# Item 3.A.1.

Attachment 3

Education Technology Committee

March 22–23, 2018

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# **Computer Science Standards Guidelines**

Guidelines for the Development of Computer Science Standards for California Public Schools, Kindergarten through Grade Twelve (CA Computer Science Standards).

Per California *Education Code* Section 60605.4, "On or before July 31, 2019, the Instructional Quality Commission shall consider developing and recommending to the state board computer science content standards for kindergarten and grades 1 to 12, inclusive, pursuant to recommendations developed by a group of computer science experts." The following proposed guidelines are based on testimony received at three focus groups and are intended to direct the work of the expert Computer Science Standards Advisory Committee (CSSAC), to be convened by the State Superintendent of Public Instruction in consultation with the State Board of Education.

The *CA Computer Science Standards* shall:

1. Include an introduction that:
2. Explains the importance of prioritizing the goal of equity and access in computer science education and describes underserved populations (including girls, low-income students, homeless students, rural students, African American and Latino students, students who are English learners, students with disabilities, and foster youth);
3. Clearly states the basic overarching purpose and goals of computer science instruction
4. States a clear definition of computer science and clarifies the distinction between computer science and digital literacy and citizenship.

**Evidence of Meeting Guideline:**

Introduction contains subsection directly addressing issues of equity with historic statistics regarding workforce, districts, and student representation in AP courses. Reference to the importance of computer science as an essential component of a broad and comprehensive education is also addressed. Problem solving and the 4 Cs table further addresses equity and Practice 1: Fostering an Inclusive Computing Culture.

“What is Computer Science?” provides explicit language on what computer science is and is not. Differentiators between computer literacy, educational technology, digital citizenship, and information technology are provided. Furthermore, computer science core concepts and core practices are provided so teachers and administrators can see the ways students can engage in computer science learning experiences.

The CSSAC utilized the concepts and practices in the recommendation of standards and specifically looked at the standards through the lens of “FOR ALL.”

1. Provide substantive guidance while also allowing for flexibility and innovation across LEAs to determine from a variety of approaches how best to incorporate computer science into their curricula based on local capacity and context;

**Evidence of Meeting Guideline:**

The appendices include a “Guide for Leadership, a “Guide for Flexible Implementation”, and a “Guide for Curriculum Development” within the Guide for Flexible Implementation. LEAs can follow sample options provided in the table or sample K–12 Computer Science Pathways. These options include both integrated and discrete computer science courses.

Many examples given in the standards provides activities that are device-based and non-device based so that LEAs have the flexibility of implementing CS standards with or without devices when appropriate.

1. Be written in language accessible to teachers, curriculum leaders, and students;

**Evidence of Meeting Guideline:**

The glossary provides explanation of terminology that can be new or challenging for teachers, curriculum leaders, and students. Additionally, each Standard is accompanied by a Descriptive Statement that includes a motivation/clarification of the Standard, an exclusionary statement (if applicable), and examples of the standard in practice.

The introduction and appendix include language familiar to teachers from other content areas, reflecting an emphasis on the 4 Cs which are familiar to educators in all subject areas. The introduction and appendix include both broad and discrete interdisciplinary connections to increase accessibility to educators and allow them to relate computer science to the context of their area of expertise.

1. Utilize work done by education stakeholders, including but not limited to other states who have adopted computer science standards, the national *K–12 Computer Science Framework*, and national organizations such as: the International Society for Technology in Education, the Computer Science Teachers’ Association, Project GUTS, Code.org, and the Partnership for 21st Century Skills;

**Evidence of Meeting Guideline:**

CS SAC began the process by reading several documents including K–12 Computer Science Framework, the CSTA K–12 Standards, ISTE Standards for Students, College Board AP computer science principles framework.

1. Be designed for the grade spans K–2, 3–5, 6–8, 9–12 and include options for full courses in middle and high school;

**Evidence of Meeting Guideline:**

Recommended standards document includes progressions and extend through 12th grade. Standards may be combined to create customized courses. The appendix contains the alignment document that shows how the standards are aligned to course content in AP and IB courses. The 9–12 specialty standards are designed to facilitate the creation of additional courses in middle and high schools.

1. Reflect an awareness of industry trends and the dynamic nature of the computer science industry;

**Evidence of Meeting Guideline:**

The committee used documents that were created and or supported by a large number of major industry leaders, including Apple, Google, Microsoft. Standards were written to be relevant even in an industry that innovates and develops new technology quickly.

7. Describe the concepts and practices that a student should know and be able to do in computer science in kindergarten through grade twelve (K–12);

**Evidence of Meeting Guideline:**

All standards are aligned to the K–12 Computer Science Framework, which has five core concepts and seven core practices that articulate what students should know and be able to do in computer science from kindergarten through grade twelve. Concepts and practices are described in greater detail in the Introduction. Descriptive statements within the statements clearly articulate student outcomes and examples.

8. Be vertically aligned and coherent across grade spans;

**Evidence of Meeting Guideline:**

The standards include a K–12 Progression Table in Grade Bands K–2, 3–5, 6–8, 9–12, and 9–12 Specialty. All standards are developmentally appropriate and build in complexity with each subsequent grade span.

9. Be written so that they can be embedded into the early education curriculum;

**Evidence of Meeting Guideline:**

Interdisciplinary Connections are categorized by Grade Bands. CS SAC embedded many examples of cross-curricular K–2 applications for most CS Standards. Interdisciplinary examples are provided in the descriptive statements of each standard and interdisciplinary connections for each standard are included in the appendix. Language is written to be accessible to general education or computer science educators, and were developed with the guidance of SAC members with early education experience.

