## Which 5 core concepts do you teach (teacher respondents, n=3)

| | | | | | |
|---|---|---|---|---|---|
| 2 Computing Systems | 1 Networks and the Internet | 0 Data and Analysis | 3 Algorithms and Programming | 1 Impacts of Computing | 0 None of the Above |

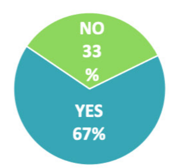
## General Findings



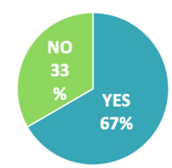

Do you currently integrate CS in your classroom? (n=3)



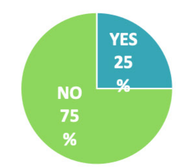

What percentage of time your students are learning about computer science? (n=3)




Does School Design plan include CS? (n=3)




Are there Community/Parent Outreach for CS? (n=3)




Do you have partnerships with organizations to support CS? (n=8)

*05/13/20*
*Page 1*

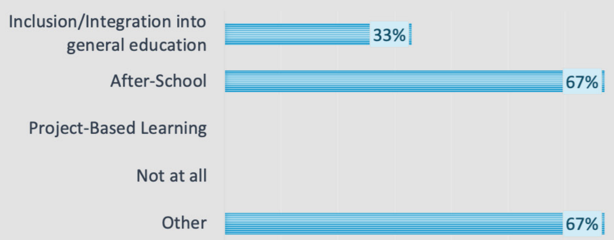
# Leilehua-Mililani-Waialua Complex Area (*n* = 8)

**Number of Schools in complex area**
**20**

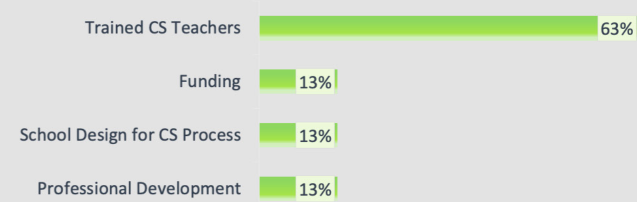
**Percentage of schools represented in the survey**
**35%**

**High school students enrolled in CS (est. SY19-20)**
**378**

## How is CS Education offered at your school? (n=3)

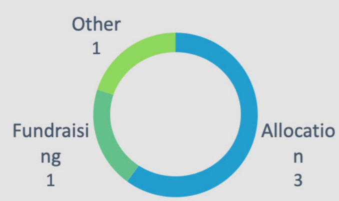



## In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=8)



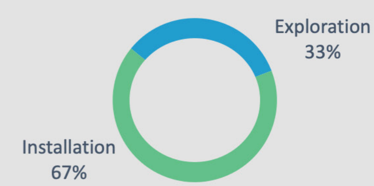

**top 4 selections*

## How is CS funded? (n=3)




## Implementation for School Design Phase (n=3)

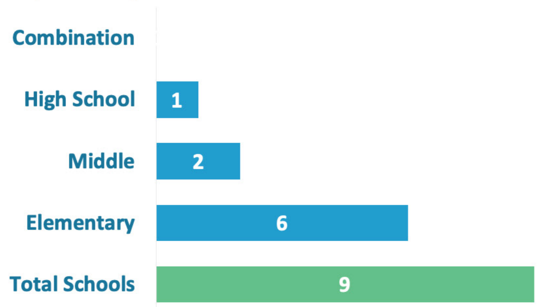

## Implementation for Equity and Access Phase (n=3)



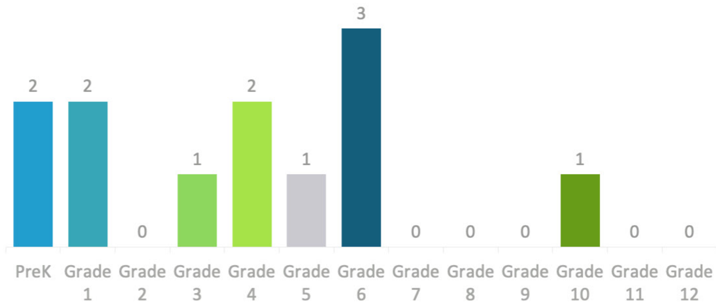
# Nānākuli-Waianae Complex Area (*n* = 21)



