

Date of Hearing: March 27, 2019

ASSEMBLY COMMITTEE ON EDUCATION
Patrick O'Donnell, Chair
AB 1410 (Quirk-Silva) – As Introduced February 22, 2019

SUBJECT: Teachers: Computer Science Access Initiative

SUMMARY: Establishes the Computer Science Access Initiative, to improve students' access to instruction in computer science by increasing the number of teachers who are authorized and trained to provide computer science instruction in California public schools. Specifically, **this bill:**

- 1) States that the act shall be known as the Computer Science Access Initiative, the purpose of which is to increase California pupils' access to instruction in computer science by increasing the number of teachers who are authorized and trained to provide computer science instruction in California public schools.
- 2) Requires that the Computer Science Access Initiative be administered by the California Department of Education (CDE) in consultation with the Commission on Teacher Credentialing (CTC).
- 3) Requires the CDE, on or before July 1, 2020, to award grants under this initiative for the purpose of increasing the number of teachers authorized and trained to instruct pupils in computer science.
- 4) States that grants awarded by the CDE through this initiative shall be used for one or both of the following purposes:
 - a) Increasing the number of single subject credential holders who obtain supplementary authorizations to teach computer science by increasing the availability of coursework required to earn that authorization.
 - b) Providing professional development to teachers who hold multiple subject or education specialist credentials so that they are able to teach computer science at the elementary level.
- 5) Requires that professional development funded through this act be aligned to the state's computer science content standards.
- 6) Authorizes the following entities to be eligible to apply for a grant under this initiative:
 - a) A school district
 - b) A county office of education
 - c) A community college

- d) A four-year institution of postsecondary education operating in a consortium with a school district, county office of education, or community college.
 - e) A consortium made up of any combination of the above entities, if at least one member of the consortium is a school district, county office of education, or community college.
- 7) Applicants for grants under this initiative shall be required to submit an application in a form and manner determined by the CDE that includes, but is not limited to, all of the following:
- a) A demonstration of the applicant's capacity to carry out the activities necessary to meet the objectives of the initiative.
 - b) A plan detailing how the applicant will meet one or both of the eligible activities for use of funding
 - c) An estimate of the number of computer science supplemental authorizations the grant is expected to produce, or the number of multiple subject or education specialist credential holders expected to be trained, or both of those, through the use of grant funding.
- 8) For applicants seeking funding to increase the number of teachers who hold a supplementary authorization in computer science, requires that the application include a description of the number of credit-bearing courses in computer science expected to be established with the use of grant funding.
- 9) Identification of any matching funds, in-kind matching resources, or outside funding expected to be leveraged in support of the proposed activities.
- 10) In awarding grants, requires the CDE to do both of the following:
- a) Ensure that at least one-half of the grants awarded are for the purpose of increasing the number of teachers awarded the supplementary authorization in computer science.
 - b) Give priority to applications that seek to improve the availability of computer science instruction to pupils who at the time of the application have limited opportunity to study computer science or who are traditionally underrepresented in the study of computer science.
- 11) States that the operation of the act is contingent upon an appropriation in the annual Budget Act for purposes of this article.
- 12) States the intent of the Legislature to appropriate an unspecified sum for purposes of the measure.

EXISTING LAW:

- 1) Authorizes the CTC to issue single subject teaching credentials in agriculture, art, business, English, foreign language, health science, home economics, industrial and technology education, mathematics, music, physical education, science, and social science.

