K-12 Computer Science TOOLKIT

COMPUTER SCIENCE EDUCATION

NATIONAL GOVERNORS ASSOCIATION

CONTENTS

Introduction

Throughout his term as Governor of Arkansas, Asa Hutchinson, 2021-2022 National Governors Association (NGA) Chair, has made it his mission to better prepare students for the evolving and increasingly technology-oriented workforce. His efforts to enroll more high school students in computer science (CS) classes, while also aligning K-12 and postsecondary educational institutions with industrial needs, have gained national recognition. Through his NGA Chair's Initiative, K-12 Computer Science Education, Governor Hutchinson promoted his state's best practices and communicated with other Governors on their strategies for success to increase CS literacy around the country.

Although the national CS community has previously supplied various resources to support states, it is often focused on individual aspects for implementation. As part of his initiative, Governor Hutchinson requested that a State Computer Science Planning Toolkit be developed to provide clear guidance and suggestions so other leaders can better support their initiative regardless of where the state is within the implementation spectrum.

This toolkit has been built using best practices, as identified by various national partners in the K-12 CS education field.

Governor Hutchinson, NGA, the Arkansas Department of Education Office of Computer Science (CSforAR), and the numerous partners and contributors that supported the development of this resource hope it will be utilized by other states and state leaders as they build successful and highly impactful CS and computing initiatives within their own states.

NGA

Governors' Compact on Expanding K-12 Computer Science Education

In July 2021, Governor Asa Hutchinson of Arkansas was named Chair of the NGA. Each NGA Chair selects a policy area to be a focal point of their one-year term. Building on his nationally-recognized efforts in Arkansas, Governor Hutchinson chose to focus on K-12 Computer Science Education.

Governor Hutchinson and NGA have engaged and convened with Governors and key stakeholders on the Chair's Initiative in multiple forums over the past year, including a kick-off roundtable with industry leaders in July 2021; an August convening of Governors in Denver, Colorado; the public launch of the Initiative at the National Press Club in Washington, D.C., in October; and a dedicated plenary session at the NGA Winter Meeting in Washington, D.C., in January 2022. The NGA Winter Meeting was attended by more than 40 Governors and featured opening remarks from Governor Hutchinson and a moderated conversation between current U.S. Secretary of Commerce (former Governor of Rhode Island) Gina Raimondo and three Fortune 500 CEOs (Beth Ford of Land O'Lakes, Julie Sweet of Accenture, and Corie Barry of Best Buy). The NGA also hosted a convening of Governors and state policymakers in Bentonville, Arkansas, in March of 2022.

Governor Hutchinson and NGA hosted the third convening of Governors in Boston, Massachusetts, in May 2022, and will host a dedicated session on the Chair's Initiative at the NGA Summer Meeting in Portland, Maine, in July 2022.

At the NGA Winter Meeting, Governor Hutchinson introduced a compact for Governors to sign on to committing to expand K-12 CS education in their states. The Governors' Compact on Expanding K-12 Computer Science Education focuses on a broad commitment to expanding student access to K-12 CS education while providing multiple, flexible pathways and strategies for how to reach that goal based on state context. The final compact will be presented with Governors' signatures at the NGA Summer Meeting.

For more information on the Governors' Compact on Expanding K-12 Computer Science Education, including how to sign on, please contact Seth Gerson (SGerson@NGA.org) or Catherine Van Ness (CVanNess@NGA.org).

PARTNERS & contributors

The National Governors Association, on behalf of its Chair, Governor Asa Hutchinson, thanks the creators, thought partners, and initiative funders that supported the development of this toolkit. Additional thanks is extended to the various states and advocacy groups that have publicly disseminated the resources listed in the toolkit.

Creators and Thought Partners

Alison Williams - Office of Governor Asa Hutchinson
Anthony Owen - Arkansas Department of Education Office of Computer Science
Cameron Wilson - Code.org
Carol Fletcher - Expanding Computing Education Pathways (ECEP)
Catherine Van Ness - NGA
Katie Hendrickson - Code.org
Sean Roberts - Code.org
Seth Gerson - NGA
Sheila Boyington - Learning Blade

Contributors

Cora-Leigh O'Neal - Learning Blade
James Bir - Office of Governor Asa Hutchinson
Leigh Ann DeLyser- CSforAll
Sarah Dunton - ECEP

Arkansas Department of Education Office of Computer Science Contributors

Alex Moeller
Emily Torres
Kelly Griffin
Leslie Savell
Morgan Warbington
Tammy Glass

Initiative Funder and Organization Toolkit Support Recognition

Amazon
American Electric Power
Best Buy
Code.org
CollegeBoard
CSforALL
Deloitte
ECEP
Google
Learning Blade
Microsoft
Walmart Foundation
Walton Family Foundation
Western Governors University

Toolkit

FOR BUILDING A SUCCESSFUL CS INITIATIVE

The resources within this toolkit have been divided into three sections: Policy, Programs, and Partnerships. Each section is broken down into practical steps complete with guidance and recommendations including:

- a description and reasoning for the suggestion,
- a set of questions for state leaders about where their state is with regards to a suggestion,
- resources (often links to outside sources) with a short description associated with each.

POLICY

The Policy section will primarily focus on Code.org's Nine Policy Ideas to Make Computer Science Fundamental to K-12 Education (Code.org's 9 Policy Suggestions). These policy recommendations have been accepted by the larger K-12 CS education community as the de facto set of policies driving any successful CS initiative, and they correlate with higher implementation rates of K-12 CS across the United States. In addition to Code.org's 9 Policy Suggestions, this toolkit provides guidance and resources for the next step in CS education policy: a state graduation requirement in CS.

PROGRAMS

The Programs section will provide information and guidance on several programs that often are the result of good policy and initiative implementation. This list is not exhaustive and may not apply to all state situations; however, they form the basis of much of the work that leading states have conducted to affect positive change.

PARTNERSHIPS

The Partnerships section is designed to assist states and its leaders as they decide how to best collaborate and utilize partners, across a variety of sectors, to assist in the building and long term sustaining of the state's efforts.

Policy

Just 51% of high schools offer computer science, up from 35% in 2018. This represents tremendous progress by teachers, school leaders, policymakers, and other advocates. But given the significance of computing in today's society, it is inadequate that half of schools lack even a single course. And new data reveals that disparities exist for who has access to and who participates in computer science education. Policy clearly matters, as states with more computer science policies in place have more schools offering computer science and more students taking it. It is time for policymakers, industry leaders, and advocates to accelerate action by advocating for policies that make computer science a fundamental part of the education system.

- Code.org, CSTA, and ECEP; 2021 State of Computer Science Education Report

---

State leaders must always work to find a balance between local control and state regulation/legislation, especially when it comes to education policy. However, the states that are leaders in making CS education both available and fundamental for every student, have done so through enacting and enforcing state-level policies designed to broaden participation in CS and computing. It is through these policies that districts and schools learn how to best drive CS and computing education within their systems in a way that makes it accessible and important to all students.

In addition to Code.org's 9 Policy Suggestions, state leaders can find guidance and resources for the next logical step in computer science education policy: a state graduation requirement in computer science.

9 Policy Suggestions

The suggestions outlined within this section are primarily aligned to Code.org's 9 Policy Suggestions. These recommendations have been accepted by the larger K-12 CS education community as the de facto set that should drive any successful CS initiative and correlate with K-12 CS implementation rates across the U.S. They are designed with five goals in mind: ensuring access and engagement by students is reflective of the demographics of the population of the entire student body; ensuring clarity in educational and state programs; building capacity within schools and states to ensure students are engaging in high-quality and meaningful learning opportunities; building CS leaders and advocates within schools and state agencies; and creating a system that is both meaningful and sustainable well into the future.

01. Create a state plan for K–12 CS

02. Define CS and establish rigorous K–12 CS standards

03. Allocate funding for rigorous CS teacher professional learning and course support

04. Implement clear certification pathways for CS teachers

05. Create programs at institutions of higher education to offer CS to preservice teachers

06. Establish dedicated CS positions in state and local education agencies

07. Require that all secondary schools offer CS with appropriate implementation timelines

08. Allow CS to satisfy a core graduation requirement

09. Allow CS to satisfy an admission requirement at institutions of higher education

https://code.org/files/Making_CS_Fundamental.pdf

Policy 1

create a state plan for K-12 CS

State plans articulate goals for implementing computer science, strategies for accomplishing the goals, and timelines. The development process often includes a wide range of stakeholders, including teachers, parents, students, school administrators, institutions of higher education, nonprofit organizations, and industry partners.

- Code.org, CSTA, and ECEP; 2021 State of Computer Science Education Report

---

Facilitating a CS Taskforce

A state sponsored CS Task Force should be convened only when needed and if the report/suggestions from the task force will drive policy, programs, and partnerships within a state's CS Education Initiative.

Template/Toolkit

State CS Taskforce Planning Document

https://bit.ly/CSTFPlanning_

8 Keys to Improving Task Forces and Committees in Higher Education

https://bit.ly/KeysToImprove

Examples to Follow

Arkansas CS Taskforce Report (2020)

https://csforar.info/CSCTF2020

Tennessee CS Taskforce Report (2020)

https://bit.ly/TNcsTaskforce

Landscape Analysis

(This may be included within your state's CS taskforce report.)

"A landscape report is an aerial picture of what a state looks like in terms of K-12 computer science education." - ECEP

Template/Toolkit

ECEP Landscape Report Toolkit

https://bit.ly/TXLndscpRpt

Examples to Follow

Hawaii Landscape Report
https://bit.ly/HILandscape

South Carolina Landscape Report
https://bit.ly/SCLandscape

State Plan Creation and Adoption

Code.org's CS State Planning Toolkit

This toolkit (linked below) explains the steps and reasoning behind decisions of what to include within a state's CS plan.

Code.org's CS Plan Template

This is a blank template based on the toolkit linked for an individualized state plan.

Examples to Follow

https://bit.ly/CSforARStrategicPlan

https://bit.ly/GAcsPlan

https://bit.ly/NVcsPlan

- How has your state facilitated a state CS task force with appropriate stakeholder involvement?
- What does your state's landscape analysis include? Did you create a public report from the landscape analysis?
- Where is your state's plan for CS education? Is it formalized into a working document? How often is it updated?
- What authoritative body within your governmental system (I.E. State Board of Education, Legislative Subcommittee, General Assembly) formally adopted your state plan? What entity is tasked with monitoring initiative alignment with the state plan?

Policy 2

define CS and establish rigorous K-12 CS standards

High-quality standards describe foundational expectations for students by providing learning objectives for all students and expectations for advanced study in specialty or elective courses. State standards ensure consistency in student expectations across schools, regardless of student demographics, and are key to equitable learning experiences.

- Code.org, CSTA, and ECEP; 2021 State of Computer Science Education Report

Defining Computer Science

While some states will interpret "define computer science" literally, the purpose of this suggestion is for the state to determine what constitutes computer science within the K-12 environment. While the term "Computer Science" can have an extremely academic definition, it is not that technical definition that drives successful and meaningful programs for states, schools, and students. Instead, states will find that defining computer science by creating and supporting educational systems that teach students problem solving, computational thinking, career awareness, and other related concepts and the application of those concepts to the digital world in which the students live, will have a greater benefit, both educationally and economically, for their state.