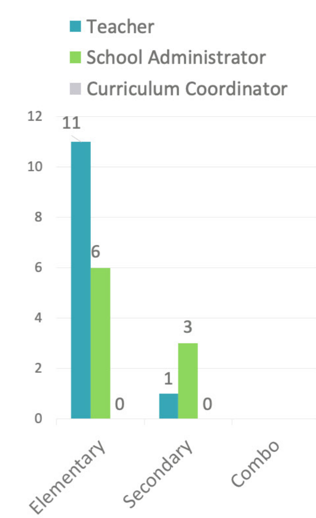
## Responses by school level




## Grade level taught (teacher respondents, n=12)




## Position of Respondents




## Which 5 core concepts do you teach (teacher respondents, n=12)

**25%** Computing Systems

**17%** Networks and the Internet

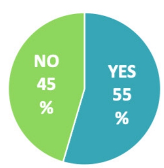
**25%** Data and Analysis

**25%** Algorithms and Programming

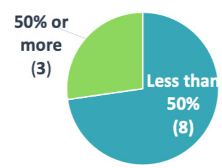
**25%** Impacts of Computing

**50%** None of the Above

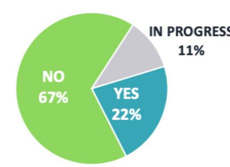
## General Findings



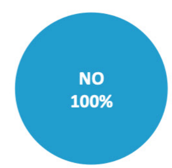

Do you currently integrate CS in your classroom? (n=11)



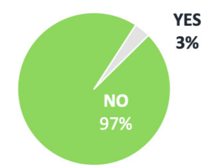

What percentage of time your students are learning about computer science? (n=11)




Does School Design plan include CS? (n=9)




Are there Community/Parent Outreach for CS? (n=9)




Do you have partnerships with organizations to support CS? (n=21)

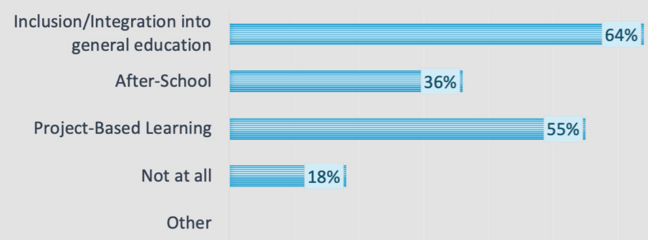
# Nānākuli-Waianae Complex Area ($n$ = 21)

**Number of Schools in complex area**
**9**

**Percentage of schools represented in the survey**
**100%**

**High school students enrolled in CS (est. SY19-20)**
**0**

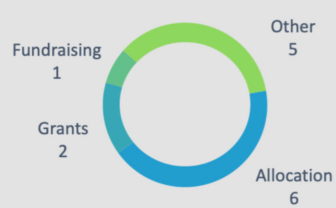
## How is CS Education offered at your school? (n=11)




## In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=21)

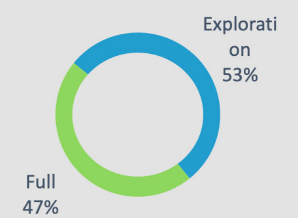

*top 4 selections

## How is CS funded? (n=9)




## Implementation for School Design Phase (n=9)


## Implementation for Equity and Access Phase (n=9)

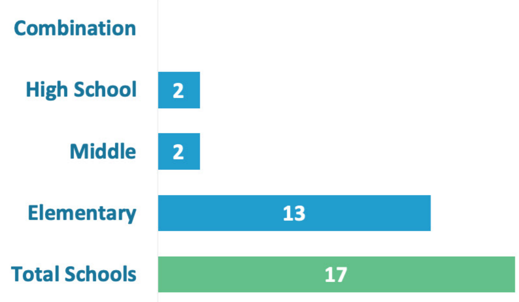



*05/13/20*
*Page 2*

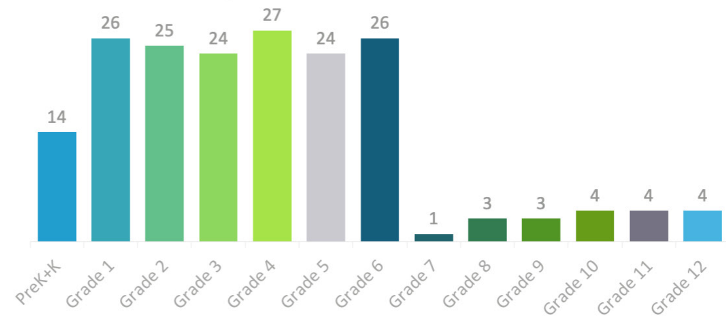
Preliminary report for
2020 Computer Science
Landscape Survey

