

Reimagining Standards for Computer Science Education for Primary and Secondary Schools

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Abstract

The Computer Science Teachers Association (CSTA) K-12 Standards were last updated in 2017, when only six states in the United States had adopted learning standards for primary and secondary education (K-12) computer science. Fast forward to 2024, and 41 states now have K-12 CS standards (and one has high school CS standards only). In preparation for writing an updated set of standards, CSTA is engaging in three stages of work: reimagining CS for high school students, conducting a crosswalk of K-12 CS standards across all 50 states compared to the CSTA standards (2017), and engaging in the technical process of defining final standards content via research and revision. All three stages draw significantly from the community of practitioners, researchers, curriculum designers, postsecondary faculty, and other interested parties. They also draw significantly from research published since the last revision to take into account the current evidence on learning computer science. In this poster, we describe our process for building the groundwork of knowledge for revising the standards, share highlights of the results to date, and describe how this data will be used to inform the upcoming revision of the CSTA standards.

CCS Concepts

- Social and professional topics → Computing education; Computing education programs; Computer science education.

Keywords

curriculum, standards, outcomes, K-12, primary, secondary

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1 Introduction and Background

Since 2003, when the first K-12 Computer Science (CS) curriculum standards were developed, the Standards have been revised several times [4, 6, 7]. The 2017 Computer Science Teachers Association (CSTA) K-12 CS Standards draw upon the learning objectives outlined in the K-12 Computer Science Framework [5]. These objectives encompass both conceptual knowledge (understanding key ideas) and computational practices (skills in applying those ideas).

Given the changes in computer science and in education since 2017, CSTA is launching a comprehensive K-12 standards revision process in 2024 with an anticipated release of the standards in summer 2026. The three-year process will result in a thoughtful, comprehensive, and evidence-based revision to these standards, involving three stages: (1) Reimagining CS for high school students, (2) Conducting a standards crosswalk, and (3) Defining new standards. Many sources of input will be necessary to inform the revision process and ensure a high-quality output.

2 Process

CSTA and the Institute for Advancing Computing Education (IACE) has worked collaboratively to bring together teachers, administrators, curriculum designers, post-secondary educators, and researchers who care about K-12 CS education and have the experiences and backgrounds to provide critical insight into how the next set of standards will be shaped.

2.1 Reimagining High School CS Education

In 2023-24, our team, along with multiple community partners, focused on redefining high school CS education. The *Reimagining CS Pathways: High School and Beyond* initiative aimed to establish what essential CS content all high school graduates need and to outline pathways for advanced CS learning. This effort seeks to shape the future of CSTA K-12 Standards and to create model pathways linking high school CS education with introductory post-secondary computing experiences.

Using focus groups, interviews, convenings, and synchronous and asynchronous feedback, we identified seven dispositions, four pillars, and five topic areas (see Figure 1). This foundational content includes five topic areas that emerged from this study: algorithms,

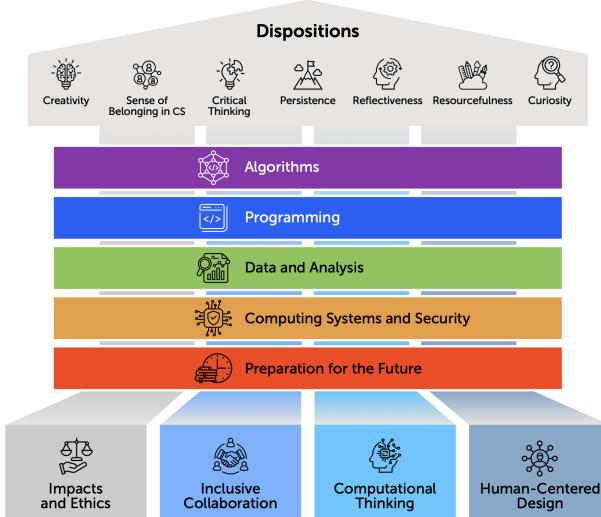


Figure 1: Foundational concepts.

programming, data and analysis, computing systems and security, and preparation for the future. The Pillars that should cut across every topic include impacts and ethics, inclusive collaboration, computational thinking, and human-centered design. Dispositions are include persistence, reflectiveness, creativity, curiosity, critical thinking, sense of belonging in CS, and resourcefulness. This content presents a shift in direction for the standards, heavily relying on what works based on recent research and practice, while also considering current and future needs with the advent of AI and anticipation of future technologies.

The final report was published in summer 2024 [3] and covers our process, foundational content, and potential pathways stemming from the foundation. Topic areas are detailed according to Bloom's Revised Taxonomy, using keywords established in ACM's *Bloom's for Computing: Enhancing Bloom's Revised Taxonomy with Verbs for Computing Disciplines* [1].

2.2 Standards Crosswalk

As a prelude to its upcoming standards revision, we are engaged in mapping CSTA standards to existing K-12 CS standards across states within the U.S. This crosswalk started in February 2024 and results will be published once completed. Similar work was conducted by the ACM and CSTA over a decade ago, when state education standards were analyzed to determine whether and how CS was incorporated in reference to CSTA's model standards; their summative report found that there were substantial gaps between state and CSTA standards [8].

The value of this research for the revisions includes identifying gaps across standards and understanding why those gaps may exist (e.g., local industry needs, states moving later-grade standards into earlier grades as they build their programs). We will also identify gaps based on an analysis of Bloom's Revised Taxonomy, a project of importance given that previous research [2] has suggested that some state standards overemphasize lower-order thinking skills.

2.3 Redefining Standards

CSTA is now undertaking a comprehensive review of existing literature in four phases. In Phase I, they will systematically examine recent research on K-12 CS education, focusing on its alignment with CSTA and state standards, with a particular emphasis on equity. Phase II will involve comparing these standards to other relevant standards and frameworks, identifying gaps, and providing recommendations to enhance them based on these findings. In Phase III, CSTA will capture input from the community and will ensure consistency and cohesion across products produced throughout the standards revision process. Finally, in Phase IV, CSTA will identify promising practices and research based strategies to be included in a final report (to be published throughout 2025-26).

3 Conclusion

The computing education community has provided a corpus of evidence that has not existed in previous standards revisions. This presents a unique opportunity to revise the standards using this current evidence. CSTA and IACE uniquely poised this research to include evidence directly from practitioners as well, since their first-hand experience and deep knowledge of K-12 CS education must be included in order to situate the standards in practical terms. We look forward to being able to share a forward-thinking set of standards that will be applicable for the next several years.

Acknowledgments

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