10. Contain concepts and practices that can be learned without the use of a computer;

**Evidence of Meeting Guideline:**

CS SAC added many example activities that can be completed unplugged. In fact the majority of activities from K–5 are “unplugged.”

11. Be computing language, hardware, and platform independent;

**Evidence of Meeting Guideline:**

Committee members were careful to avoid wording that recommended a specific hardware or language. We do not specify languages, platforms, or hardware; rather, we use academic language that details concepts that cross multiple platforms and languages.

12. Detail a progression of learning that provides all K–12 students with opportunities to learn computer science and provides for multiple entry points;

**Evidence of Meeting Guideline:**

The progression of California K–12 Computer Science Standards details the progression of learning from Grades K through 12. The chart clearly outlines the opportunities for all K–12 students to learn Computer Science and to access those standards no matter where the entry point might be. Appendix contains guidelines for flexible implementation with sample options for multiple entry points for all students, including both integrated and discrete options for computer science instruction.

13. Be consistent with, supportive of, and showing integration with all other SBE-adopted curriculum standards;

**Evidence of Meeting Guideline:**

The Interdisciplinary Connections sub section of the Appendices provides details of cross-curricular connections to standards by grade-band, taking into account standards from all SBE adopted other areas: English Language Arts/Literacy, Mathematics, Next Generation Science, History/Social Studies, VIsual & Performing Arts, Career and Technical Education, School Model Library, Physical Education, Health Education and English Language Development. Appendix contains broad interdisciplinary connections for K–12, in addition to discrete interdisciplinary connections by grade band.

14. Emphasize the artistic nature of computer science as a creative endeavor;

**Evidence of Meeting Guideline:**

The word “create” occurs multiple times within the K–12 standards, emphasizing the artistic nature of computer science as a creative endeavor. Creativity is also stated as a skill and a practice in the sub-section “Problem Solving and the 4C’s “in the introduction to the standards. Specifically, Practices 5 and 6 state creating computational artifacts and testing and refining computational artifacts as listed as being a California computer science core practice.

15. Focus on perseverance in solving real-world or community-based problems (e.g., issues of accessibility for software users);

**Evidence of Meeting Guideline:**

There are standards in each grade band that address real world issues and/or user interactions. Computer science practice 1: Foster an Inclusive Computing Culture calls upon students to include unique perspectives and consider diverse user preferences when designing and creating computational artifacts. The Impacts of Computing concept within the standards requires students to carefully consider the positive and negative effects of computing on culture.

16. Consider including activities such as:

* 1. Creating an original program according to an iterative design process that involves interaction between the creator and user;
  2. Creating computational artifacts that students enjoy, artifacts that consider the needs and wants of others, and artifacts that satisfy the needs of the community;
  3. Creating modular software;
  4. Writing, reading, and modifying existing algorithms or code.

**Evidence of Meeting Guideline:**

(a) The standards progression includes standards that specifically address the iterative design process and require students to incorporate user feedback in iterations.

(b) Specific projects or project topics have not been prescribed in the standards, with the intention of creating opportunities for student choice and options. Computer science practice 1: Foster an Inclusive Computing Culture calls upon students to include unique perspectives and consider diverse user preferences when designing and creating computational artifacts.

(c) The algorithms and programming standards address modularity.

(d) Standards have been incorporated that include modifying code, creating code, and debugging programs.

17. For secondary grades, be compatible with any University of California approved computer science course and the California Standards for Career Technical Education Career Pathways;

**Evidence of Meeting Guideline:**

The appendix includes a section aligned to CTE ICT standards and other CTE pathway standards. This section describes how these standards support students in preparing them for CTE courses. The appendix aligns the CS standards with AP Computer Science Principles and AP Computer Science A as well as the International Baccalaureate Syllabus Content. The 9–12 core and 9–12 specialty standards represent materials commonly taught in both UC non-majors and majors (first 1–2 years) computer science courses.

18. Address the legal and safe use of all of their personal devices without harming themselves or others;

**Evidence of Meeting Guideline:**

In the Safety, Law, and Ethics strand of Impacts of Computing, standards relate to keeping private information safe, understanding how to appropriately use the work of others, and explaining and evaluating the tradeoffs between keeping information more or less available to others. In the Cybersecurity strand of Networks & The Internet, students discuss passwords and other mechanisms for protecting devices and the information stored on them, potential security threats, and encryption methods.

19. Encourage student critical thinking and discussion about the broader ethical and social implications and questions related to the growing capabilities of technology, such as spreading of fake news through social media, the loss of jobs to automation, and others;

**Evidence of Meeting Guideline:**

In the Social Interactions strand of Impacts of Computing, standards relate to teaching students to work respectfully and responsibly when communicating electronically, and explore and gather diverse perspectives for the purpose of improving computational artifacts. In the Culture strand of concept Impacts of Computing, students also discuss accessibility and usability, design bias, and the impacts of technology on people’s lives.

20. Include a glossary of computer science terms used throughout the standards;

**Evidence of Meeting Guideline:**

See the glossary in the Appendices.

21. Include appendixes to support the flexible implementation of the standards for both college and career readiness as well as lifelong learning.

**Evidence of Meeting Guideline:**

The appendix includes a section aligned to CTE ICT standards and other CTE pathway standards. This section describes how these standards support students in preparing them for CTE courses. The appendix aligns to CS standards with AP Computer Science Principles and AP Computer Science A as well as the International Baccalaureate Syllabus Content. The portion of the introduction entitled “Problem Solving and the 4 Cs” parallels the emphasis on the 4 Cs in the ELA/ELD framework Chapter 10, which discusses 21st century learning to promote lifelong learning and ensure students are college/career ready.

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