# Pearl City-Waipahu Complex Area ($n$ = 111)

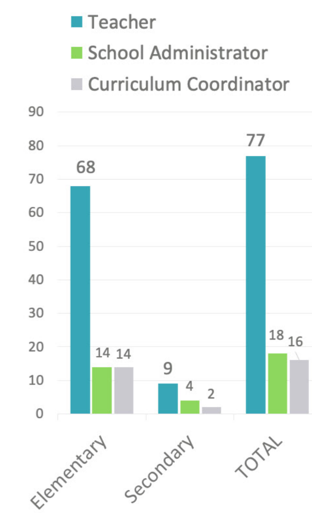
## Responses by school level




## Grade level taught (teacher respondents, n=73)




## Position of Respondents




## Which 5 core concepts do you teach (teacher respondents, n=74)

**30%** Computing Systems

**31%** Networks and the Internet

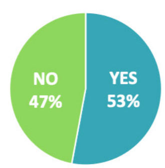
**14%** Data and Analysis

**41%** Algorithms and Programming

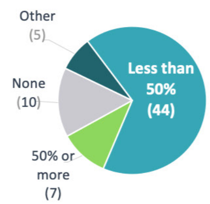
**26%** Impacts of Computing

**36%** None of the Above

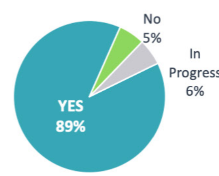
## General Findings



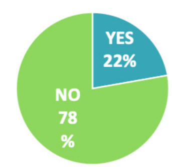

Do you currently integrate CS in your classroom? (n=68)



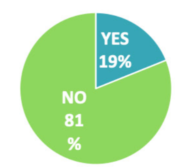

What percentage of time your students are learning about computer science? (n=66)




Does School Design plan include CS? (n=18)




Are there Community/Parent Outreach for CS? (n=18)




Do you have partnerships with organizations to support CS? (n=111)

*05/13/20*
*Page 1*

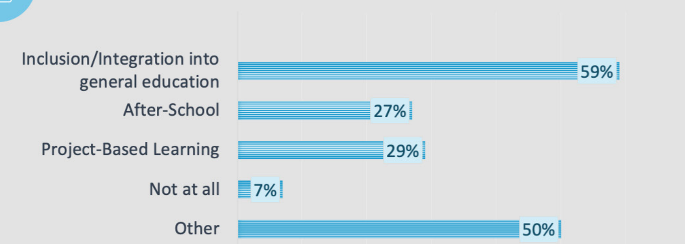
# Pearl City-Waipahu Complex Area (*n* = 111)

**Number of Schools in complex area**
**17**

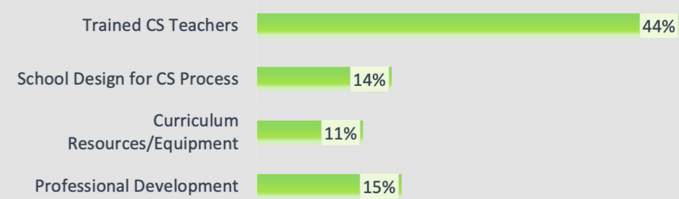
**Percentage of schools represented in the survey**
**100%**

**High school students enrolled in CS (est. SY19-20)**
**297**

## How is CS Education offered at your school? (n=68)

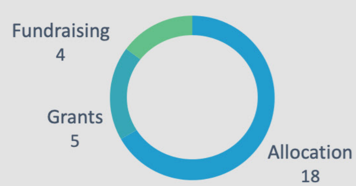



## In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=111)

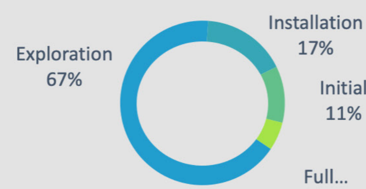



*top 4 selections

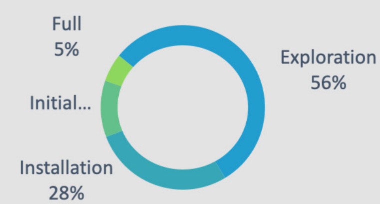
## How is CS funded? (n=18)




