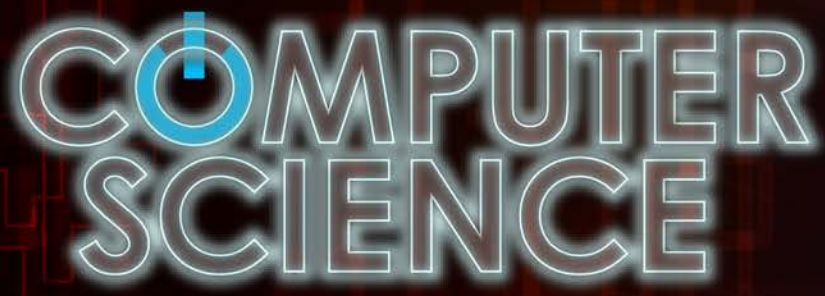


# Computer Science Standards Final Report

June 15, 2018

State of Iowa
Department of Education
Grimes State Office Building
400 E. 14th Street
Des Moines, IA 50319-0146

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# Introduction

Iowa's academic standards define the grade-level expectations for students in science, social studies, English language arts, mathematics, and 21st Century skills (employability skills; and civic, financial, health and technology literacy). The intent is to give students the skills and knowledge they need to succeed after high school, while giving local school districts the ability to make decisions about curriculum and instruction.

These standards are periodically reviewed to evaluate the content and receive feedback on ways to update and enhance them. Since the inception of Iowa's academic standards, Iowans have recognized students need additional skills beyond the original core content areas that can further strengthen their learning and better prepare them for jobs and life after graduation.

One of these skill sets is computer science. Computer science is more than digital literacy; it's more than coding. It's about understanding the theory and practice of computer technology, which has transformed the way we live and communicate, and this is foundational for all students in all fields. The effects and influence of computing are experienced daily from a personal to global level from the medical field to automotive industry and far beyond, according to the K12 Computer Science Framework, a document developed for states, schools, and organizations to inform the creation of standards and curriculum, advise in expanding and teaching computer science, and implement computer science pathways.

The Iowa Legislature, through Senate File 274 in 2017, directed the creation of a task force to develop recommendations for ensuring all students have the opportunity to develop computer science skills as they progress through school. Accordingly, the task force focused on developing recommendations with a vision that every elementary student in Iowa learns the foundations of computer science; every middle school student participates in an introduction to computer science; and every high school student takes a computer science class. The goal is to expand the reach and rigor of computer science and to make it more accessible to more students.

The task force recommended a review team be created to form a set of standards for possible adoption by school districts and schools in Iowa. The standards will be voluntary, only mandated if schools accept categorical funding through sources such as the Computer Science Professional Development Incentive Fund. The Computer Science Standards Review Team is composed of 27 experts in business and academia related to computer science.

This report is a summary of the team's work and includes its recommendations for implementation of the Computer Science Teachers Association (CSTA) K-12 Computer Science Standards to improve and provide further access to computer science for Iowa's students and to serve as a framework to guide educators across the state. The recommendations had unanimous approval among team members.

# Standards Review Process

The Computer Science Standards Review Team was convened in January 2018 and met five times through May 2018.

During five daylong meetings, the review team studied several sets of national and state standards, talked with computer science educators from other states that had implemented the CSTA standards, revised them, or had written their own; evaluated feedback from stakeholders across the state; and decided how the standards would be implemented in Iowa.

The team was given the following direction:

1. Examine the national CSTA standards, as well as standards for five states, and determine likes and dislikes, as well as which standards best fit required criteria.
2. Create and/or recommend statewide computer science standards by either grade level or grade band/span. Of the 12 states that have standards, the majority have them organized by grade band. The standards should enhance what a school is already offering and not make it difficult to continue or force officials to disband their programs.
3. Create a guidance document regarding implementation of the standards through professional learning and materials and resources that are available (including the Computer Science Professional Development Incentive Fund) to assist schools/districts and systems with program start-up or expansion.
4. Offer final recommendations to the State Board of Education.

In addition, the team believed that any recommended computer science standards for Iowa also needed to address mindset development and give students the ability to think and analyze in new ways through computer science; be created in a sequential order so that students learn applications at a specific grade level and move on to more complicated instruction as they move up a grade; place an early emphasis on career options to help future workforce development; and provide equity among, and opportunity for all, students.

The review team also thought it was important to have computer science standards that were easy to integrate with other subject areas to show how computer science fits with math, science, career and technical education, and information technology pathways.