Formal Definition Example from the K-12 Computer Science Framework

https://bit.ly/DefineCS

Programmatic Definition Examples

Arkansas
https://csforar.info/Defined

Iowa
https://bit.ly/IAcsDefinition

Building K-12 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.

- Code.org

Guidance for Standards Developers

The checklist linked below helps a state use the recommendations in the K–12 Computer Science Framework's Chapter 7: Guidance for Standards Developers
https://bit.ly/K12CSFrame

For an interactive look, visit: https://k12cs.org/

Examples to Follow

Arkansas
https://csforar.info/courses

Kentucky
https://bit.ly/KYstandard

Nevada
https://bit.ly/NVstandard

Oklahoma
https://bit.ly/OKstandard

South Carolina
https://bit.ly/SCstandard

- Does your state define CS (is it a formal definition or programmatic definition)?
- What is the legislative/regulatory authority regarding adopting curriculum standards and courses?
- Has your state developed and/or adopted CS standards and courses?
- What is the legislative/regulatory authority regarding the adoption of a curriculum aligned to your state-adopted standards/courses?
- Has your state developed and/or adopted CS curriculums aligned to your state-adopted standards and courses?

Policy 3

allocate funding for rigorous CS 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 resources for professional learning to prepare in-service teachers from diverse backgrounds to teach K–12 computer science.

- Code.org; Making CS Fundamental

Guidance for Policy Makers

The Standards for CS Teachers focus on teacher professional growth, content knowledge and skills, equity and inclusion, instructional design, and classroom practice. State leaders and policymakers can learn how to use these Standards when enacting statewide policies around CS education, including legislative initiatives and funding opportunities.

- CSTA Guidance for Policymakers

Sample Budget Language for Funding CS Education from Code.org

Education Commission of the States - Best Practices for Funding

- **Prioritize professional learning** - Although securing high-quality instructional resources is important, the key lever for increasing students' access to courses is professional learning for in-service teachers.

- **Set grant priorities, such as a focus on equity** - States can meet diversity goals by requiring districts or organizations to demonstrate plans to address underrepresented groups in order to qualify for grants, or by prioritizing districts and organizations that primarily work with underrepresented groups.

allocate funding for rigorous CS teacher professional learning and course support

Education Commission of the States - Best Practices for Funding (continued)

- **Dedicate continuing funds or multi-year funding** - It can be difficult for states to ramp up CS efforts quickly, and professional development funding initiatives are generally rolled out over several years. States could consider dedicating the same amount of funds for each year of a biennial budget.
- **Dedicate a portion of federal funds received by the state to CS education** - States can use funds received for STEM education (for example, Math and Science Partnership, ESSA, Perkins, and Title II funds) to provide professional development and supports for CS education.
- **Build partnerships** - Multi-sector partnerships can help state government see clear pathways to sustainability. Include representatives from public institutions of higher education, K-12 education, state government, other state-based institutions, and industry in conversations about funding for K–12 CS. Creating proposals that impact multiple areas may increase funding prospects. - https://bit.ly/BNYRpt, page 24

Exemplar

Hawaii CS Funding Legislative Language	Code.org Models for Funding	Missouri CS Funding Legislative Language
https://bit.ly/HIcsFunding	https://bit.ly/CodeFundingModels	https://bit.ly/MOcsFunding

Arkansas Statewide CS Specialist Support System

When the Arkansas CS and Computing Initiative first began in 2015, the initiative received $5 million from the Governor's discretionary grant funds to kickstart it. Early on, the initial funding was used for a variety of decentralized efforts to grow CS capacity within Arkansas schools. After the first biennium, an annual allocation and appropriation for the Arkansas Computer Science and Computing Initiative of $2.5 million became a line item in the state budget (growing to $3.5 per year in fiscal year 2022) with no sunset clause.

allocate funding for rigorous CS teacher professional learning and course support

Arkansas Statewide CS Specialist Support System (continued)

Two of these decentralized efforts, which had the largest fiscal footprint, included:

- providing approximately $1.7 million in one-time grants of $20k to any high school that agreed to teach a CS course face-to-face within the first two years of the program (https://csforar.info/2015SGrants),
- establishing a competitive grant system (https://csforar.info/2016PDGrants) in which institutions of higher education and regional training systems would devise and deliver their own professional development to train teachers to:
  - integrate the embedded K-8 Computer Science Standards within multiple content areas and provide guidance in how to integrate these standards within multiple content areas to other K-8 teachers within their school,
  - instruct students in the 7th/8th grade coding block, integrate the embedded K-8 Computer Science Standards within multiple content areas, provide guidance on how to instruct students in the 7th/8th grade coding block, and integrate the embedded K-8 Computer Science Standards within multiple content areas to other K-8 teachers within their school,
  - pass the assessment necessary to gain an ADE Computer Science Endorsement on an Arkansas Educator's License (or individuals in non-traditional licensure programs to pass the assessment necessary to obtain an ADE Provisional License in CS) and teach high school level CS content.

While these two efforts did provide some benefits for the initiative early on, it was determined that a centralized approach built around the mission and vision of the initiative and led by the Arkansas Department of Education Director of Computer Science would provide a consistent system that could be quickly and easily monitored and measured for successes and failures. This created an opportunity to affect necessary and beneficial changes quickly.

allocate funding for rigorous CS teacher professional learning and course support

This system was built around the concept of employing statewide CS specialists (https://csforar.info/specialists), who would be housed in various regions across the state. Arkansas began with five statewide CS specialists in early 2017, a number which has since doubled and includes a lead, who helps coordinate professional development opportunities created and provided by the team, at no cost to schools or teachers. The team of specialists, under the programmatic direction of the State Director of Computer Science Education, works together to develop and deliver teacher training. Since 2017, it has provided over 100,000 hours of various K-12 CS professional development offerings (https://csforar.info/PD) to over 10,000 of the 30,000 certified Arkansas educators.

Through the high school certification training provided primarily by the Arkansas specialist team, the state has seen the number of certified high school teachers grow from around 20 in 2015 to over 700 in 2022. The grant, which provides the salaries, equipment, and other expenses for the statewide CS specialist team, is the largest item within the initiative's budget at approximately $1.3 million in the 2022 fiscal year. The statewide CS specialist team is the primary reason the state has been able to build its certified teacher capacity, increase the number of trained teachers at the K-8 level, and broaden the scope of teacher content knowledge growth beyond initial certification. In short, this model has the highest return on investment of any expenditures by the Arkansas Computer Science and Computing Initiative.

allocate funding for rigorous CS teacher professional learning and course support

- What mechanism is your state using to provide CS professional development?
- What level of funding has your state allocated to this professional development work?
- What is your state providing as an incentive to recruit teachers from other industries or other subject areas to teach CS?
- What are your state-supported partnerships (ie. Code.org's Regional Training Model) to expand professional development opportunities?
- Does your state have a dedicated professional development team for CS that reports to the state CS supervisor and is working under a common vision/mission?

Policy 4

implement clear certification pathways for CS teachers

Certifications ensure that teachers have sufficient content knowledge to teach computer science. These credentials should have clear pathways with multiple options for demonstration of knowledge, such as passing an educator content exam or graduate-level computer science courses or earning a microcredential. Any new certification requirements should be phased in over time and include financial support for teachers and preparation programs.

- Code.org, CSTA, and ECEP; 2021 State of Computer Science Education Report

Teacher Pathways Recommendations from Code.org

The growth and sustainability of K-12 CS depends on having an adequate number of well-prepared CS teachers. However, CS teachers in many states have no logical pathway to build the necessary skills (including computational thinking) and obtain credentials acknowledging these skills.

https://bit.ly/CodeTeachPathway

Various States' Model for CS Teacher Pathways

https://bit.ly/StateModels

Arkansas's Updated List of CS Teacher Certification Pathways

http://bit.ly/CSforARCourseandTeacher

Certification Eligibility by State

https://bit.ly/CertEligibility

- What current state-approved pathways exist to certify CS teachers? If there are multiple, do they provide flexibility for non-traditional situations?
- Does the state have a process that encourages or discourages current teachers who are interested in becoming certified to teach CS?
- What plan does the state have regarding preservice teachers interested in becoming CS certified?
- What state-provided finances are in place specifically to support both certifying teachers in CS and growing existing CS teachers' content knowledge and skills?
- What short-term and long-term goals for the number of high school CS endorsements and/or certifications has your state established? Do your long-term goals include having at least one CS certified teacher in every high school in your state?

Policy 5

create programs at institutions of higher education to offer CS 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.

-Code.org; Making CS Fundamental

The most important and sustainable long-term strategy to prepare CS teachers is to introduce preservice teachers across all grade levels and subject areas to the subject. Currently, Arkansas and Indiana require all K–6 teacher preparation programs to include instruction in CS. It is a requirement for all teacher preparation programs in Connecticut, Nevada, and Ohio. In these five states, an average of 67% of high schools offer CS, compared to just 51% nationally.

Higher Education & Preservice Programs

It is important for initiatives to be aligned so that new courses can be taught by qualified teachers. Being strategic at the start of planning by considering the relationship between frameworks, standards, curriculum, and teacher certification will help to create a clear pathway to certification and alignment with other state-led efforts.

- BNY Mellon, State of the States Landscape Report

Template/Toolkit

State CS Task Force Planning Toolkit

https://bit.ly/StateCSPlan (pages 18-19)

Examples to Follow

Arkansas
https://csforar.info/Competencies4PreK

Indiana
https://bit.ly/INStateFunding

The Indiana Department of Education has approved computer science teacher preparation programs leading to certification in computer science and lists these programs publicly. In 2020, Indiana began requiring all preservice K-6 teachers to learn computer science.

- https://code.org/advocacy/state-facts/IN.pdf

- Does your state include level-appropriate basic CS a requirement for all teacher preparatory programs for all K-8 teachers and/or all high school teachers of any content area?
- How has your state approached the issue of developing preservice programs for teachers who want to teach CS at a high school level?
- What has your state done to motivate and incentivize institutions of higher education to make a CS education pathway available for preservice teachers?
- How has your state partnered with institutions of higher education to actively recruit students to become CS teachers?

Policy 6

establish dedicated CS positions in state and local education agencies

Centralized leadership at the state education agency ensures that policies are implemented holistically. A dedicated computer science supervisor can focus on balancing the scaling of computer science education with the quality of implementation and reducing ensuring existing disparities.

- Code.org, CSTA, and ECEP; 2021 State of Computer Science Education Report

---

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.

- Code.org; Making CS Fundamental

The role of the State Computer Science Supervisor (SCSS) position is to facilitate the implementation and expansion of the state's CS initiative. This work will be accomplished by building and maintaining a strong CS network throughout the state. The SCSS will develop relationships with the business sector in order to continue the promotion of CS education and align academic needs to business and industry.

Ideally, this SCSS reports directly to the Commissioner of Education, Deputy Commissioner of Education, or to a Deputy Chief of Staff (or higher level position within the Governor's office) and will be responsible for collaborating with various other educational units, including but not limited to: the Department of Higher Education, the Department of Career Education, Education Service Cooperatives, other external organizations and agencies, and other stakeholders to ensure that CS programs and efforts are in line with and support larger agency goals and efforts.