## Implementation for School Design Phase (n=18)




## Implementation for Equity and Access Phase (n=18)

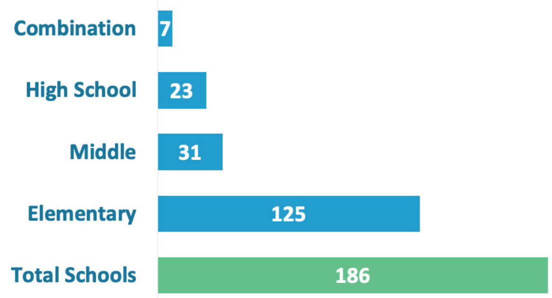



*05/13/20*
*Page 2*

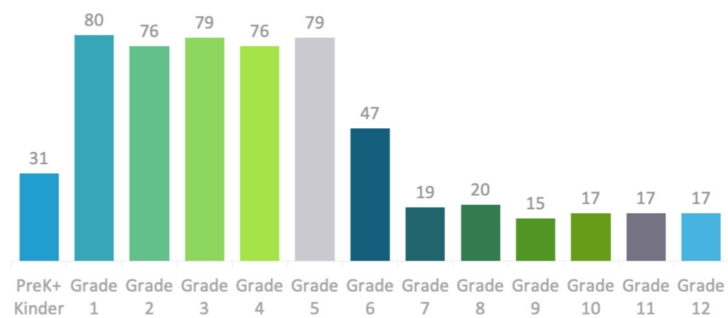
2020 Computer Science
Landscape Survey

# Hawai'i Statewide (*N* = 492)

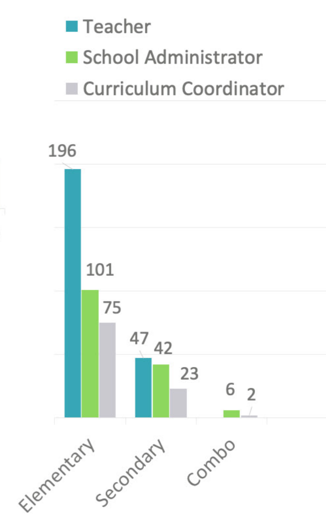
## Schools Responding




## Grade level taught (teacher respondents, n=243)




## Position of Respondents




## Which 5 core concepts do you teach (teacher respondents, n=229)

**41%** Computing Systems

**38%** Networks and the Internet

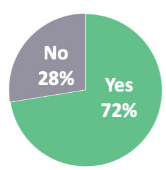
**26%** Data and Analysis

**49%** Algorithms and Programming

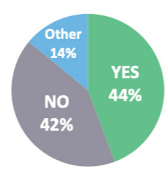
**33%** Impacts of Computing

**28%** None of the Above

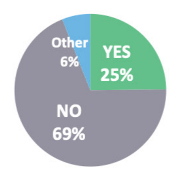
## General Findings



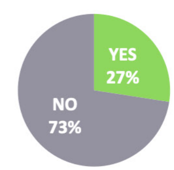

Do you currently integrate CS in your classroom? (elementary teacher, n=196)




Does School Design plan include CS? (n=149)




Are there Community/Parent Outreach for CS? (n=149)




Do you have partnerships with organizations to support CS? (n=492)

*06/30/20*
*Page 1*

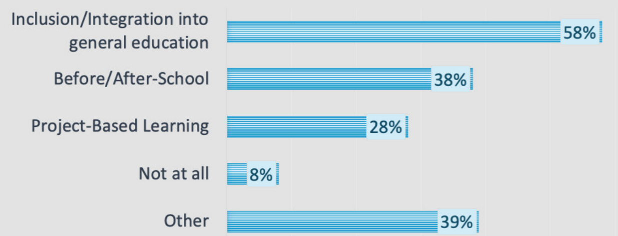
# Hawai'i Statewide (*N* = 492)

**Number of schools** (excluding charter)
**256**

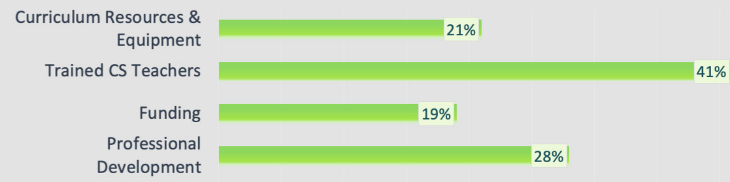
**Percentage of schools represented in the survey**
**72.66%**

**Students enrolled in CS-designated courses (SY19-20)**
**5,322**

## How is CS education offered at your school? (n=244)

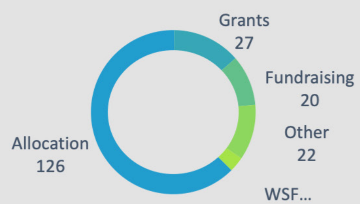



## In your opinion, what is the top priority area needed to support and provide equitable access to CS education in your school?* (n=492)