In addition, the team agreed that Iowa's computer science standards would need to incorporate the concepts from the K12 Computer Science Framework. Twenty-seven writers and 25 advisers, including representatives from Iowa, developed the Framework from hundreds of reviews and feedback. The concepts included are computing systems, networks and the Internet, data and analysis, algorithms and programming, and impacts of computing. Many states, along with CSTA, have used the Framework to help organize the structure and create their own standards.

The review team examined sets of computer science standards from national organizations, as well as five states that have created and/or modified a set of national standards for their state. This included the CSTA standards, which were created in 2009 and revised in 2017, to take into account college and career readiness, teacher input, standards from other countries and states, and concepts and practices from the Framework. The CSTA standards are a compilation of learning objectives that lay out a computer science curriculum from kindergarten to 12$^{th}$ grade. These standards introduce students to

computer science at the elementary level and provide secondary-level schools with the requirements students need to fulfill graduation credits. The standards are designed to give students more in-depth knowledge of computer science and how it can relate to the workforce or better prepare them for college. The CSTA standards have been accepted, either as written or customized, by several states and their education departments as a set of computer science standards for their students in grades kindergarten through 12.

The review team looked at revisions the states of Massachusetts, Nevada, Oklahoma, Virginia, and Wisconsin have made to customize CSTA standards to meet the needs of their students. The team reviewed the standards in the areas of rigor, focus/manageability, specificity, equity/diversity, clarity/accessibility, coherence/progression, measurability, integration of practices and concepts, and connections to other disciplines.

The review team also knew public input was critical to the process. Accordingly, the team, with the assistance of Iowa Department of Education staff, crafted an online survey to request feedback about the CSTA standards from Iowa students, parents, educators, and community members. There were more than 800 respondents who answered questions for the survey. The team analyzed the feedback from the online survey and two public forums to look for consistent areas of agreement or disagreement about the standards as a whole or a specific standard (see page 9 for a detailed summary of public input on the standards).

Team members used input from the survey, along with the two public forums, discussions with each other, and presentations from educators from other states who have already implemented and revised the CSTA standards, to create their final recommendations for computer science standards in Iowa.

# Recommendations

After review and discussion of all sets of standards, the team decided the CSTA standards best fit the needs of Iowa's students and that adoption of those standards would allow Iowa to more easily revise its standards and keep pace with CSTA as updates are made. The team found there was strong support among educators at all grade levels, as well as parents and other members of the community, to adopt the CSTA standards. After much discussion, the team did not change or revise the CSTA standards. The team also recommended the creation of a guidance document to assist schools/districts and teachers with implementation of the computer science standards.

All 18 members of the review team who were present for the May vote, voted unanimously in favor of using the CSTA standards for Iowa's students.

The team discussed changing the wording for some of the 3-5 grade span standards but ultimately decided the proposed changes were unnecessary. There also was a desire by the team to keep the standards aligned to CSTA and to avoid mismatch, so Iowa's standards could be updated and revised when/if CSTA makes an update.

The team also reviewed other recommendations for standards support materials, professional learning, and the standards review process. After much discussion about what professional learning recommendations should be included, the team decided against submitting any recommendation for this area. Instead, information about professional development and learning will be included in the guidance document that will accompany the computer science standards.

The review team submitted these recommendations for standards support materials:

1. Include examples and clarifying statements with the CSTA standards.
2. Develop a guidance document that provides curriculum and activity examples, ideas for how to integrate computer science into other subject areas, as well as scope and sequence suggestions for grade-specific implementation.

The review team also submitted this recommendation for the standards review process:

> Computer science and 21st Century technology literacy standards require an accelerated review due to the rapid change of these skills and technologies.

# Conclusion

The Computer Science Standards Review Team has completed its recommendation of the voluntary adoption computer science standards for Iowa and has adequately considered all public feedback that was received during this process. As a result, the review team puts forth this document to the Iowa State Board of Education for its approval.

