

Making Computer Science Fundamental to K-12 Education: Eight Policy Ideas

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.**

Only 1/4 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) fields¹.

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.

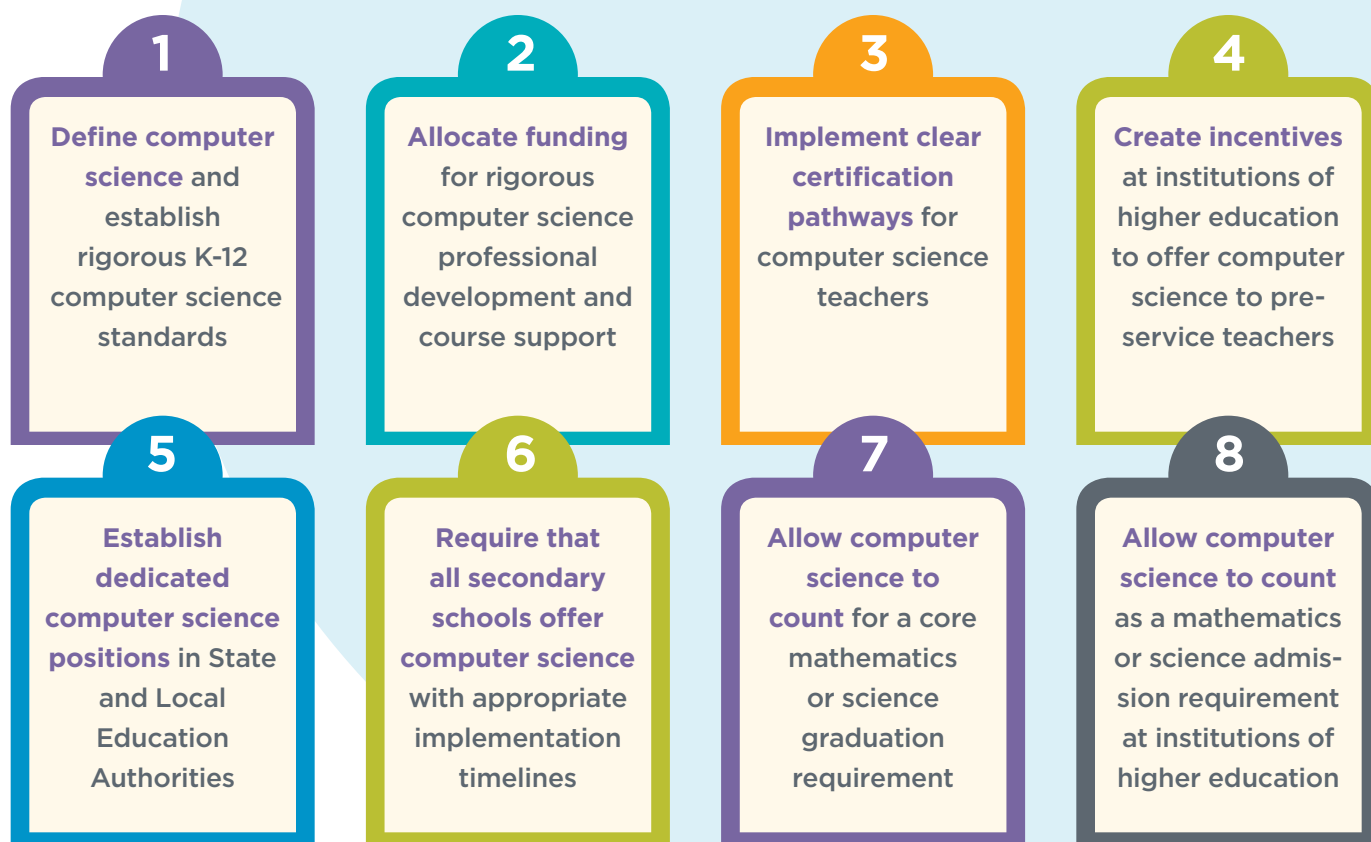
States and local school districts need to adopt a broad vision of a policy framework to support and expand K-12 computer science. The eight recommendations listed are for building and sustaining a comprehensive policy framework that supports broadening the teaching and learning of computer science. They support a vision built on four principles: 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 Searching for Computer Science: Access and Barriers in K-12 Education: <http://csedu.gallup.com/>

Eight ideas to make computer science fundamental to K-12 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.

Principle: Clarity

Define Computer Science and Establish K-12 Computer Science Standards

Confusion between computer science education and broader technology or technology education goals has worked against computer science curricu-

lum in schools. States have largely focused on teaching students how to use technology through existing subjects. Our goal is to teach students how to create technology through studying the academic subject of computer science. States should adopt

discrete standards for computer science education. For example, standards can be modeled after the **Computer Science Teachers Association's K-12 Computer Science Standards**.^{*} These standards

would focus on both the creation and use of software and computing technologies at all levels of K-12 education and define learning targets to ensure consistency across the state.

Principle: Capacity

Allocate Funding for Rigorous Computer Science Professional Development and Course Support

Because computer science courses are often electives, there is a lack of funding for professional development and staffing support at the district level for teachers. States should provide professional development 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 pre-service 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. By creating clear, navigable and rewarding professional paths tied to content knowledge for computer science teachers, we can grow their ranks. 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 Incentives at Institutions of Higher Education to Offer Computer Science to Pre-Service Teachers

The computer science teacher shortage can also be addressed by exposing more pre-service 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 easily become computer science teachers in many states if they were exposed to relatively minimal computer science coursework within teacher preparation programs. Further, pre-service education technology courses could easily integrate in computer science content. Finally, with reforms to state certification programs for computer science teachers, states can expand computer science preparation programs at schools of education. States should create competitive programs for schools of education to encourage pre-service teachers to take computer science courses, integrate computer science content in education technology courses, or create specific methods courses to prepare computer science teachers. In addition, states should incentivize partnership opportunities between local school districts and schools of education to create direct pathways for teachers into high-need school districts.

Principle: 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 a signal to

^{*} <https://csta.acm.org/Curriculum/sub/K12Standards.html>

schools that computer science is an important core offering needed for all levels of education. This position would also 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

Principle: 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. 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 Count for a Core Mathematics or Science Graduation Requirement

Currently, only 25 states and DC have clear, publicly accessible policies allowing rigorous computer science courses to satisfy existing high school

building, and community events. In addition, to encourage districts' expansion of computer science offerings and professional development for educators, states could encourage districts to provide funding for similar positions at the local level.

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.²

Allow Computer Science to Count as a Mathematics or Science Admission Requirement for 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. State leaders can 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, to take computer science in high school.

² Review of 2012 AP Data on a per state basis for AP Computer Science and AP Calculus provided by the College Board.