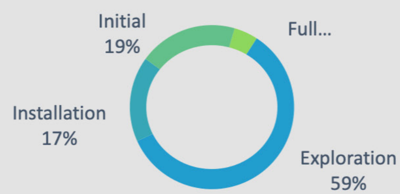



*top 4 selections

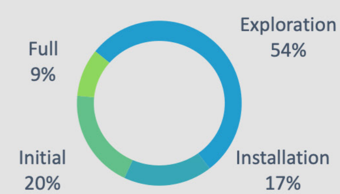
## How is CS funded?
(n=149; check all that apply)




## Implementation for School Design Phase (n=149)




## Implementation for Equity and Access Phase (n=149)




*06/30/20*
*Page 2*

## Appendix 5. Suggested Literature Informing Strategies for CS Equity and Access

| Author(s) | Article Title and Key Area |
|---|---|
| Baytak & Land, 2011 | Case study: Advancing elementary-school girls' programming through game design<br><br>Keywords: Gender; girls; game design |
| Chinn, 2002 | Asian and Pacific Islander women scientists and engineers: A narrative exploration of model minority, gender, and racial stereotypes<br><br>Keywords: K–12; Asian and Pacific Islander; women; STEM; stereotype threat |
| Denner et al., 2005 | The Girls Creating Games program: Strategies for engaging middle-school girls in information technology<br><br>Keywords: Girls; middle school; information technology; after-school |
| Dryburgh, 2020 | Underrepresentation of girls and women in computer science: Classification of 1990s research<br><br>Keywords: Gender; women; college; research |
| Fanscali et al, 2018 | A landscape study of computer science education in NYC: Early findings and implications for policy and practice<br><br>Keywords: Landscape report; longitudinal research; underrepresented groups; teachers |

| Finding |
| --- |
| Developments have been seen in schools and workplaces throughout the last decade. However, girls' representation in technology studies has not grown in accordance. This case study describes introduction to programming via a computer-game design approach to a class of 5th-grade girls.  Although the case study is exploratory, implications are drawn for the potential role of game design as a vehicle to involve more girls in computer science. |
| This qualitative study uses narrative methodology to understand what becoming a scientist or engineer entails for women stereotyped as "model minorities." Interviews with four Chinese and Japanese women focused on the social contexts in which science is encountered in classrooms, families, and community. Interpretation was guided by theories that individuals construct personal narratives mediated by cultural symbolic systems to make meaning of experiences. Narratives revealed that Confucian cultural scripts shaped gender expectations even in families several generations in America. Regardless of parents' level of education, country of birth, and number of children, educational expectations, and resources were lower for daughters. Parents expected daughters to be compliant, feminine, and educated enough to be marriageable. Findings suggest K–12 gender equity science practices encouraged development of the women's interests and abilities but did not affect parental beliefs. The author's 1999 study of Hawaiians/Pacific Islander and Filipina female engineers is included in implications for teacher education programs sensitive to gender, culture, ethnicity, and language. |
| This paper describes Girls Creating Games (GCG), an after-school and summer program for sixth- through eighth-grade girls designed to address the barriers to girls' active participation in information technology (IT). It also offers strategies for engaging middle-school girls in information technology. |
| This article presents a categorization by educational stages of the research into this topic, and an evaluation of the generalizability of findings to broader contexts. The categorization shows that the most extensive research on women in computing is done at the post-secondary stage, and uses students as non-randomly selected subjects. These studies are non-comprehensive, but where similar results are found in a number of studies, the findings are supported. The emphasis in research focuses on structural factors at the elementary stage, but by the post-secondary stage the emphasis is more likely to be on social psychological factors. |
| NYC's Computer Science for All (CS4All) is a 10-year, districtwide initiative aimed at providing high-quality computer science (CS) education to all NYC public school students. This paper presents findings from an assessment of CS in NYC, conducted in the second year of the CS4All initiative. The authors found high participation in CS teacher training opportunities (both through and independent of the initiative) and widespread offering of CS courses. Specifically, the authors estimate just over half of schools districtwide (56%) participated in some type of CS training in the 2015-16 school year, and about two thirds of schools (64%) offered students some kind of CS coursework in the 2016-17 school year (through either stand-alone CS courses or the integration of CS into other subjects). The type of programming and training varied by school level (elementary, middle and high). The paper also explored the extent to which programming and training are reaching schools and students who are historically underrepresented in CS--including women and girls, students of color, low-income students and students with disabilities, finding that that schools offering CS courses and activities served fewer Black and Latino students and more White and Asian Students, compared with schools not offering CS. This work is unique, as it is the only district wide assessment of CS education conducted anywhere in the country to date, thus adding to an under-researched but important and growing field of study. |

