Date of Hearing: April 7, 2021

ASSEMBLY COMMITTEE ON EDUCATION
Patrick O'Donnell, Chair
AB 498 (Quirk-Silva) – As Introduced February 9, 2021

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 (CS) 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 students' access to instruction in computer science by increasing the number of teachers who are authorized and trained to provide CS 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, 2022, to award grants under this initiative for the purpose of increasing the number of teachers authorized and trained to instruct students in CS.

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 supplemental authorizations to teach CS.

   b) Providing professional development to teachers who hold multiple subject or education specialist credentials so that they are able to teach CS at the elementary level.

5) Requires that professional development funded through this act be aligned to the state's CS content standards.

6) States that the following entities are eligible to apply for a grant under this initiative:

   a) A school district

   b) A county office of education

   c) A charter school

   d) A consortium made up of any combination of the above entities.

7) Requires applicants for grants under this initiative 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.

   d) Identification of any matching funds, in-kind matching resources, or outside funding expected to be leveraged in support of the proposed activities.

8) Requires the CDE, in awarding grants, 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 CS instruction to students who at the time of the application have limited opportunity to study CS, who are traditionally underrepresented in the study of computer science or who live in geographic areas that have limited access to the study of computer science.

9) Requires a grant recipient to submit to the CDE, in a form and manner determined by the department, a report on all of the following:

   a) The number of multiple subject teachers trained and the number of authorizations in computer science produced as a result of the grant.

   b) The number of additional classes or amount of instruction planned as a result of the grant.

   c) The demographics of the students served or expected to be served by the teachers who have earned an authorization in computer science or who have received professional development as a result of the grant.

10) States that the operation of the act is contingent upon an appropriation in the annual Budget Act for purposes of this article.

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. Requires education specialist teaching credentials 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 students in all grades; and

   c) ensuring that all students 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. According to the author, "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 498 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."

Governor's proposed 2020-21 budget computer science proposals rescinded due to COVID-19 pandemic. In his proposed budget for 2020-21, the Governor proposed several initiatives related to CS education, including one (the first listed below) similar to this bill:

- $15 million for grants to local educational agencies to provide $1,500 stipends to support 10,000 teachers in obtaining supplementary authorizations to teach computer science.

- $2.5 million for a county office of education within the Statewide System of Support to identify, compile, and share computer science resources for professional development, curriculum, and best practices.

- $1.3 million to develop a new UC Subject Matter Project in computer science and $340,000 for one cohort of approximately 1,200 educators to participate in the new project.

- $350 million in funding for professional development in computer science and science, technology, engineering, and math.

These proposals were made in January, prior to projections of dramatic revenue shortfalls resulting from the COVID-19 pandemic. In his May Revision, noting that "this is no normal year," the Governor proposed rescinded these proposals.

The Governor's Budget for 2021-22 proposes significant new investments in professional development for teachers, totaling $315.3 million, and also proposes new funding to address the teacher shortage, totaling $225 million. Among those proposals are:

- $100 million investment in the Golden State Teacher Grant Program, which provides grants to students enrolled in teacher preparation programs who commit to working in high-need fields, including computer science, and at schools with high rates of under-prepared teachers.

- $100 million to expand the Teacher Residency Program, which supports clinical teacher preparation programs dedicated to preparing and retaining teachers in high-need communities and subject areas, including special education, bilingual education, and STEM.

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 adopted the California Computer Science Strategic Implementation Plan in May, 2019, which establishes a vision statement: "California's vision is to ensure that all students develop foundational knowledge and skills in computer science to prepare them for college, careers, and civic engagement."

The plan notes that "to grow K–12 CS education in California, the state will need to increase the number of teachers qualified to teach CS. Supporting more educators to teach CS would involve a multi-pronged approach that attends to credentialing, new teacher recruitment, professional learning for teachers, administrators, and counselors regarding the California CS Standards, and institutional and financial support." The plan outlines several strategies for improving the availability of computer science instruction:

- A grant program could be established to support teachers to complete course work for the CS supplementary authorization, with additional incentives for teachers who work in low-income and underserved school districts and rural and urban school districts.

- The state could consider offering incentives for institutions of higher education (IHEs) to offer credit-bearing courses or teacher preparation programs that satisfy the CS supplementary authorization and future CS teaching credentials to help teachers learn how to teach concepts and practices aligned to the California CS Standards and differentiated for grade and skill levels. IHEs could work with CTC to establish course articulation agreements with CTC-approved teacher preparation programs.

- While the draft plan suggested that the state consider providing "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," the final plan identifies establishing a University of California Subject Matter Project in CS as a means of providing in-service training opportunities.