This SCSS will supervise the CS unit personnel and oversee the initiative's grant, bonus, incentive, and reimbursement programs. An important part of the SCSS role is the ability to attract and retain CS educators as well as encourage candidates to pursue employment opportunities within the field of CS. The SCSS and other members of the CS unit are responsible for communication and implementation regarding the CS and computing content-area standards and professional development.

Code.org Model CS State Supervisor Job Description

https://bit.ly/CSSupervisorJob

Description of Duties & Suggestions

https://bit.ly/CSSupervisorDuties

Best Practices

https://bit.ly/StateofStateLandscape

Examples to Follow

Arkansas

https://csforar.info/DirINTVW

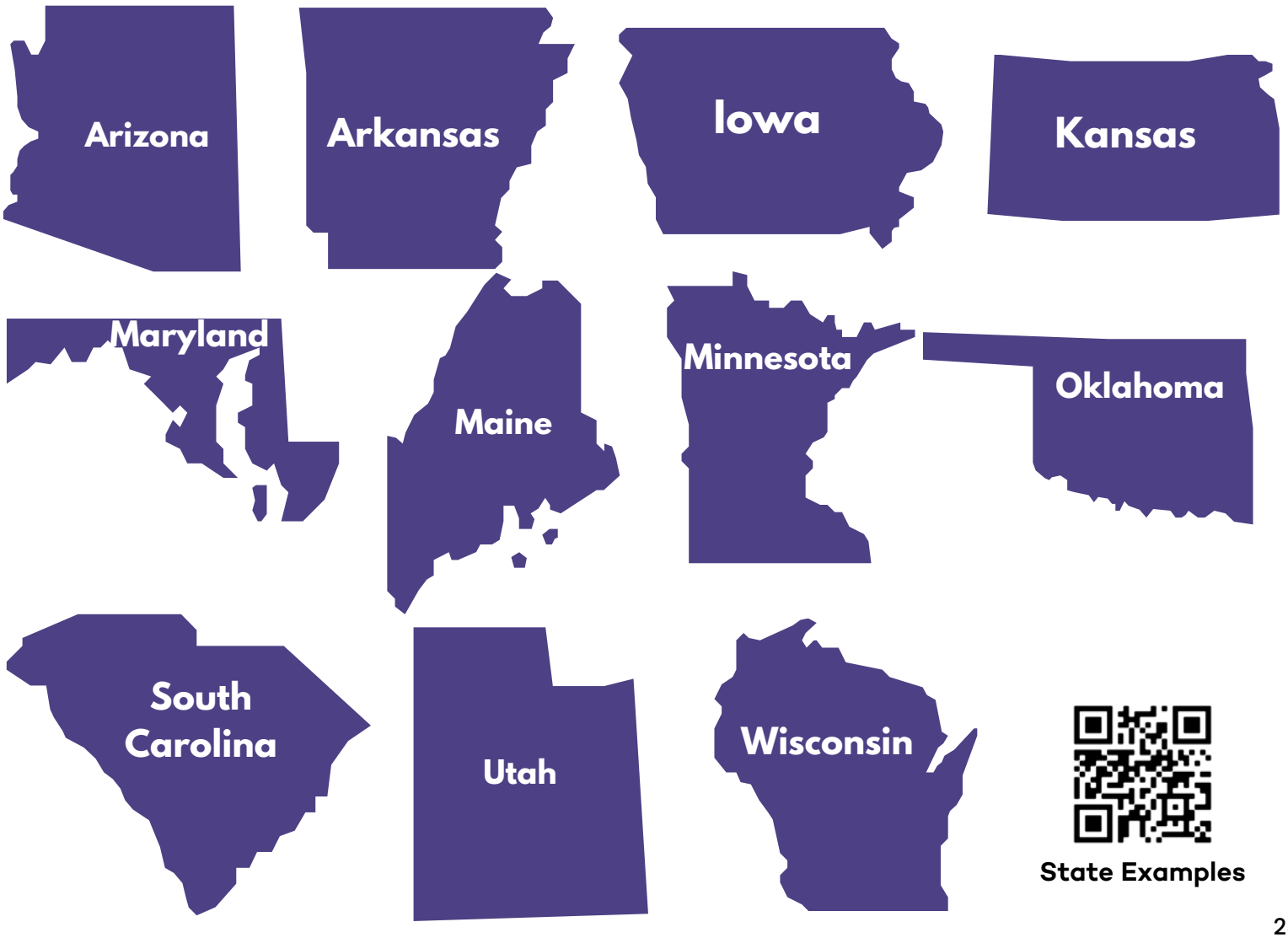
Alaska

https://bit.ly/AKCSCareerCoordinator

Working closely with Governor Asa Hutchinson, the Computer Science State Supervisor, Anthony Owen, was critical in turning his state into a leader in high-tech education.

- https://csforar.info/DirINTVW

Example States with State Leadership



State Examples

- Where does your state place this position within the chain of command of the state's Department of Education or Governor's Office?
- Does the placement of this position allow for innovative and different ideas to easily rise to top-level decision-makers or must those suggestions traverse several layers of bureaucracy before getting to someone who can make and enact a decision?
- Does this position have access to speak freely with the Governor, Governor's Chief of Staff, and/or Chief Education Officer (Secretary/Commissioner) about the initiative including its plans, its successes, and failures?

Policy 7

require that all secondary schools offer CS with appropriate implementation timelines

Half of high schools don't offer computer science courses because states or local school districts have not prioritized this discipline. Students from marginalized racial and ethnic groups are less likely to attend a school that offers computer science. 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.

- Code.org; Making CS Fundamental

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.

- Code.org; Making CS Fundamental

Model Legislation

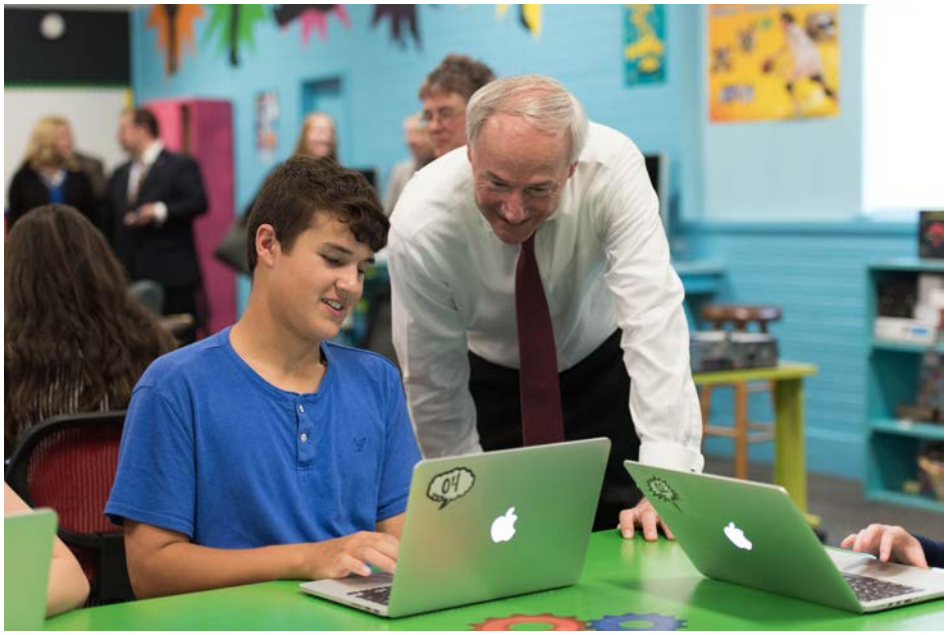
https://bit.ly/ModelCSLegislation

All High Schools Offer CS - State Examples

https://bit.ly/HSOfferCS

Best Practices

https://bit.ly/StateofStateLandscape (pages 34-37)



Arkansas Computer Science Strategic Plan (page 2) has a graphical outline of the state initiative's overall timeline.

- https://csforar.info/ArSPLAN

require that all secondary schools offer CS with appropriate implementation timelines

- How has your state appropriately defined what would meet the requirement to offer CS? Have you ensured it is not keyboarding or application work and truly involves computational thinking, problem solving, and requisite CS knowledge?
- What is your state's plan to have adequate teacher capacity in place? Are you allowing/providing a virtual option for schools to use?
- What is a reasonable timeline for your state? Has this timeline been adequately balanced against available implementation resources for schools?
- Will your state seek this requirement through legislation (preferred), regulation, or executive action?
- What course pathways has your state created that provide opportunities for students to go beyond the initial offering?

Policy 8

allow CS to satisfy a core graduation requirement

Currently, the majority of states have clear, publicly accessible policies allowing rigorous computer science courses to satisfy existing core high school graduation requirements. But many states still do not include computer science as a core course for graduation. Computer science should be a flex credit that can substitute for a core requirement. 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.

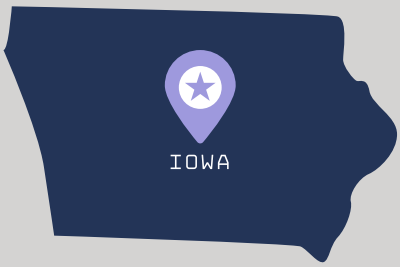
- Code.org; Making CS Fundamental

The majority of states allow for computer science to count towards a graduation requirement, the rest have it as a district decision.

- Code.org State by State Data

Exemplar

https://csforar.info/ARFlxCrd



https://bit.ly/IAGradRequirement

https://bit.ly/SCGradRequirement

- How has your state appropriately outlined what would meet the definition of a high school CS course?
- What existing core graduation requirement will this credit count in place of (math, science, or both)?
- How does your state handle students that earn multiple CS credits? Can two credits be used to replace both a math and science requirement? Can multiple credits be used to replace career focus credits?
- How does your state ensure schools are providing this opportunity to students? Is it allowed but left to the school to decide?
- How is your state marketing this option directly to students and parents?

Policy 9

allow CS to satisfy an admission requirement at institutions of higher education

By aligning high school graduation requirements to higher education admission requirements, college-bound students are incentivized to take a computer science course. States with prescriptive admissions requirements may unintentionally create a conflict for students who want to study computer science in both high school and college.

- Code.org, CSTA, and ECEP; 2021 State of Computer Science Education Report

---

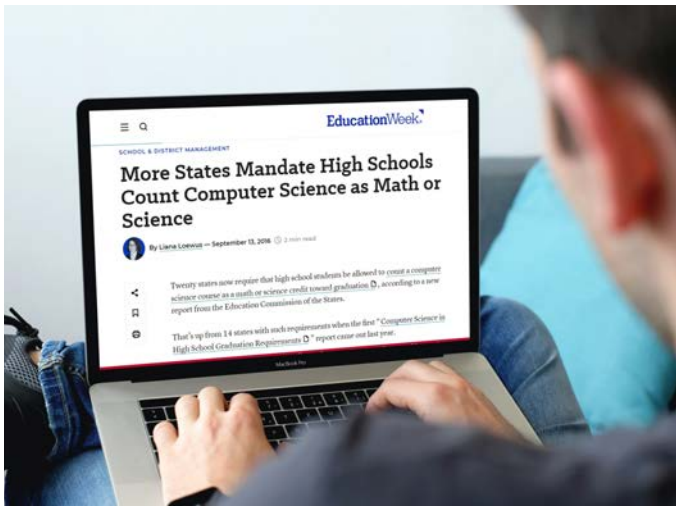
Currently, only 21 states allow for computer science to count or substitute as part of their admission requirements from the high school level.