- 2) Through regulation, authorizes holders of credentials in mathematics, business, and industrial and technology education (ITE), as well as holders of supplementary authorizations in computer science, to teach computer science.
- 3) Authorizes the CTC to issue a multiple or single subject teaching credential with a specified concentration in a particular subject based upon the depth of an applicant's preparation in an important subject of the school curriculum in order to ensure excellence in teaching in specific subjects.
- 4) Authorizes the CTC to issue credentials for teaching specialties, including bilingual education, early childhood education, and special education. Education specialist teaching credentials are to be based upon a baccalaureate degree from an accredited institution, completion of a program of professional preparation, and standards that the CTC may establish.
- 5) Requires the Superintendent of Public Instruction (SPI) to convene a computer science strategic implementation advisory panel (panel) to develop recommendations for a computer science strategic implementation plan, and requires the panel to submit recommendations for a strategic plan to the State Board of Education (SBE) by January 15, 2019.
- 6) Requires the plan to include, at a minimum, recommendations on all of the following:
 - a) broadening the pool of teachers to teach computer science
 - b) defining computer science education principles that meet the needs of pupils in all grades
 - c) ensuring that all pupils have access to quality computer science courses
- 7) Requires the Instructional Quality Commission (IQC) to consider developing and recommending to the SBE, on or before July 31, 2019, computer science content standards for kindergarten and grades 1 to 12 pursuant to recommendations developed by a group of computer science experts.
- 8) States that if a school district requires more than two courses in mathematics for graduation from high school, the district may award a student up to one mathematics course credit for successfully completing a "category C" approved computer science course. (EC 51225.35)
- 9) Requires the California State University, and requests the University of California, to develop guidelines for high school computer science courses that may be approved for the purposes of recognition for admission. (EC 66205.5)

FISCAL EFFECT: Unknown

COMMENTS:

Need for the bill. The author states, "The need for computer science as part of primary education is paramount. Computer science coursework and opportunities prepare students for both careers in this fast growing field, and higher education degrees for top earning and highly valued expertise across disciplines and industry sectors. California's prosperity has been built

upon a diverse and accomplished workforce, and despite a booming tech sector, California's high schools offer few of these courses. Breaking down the perception that computer science is the realm of higher education alone is vital to expanding and empowering all students and communities to pursue this field of study, and provide for a robust information technology workforce in California.

AB 1410 establishes the Computer Science Access Initiative for this purpose, directing the Department of Education to award grants for professional development and authorization of educators for computer science instruction. The goal is to ensure we have more qualified Computer Science teachers and the resources to offer coursework for our students to take full advantage of.”

Computer Science Strategic Implementation Panel recommends that the state support teacher professional development and increasing the number of supplementary authorizations in CS.

Current law requires the SPI to convene a computer science strategic implementation advisory panel to develop recommendations for a computer science strategic implementation plan, and requires the panel to submit recommendations for a strategic plan to the SBE by January 15, 2019. In September, 2018, the panel submitted a draft strategic plan to the SBE for consideration, and the SBE is expected to act on the plan this spring.

The draft plan outlines several strategies for improving the availability of computer science instruction including:

- Establish a grant program for teachers to support the completion of course work for the computer science supplementary authorization, with additional incentive for teachers who work in low-income and underserved school districts and rural and urban school districts.
- Provide professional development programs for in-service teachers to learn how to teach concepts and practices aligned to the California computer science standards, differentiated for grade and skill levels.

Who is authorized to teach computer science in California? California has three single subject teaching credentials (mathematics, business, and ITE) authorize teachers to provide instruction in computer science. Supplementary authorizations are added to a teacher's authorization in another subject.

The CTC recently modified their Computer Concepts and Applications authorization to reflect a change in focus from teaching basic computer use, keyboarding, and software application to broader preparation in computer science education. The CTC approved the proposed modifications, including changing the name of the authorization to “Computer Science” in 2016.