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

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 from 1,609 teachers in 2014-2015 to 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.
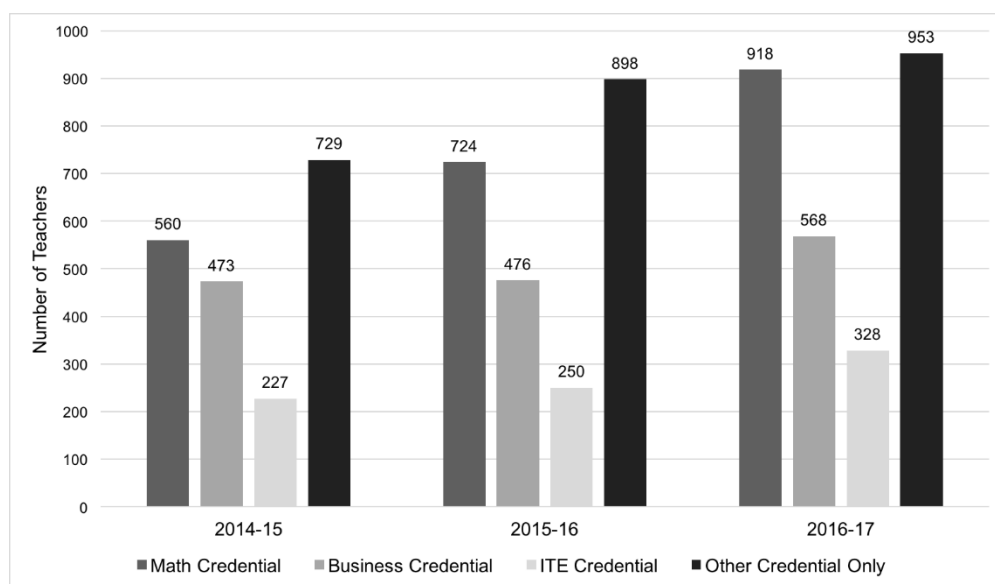
Because elementary school teachers do not require specific authorization to teach computer science, and because instructional minutes in CS are not tracked, it is not possible to identify which elementary school teachers currently teach computer science.

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."

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.

What is the subject of computer science in grades K-12?

California High Schools Offering CS Courses, 2016-17 Source: Draft CS Plan, 2018	
Course title	**% of schools offering course**
Exploring Computer Science	12%
Computer Science	12%
AP Computer Science Principles	3%
AP Computer Science A	10%
Robotic Technologies	13%

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, Networks and Information systems, Data and Analysis. Algorithms and Programming, and Impacts of 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.

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 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

Arguments in support. The California Chamber of Commerce writes, "California is a leader in technology, with computer science skills in higher demand than ever before – but such education cannot start at college. Students must begin their computer literacy earlier to remain competitive in a global market. To that end, we see AB 498 as helping ensure California's teachers are able to provide economically valuable and in-demand skills to future generations."

Recommended Committee amendments. Staff recommends that this bill be amended to:

1) Change the administering agency from the CDE to the CTC.

2) Establish a maximum grant amount of $1,500 per participating teacher and require that they currently hold a valid secondary credential. Specify that funding granted for the purpose of increasing the number of secondary teachers holding CS authorizations is for the purpose of paying the teacher costs of coursework, books, fees, and tuition, as applicable, of obtaining an authorization in CS.

3) Require a 1 to 1 match of grant funding, including an in-kind match of release time or substitute teacher costs for the participating teacher.

4) State that it is the intent of the Legislature to appropriate $15 million in one-time Proposition 98 funds, available over five years, for the operation of this program.

Related legislation. AB 1932 (Quirk-Silva) of the 2019-20 Session was substantially similar to this bill. It was held in this Committee.

AB 2309 (Berman) of the 2019-20 Session would have required the CTC to develop and implement a program to award competitive grants to postsecondary educational institutions for the development of preservice credential programs for individuals seeking a teaching credential, and the expansion of programs of study for single subject or multiple subject credentialed teachers seeking a supplementary authorization in computer science. This bill was held in this Committee.

AB 2274 (Berman) of the 2019-20 Session would have required the CDE to annually compile and post on its website a report on computer science courses, course enrollment, and teachers of computer science courses, for the 2019-20 school year and each subsequent school year. This bill was held in this Committee.

AB 1967 (Luz Rivas) of the 2019-20 Session would have established a UC Subject Matter Project in Computer Science. This bill was held in the Higher Education Committee.

AB 20 (Berman) of the 2019-20 Session would have established a Computer Science Coordinator position at the CDE. This bill was held in the Assembly Appropriations Committee, but the position was funded in the 2019-20 budget.

AB 52 (Berman) of the 2019-20 Session would have required the computer science strategic implementation plan to be regularly updated. This bill was held in the Assembly Appropriations Committee.

AB 182 (Luz Rivas) of the 2019-20 Session would have created a single subject credential in computer science. This bill was held in the Assembly Appropriations Committee.

AB 1410 (Quirk-Silva and O'Donnell) of the 2019-20 Session would have established the Computer Science Access Initiative, to provide grants to LEAs for the purpose of increasing the number of teachers authorized and trained to instruct students in computer science. This bill was held in the Assembly Appropriations Committee.

SB 675 (Chang) of the 2019-20 Session would have enacted 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. This bill was held in the Senate Governmental Organization Committee.

AB 2329 (Bonilla), 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 students. 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

California Chamber of Commerce

Opposition

None on file

Analysis Prepared by: Tanya Lieberman / ED. / (916) 319-2087