- Code.org State by State Data

Best Practices

https://bit.ly/StateofStateLandscape

Overview
with Interactive Map



https://bit.ly/CSCountsMap

Arkansas

Any CS course can count as a mathematics or science credit required for admission at institutions of higher education, which aligns with Arkansas's high school graduation policy.

California

Any CS course could potentially count as a math, science, career technical education course, or as an elective for admission to a higher education institution. It is up to the school to make their own decision in the local context.

Washington

In 2021, one policy passed regarding CS: SB 5299 allows high school students to count one CS elective toward math and science credit for admission to a higher education institution.

allow CS to satisfy an admission requirement at institutions of higher education

- How does your state handle admittance requirements to public institutions of higher education? Are these requirements tied to public school graduation requirements? Are they established through legislation statewide or set by individual institutions?
- How do your state institutions of higher education recognize high school level coursework (regular high school CS courses, Advanced Placement CS Courses, International Baccalaureate CS Courses, Concurrent Enrollment CS Courses) in computer science toward computer science degrees?
- How is your state working toward aligning high school CS standards to postsecondary programs?

Beyond the 9

a CS graduation requirement

As early as 1983 the need for all students to study computer science was suggested. Within A Nation at Risk, which suggested ½ credit in Computer Science be a graduation requirement for all students, it is stated "[t]he teaching of computer science in high school should equip graduates to: (a) understand the computer as an information, computation, and communication device; (b) use the computer in the study of the other Basics and for personal and work-related purposes; and (c) understand the world of computers, electronics, and related technologies." Over the past 40 years, computers and computing technology has become a more pervasive way of life and business; therefore, the necessity and appropriateness has not diminished but has increased. If the national K-12 Computer Science Education movement is to truly reach its fullest potential, all states should have a plan for and work toward instituting a graduation requirement.

- Anthony Owen; Arkansas State Director of Computer Science Education

https://www.reaganfoundation.org/media/130020/a-nation-at-risk-report.pdf

A large majority of parents (84%), teachers (71%), principals (66%) and superintendents (65%) agree that offering Computer Science is more important or just as important as required core courses like math, science, history and English.

- Making Computer Science Accessible to All; Cheryl Charlton

Five states have adopted a high school graduation requirement in computer science (Arkansas, Nebraska, Nevada, South Carolina, and Tennessee). Creating space for computer science in schools—by requiring schools to offer it or allowing students to apply the course towards graduation requirements—ensures the sustainability of computer science initiatives.

- 2021 State of Computer Science Education

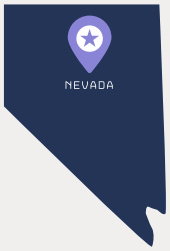
Beyond the 9

a CS graduation requirement

Other States with a CS Graduation Requirement

Arkansas
https://csforar.info/GovtTechArt

Nebraska
https://bit.ly/NELB1112

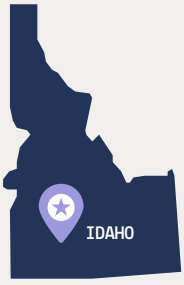


Nevada
https://bit.ly/NVHSGrdReq

Rhode Island
https://bit.ly/RIHSGrdReg

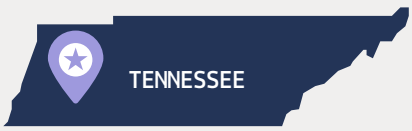
South Carolina
https://bit.ly/SCHSGrdReq

States Working on Developing a CS Graduation Requirement



Idaho
https://bit.ly/IDK12Leg

Missouri
https://bit.ly/MOHSGrdReq



Tennessee
https://bit.ly/TNGA

Beyond the 9

a CS graduation requirement

South Carolina

CS Graduation Requirement Case Study

https://bit.ly/SCcsRequire

- Nationally, 31% of high school students enrolled in a CS course are young women. In South Carolina, it is 46%.
- There are more young women taking CS in South Carolina than any other state in the U.S.
- South Carolina has more than doubled the rate of high schools (92%) offering a CS course in just four years.
- South Carolina graduation rates have increased every year since the CS graduation requirement was implemented.

Arkansas

ACT 414

https://csforar.info/ACT414

The Computer Science Education Advancement Act of 2021: Beginning with the entering ninth grade class of 2022-2023, a public high school student shall be required to earn one (1) unit of credit in a Department of Education-approved high school CS course before the student graduates.

Implementation Guidance

Beyond the 9

a CS graduation requirement

- What programs do you have in place to build teacher/student capacity?
- What funding do you have set aside to build teacher capacity (i.e. bonus, stipends, training, etc.)?
- What course steps would you have to go through to put this in place?
- Are your current standards appropriate for a graduation requirement course?
- What entities could help with aligning your CS initiative with current industry standards?

Programs

Programs that are implemented as part of a Computer Science and Computing Initiative should be a reflection of the policies of the state and priorities set by the state's advisory groups, such as a state Computer Science Task Force or Advisory Council. Programs are those state level implementation actions that make the initiative successful at a local district level by informing and incentivizing communities, schools, teachers, parents, and students to engage in this crucial work in a meaningful and impactful way.

Content Minimums for a Rigorous High School CS Course

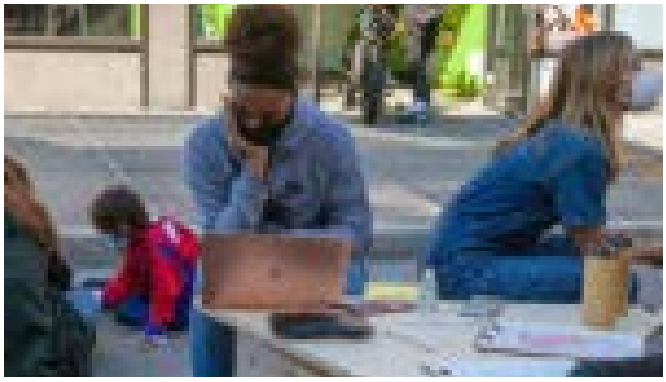
As states consider implementing a requirement that all schools must offer a CS course or a requirement for all students to earn a high school credit in CS for graduation, it is imperative that states and schools establish appropriate minimum learning expectations for courses that can be used to meet these requirements. While keyboarding, spreadsheet manipulation, and word processing are practical skills for students to have, they should not be used in substitution for CS courses.

College Board has established a great minimum expectation example with the Advanced Placement (AP) CS Principles course, which was designed to be a high school introduction to computer science that is approachable and attractive to traditionally underserved populations. For states that want to create their own minimum courses/expectations in place of or to supplement the AP CS Principles course, the following student learning concepts should be included, with specific learning objectives developed or included:

- Habits of mind or standard practices including soft skills necessary for productive members of a technological workforce
- Computational thinking development
- Problem solving through technology
- Properly working with data and digital information
- Securing data and systems
- Creating algorithms of an appropriate complexity and turning those algorithms into digital implementations/programs
- Developing a basic understanding of computing systems and the various ways they communicate
- Developing a solid appreciation of the societal, personal, and communal impacts of computing

What are the minimum learning requirements of every student who studies CS at a high school level? Is your state really requiring a CS or a course that is related to computers?

Arkansas's Year One High School Computer Science Courses
https://csforar.info/courses



The CSTA K–12 Computer Science Standards, released in 2017, delineate a core set of learning objectives designed to provide the foundation for a complete computer science curriculum and its implementation at the K–12 level.

The standards have been written by educators to be coherent and comprehensible to teachers, administrators, and policymakers.
https://bit.ly/CSTAk12Standards

K–12 Computer Science Framework The Association for Computing Machinery, Code.org, Computer Science Teachers Association, Cyber Innovation Center, and National Math and Science Initiative have collaborated with states, districts, and the computer science education community to develop conceptual guidelines for computer science education.
https://k12cs.org

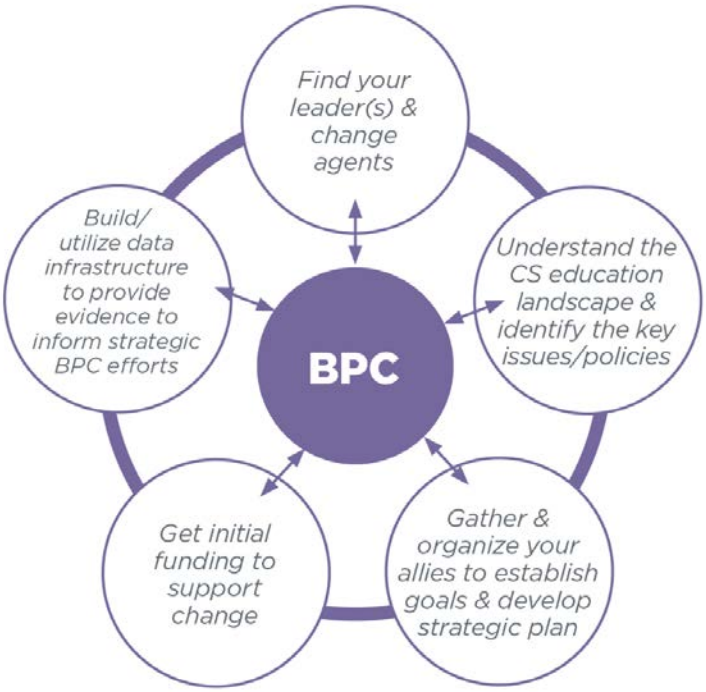
- What are the learning requirements expected of students who study computer science at a high school level? Is your state really requiring a computer science or a course that is related to computers?
- What standards or frameworks can be put in place to allow for rigorous content minimums?
- What guidelines will be used to establish the minimum expectation of your students and the course work?

Broadening Participation in Computing

Studies show that children who study computer science perform better in other subjects, excel at problem-solving, and are 17% more likely to enroll in college. Among young women, those who try AP Computer Science in high school are 10 times more likely to major in computer science.

- Code.org

Expanding Computing Education Pathways (ECEP)



https://bit.ly/ChangeAState

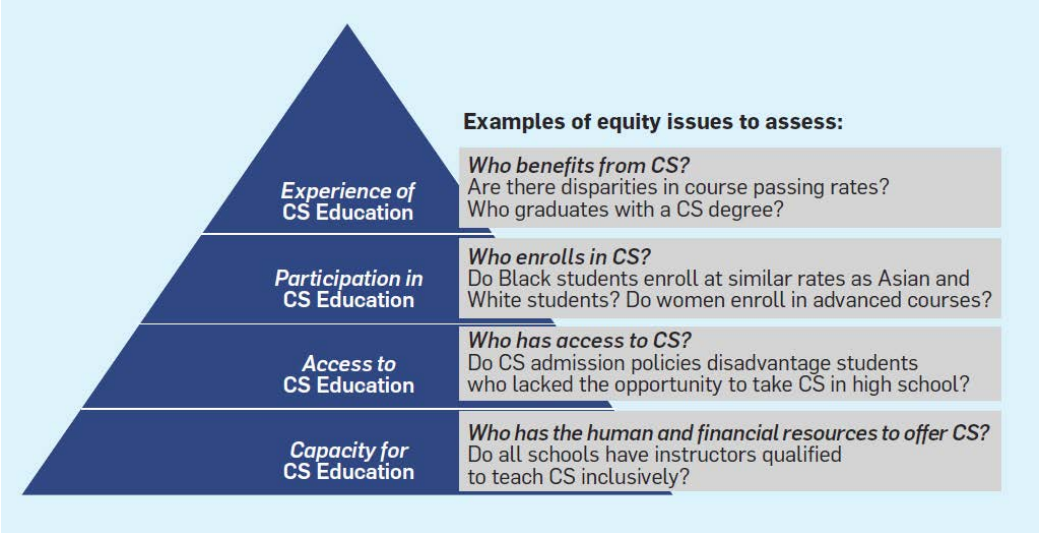
The National Science Foundation (NSF) supports ECEP through its Broadening Participation in Computing Alliance (BPC-A) program. The Expanding Computing Education Pathways (ECEP) Alliance seeks to increase the number and diversity of students in the pipeline to computing and computing-intensive degrees by supporting state-level computing education reforms. Through interventions, pathways, partnerships, and models that drive state-level computing education change, ECEP supports states as they work to align their state efforts with the national vision for computer science for all.