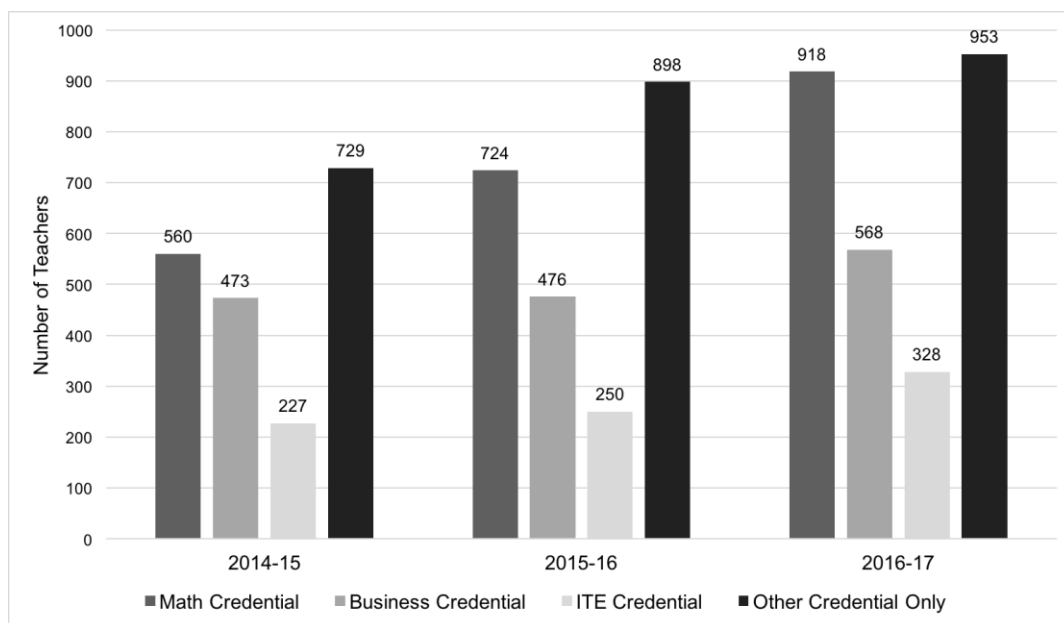
To obtain a supplementary authorization in computer science, teachers must complete twenty semester units or ten upper division semester units, or the equivalent quarter units, of non-remedial course work in computer science. They may also qualify by holding a collegiate major from a regionally accredited college or university in a subject directly related to the subject to be listed on the credential. The coursework must cover the following content areas:

- **Computer Programming:** includes expertise in at least one modern, high-level programming language (e.g., Python, Java, C/C++/C#).

- Data structures and algorithms: covers data representation, abstraction, searching and sorting in the context of solving problems using programming and computational tools.
- Digital devices, systems and networks: covers computer and communication devices and the systems they compose, including the concepts and abstractions that enable stand-alone, networked, and mobile digital devices to operate and communicate.
- Software design: covers the process of planning, engineering and implementing a software system to solve a problem, typically using both a design and a programming methodology, such as object-oriented and functional approaches.
- Impacts of computing: includes the social, ethical, and legal issues and impacts of computing, as well as the contributions of computer science to current and future innovations in the arts, business, humanities, medicine, and science.
- The balance of the units may be in any course that falls within the academic department for that subject category.

Because this supplementary authorization was developed prior to the state adoption of content standards in computer science in 2018, the authorization may need to be revised again.

Who currently teaches computer science in California? According to the draft computer science strategic implementation plan, in the 2016-2017 academic year, approximately 2,273 teachers in California taught core academic computer science courses. This number has grown steadily to 1,609 teachers in 2014-2015 from 1,996 teachers in 2015-2016. As shown in the adjacent table, most teachers leading core academic CS courses are credentialed in subjects other than mathematics, business, or ITE and hold a supplementary authorization to teach computer science. Teachers credentialed in mathematics comprise the largest number.



No preservice

preparation programs in computer science exist in California. The draft plan notes that there are no pre-service CS teacher preparation programs in California. This is not surprising, since there is no CS credential to earn through such a program. Some content on computational thinking and CS have been added to some preparation programs in other disciplines, such as math and science. Some universities have created programs for in-service teachers to satisfy the course requirements for the supplementary authorization in CS. The plan notes that there are programs at University of California, Irvine and University of California, Riverside.

Teachers currently authorized to teach computer science receive no training in computer science in their preparation programs. The draft computer science strategic implementation

plan notes that “A major weakness of the existing situation is that single-subject credentialed teachers authorized to teach CS (i.e., Math, Business, or ITE) do not have subject matter requirements that cover basic CS content. Furthermore, they are not trained in pedagogical knowledge relevant to CS, which is different from their core subject. The supplementary authorizations in CS, on the other hand, do require courses that cover CS content knowledge. Yet, there are very few opportunities for credentialed teachers to enroll in such programs and these teachers will not necessarily have had practice teaching in a CS classroom.”

What is the subject of computer science in grades K-12? Computer science is a new field of study in K-12 education. The draft strategic plan notes that there is some confusion over what constitutes computer science instruction in K-12 schools: “CS is often misconstrued with other technological terminology such as computer literacy, educational technology, digital citizenship, and information technology. These areas focus more on the use of computing systems (e.g., learning to use word processing software). In contrast, computer science calls upon students to understand why and how computing technologies work, and then to build upon that conceptual knowledge by creating computational artifacts.”

