

A case for systematic availability of opportunities for computer Science learning in K-12 Education.

In support of HB170. Dell EMC would like to offer its testimony to support the advancement of Computer Science Information Education in the state of Ohio.

By Jon Phillips, Managing Director Vertical Practice Dell EMC.

Overview

Computer Scientists are in high demand, but are students prepared for the workforce? We strongly advocate for computer science coursework counting toward either math or science graduation requirements. Nationally speaking, we need to see states take toward the advancement and updates to Education requirements in public education that incentivize computer science coursework in all public and charter high schools to count toward either math or science graduation requirements.

We advocate for computer information science and computer coding learning and course work to be convenient and available for all students as earlier as 2nd grade.

Take coding—"not just a set of technical skills," [according to MIT computer scientist Mitch Resnick](#), who developed the programming language [Scratch](#) for children. "It's similar to learning to write—a way for kids to organize, express, and share ideas."

"If you have kids put blocks together to solve the puzzle, that can be useful for learning basic computing concepts. But we think it's missing an important part of what's exciting about coding. If you present just logic puzzles, it's like teaching them writing by only teaching grammar and punctuation."

The Problem

Last year, there were more than 600,000 high-paying tech jobs across the United States that were unfilled, and by 2018, 51 percent of all STEM jobs are projected to be in computer science-related fields. Computer science and data science are not only important for the tech sector, but for so many industries, including transportation, healthcare, education, and financial services.

Parents increasingly recognize this need, several school-district based and national non-profit organizations indicate the overwhelming majority of parents surveyed indicate the need and desire for their children to experience and have the opportunity to learn computer science. However, by some estimates, just one quarter of all the K-12 schools in the United States offer high-quality computer science with programming and coding and 22 states still do not allow it to count towards high school graduation, even as other advanced economies are making it available for all students.

Wide disparities exist even for those who do have access to these courses. In addition to course access challenge, media portrayals, classroom curriculum materials, unconscious bias and widely-held stereotypes exacerbate the problem and discourage many of our students from taking these courses. For example, in 2015, only 22 percent of students taking the AP Computer Science exam were girls, and only [13 percent were African-American or Latino students](#). These statistics mirror the current makeup of

some of America's largest and more innovative tech firms in which women compose less than one-third of their technical employees, and African-Americans less than 3 percent.

There are many reasons students are not prepared for these positions. We believe that one reason is CS courses are not valued in schools. Many students have historically declined to take advanced placement computer science, for example, because it was counted only as an elective despite the heavy math and science content.

Yet it is important that public schools offer CS courses because they are the most accessible venues for many. Both people of color and women are under-represented in the tech and STEM workforces, and access to CS education early on can create a stronger pipeline for those groups.

We see some movement in other like-minded States.

States and cities have been leaders in the movement to expand CS education. Since 2014, [more than 60 school districts across the nation have committed](#) to give more of their students an opportunity to learn CS. In just the past year, both Republican and Democratic state leaders have championed ambitious CS efforts, and New York City announced an aggressive 10-year plan to expand CS opportunities to all one-million of its students. Today, leaders at the state and local levels are announcing new and expanded commitments to expand CS, including:

- The State of Delaware is expanding CS education to 13 additional high schools, and launching an online CS course for all students.
- The Hawaii State Department of Education's will expand its efforts to integrate CS throughout K-12.
- More than 30 K-12 public school districts, representing more than one million students, are committing to expand CS education.
- Broward County Public Schools, the nation's sixth largest public school system, is announcing a goal for every student to have some exposure to CS while in school.

By way of example. We've seen some recent progress in terms of critical legislation to support the rigorous adoption of CS standards for State Education. We'd like to draw reference to the work in Virginia and Pennsylvania. The State of Virginia has officially become the first state to add computer science to its core academic requirements for elementary, middle, and high school.

As we wrote in April, the state legislature unanimously passed a bill adding "computer science and computational thinking, including computer coding" to Virginia's K-12 standards. Gov. Terry McAuliffe signed the legislation on Monday, as was expected.

A [robot delivered the bill to the governor](#) during the signing ceremony in Richmond, local news sources report.

"We will be sending a clear message ... to all the businesses around the globe that we're [very serious about this, computer science](#), and what we need to do to build those skill sets of the future," McAuliffe said, according to the Roanoke Times. "States talk about it. We're taking action today to get that done."

The bill's sponsor was Del. Thomas Greason, R-Loudoun.

Several other states are working to [expand access to computer science as well](#), though none have gone as far as Virginia. Starting in 2017-18, all [Arkansas elementary and middle school students](#) will learn the subject. That state already [requires that high schools offer computer science courses](#), but students don't have to take them.

Therefore Dell EMC, representing Industry, supports the new Bill provisions including but not limited to the following sections of HB170.

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Sec. 3301.012. As used in Chapters 3301. to 3329. and Chapter 3365. of the Revised Code, "computer science" means logical reasoning, computing systems, networks and the internet, data and analysis, algorithms and programming, impacts of computing, and structured problem solving skills applicable in many contexts from science and engineering to the humanities and 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 H. B. No. 170 Page 2 As Introduced business.