- ECEP

Beyond professional development, it is essential for schools, districts, and states to build strong systems that give teachers the tools and ongoing support needed to broaden students' participation in CS. A 2017 report written by EDC, Code.org, and other partners, "State of the States Landscape Report: State-Level Policies Supporting Equitable K-12 Computer Science Education," explains the systems-change work needed to ensure all students can access CS learning to better prepare them for the future.

bit.ly/StateofStateLandscape

CAPE Framework



A framework for assessing equity throughout the CS education ecosystem

https://bit.ly/CAPEFramework

BroadbandUSA

Broadband is an essential component of modern life and a requirement for economic growth, education, health care, and public safety. Maximizing broadband coverage and meaningful use is imperative for national and individual success. The BroadbandUSA program, housed within the National Telecommunications and Information Administration (NTIA), serves state, local, and tribal governments, industry, and nonprofits that seek to expand broadband connectivity and promote digital inclusion. BroadbandUSA promotes planning and funding efforts through solution-neutral guides and resources, hosting local and regional planning workshops that offer opportunities to convene with broadband stakeholders across the country, the National Broadband Availability Map (NBAM), and promoting interagency coordination. - BroadbandUSA

https://broadbandusa.ntia.doc.gov/

Arkansas Rural Connect (ARC) is a grant program designed to expand the broadband footprint in rural Arkansas communities. Other states have similar efforts.

https://csforar.info/ARBROAD

Participation Yields Results

Table 3

Amount of College Course Work in a Closely Related Discipline

AP Exam	AP Students Taking at Least One Course in a Related Area (%)	Non-AP Students Taking at Least One Course in a Related Area (%)	All AP Students: Number of Courses in Related Areas	All Non-AP Students: Number of Courses in Related Areas
U.S. History	61	70	1.7	1.6
Art History	45	14	1.5	0.3
Art–Drawing	36	9	4.4	0.3
Art–General	43	9	4.4	0.3
Biology	63	59	4.5	2.6
Chemistry	71	56	5.5	2.7
Computer Science A	58	28	3.7	0.9
Computer Science AB	56	28	4.9	0.9

High school AP CS students are twice as likely to try CS in college than non-AP CS students
(58% vs 28%).

Source: Anybody Can Learn; Code.org

High School AP CS students are six times more likely to major in CS than non-AP CS students (19% vs 3%).

Table 7

Percentage of Students Majoring in a Discipline Closely Related to the AP Exam

AP Exam	Majors Related to AP Exam	AP Graduates with Closely Related Majors (%)	Non-AP Graduates with Closely Related Majors (%)
U.S. History	American Civilization, American Studies, History, History Teaching, International Affairs	5%	2%
Art History	Art, Art History, Fine Art	5%	< 1%
Art–Drawing	Art, Illustration	13%	1%
Art–General	Art, Art Education	18%	1%
Biology	Animal Science, Biology, Applied Biology, Biological Studies, Biology and Society, Psychobiology, Biology Technology, Botany, Zoology	19%	6%
Chemistry	Chemistry, Biochemistry, Chemistry Education, Chemical Engineering, Textile Chemistry	15%	2%
Computer Science A	Computer Science Information Systems, Computer Science, Computer Engineering, Information Systems	19%	3%
	Computer Science Information Systems, Computer Science, Computer		

Source: Anybody Can Learn; Code.org

Participation Yields Results
(continued)

Table 8

Percentage of Students Majoring in a Discipline Closely Related to the AP Exam by Gender and Racial/Ethnic Group

	Percent of AP Students Majoring in Related Math/Science Content Area						*Percent of Non-AP Students Majoring in Related Math/Science Content Area*					
	Asian American	*African American*	*Hispanic*	*White*	*Female*	*Male*	*Asian American*	*African American*	*Hispanic*	*White*	*Female*	*Male*
Biology	22	18	16	18	20	17	7	6	4	5	6	5
Chemistry	17	14	13	14	15	15	2	2	2	1	1	2
Computer Science A	15	14	17	20	11	20	3	2	2	3	1	4
Computer												

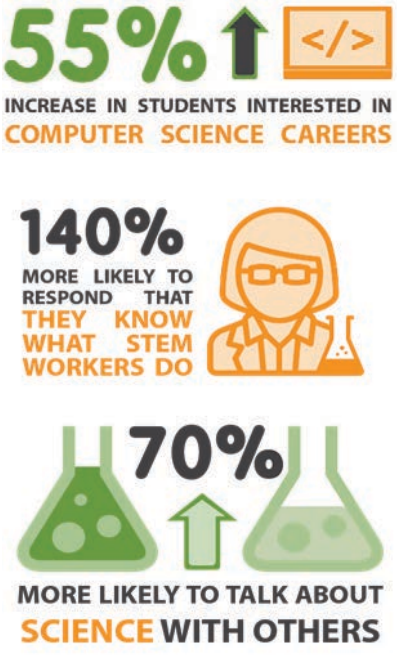
Girls and underrepresented minorities are more likely to major in CS if they are introduced to it in high school.

Source: Anybody Can Learn; Code.org

Learning Blade

Learning Blade's research has shown that while the demand for STEM and CS workers is growing, participation by students is lacking. Students need exposure to STEM careers as early as middle school. Learning Blade's student surveys have been validated by Battelle. This data shows that the use of Learning Blade for exposure to STEM/CTE/CS:

- 55% increase in students who strongly agree that they are interested in a career in CS
- Doubles the number of students interested in becoming an engineer and/or scientist
- 56% increase in students interested in taking advanced math classes in high school



- How does your state currently collect data about participation? Does your system allow you to disaggregate this data by race, gender, ethnic, socioeconomic, disability, and age/grade demographics?
- How has your state addressed diversity and equity in your planned goals?
- What mechanisms does your state implementation leaders have in place to identify and address barriers to participation by all students?
- What equity-based organizations has your state included as thought partners for your initiative's implementation?
- Has your state connected with national organizations dedicated to supporting state efforts to broaden participation in CS such as the Expanding Computing Education Pathways Alliance, CSforAll, Governors for CS, Code.org, CSTA, or others?
- How has your state addressed the digital divide and the lack of access to broadband internet or capable devices both at school and home?

Driving Interest Throughout Earlier Grade Levels in CS and Related STEM Fields

"Should we teach computer science in elementary school? Yes. We should definitely be teaching computer science (CS) in elementary school. Why? The most common answer to this question is jobs — but not necessarily traditional computing or programming jobs. Our nation's current trajectory points to a lasting digital era, and we'll need people who can think like software engineers and network architects, whether they are writing an app or solving resource distribution problems in a third-world setting — or doing both at the same time. But let's forget about jobs for the moment. After all, we don't really know where the economy will be in 15 years, and we're talking about 5- to 10-year-olds here! The rationale to teach CS to K-5 students goes well beyond career development. For kids just entering school, teaching CS is about giving them the thinking skills that will help them become proactive learners and citizens — as opposed to just consumers and denizens — in a world that's increasingly influenced by the manipulation of the digital bit."

- Pat Yongpradit; Chief Academic Officer Code.org
https://bit.ly/TeachCSElementary

"STEM (science, technology, engineering and mathematics) has been a powerful engine of prosperity in the US since World War II. Currently, American students' performances and enthusiasm in STEM education are inadequate for the US to maintain its leadership in STEM professions unless the government takes more actions to motivate a new generation of US students towards STEM careers. Despite of coherent actions taken by the government and various institutions, the US cannot ensure the production of a sufficient number of experts in STEM fields to meet its national and global needs."

- Md. Mokter Hossain and Michael G. Robinson
https://bit.ly/STEMmotivation

Science, technology, engineering, and mathematics have been a source of inspirational discoveries and transformative technological advances, helping our nation develop the world's most competitive economy and preserving peace through strength. The pace of innovation is accelerating globally, and with it the competition for scientific and technical talent. Now more than ever the innovation capacity of the United States—and its prosperity and security—depends on an effective and inclusive STEM education ecosystem. Individual success in the 21st century economy is also increasingly dependent on STEM literacy. To function as an informed consumer and citizen in a world of increasingly sophisticated technology requires the ability to merge the use of digital devices into every day problem solving.

https://bit.ly/STEMstrategicPlan

Resources

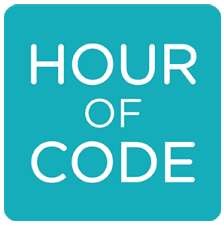
Learning Blade

Learning Blade is a CS career awareness toolbox of online student-ready lessons with coordinating teacher lesson plans including hands-on projects, design thinking, 3D printing, coding activities, career videos, and parent activities, aligned to all states academic standards.

Learning Blade engages students with over 200 hours of interactive STEM/CS activities that have been proven to increase interest in related careers by showing how they solve human-centered problems. Many states have adopted this statewide.

https://learningblade.com/

Code.org's Hour of Code



The Hour of Code started as a one-hour introduction to CS, designed to demystify "code," to show that anybody can learn the basics, and to broaden participation in the field of CS.

https://hourofcode.com/us

Google's CS First

CS First is an easy-to-use CS curriculum designed for students in grades 4-8 (ages 9-14) that is free of charge. Teachers use the video content to teach kids coding basics with Scratch for CS First, a special version of the Scratch coding editor inside the CS First website. CS First is available online at http://g.co/csfirst and can be used by anyone, and in any setting (in school, after school, or outside of school).

https://csfirst.withgoogle.com/s/en/home

Amazon's Project STEM and Amazon Future Engineer

Amazon Future Engineer is a comprehensive childhood-to-career program aimed at increasing access to CS education for children and young adults from underserved and underrepresented communities.

https://projectstem.org/amazon

Best Buy's Teen Tech Center

Best Buy, together with our partners, is building brighter futures for teens from disinvested communities. Through Best Buy Teen Tech Centers and other Best Buy Foundation tech education programs, we're committed to improving tech equity by giving teens unparalleled access to:

- Cutting-edge technology, resources and training to make, create and innovate
- Mentors and peers who inspire new passions and possibilities
- Technical training and college guidance support that clear paths and open doors

https://bit.ly/TeenTechCenter

Microsoft Makecode

Microsoft MakeCode is a free online learn-to-code platform where anyone can build games, code devices, and mod Minecraft!

https://www.microsoft.com/en-us/makecode

- How can you start planning to implement CS education in your earlier grades and what barriers will be faced during implementation?
- In what ways can early childhood educators be encouraged to implement CS education? What possible incentive programs can be implemented ?
- What tools/curriculum in schools would be best for earlier grades learning CS?