# Membership

- Deidra Baker, president of ICTM
- John Bedward, professor at Buena Vista University
- Bennett Brown, teacher at South East Junior High School in Iowa City and team co-facilitator
- Dan Carver, teacher at Carlisle Elementary School
- Soma Chaudhuri, associate professor of computer science at Iowa State University
- Samantha Dahlby, K-12 education coordinator for NewBoCo
- Steven Davis, president of Bio::Neos, Inc.
- Sharon Flinspach, teacher at Fairfield High School
- Stephen Fyfe, professor at Central College
- Clint Gentry, teacher at Valley High School in West Des Moines
- Amanda Goranson, teacher at Dubuque Senior High School
- Mark Gruwell, LearnAcre, LLC
- Mauree Haage, teacher at Twin Cedars Community Schools
- Marc Hauschildt, teacher at West Liberty High School
- Cindy Herren, K-12 technology and innovation leader for Waukee Community School District
- Spencer Herzberg, computer programmer for ADT
- Denise Hoag, teacher at Thomas Jefferson High School in Council Bluffs
- Tony Kioko, director of information technology at Principal Financial Group
- Kyle Kuhlers, teacher at Union Community School District
- Aaron Maurer, Mississippi Bend Area Education Agency
- Patrick Miller, principal of Odebolt-Arthur Battle Creek-Ida Grove High School
- Nancy Mwirotsi, founder of Pi515
- Aaron Odekirk, K-12 technology integration instructional coach for Fort Dodge Community School District
- Jason Pontius, director of institutional research for the Iowa Board of Regents
- Steve Rittgers, professor at William Penn University
- Ben Schafer, professor at the University of Northern Iowa
- Ann Wiley, instructional technology coordinator for Johnston Community Schools and team co-facilitator

# Public Input Findings

Public feedback on the CSTA standards was sought in several ways. An online survey was created and available to the public through the Iowa Department of Education website. The department posted a press release about the survey and distributed the information to statewide media on March 21, 2018. Team members were asked to help compile a distribution list for prospective survey-takers from their professional networks.

The survey covered three general areas:

1. Introduction: This included questions about the demographics of the survey-taker and general knowledge of computer science and whether standards would benefit Iowa's students.
2. Review: Survey-takers were able to choose grade-span specific standards to review and provide feedback. Within each grade, they could review the individual standards and select to keep the standard as is, suggest a revision, or eliminate the standard. Survey-takers could make comments about why a standard should be revised or removed. Respondents were able to review more than one grade-span and provide feedback
3. Professional Learning: Survey-takers were asked several questions about the type of professional learning that would help them best learn about the computer science standards.

The survey was open online for four weeks. During that time, there were more than 800 responders. The majority of survey respondents (almost 61 percent) were teachers, and 41 percent taught elementary-age students in grades kindergarten through five.

Most survey-takers (84 percent) either strongly agreed or agreed that having computers science standards would improve student learning in Iowa. The survey also asked about respondents' knowledge of computer science. Almost 17 percent were unfamiliar, and 51 percent said they were somewhat familiar with the area. Much of the feedback provided about how the standards were written, and the resulting review team member discussion, focused on whether the CSTA standards were too complicated and needed more examples to explain the meaning of the standard and how it could be implemented in the classroom.

Of those who reviewed the grade-span specific standards, almost 23 percent provided more specific feedback about the standards. The majority of those comments (44 percent) were for the K-2 and 3-5 grade span sections.

The majority of the comments from the K-2 grade span had to do with not understanding terminology or saying the standard was too complex. The review team thought these points of feedback could be addressed with the guidance document that will accompany the standards.

The review team, based upon feedback, initially recommended the most changes to the CSTA standards for the 3-5 grade span. The survey indicated some respondents wanted specific standards moved to a higher grade span or changes made to the language of the standard.

For example, it was suggested that the original standard "Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences" be rewritten as follows: "Plan the development of a program by including others' perspectives and considering user preference, revising as needed."

After discussion, the team decided to keep the 3-5 grade span CSTA standards as written because the revisions were not substantial enough to change the meaning of the standard, and therefore unnecessary.

A large chunk of respondents (78 percent) answered questions about the type of professional learning that would assist them in being prepared to teach the computer science standards. The highest ranked types of assistance, in order, were: collaborative planning time with colleagues or professional learning communities; district professional learning or communication; formal conferences, seminars, or workshops; state or AEA professional learning online or face-to-face; job-embedded training or coaching; and webinars.

Respondents were asked about the Computer Science Professional Development Incentive Fund and which criteria should be considered for applicants (school districts). They were allowed to provide an open-ended answer that ranged from district commitment of a current program, to training all teachers, to considering the income level of the students, to diversity of staff and students, to awarding money to any school that has a need.

The state also held public input forums on April 10, 2018, at Summit Middle School Media Center in Johnston and on April 12, 2018, at South East Junior High Media Center in Iowa City. Both forums were linked to satellite locations throughout the state.

Team members received transcripts of forum discussion and comments. Each review team meeting was also open to the public, and minutes of each meeting were posted to the department's website.