The state’s new CS standards define CS education as “the study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society.” The core concepts in computer science instruction are:

Computing systems: People interact with a wide variety of computing devices that collect, store, analyze, and act upon information in ways that can affect human capabilities both positively and negatively. The physical components (hardware) and instructions (software) that make up a computing system communicate and process information in digital form. An understanding of hardware and software is useful when troubleshooting a computing system that does not work as intended.

Networks and Information systems: Computing devices typically do not operate in isolation. Networks connect computing devices to share information and resources and are an increasingly integral part of computing. Networks and communication systems provide greater connectivity in the computing world by providing fast, secure communication and facilitating innovation.

Data and Analysis: Computing systems exist to process data. The amount of digital data generated in the world is rapidly expanding, so the need to process data effectively is increasingly important. Data is collected and stored so that it can be analyzed to better understand the world and make more accurate predictions.

Algorithms and Programming: An algorithm is a sequence of steps designed to accomplish a specific task. Algorithms are translated into programs, or code, to provide instructions for computing devices. Algorithms and programming control all computing systems, empowering people to communicate with the world in new ways and solve compelling problems. The development process to create meaningful and efficient programs involves choosing which information to use and how to process and store it, breaking apart large problems into smaller ones, recombining existing solutions, and analyzing different solutions.

Impacts of Computing: Computing affects many aspects of the world in both positive and negative ways at local, national, and global levels. Individuals and communities influence computing through their behaviors and cultural and social interactions, and in turn, computing

influences new cultural practices. An informed and responsible person should understand the social implications of the digital world, including equity and access to computing.

According to the International Society for Technology in Education’s report, *ISTE Standards for Computer Science Education*, the field of computer science will continue to rapidly evolve in sometimes unpredictable ways, and as such, plans for teaching computer science will also need the flexibility to continuously adapt.

State’s first computer science content standards adopted in 2018. Current law requires the IQC to consider developing and recommending computer science content standards to the SBE. In 2018, the SBE adopted California’s first set of computer science standards for grades K-12. The standards are based on the five computer science core concepts and seven core practices:

| Core Concepts | Core Practices |
|----------------------------|---|
| Computing systems | Fostering an inclusive computing culture |
| Networks and the internet | Collaborating around computing |
| Data and analysis | Recognizing and defining computational problems |
| Algorithms and programming | Developing and using abstractions |
| Impacts of computing | Creating computational artifacts |
| | Testing and refining computational artifacts |
| | Communicating about computing |

Each standard includes a descriptive statement as well as examples for classroom application. As students progress through the standards from grades K–12, the standards call for students to build conceptual knowledge through active engagement in creative problem solving activities with an awareness of cultural and societal contexts. The 9–12 grade span also includes an additional set of standards, referred to as “9–12 Specialty,” which provides options for extending a pathway in computer science with content containing increased complexity and depth, and which may be used to create electives that are outside an introductory course. In addition, the standards contain significant themes of equity, “powerful ideas,” computational thinking, and breadth of application.

Access to computer science education in California schools. The draft Computer Science Strategic Implementation Plan notes that California students face significant problems of access in the study computer science, noting that at the secondary level, very few high schools offer CS courses, as shown in the adjacent table.

The draft strategic plan includes data from The College Board showing that, compared to other disciplines, the number of California students who take Advanced Placement (AP) CS exams is extremely low. In 2017, 8,679 California public school students took the AP CS A

California High Schools Offering CS Courses, 2016-17

| Course Name | % of Schools offering course |
|--------------------------------|------------------------------|
| Exploring Computer Science | 12% |
| Computer Science | 12% |
| AP Computer Science Principles | 3% |
| AP Computer Science A | 10% |
| Robotic Technologies | 13% |

Source: Draft CS Strategic Implementation Plan, 2018

exam and 7,636 California public school students took the AP CS Principles exam. These numbers are far less than the number of students who took exams for AP Biology (34,984), AP Calculus AB (48,473), AP Chemistry (20,008), AP Statistics (30,196), AP English Language & Composition (84,960), and AP US History (69,729).