Teacher Training and Support Systems

Teachers are the ultimate gatekeepers for the success and/or failure of any educational pursuit within a state's public schools. Not only are teachers responsible for the day-to-day instruction of the content, they also hold the power within their classroom to make that content engaging or unpleasant, exciting or boring, meaningful or insignificant. It is the responsibility of the visionaries and leaders of state educational initiatives, such as a state's CS initiative, to ensure that teachers can focus on ensuring they are reaching students in a productive manner by providing them with the content knowledge, training, and pedagogical support systems necessary. Equipping our teachers with the skills and support systems they need is paramount to them doing their jobs effectively and efficiently.

Arkansas Statewide Computer Science Educator Academy

The Arkansas Computer Science and Computing Educator Academy (ACSCEA) was established with ARP-ESSER funding. ACSCEA has provided up to 120 candidates with the opportunity to learn basic CS, which provides a starting point for new teachers to be successful. The candidates who attend the academy receive preparation for passing the Computer Science Content Knowledge Praxis exam, gain approval to teach high school CS courses, earn up to 18 postsecondary graduate-level credits in CS, and expand skills in specialized areas aligned to state adopted programs of study.

Arkansas Statewide Computer Science Specialist Support System

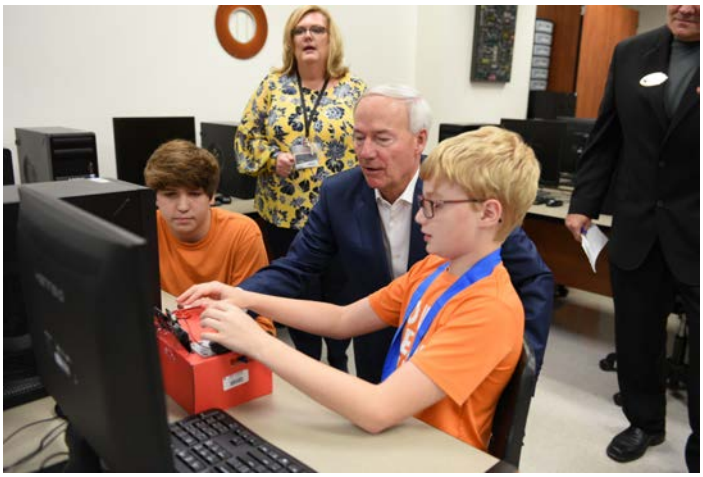
When the Arkansas Computer Science and Computing Initiative first began in 2015, it initially received $5 million from the Governor's discretionary grant funds to kickstart the initiative. Early on, the initial funding was used for a variety of decentralized efforts to grow CS capacity within Arkansas schools. After the first biennium, an annual allocation and appropriation for the Arkansas Computer Science and Computing Initiative of $2.5 million became a line item in the state budget (growing to $3.5 per year in fiscal year 2022) with no sunset clause.

While these two efforts did provide some benefits for the initiative early on, it was determined that a centralized approach built around the mission and vision of the initiative and led by the Arkansas Department of Education Director of Computer Science would provide a consistent system that could be quickly and easily monitored and measured for successes and failures. This created an opportunity to affect necessary and beneficial changes quickly.

This system was built around the concept of employing statewide CS specialists (https://csforar.info/specialists), who would be housed in various regions across the state. Arkansas began with five statewide CS specialists in early 2017. A number which has since doubled and includes a lead who helps coordinate the professional development opportunities developed and provided by the team, at no cost to schools or teachers. The team of specialists, under the programmatic direction of the State Director of Computer Science Education, works together to develop and deliver teacher training. Since 2017, it has provided over 100,000 hours of various K-12 CS professional development offerings (https://csforar.info/PD) to over 10,000 of the 30,000 certified Arkansas educators. Through the high school certification training provided primarily by the Arkansas specialist team, the state has seen the number of certified high school teachers grow from around 20 in 2015 to over 700 in 2022.

Arkansas Statewide Computer Science Specialist Support System (continued)

The grant, which provides the salaries, equipment, and other expenses for the statewide CS specialist team, is the largest item within the initiative's budget at approximately $1.3 million in the 2022 fiscal year. The statewide CS specialist team is the primary reason the state has been able to build its certified teacher capacity, increase the number of trained teachers at the K-8 level, and broaden the scope of teacher content knowledge growth beyond initial certification. In short, this model has the highest return on investment of any expenditures by the Arkansas Computer Science and Computing Initiative.



In short, this model has the highest return on investment of any expenditures by the Arkansas Computer Science and Computing Initiative.

- https://csforar.info/ACSCEA22

Code.org's Regional Partner Program

Code.org partners with select United States-based organizations to help spread computer science in a local, sustainable fashion. This network of Regional Partners are working towards the goal that every student in every school should have the opportunity to learn computer science. As an established K-12 computer science hub for their region, Regional Partners offer professional learning opportunities for teachers and building a strong local community.

- https://code.org/educate/regional-partner

Microsoft Technology Education and Literacy in Schools (TEALS)

Microsoft Technology Education and Literacy in Schools (TEALS) is a Microsoft Philanthropies program that builds sustainable CS programs in high schools. TEALS focuses on serving students excluded from learning CS because of race, gender, or geography. TEALS helps teachers learn to teach CS by pairing them with industry volunteers and proven curricula.

https://www.microsoft.com/en-us/teals

- What are some support systems that your state could put in place to train and support more CS educators?
- Are there regional/industry/corporate partners in your state that could help facilitate training and/or support for your teachers?
- Could your state potentially develop and support an academy or statewide professional development systems for your educators?

Teacher Incentive Programs

It's near impossible to persuade a computer science graduate to turn down a lucrative tech salary and enter teaching full-time, and these economics are unlikely to change soon. Given this reality, schools should continue to encourage existing teachers without a traditional CS background to jump-start their CS programs, while the education system works on the necessary processes and incentives to fill the pipeline with new CS teachers.

- https://bit.ly/ExpandCSforAll

Arkansas has Several Incentive/Bonus Programs for CS Teachers

- Providing all professional development offered by the Arkansas Computer Science and Computing Initiative at no charge to teachers or schools
- Providing fully certified high school CS teachers with an annual $2000 bonus for up to five years
- Providing fully certified K-8 Lead CS Teachers with a one time $2,000 bonus for attending a week-long training and providing a requisite number of hours of support back to the teachers in their local schools
- Providing bonuses to certified CS teachers who attend advanced level training, including AP CS A and AP CS Principles training
- Reimbursing educator license renewal and application fees for teachers who hold a CS certification
- Reimbursing educators who pass the CS content knowledge PRAXIS for PRAXIS exam fees and add the CS certification to their Arkansas License
- Providing a paid CSTA+ membership for Arkansas educators who hold a CS certification
- Paying the $3000 fee for teachers participating in the Arkansas Professional Educator Pathway (ArPEP) alternative licensure pathway

- https://csforar.info/Bonuses

- What are some creative ways to retain CS educators in the classroom?
- Does your state have the capability to offer incentive programs for educators?
- Can your state develop a budget that would be strictly used for STEM educator retention?

Student Incentive and Competition Programs

Many states, including Arkansas, have found that engaging students in CS-oriented competitions (hackathons, coding competitions, etc.) and providing incentives to do well in these competitions and higher-level CS work has increased participation. The excitement expressed by students and participating communities has bolstered these programs' success.

Student Incentive Programs

Arkansas AP CS A Student Incentive Program

Under this program, Arkansas students and schools may be eligible to receive a tiered monetary incentive/reward when the student receives one CS flex credit for successfully completing an AP CS A course in an Arkansas public school and makes a qualifying score on the AP CS A exam.

The tiered rewards are as follows:

- For a qualifying score of 5 on the AP CS A exam, an Arkansas public school student can receive up to $1,000.00, with the school receiving up to $250.00,
- For a qualifying score of 4 on the AP CS A exam, an Arkansas public school student can receive up to $750.00, with the school receiving up to $150.00,
- For a qualifying score of 3 on the AP CS A exam, an Arkansas public school student can receive up to $250.00, with the school receiving up to $50.00.

- https://csforar.info/APCSA

National Competition Examples

CyberPatriot

CyberPatriot is the National Youth Cyber Education Program created by the Air Force Association to inspire K-12 students toward careers in cybersecurity or other science, technology, engineering, and mathematics (STEM) disciplines critical to our nation's future.

https://www.uscyberpatriot.org/

picoCTF

PicoCTF is a free computer security education program with original content built on a capture-the-flag framework created by security and privacy experts at Carnegie Mellon University.

https://picoctf.org/

picoCTF

Technology Student Association (TSA)

TSA
TECHNOLOGY STUDENT ASSOCIATION ®

The Technology Student Association (TSA) offers middle and high school students in-school and virtual opportunities to apply their skills and knowledge through relevant competitions.

https://tsaweb.org/competitions-programs/tsa/computer-science

Congressional App Challenge

The Congressional App Challenge is the most prestigious prize in student CS. Participation in the challenge has grown exponentially and has reached underserved, diverse, and rural student populations.

https://www.congressionalappchallenge.us/

CONGRESSIONAL APPCHALLENGE

National Competition Examples (continued)

VEX Robotics

VEX Robotics is educational robotics for everyone. VEX solutions span all levels of both formal and informal education with accessible, scalable, and affordable solutions.

https://www.vexrobotics.com/

National Cyber Cup by Cyber.org

Pursue cybersecurity learning in a safe, fun, interactive environment. Teams of high school participants will be able to test themselves against others across the country through an engaging, virtual capture the flag (CTF) competition.

https://cyber.org/career-exploration/camps-and-competitions

FIRST® Robotics Competition

FIRST® is a robotics community that prepares young people for the future through a suite of inclusive, team-based PreK-12 robotics programs that can be facilitated in school or as a structured after-school program.

https://www.firstinspires.org/

Future Business Leaders Association (FBLA) works to prepare middle and high school students for careers in business through academic competitions, leadership development, and educational programs.

https://bit.ly/FBLAEvnts

SkillsUSA consists of a a partnership of students, teachers, and industries that work together to ensure a skilled workforce. SkillsUSA provides opportunities for students to excel through educational programs, events, and competitions that support career and technical education in the classroom.

https://bit.ly/SkIlsUSACntst

State Specific Competition Examples

The Great Arkansas History Video Game Coding Competition

The Great Arkansas History Video Game Coding Competition is open to students in grades 4-8. The competition emphasizes storytelling, state history, and coding, and gives students the ability to use their coding abilities while supporting literary growth and expanding their knowledge of Arkansas history.

https://csforar.info/GAHVGCC

Arkansas School for Mathematics, Science, and the Arts' HighSchoolHack

Arkansas School for Mathematics, Science, and the Arts' HighSchoolHack is an all-day CS competition targeted at Arkansas students. The competition consists of a series of challenges/puzzles that focuses on on reverse engineering, cryptography, programming, pen testing, web vulnerabilities, and forensics.

https://csforar.info/ASMSAHsHack

University of Arkansas Fayetteville High School Programming Contest

UofA Fayetteville High School Programming Contest - hosted by the Department of Computer Science and Computer Engineering. This contest brings talented students to campus for an exciting problem solving and programming event. Our problems will challenge the competitors to use their problem solving abilities and programming skills in the C, C++, or Java programming languages

http://hspc.csce.uark.edu/

Arkansas Governor's All-Region/All-State Coding Competition

The competition is open to Arkansas public, private, and homeschooled school students in grades 8-12. Schools that sponsored the 1st, 2nd, and 3rd place teams will receive the following awards to support their CS program: 1st Place - $10,000, 2nd Place - $6,000, 3rd Place - $4,000. These awards are for the State Competition only. Each team member of the 1st place team will receive a $2000 award. Each team member of the 2nd place team will receive a $1000 award. Each team member of the 3rd place team will receive a $500 award.

https://csforar.info/CDComp

- What competitions could your state support and develop for CS students?
- What regional, state, or national partners could your state work with to develop incentives for CS students?
- Does your state have the means to create monetary incentives for CS students and how could those be used?
- In what ways would incentives increase CS student engagement in your state?