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(4) Not later than July 1, 2018, the state board shall adopt standards for instruction in computer science in grades kindergarten through twelve. When developing these standards, the state board shall consider recommendations from computer science education stakeholder groups, including teachers and representatives from higher education, industry, computer science organizations in Ohio, and national computer science organizations. Any district or school may utilize the computer science standards adopted pursuant to division (A)(4) of this section. However, no district or school shall be required to utilize all or any part of those standards.

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Development program endorsed or provided by the organization that creates and administers national advanced placement examinations. For this purpose, the individual may complete the program at any time during the calendar year. An individual who is licensed to teach computer information science and meets the requirements prescribed in division (A)(3) of this section shall be considered a highly qualified teacher in the core subject area of mathematics.

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Recommendations:

Involving our young people in real problems they can help solve in their own communities is a best practice in education and is exciting for our youth. [Next Generation High Schools](#)) typically have significant computer science opportunities for American youth that pull them in as partners in solving

challenges and engaging in their future. Seattle leadership hosted “Hack-the-Commute” involving community members from across the city. New Orleans is engaging youth and others in their open data initiatives as part of their work on the Police Data Initiative with 25 other cities. Denver libraries are hosting teen-developer camps. Let’s do more of this youth engagement as part of their learning experience!

Action 1: Develop state computer science standards for K-12.

As recommended by SREB Commission on Computer Science and Information Technology. *

- Work in partnership with secondary and postsecondary educators, experts and industry leaders to develop K-12 computer science standards that include the essential concepts and practices students should master in the elementary and middle grades and high school.
- Develop or adopt standards-based, developmentally appropriate computer science curricula that appeal to diverse learners in the elementary and middle grades.
- Require all high schools to offer students access to rigorous, standards-based computer science courses, such as Exploring Computer Science and Advanced Placement Computer Science Principles.
- Provide funding at the state, district and school levels to support expanded computer science learning opportunities in schools.
- Extend early and frequent opportunities for K-12 students and their families — especially girls, black and Hispanic students, and students from low-income families — to explore computer science and computer science-related careers.

Action 2: Lay the groundwork for learning computer science.

- Throughout K-12, integrate and teach the essential literacy skills that students need to master grade appropriate computer science standards.
- Throughout K-12, integrate and teach the essential math concepts and skills that students need to master grade-appropriate computer science standards. SREB Commission on Computer Science and Information Technology
- Provide targeted interventions and readiness courses to students who need extra help mastering the grade level literacy and math skills needed for success in computing fields.
- Require students to take four years of math aligned with their career and college goals.
- Support K-12 academic and computer science teachers in designing interdisciplinary, project-based instruction and assignments that engage students in applying literacy, math and computational thinking skills to solve problems.

Action 3: Create clear pathways to computing careers.

- Charge a state career pathway advisory council with developing pathways that meet identified workforce needs in computing fields.
- Build career pathways consisting of four or more courses that connect seamlessly to postsecondary programs in high-demand career fields, such as cybersecurity, informatics and software development.
- Redesign the high school senior year to allow students who meet college-readiness benchmarks to earn college credits that transfer to associate and bachelor's degrees and to help struggling students prepare for college.
- Include computer science and computer science-related career pathways in state accountability and funding systems.

Action 4: Prepare great computer science teachers.

Recruit teachers with the content knowledge, interest, passion and willingness to learn and explore computer science alongside their K-12 students.

- Offer teaching endorsements to new computer science teachers who complete a two- to four-week, full-day summer institute, led by a master teacher, in which they learn their curriculum by completing the same projects and assignments as their students.
- Create clear pathways to teacher certification and licensure to ensure that all teachers, regardless of their backgrounds, have the appropriate content knowledge and pedagogical skills needed to teach standards based computer science and IT curricula.
- Partner with other states, national and regional organizations, the Educational Testing Service or other licensing exam providers to design a new computer science Praxis or other standardized assessment that measures teachers' mastery of the most current content knowledge and pedagogical knowledge required to teach computer science.

Action 5: Educate communities about computer science and computing careers.

- Embed career advisement and exploration across K-12 as a means of educating students, parents and communities about computer science and computing careers.
- Encourage employer partners to invest in the computing and IT workforce of the future.
- Enact legislation to recognize communities that improve computer science education and meet workforce needs in computing fields.

In conclusion

We strongly encourage states like Ohio take on ambitious computer science education efforts and pass legislation to make computer science count towards high school graduation. Similarly, cities like New York, Chicago, and San Francisco have already announced major expansions of computer science education.

Local leaders are using computer science to solve many of our most intractable local challenges and opportunities: Check out the [Smart Cities Initiative](#), [Police Data Initiative](#), [TechHire](#), and more.

Cited sources within this testimony:

The 5 Actions recommended herein is from the SREB report written by expert consultants of the Commission on Computer Science and Information Technology. For additional information, contact Kirsten.Sundell@SREB.org or Gene.Bottoms@SREB.org or visit SREB.org/ComputerScience.

The Southern Regional Education Board works with states to improve education at every level, from early childhood through doctoral education. A nonprofit, nonpartisan organization based in Atlanta, SREB was created in 1948 by Southern governors and legislators to help leaders in education and government advance education to improve the social and economic life of the region. Member states are Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia and West Virginia.

<https://obamawhitehouse.archives.gov/blog/2016/01/30/computer-science-all>

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