| Author(s) | Article Title and Key Area |
|---|---|
| Hansen et al., 2016 | Differentiating for diversity: Using universal design for learning in elementary computer science education<br><br>Keywords: Special education; diversity; computer science; universal design for learning; high school |
| Hanson et al., 2000 | Does ""All"" mean ""All?"": Education for girls and women<br><br>Keywords: Gender; vocational education; high school |
| Hur et al, 2017 | Girls and computer science: Experiences, perceptions, and career aspirations<br><br>Keywords: Girls; computer science |
| Ibe et al, 2018 | Reflections of a Diversity, Equity, and Inclusion Working Group based on data from a national CS education program<br><br>Keywords: TEALS; underrepresented groups; diversity |

| Finding |
| --- |
| The authors present how Universal Design for Learning (UDL) was used to develop and refine a programming environment and curriculum for upper-elementary school classrooms (students aged 9-12), followed by a presentation as to how the accommodations and modifications to emphasize the ways our development environment and/or curriculum enabled such uses. Ensuring introductory computer science experiences are equitable and accessible for a wide range of student learners may broaden the diversity of individuals who perceive themselves as capable of pursuing computer science in the future. |
| This report compiles a series of working documents that condenses research conducted by the Gender and Diversities Institute at the Education Development Center, Inc., in Massachusetts. Gender equity "is more than putting girls on equal footing with boys--it's eliminating the barriers and stereotypes that limit the opportunities and choices of both sexes" (McGeeBailey, 1996, p.75). Equity should be the absence of gender differences in outcomes. However, no difference in outcomes when all students score poorly is not equity. Little evidence indicates that girls are born less inclined to mathematics or mechanics then boys, but strong evidence indicates that society believes this to be the case and encourages a division between boys and girls. Reaction to the attitudes of their teacher, parents and peers matter (Vetter, 1996). Changing the curriculum, changing the school climate, paying attention to employment as an outcome indicator, reexamining assessments and policies, and discussing gender-equity practice should not be adds ons, but central to professional education of school personnel. As the work continues, resist efforts to put males and females against each other. Remember that gender equity encourages options for everyone. Both boys and girls benefit from nonstereotyped thinking, expanded methods of teaching and learning, opportunities to participate in a range of courses and careers, and habits of respecting and valuing others. |
| The purpose of the study was to examine ways to promote computer science (CS) among girls by exploring young women's experiences and perceptions of CS as well as investigating factors affecting their career aspirations. American girls aged 10–16 participated in focus group interviews as well as pre-, post-, and follow-up surveys while attending a CS camp. The analysis of data revealed that although the participants were generally positive about the CS field, they had very limited knowledge of and experience with CS, leading to little aspiration to become computer scientists. The findings also indicated that girls' affinity for and confidence in CS were critical factors affecting their motivation for pursuing a CS-related career. The study demonstrated that participation in the CS camp motivated a small number of participants to be interested in majoring in CS, but the activity time was too short to make a significant impact. Based on the findings, the authors suggest that providing CS programming experiences in K–12 classrooms is important in order to boost girls' confidence and interest in CS. |
| Many of the activities of TEALS (Technology Education and Literacy in Schools), a national computer science education program, have the potential to impact the diversity of students enrolled in computer science classes, student performance on AP exams, and student attitudes towards CS careers. TEALS works with high schools to build and grow sustainable computer science programs through teaching partnerships between classroom teachers and volunteers who work in the tech industry. In 2016, TEALS initiated a Diversity, Equity, and Inclusion Working Group (DEIWG) to holistically address the overall impact of the program on increasing diversity in CS, including TEALS' approach to: selection of schools, student recruitment efforts into CS courses, recruitment and training of TEALS volunteers, curriculum design and resources, and instructional support of volunteers and teachers. The working group compared national, regional, and statewide outcomes and demographics to those of TEALS partner schools, students, volunteers, and teachers to identify best practices and areas in need of investment. This paper describes these findings and presents strategies for future work. |

| Author(s) | Article Title and Key Area |
|---|---|
| Jordt et al. 2017 | Values affirmation intervention reduces achievement gap between underrepresented minority and white students in introductory biology classes<br><br>Keywords: Underrepresented groups; biology; college; stereotype threat |
| Martinez et al., 2015 | A comparison of preschool and elementary school children learning computer science concepts through a multilanguage robot programming platform<br><br>Keywords: Gender; early education |
| Master et al, 2016 | Computing whether she belongs: Stereotypes undermine girls' interest and sense of belonging in computer science<br><br>Keywords: Stereotype threat; sense of belonging; high school; girls |
| Master et al, 2017 | Programming experience promotes higher STEM motivation among first-grade girls<br><br>Keywords: Elementary education; programming; girls; stereotype threat |