Supporting Higher Level Coursework through Pathways and Career Technical Education Programs of Study

Taking challenging classes in high school is a great way to build new skills. And it will serve you well when you get to college, because you'll be more prepared for the work. In a recent survey of college freshmen, more than half of the students surveyed said that they wish they had worked harder in high school. Challenging classes, such as honors and college-level courses, also help you get into college. They are exactly what admission officers like to see on applications.

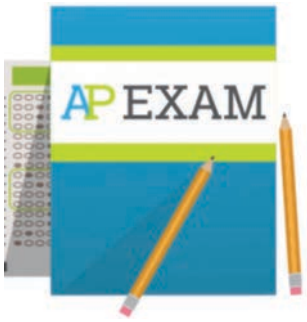
- https://bit.ly/HSNextLevel

Rethinking Perkins to Expand Access to K-12 Computer Science

This study provides insight on how to effectively implement CS and Programs of Study under Career of Technical Education guidelines. Although this paper was produced before Perkins V, many of the suggestions are still appropriate.

https://bit.ly/K12Prkns

Advanced Placement CS Courses



AP CS Principles

The AP CS Principles course complements AP CS A and focuses on the broader aspects of computing. Students learn to design and evaluate solutions and to apply CS to solve problems through the development of algorithms and programs. They incorporate abstraction into programs and use data to discover new knowledge. Students also explain how computing innovations and computing systems including the internet work, explore the potential impacts of these innovations, and contribute to a computing culture that is collaborative and ethical.

- https://bit.ly/ClgBrdAPCSA

AP CS A

The AP CS A course and exam focus on leveraging programming in Java to solve problems. Students cultivate their understanding of coding through analyzing, writing, and testing code as they explore concepts like modularity, variables, and control structures.

- https://bit.ly/ClgBrdAPCSA

Though both of these are AP CS courses and are each beneficial in their own way, many states, including Arkansas, view the AP CS Principles as an introductory level course whereas the AP CS A course is viewed as a capstone or upper-level course.

Dual Enrollment or Concurrent Computer Science Coursework

Concurrent and dual enrollment partnerships provide high school students the opportunity to take college credit-bearing courses. National Alliance of Concurrent Enrollment Partnerships (NACEP) defines concurrent enrollment as the subset of dual enrollment courses taught by college-approved high school teachers in a secondary environment. Concurrent and dual enrollment partnerships and early college programs successfully transition students from high school to college.

- https://bit.ly/NACEPCncrEnrl

- How is your Department of Education and Career Education set up? Would it be easy for the agency/department to collaborate on coursework to prepare pathways for your students?
- What partnerships would benefit your students in supporting various pathways and programs of study?
- When thinking of AP courses and dual enrollment for CS coursework, what does your state already have in place, or what would your state need to have in place to create such options?

Partnerships

Building appropriate and strong partnerships with outside entities supports the longevity of any educational initiative. CS initiatives should work to identify and align their efforts with national advocacy and educator support groups while also building relationships with local non-profits and industries within their state. This ensures that administrational changes and/or political swings do not have a profound impact on the continuation and long-term success of the initiative. In addition to cultivating partnerships with appropriate outside entities, state and initiative leaders must look both internally and externally to identify, build, and maintain positive relationships with champions for the initiative that hold influential positions of power.

National CS Advocacy Partnerships

Code.org

https://advocacy.code.org

Code.org is a nonprofit dedicated to expanding access to computer science in schools and increasing participation by young women and students from other underrepresented groups. Our vision is that every student in every school has the opportunity to learn computer science as part of their core K-12 education. Code.org is the leading provider of K-12 computer science curriculum in the largest school districts in the United States, Code.org also created the annual Hour of Code campaign, which has engaged more than 15% of all students in the world.

Expanding Computing Education Pathways Alliance

https://ecepalliance.org

The National Science Foundation (NSF) supports ECEP through its Broadening Participation in Computing Alliance (BPC-A) program. The Expanding Computing Education Pathways (ECEP) Alliance seeks to increase the number and diversity of students in the pipeline to computing and computing-intensive degrees by supporting state-level computing education reforms. Through interventions, pathways, partnerships and models that drive state-level computing educational change, ECEP supports states as they work to align efforts with the national vision for computer science for all.

CSforALL

https://www.csforall.org

CSforALL's mission is to make high-quality computer science an integral part of the educational experience of all K-12 students and teachers and to support student pathways to college and career success.

Computer Science Education Week

Computer Science Education Week is an annual call to action that inspires K-12 students to learn CS, advocate for equity, and celebrate the contributions of students, teachers, and partners to the field.

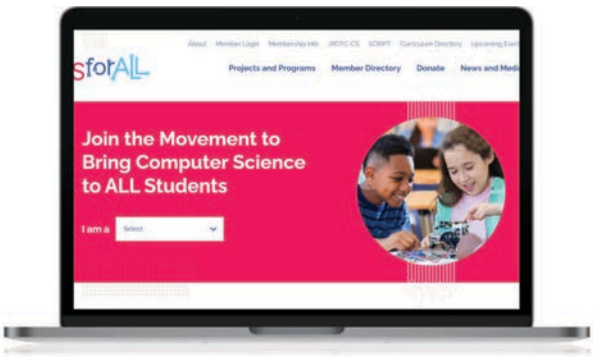
https://www.csedweek.org

Governors for CS

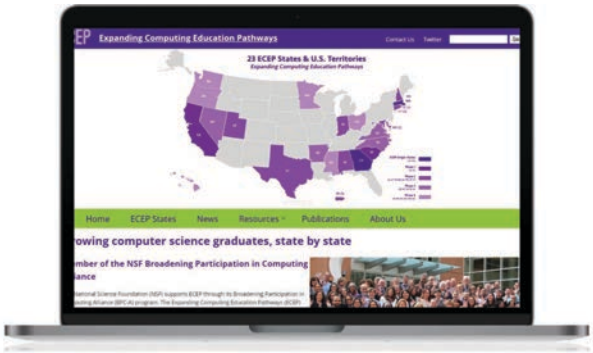
The Governors' Partnership for K-12 Computer Science is a group of bi-partisan state leaders committed to advancing policy and funding to expand access to, and increase equity in, K-12 CS education.

Governors for K-12 Computer Science
https://www.governorsforcs.org

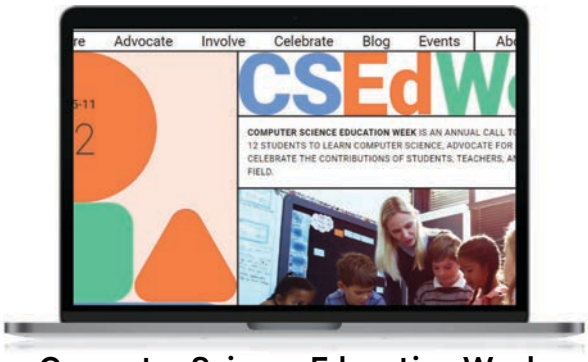
Code.org



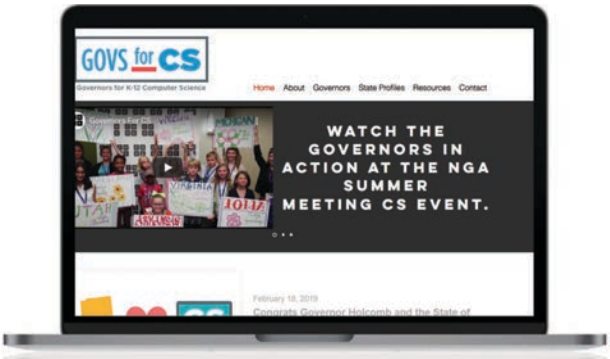
CS forAll



Expanding Computer Education Pathways



Computer Science Education Week



Governors for CS

If viewing a digital copy of this toolkit, select the interactive computer screen to access the resource's website.

- What are the national partners that engage in CS education that your state already connects with? What additional national CS partners should your state connect with?
- How will these national CS advocacy partnerships benefit your state?
- What is your process for identifying and engaging with new partnerships?

National CS Teacher and Teacher Resource Partnerships

During this time of unprecedented teacher shortages and burnout, it is more important than ever that educational systems provide support for teachers who are the backbone of all schools. This support can come in a variety of ways; however, one impactful way is assisting them in feeling like they are part of something larger than the four walls of their classroom. This is one reason Arkansas provides CSTA+ Memberships for all of its fully certified CS educators and paid sponsorships for educators to attend the CSTA National Conference. There are many wonderful organizations and groups within which CS educators can find comradery. Help your teachers find and become part of one!

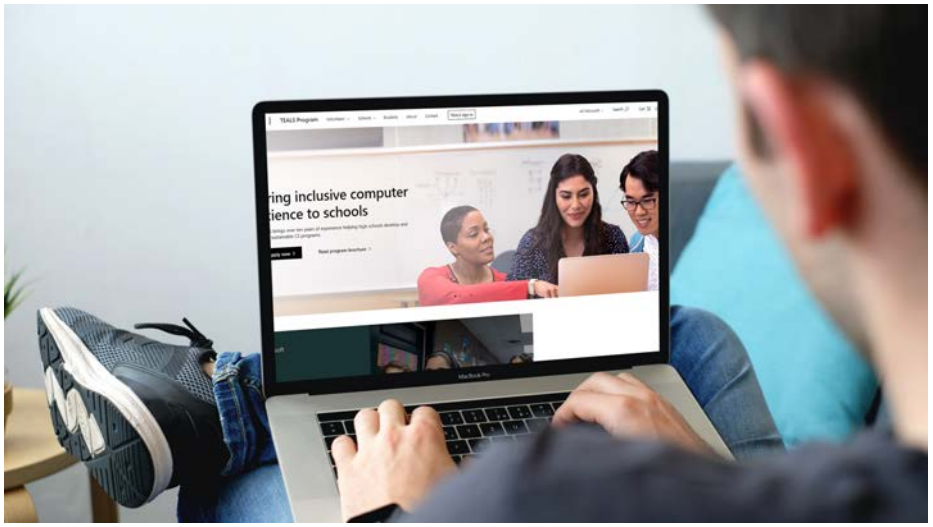
Computer Science Teacher Association

Computer Science Teacher Association (CSTA) is led by K-12 CS teachers and puts teachers' needs first by sharing the latest best practices in K-12 CS education. CSTA creates local communities across the U.S. and Canada that makes sure every CS teacher has a home. It also builds the largest teacher-led CS professional development event in the world each year! CSTA also provides access to exclusive discounts on courses and tools that will take your teaching practice to the next level.

www.csteachers.org

Microsoft TEALS

Technology Education and Literacy in Schools (TEALS) is a Microsoft Philanthropies program that builds sustainable CS programs in high schools. We focus on serving students excluded from learning CS because of race, gender, or geography. TEALS helps teachers learn to teach CS by pairing them with industry volunteers and proven curricula.