Race, gender, and income disparities in CS course access. According to a 2015 report by the Level Playing Field Institute titled, *Path Not Found: Disparities in Access to Computer Science Courses in California High Schools*, access to computer science courses varies considerably. The report found that in California public high schools:

- Of the more than half a million high school students in the largest 20 districts, just 1% are enrolled in any computer science course.
- Nearly 75% of schools with the highest percentage of underrepresented students of color offer no computer sciences courses.
- African-American and Latino students make up 59% of California high school public school students but were just 11% of the 2014 AP Computer Science test takers.
- Only 4% of schools with the highest percentage of low-income students offer AP Computer Science courses.
- Only 8% of schools with the highest percentage of English Learners offered AP Computer Science courses.
- Of the high school students who took the AP computer science exam in 2015, only 26 percent were female, 973 were Latino, and 148 were African American.

The draft strategic plan also notes that female enrollment in CS courses, from the introductory level through advanced courses, is roughly half that of male enrollment, as shown below.

| Course Name | % of total high school enrollment | % Male Enrollment | % Female Enrollment |
|--------------------------------|-----------------------------------|-------------------|---------------------|
| Exploring Computer Science | 1.0% | 69% | 31% |
| Computer Science | 0.8% | 64% | 36% |
| AP Computer Science Principles | 0.2% | 70% | 30% |
| AP Computer Science A | 0.5% | 72% | 29% |
| Robotic Technologies | 0.7% | 71% | 29% |

Source: Draft CS Strategic Implementation Plan

Recommended amendments. *Staff recommends that this bill be amended* as follows:

- 1) Clarify that one of the purposes of the act is supporting teachers in taking the coursework necessary to earn the CS supplementary authorization (not by directly increasing the availability of coursework required to earn that authorization.)
- 2) Authorize charter schools to apply for the grant, and strike the eligibility of institutions of higher education. Make a conforming change to delete the requirement that higher education applicants report on the number of courses created.
- 3) Add a requirement that grantees report back to the CDE on the number of multiple subject teachers trained and the number of single subject authorizations in CS produced, the number of additional classes or instruction planned as a result of the grant, and the demographics of the pupils expected to be served by the teachers who have earned the authorization.
- 4) Add to the priority in funding geographic areas that have limited access to the study of computer science.
- 5) Require that at least one-half of the funds (rather than grants) awarded are for the purpose of increasing the number of teachers who earn a supplemental authorization in CS.
- 6) State the intent of the Legislature to provide ten million in one-time funds for this purpose.
- 7) Technical and conforming changes as necessary.

Prior and related legislation. AB 20 (Berman) of this Session would establish a Computer Science Coordinator position at the CDE.

AB 52 (Berman, 2019) of this Session would require the computer science strategic implementation plan to be regularly updated.

AB 182 (Luz Rivas, 2019) of this Session would create a single subject credential in computer science.

AB 1410 (Quirk-Silva and O'Donnell) of this Session would establish the Computer Science Access Initiative, to provide grants to LEAs for the purpose of increasing the number of teachers authorized and trained to instruct pupils in computer science.

SB 675 (Chang, 2019) of this Session would enact the Computer Occupations and Developing Education (CODE) Act, pursuant to which the State Board of Education would administer a grant program promoting the teaching of computer science courses in the public secondary schools.

AB 2329 (Bonilla, 2016), Chapter 693, Statutes of 2016, requires the SPI to convene a computer science strategic implementation advisory panel to develop recommendations for a computer science strategic implementation plan.

AB 2275 (Dababneh) of the 2015-16 Session would have authorized a person who holds a single subject teaching credential in business, industrial and technology education, mathematics, or science or a designated subjects career technical education teaching credential to teach courses in computer science to all pupils. This bill was held in the Assembly Education Committee.

AB 1539 (Hagman, 2014), Chapter 876, Statutes of 2014, requires the IQC to consider developing and recommending to the SBE, on or before July 31, 2019, computer science content standards for kindergarten and grades 1 to 12, pursuant to recommendations developed by a group of computer science experts.

AB 1764 (Olsen), Chapter 888, Statutes of 2014, states that if a school district requires more than two courses in mathematics for graduation from high school, the district may award a student up to one mathematics course credit.

REGISTERED SUPPORT / OPPOSITION:**Support**

None on file

Opposition

None on file

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