| Finding |
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| Achievement gaps between underrepresented minority (URM) students and their white peers in college STEM classrooms are persistent across many white-majority institutions of higher education. Attempts to reduce this phenomenon of underperformance through increasing classroom structure via active learning have been partially successful. In this study, the authors address the hypothesis that the achievement gap between white and URM students in an undergraduate biology course has a psychological and emotional component arising from stereotype threat. Specifically, the study introduced a values affirmation exercise that counters stereotype threat by reinforcing a student's feelings of integrity and self-worth in three iterations of an intensive active-learning college biology course. On average, this exercise reduced the achievement gap between URM and white students who entered the course with the same incoming grade point average. This result suggests that achievement gaps resulting from the underperformance of URM students could be mitigated by providing students with a learning environment that removes psychological and emotional impediments of performance through short psychosocial interventions. |
| This paper describes a school intervention to teach fundamental Computer Science (CS) concepts to 3-11 year old students with a multilanguage robot programming platform (using drag and drop, Python and C++ languages) in Argentina. Data show that all students can intuitively learn sequence, conditional, loops and parameters and that girls performed slightly better than boys. Older students can easily combine these concepts to write a program. The multilanguage platform promotes student spontaneous exploration of more sophisticated CS concepts and languages. These findings imply that introducing CS in mandatory schooling from an inquiry based approach is both achievable and beneficial. |
| Two experiments investigated whether high-school girls' lower interest than boys in enrolling in CS courses is influenced by stereotypes of the field. In 2 experiments (N = 269), a computer science classroom that did not project current computer science stereotypes caused girls, but not boys, to express more interest in taking computer science than a classroom that made these stereotypes salient. The gender difference was mediated by girls' lower sense of belonging in the course, even beyond the effects of negative stereotype concerns, expectations of success, and utility value. Girls' lower sense of belonging could be traced to lower feelings of fit with computer science stereotypes. Individual differences in fit with stereotypes predicted girls' belonging and interest in a stereotypical, but not a nonstereotypical, classroom. Adolescence is a critical time for career aspirations. Girls may avoid computer science courses because current prevailing stereotypes of the field signal to them that they do not belong. However, providing them with an educational environment that does not fit current computer science stereotypes increases their interest in computer science courses and could provide grounds for interventions to help reduce gender disparities in computer science enrollment. |
| In the study (N = 96), the authors assessed 6-year-old children's stereotypes about STEM fields and tested an intervention to develop girls' STEM motivation despite these stereotypes. First-grade children held stereotypes that boys were better than girls at robotics and programming but did not hold these stereotypes about math and science. Girls with stronger stereotypes about robotics and programming reported lower interest and self-efficacy in these domains. Children were randomly assigned either to a treatment group that was given experience in programming a robot using a smartphone or to control groups (no activity or other activity). Girls given programming experience reported higher technology interest and self-efficacy compared with girls without this experience and did not exhibit a significant gender gap relative to boys' interest and self-efficacy. These findings show that children's views mirror current American cultural messages about who excels at computer science and engineering and show the benefit of providing young girls with chances to experience technological activities. |

| Author(s) | Article Title and Key Area |
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| Moreno Sandoval et al. 2017 | Intersectional rights of teachers and students in computer science and special education: Implications for urban schooling<br><br>Keywords: Teachers; special education; urban education; computer science |
| Roger & Walker, 1996 | Activities to attract high school girls to computer science<br><br>Keywords: High school; girls; computer science |
| Scott et al., 2017 | Broadening participation in computing: Examining experiences of girls of color<br><br>Keywords: Girls of color; advanced placement; college pathway; computing |
| Shah et al., 2014 | Analyzing equity in collaborative learning situations: A comparative case study in elementary computer science<br><br>Keywords: Equity; elementary education |
| Smith et al. 2018 | AP® STEM participation and postsecondary STEM outcomes: Focus on underrepresented minority, first-generation, and female students<br><br>Keywords: Advanced Placement; high school; underrepresented groups; women; STEM |