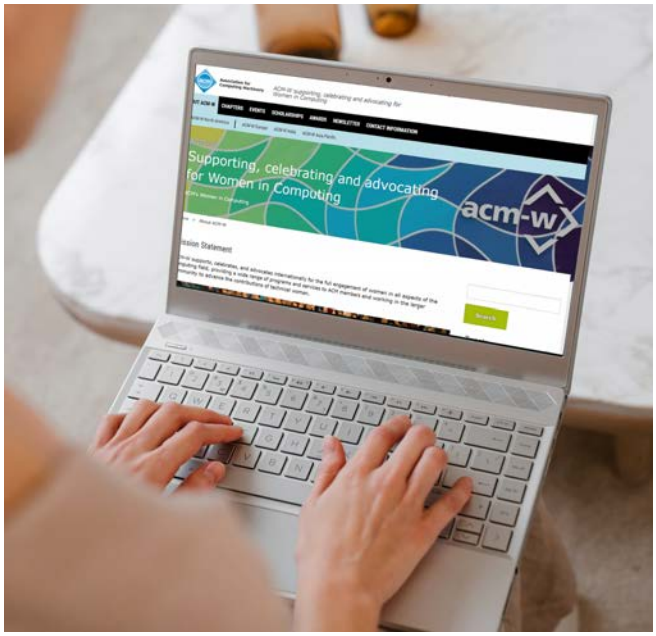


https://www.microsoft.com/en-us/teals

Association for Computing Machinery (ACM)

ACM brings together computing educators, researchers, and professionals to inspire dialogue, share resources, and address the field's challenges. As the world's largest computing society, ACM strengthens the profession's collective voice through strong leadership, promotion of the highest standards, and recognition of technical excellence. ACM supports the professional growth of its members by providing opportunities for life-long learning, career development, and professional networking

https://www.acm.org



ACM's Women in Computing

Association for Computing Machinery for Women in Computing supports, celebrates, and advocates internationally for the full engagement of women in all aspects of the computing field, providing a wide range of programs and services to ACM members and working in the larger community to advance the contributions of technical women.

https://women.acm.org/

Institute of Electrical and Electronics Engineers Computer Society

The Institute of Electrical and Electronics Engineers (IEEE) Computer Society is the premier source for information, inspiration, and collaboration in CS and engineering. Connecting members worldwide, the Computer Society empowers the people who advance technology by delivering tools for individuals at all stages of their professional careers. Our trusted resources include international conferences, peer-reviewed publications, a robust digital library, globally recognized standards, and continuous learning opportunities.

https://www.computer.org/about

National Center for Women & Information Technology

The National Center for Women & Information Technology (NCWIT) is the farthest-reaching network of change leaders focused on advancing innovation by correcting underrepresentation in computing.

https://ncwit.org/

- How is your state currently supporting educators? What ways can your state better support teachers knowing resources available?
- What incentives, programs, and support systems are your state offering to support educators?

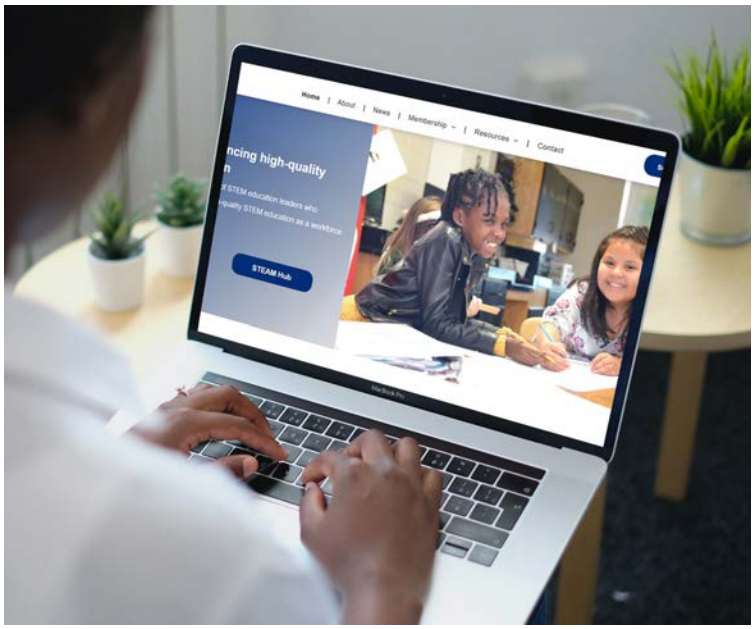
Building State Level Non-Profit Entity and Industry Partnerships

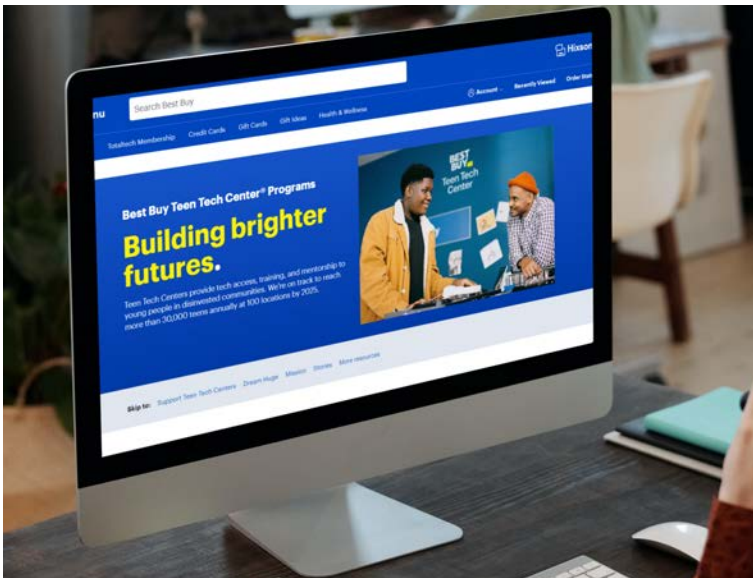
State-led Computer Science and Computing Initiatives must facilitate meaningful communication and synergy among the initiative and its leaders, local non-profits, tech-related industries, and school districts to develop a system of statewide and regional support. These partnerships will provide resources and strengthen strategies needed to create a greater student demand, school capacity, and economic value in CS and computing programs and graduates entering the workforce within the state.

STEMx

STEMx works to build states' capacities for STEM education while leveraging a community of practice to support state STEM initiatives. They advocate to make STEM a national priority, as well as identify and scale promising practices to close the nation's STEM access, talent, and skills gap.

https://stemx.us/





BestBuy's Teen Tech Centers

Best Buy, together with partners, is building brighter futures for teens from disinvested communities. Through Best Buy Teen Tech Centers and other Best Buy Foundation tech education programs, we're committed to improving tech equity.

https://bit.ly/BstBuyTECH

Walton Family Foundation

For more than three decades, the Walton Family Foundation has focused on three core objectives: improving K-12 education, protecting rivers, oceans and the communities they support, and advancing our home region of Northwest Arkansas and the Arkansas-Mississippi Delta.

https://www.waltonfamilyfoundation.org/stories/innovation/

Family Code Nights and CS is Elementary

CS is Elementary is a new national movement building upon the success of FamilyCodeNight.org.

https://www.csiselementary.org/s/

ASMSA's CodingARFuture

Since 2015, the Arkansas School for Mathematics, Sciences, and the Arts has provided CS teachers with professional development, digitally-delivered content aligned to state standards, and ongoing support to Arkansas students and teachers. We work with talented educators across Arkansas to help them learn and teach CS.

https://www.asmsa.org/outreach/digital-learning/

building state level non-profit entity and industry partnerships

- What non-profit entities and industries does your state currently have that could support your state computing needs?
- How can your state help facilitate a partnership of this level with your schools across the state?
- How is your state utilizing the knowledge and resources that local nonprofits have?

Champion Building

The success of Arkansas's Computer Science and Computing Initiative is due to many factors; however, having champions for the initiative has been crucial for the quickness and quality of progress. Many states have champions who have supported efforts. Arkansas champions include:

Governor Asa Hutchinson

Governor Asa Hutchinson has provided the vision and top-level support and interest in the initiative throughout his administration propelling it to receive national recognition. Some of the most recognizable actions of Governor Hutchinson include:

- Being one of the first gubernatorial candidates to mention "coding" in a campaign ad,
- Taking an active interest in the progress of the initiative by requesting regular updates and engaging directly with district and school leaders when witnessing wasted opportunities for students,
- Visiting over 80 schools as part of his Computer Science Coding Tours to speak directly with students and faculty about the importance of CS education,
- Connecting the state's economic development directly to the technological pipeline being built with the state's K-12 CS initiative,
- Providing $5 million in discretionary grant funding, and working to establish line item budget funding at $3.5 million per year to support the CS initiative at the state level,
- Brought awareness to state department and division leaders of the importance of this initiative, clearing the way for the implementation of programs that disrupted the status quo by eliminating bureaucratic hurdles,
- Working with the legislature to pass two funding bills and two keystone bills that established the requirements of:
  - all high schools to offer CS (Act 187 of 2015),
  - every student to earn a CS credit for graduation (Act 414 of 2021),
  - every school to employ a certified CS educator (Act 414 of 2021).

Mr. Bill Gossage

Mr. Bill Gossage sponsored the 2015 legislation that established that all high schools must offer a CS course, led the 2020 CS task force and has remained a strong advocate for the initiative within the Governor's Office.

Senator Jane English

Senator Jane English has long promoted STEM education within Arkansas, and sponsored the legislation that required every student to earn a CS credit for graduation and for every school to employ a certified CS educator (2021).

Representative DeAnn Vaught

Representative DeAnn Vaught also sponsored the legislation that required every student to earn a CS credit for graduation and for every school to employ a certified CS educator (2021).

Secretary of Education Johnny Key

Secretary of Education Johnny Key has promoted the CS initiative within the state with superintendents and other educational leaders along with being a staunch evangelist for the initiative outside of Arkansas.

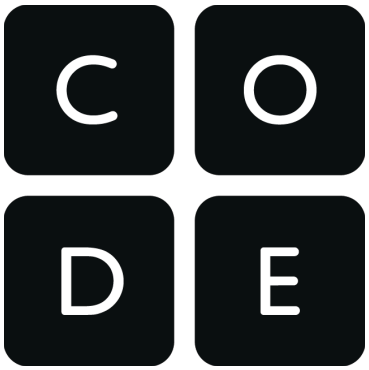
- How has your top-level leadership made it clear to all state agency leaders that CS education is a priority?
- Who within the state's legislature has your leadership identified as a partner to carry and advocate for legislative changes?

Notes

Notes

Partner Support

Thank you to these organizations for your support in the development of this toolkit.



This is a group of selected thought partners through the NGA Chairman's Initiative and national leaders in this space. It may not include all contributors to this initiative.

NATIONAL GOVERNORS ASSOCIATION

Scan the QR code to view a digital version of this toolkit