Nine Policy Ideas to Make Computer Science Fundamental to K-12 Education

Computing is a fundamental part of daily life, commerce, and just about every occupation in our modern economy. It is essential that students are exposed to the field of computer science in our K-12 system—as it is foundational in transforming the way a student thinks about the world. It not only teaches them about technology, it also teaches them how to think differently about any problem. Computer science puts students on the path toward some of the highest paying, fastest growing jobs in America.

Fewer than half of schools teach it. A lack of access hurts our economy and creates major inequities in education, particularly for those groups that have been traditionally underrepresented in computer science and other Science, Technology, Engineering and Mathematics (STEM) fields[1].

States and local school districts recognize the need for change. More than a dozen states have recently proposed new policies to allow computer science courses to count toward core mathematics or science high school graduation requirements. This is a good step, but it is only the first of many.

States and local school districts need to adopt a broad vision of a policy framework to support and expand K-12 computer science. The nine recommendations listed are for building and sustaining a comprehensive policy framework that supports broadening the teaching and learning of computer science. They support a vision built on five principles: **Equity and Diversity, Clarity, Capacity, Leadership, and Sustainability**.

Simply establishing these policies does not guarantee student success in computer science. We need great teachers and leaders as well as access to technology—devices and broadband—to teach computer science. The absence of policies that support computer science can and should be addressed by states and local school districts.

[1] Gallup research study *Trends in the State of Computer Science in U.S. K-12 Schools*: http://csedu.gallup.com/

Nine ideas to make computer science fundamental to K-12 education:

1. **Create a state plan** for K-12 computer science
2. **Define computer science** and establish rigorous K-12 computer science standards
3. **Allocate funding** for rigorous computer science teacher professional learning and course support
4. **Implement clear certification pathways** for computer science teachers
5. **Create programs** at institutions of higher education to offer computer science to preservice teachers
6. **Establish dedicated computer science positions** in State and Local Education Authorities
7. **Require that all secondary schools offer computer science** with appropriate implementation timelines
8. **Allow computer science to satisfy** a core graduation requirement
9. **Allow computer science to satisfy** an admission requirement at institutions of higher education

These ideas are intended to be a menu of choices that states have to ensure that computer science is a central part of K-12 education. We recognize that not all states will be in a position to adopt them and many will require years of careful implementation. We have articulated below which policies we believe should have a long implementation pathway to ensure success. Further, these policy ideas may require resources in either funding or time. States should adopt the policies for which they are best positioned and work to ensure that computer science is at the core of our education system. We should not continue to let computer science be marginalized.

We recommend that state officials bring together key stakeholders from the state and local education authorities, representatives from the state's executive branch, local computer science teacher leaders, national groups with expertise in computer science education and industry leaders and legislators to discuss these ideas, identify which are viable and develop plans to implement them.

Equity and Diversity

Access to and equity within rigorous and engaging computer science courses are top priorities that must be addressed in K-12. Data clearly show females and underrepresented groups (including rural students) do not have access to high-quality computer science content. If unaddressed, we will exclude entire populations from this fast-growing field.

Equitable access and diversity should be intentionally addressed in each of the nine policy ideas. The result of equitable access should be computer science classrooms that are diverse in terms of race, gender, disability, socioeconomic status, and English language proficiency.

Prioritizing equity and diversity requires policymakers to focus attention on underserved populations and under-resourced schools. To increase equity and diversity during implementation, policy proposals should target schools qualifying for Title I status under the Every Student Succeeds Act and/or rural schools.

In drafting and proposing equitable policies seeking diversity, we recommend including specific language targeting underrepresented minority and female students. For example, in 2015, legislation passed in Washington state called for the creation of a set of comprehensive computer science education policies and included language indicating that the grant program was "intended to support innovative ways to introduce and engage students from historically underrepresented groups, including girls, low-income students, and minority students, to computer science and inspire them to enter computer science careers."

Increasing diversity in computer science requires careful attention to language and potential policy consequences. Proactively building equity into legislation and other policy proposals ensures access for students who may otherwise never experience a computer science course.

Clarity

Create a State Plan for K-12 Computer Science

Computer science courses have mostly existed only in secondary education or Career and Technical Education programs and have not been an integral part of a state's education priorities for all students. Making computer science a fundamental part of a state's system of education means adding an entirely "new" subject to most states. States will need to create roadmaps to address a number of policy and implementation issues to integrate computer science as a new subject into its existing system. The plan should articulate the goals for computer science, strategies for accomplishing the goals, and timelines for carrying out the strategies. Equitable access to K-12 computer science must be at the foundation of a state's plan. The foundational policies that should be part of a plan should include, at a minimum, full K-12 standards, a roadmap to enable all high schools in the state to offer at least one rigorous computer science course, and funding sources for computer science professional learning and course support. The elements of that roadmap should include the eight other ideas in this document. An implementation plan can reference this guide to providers of computer science curriculum and professional learning: https://code.org/educate/curriculum/3rd-party

Define Computer Science and Establish K-12 Computer Science Standards

High-quality, equitable standards create foundational expectations for all students, rather than just those interested in advanced study, and prepare students for success in a variety of postsecondary, college, and career opportunities. But confusion between computer science and computer literacy or broader technology education goals is a barrier for introducing rigorous and high-quality computer science curriculum into schools. Although states have largely focused on teaching students basic technology literacy and how to ***use*** technology,

our goal is to teach students how to ***create*** technology through studying the academic subject of computer science. States should develop discrete standards for computer science education guided by the concepts, practices, and recommendations in the K–12 Computer Science Framework[2]. The Computer Science Teachers Association standards are an example, along with other state-developed examples, of standards[3] that have been informed by the K–12 Computer Science Framework.