| Finding |
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| This article advocates for the intersectional rights of teachers and students of computer science (CS) and special education (SPE) in urban education. Using an intersectional nepantla lens, we propose that CS education be accessible to all SPE teachers and students with dis/abilities. We argue for a focus on social-emotional intersectional rights as crucial foundations for an equitable approach to teaching and learning in CS SPE. We end with implications for educational stakeholders and teacher education programs that open pathways for socioemotional and intersectional rights of underrepresented teachers and students of CS and SPE. |
| The authors present several activities used in the two-week PipeLINK summer program for high school girls. These hands-on activities and interactive talks, presented mostly by female faculty, undergraduates, and graduate students, showed the girls the wide range of opportunities in the field of computer science. |
| In order to enhance participation in computer science for girls of color, this study examines the outcomes of a rigorous out-of-school culturally relevant computer science intervention designed to engage underrepresented students in computing. Findings demonstrated that within-race gender differences exist in early interest in computing. Female students of color demonstrated significantly lower engagement and interest in computing, suggesting that being a member of a marginalized gender group plays a unique role and has a multiplying (negative) effect. Further, there were still significant gender differences in computing engagement after participation in one summer of the computer science intervention. Promising outcomes were revealed among a group of students who chose to enroll in the optional Advanced Placement CS A preparatory course; there were no gender differences in enrollment and completion of the course. In examining longitudinal outcomes, gender is a significant predictor of majoring in computer science in college, with male students much more likely to major in computer science than female students. These findings have important implications for addressing the gender gap in computing, including understanding how the intersection of race and gender presents unique barriers and challenges for women of color in computing, and that interventions to broaden participation in computing must address the unique experiences of women of color. |
| This paper presents a comparative case study of the different ways that equity and inequity emerged as an elementary computer science student collaborated with two different classmates on programming tasks. Findings indicate that despite the existence of participation structures designed to foster equitable collaboration, inequities emerged in both dyads as students positioned themselves and their classmates with identities as more or less competent in computer science. While in the first dyad this positioning was often overt, in the second dyad positioning assumed a more passive form. Further, there is evidence that these positionings had an impact on students' opportunities to learn. |
| In this study the authors ask if participation and performance in Advanced Placement STEM Exams in high school is predictive of a student's performance in STEM courses in the first year of college and the likelihood that a student will graduate with a STEM major, particularly for traditionally underrepresented populations in STEM fields--first-generation, underrepresented minority, and female students. The authors find that AP STEM examinees had 7% higher first-year STEM grades and a 13% higher probability of STEM major completion than matched non-AP STEM peers. Nearly all of these positive results held for first-generation, underrepresented minority, and female students. |

| Author(s) | Article Title and Key Area |
|---|---|
| Voyles & Williams, 2004 | Gender differences in attributions and behavior in a technology classroom<br><br>Keywords: Gender; 4-6 grade; robotics |
| Werner et al., 2004 | Pair-programming helps female computer science students<br><br>Keywords: Pair programming; gender |
| Wilson, 2002 | A study of factors promoting success in computer science including gender differences<br><br>Keywords: College; computer science; gender |
| Yuen et al., 2016 | A culturally relevant pedagogical approach to computer science education to increase participation of underrepresented populations<br><br>Keywords: Culturally relevant pedagogy; diverse learners; STEM |

| Finding |
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| The attributions that students make to explain their successes and failures have been implicated as being important in affecting their future expectations, outcomes, and decisions and could be part of the reason for the under-representation of women in the fields of computer science and engineering. This study examines the perception of accomplishment, attributions and behavior of fourth- through sixth-grade girls and boys in a technology course where students learned to build simple Lego® robots and program them using RoboLab™ software. There were no significant differences in the girls' and boys' assessments of their daily accomplishment or in their attributions for their successes or failures, but the girls' behavior during the course was significantly different from that of the boys in that they asked more questions of teachers and made fewer self-assured statements. |
| Pair-programming has been found to be very beneficial in educational settings. Students who pair in their introductory programming course are more confident, have greater course completion and pass rates, and are more likely to persist in computer-related majors. Although pairing helps all students, the authors suggest that it is particularly beneficial for women because it addresses several significant factors that limit women's participation in computer science. |
| This study was conducted to determine factors that promote success in an introductory college computer science course and to determine what, if any, differences appear between genders on those factors. The study revealed three predictive factors in the following order of importance: comfort level (with a positive influence), math background (with a positive influence), and attribution to luck (with a negative influence). No significant gender differences were found in these three factors. The study also revealed that both a formal class in programming (which had a positive correlation) and game playing (which had a negative correlation) were predictive of success. The study revealed a significant gender difference in game playing with males reporting more experience with playing games on the computer than females reported. |
| This paper presents a theoretical discussion of a culturally relevant pedagogical approach to computer science education. The paper builds a framework of strategies that computer science educators can use to empower diverse learner populations, especially those from underrepresented minority groups, to participate in computer science as well as other STEM fields. This framework draws from education theories on sociocultural learning, critical pedagogy, and culturally relevant pedagogy. |

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CRDG CURRICULUM RESEARCH & DEVELOPMENT GROUP COLLEGE OF EDUCATION UNIVERSITY OF HAWAI'I AT MĀNOA