Capacity

Allocate Funding for Rigorous Computer Science Teacher Professional Learning and Course Support

Because computer science courses are often electives, there is a lack of funding for professional learning and staffing support at the district level for teachers. States should provide professional learning resources by creating matching fund opportunities to bring computer science to school districts. Funding priority should be given to districts in which a demonstrable effort will be made to engage underrepresented groups. This will expand the capacity for in-service teachers and motivate preservice teachers to pursue teaching computer science.

Implement Clear Certification Pathways for Computer Science Teachers

The expansion of K-12 computer science education offerings is hampered by the lack of qualified computer science teachers which disproportionately affects underrepresented minority students. By creating clear, navigable and rewarding professional paths tied to content knowledge for computer science teachers, we can grow their ranks and increase equitable access. Existing incentives for teacher endorsements in mathematics (or other high-need STEM fields) should be replicated for computer science teacher endorsements. As these certification requirements are developed, existing teachers should be grandfathered into any new classifications. In addition, computer science professionals should be encouraged to become teachers through expedited certification processes, ensuring that a transition to the classroom is as seamless as possible.

Create Programs at Institutions of Higher Education to Offer Computer Science to Preservice Teachers

The computer science teacher shortage should be addressed by exposing more preservice teachers to computer science during their required coursework or by creating specific pathways for computer science teachers. Students preparing to be mathematics, science or broader technology teachers could become computer science teachers in many states if they were exposed to relatively minimal computer science coursework within teacher preparation programs. To meet this goal, states could create scholarship programs for preservice teachers to take computer science courses as part of the teacher preparation pathway. Further, states could create funding incentives for preservice education programs to create pathways in computer science education. Finally, with reforms to state certification programs for computer science teachers, states should expand computer science preparation programs at schools of education. In addition, to address equity concerns, states should fund partnership opportunities between local school districts and schools of education to create direct pathways for teachers into high-need school districts.

Leadership

Establish Dedicated Computer Science Positions in State and Local Education Authorities

In order to ensure rapid scaling and statewide support, it is essential that states provide support to — and facilitate the sharing of best practices with — school districts. Creating a statewide computer science leadership position within the State Education Authority will send

[2] www.k12cs.org
[3] http://www.csteachers.org/CSTA_Standards

a signal to schools that computer science is an important core offering needed for all levels of education. This position would promote the expansion of computer science in the state through new policies to help expand K-12 CS, professional learning of teachers, district engagement and capacity building, and community events. This position would also monitor the scaling process for issues of equitable access and diversity of students reached. In addition, to encourage districts' expansion of computer science offerings and professional learning for educators, states could encourage districts to provide funding for similar positions at the local level.

Sustainability

Require that All Secondary Schools Offer Computer Science

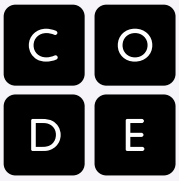
Most high schools don't offer computer science courses because states or local school districts have not prioritized this discipline. Underrepresented minority students are less likely to attend a school that offers computer science[4]. Given the important role computer science plays in our economy and the world around us, ensuring all students have access to computer science in K-12 is critical. This should start early by embedding computer science in the K-5 curriculum, which could steer students toward computer science courses in middle and high school. At the high school level, states (where appropriate) should adopt policies that require schools to at least offer a computer science course based on rigorous standards to students, whether it be a remote course or an in-person course. This policy can't—and shouldn't—happen overnight; rather, schools and state education authorities should be given a five-year window to effectively plan and implement the provision of computer science to all secondary students.

Allow Computer Science to Satisfy a Core Graduation Requirement

Currently, only 32 states and DC have clear, publicly accessible policies allowing rigorous computer science courses to satisfy existing high school graduation requirements for mathematics (taken after or concurrently with Algebra II) or science. States that count computer science as a core graduation requirement see 50% more enrollment in their AP Computer Science courses and increased participation from underrepresented minorities.[5]

Allow Computer Science to Satisfy an Admission Requirement at Institutions of Higher Education

Admission policies for most colleges and universities do not include rigorous computer science courses as meeting the mathematics or science entrance requirements, which discourages students from taking such courses in secondary education—even if they count as a high school graduation requirement. Aligning these policies would incentivize students to explore computer science earlier, which is an important step in increasing diversity in the field. State leaders should work with institutions of higher education to ensure credit and articulation policies align with secondary school graduation requirements. Alternatively, higher education institutions could adopt policies that recommend students, particularly those planning on majoring in STEM fields, take computer science in high school.



Code.org, a public 501c3 nonprofit, also organizes Computer Science Education Week (CSEdWeek), which is the awareness-building activity of the computer science education community. Code.org is supported by Microsoft, Google, Amazon, Bill Gates, Mark Zuckerberg, and many others who desire to bring CS education to all students.

[4] http://changetheequation.org/blog/new-data-bridging-computer-science-access-gap-0
[5] Review of 2012 AP Data on a per state basis for AP Computer Science and AP Calculus provided by the College Board.