Report finds K-12 computer science education declining

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Computer-related technology is increasingly driving the U.S. economy, yet computer science education is scant in most American elementary and secondary school classrooms and the number of introductory and Advanced Placement courses in computer science has actually declined in the last five years, according to a report released this fall.

"Some states and some schools are offering some really excellent courses," said Mark Stehlik, co-author of the report, "Running on Empty: The Failure to Teach K-12 Computer Science in the Digital Age," http://www.acm.org/runningonempty/. "But overall, the picture is pretty bleak," added Stehlik, assistant dean for undergraduate education at Carnegie Mellon University's School of Computer Science.

The report by the Association for Computing Machinery (ACM) and the Computer Science Teachers Association (CSTA) found that most schools focus on teaching students how to use a computer and run available applications, rather than also teaching deeper concepts, such as computational problem-solving, that lay the foundation for innovation. Fourteen states have adopted no standards at all for upper-level computer science education.

The report's findings are sobering as educators observe Computer Science Education Week, Dec. 5-11, http://www.csedweek.org, which focuses on the critical role of computer science in preparing students for 21st century careers. Carnegie Mellon will host Computer Science Education Day on Dec. 8, www.cs.cmu.edu/csed/.

Recent federal initiatives such as No Child Left Behind and various programs designed to boost science, technology, engineering and mathematics (STEM) education have had the unintended consequence of undermining computer science lessons, the report noted. Those initiatives have focused lessons on traditional science and math courses that are covered by achievement tests or are core requirements for high school graduation. Only nine states count computer science credits toward graduation requirements.

The point is not that every student needs to become a computer scientist, but that all students have the basic knowledge they need to understand an increasingly technological world, said Leigh Ann Sudol, a PhD student in Carnegie Mellon's Computer Science Department and another study co-author.

"Just like understanding a cell in biology class, understanding how a computer works is a fundamental skill for competing in the 21st century global marketplace," she said.

The ACM and CSTA issued a model K-12 curriculum for computer science in 2006. Though no state has a set of standards addressing computer science specifically, the Running on Empty authors set out two years ago to assess the degree to which state school standards for science, math and other subjects included the 55 standards outlined in the model curriculum. In addition to Sudol and Stehlik, the report's authors included Chris Stephenson, CSTA executive director, and Cameron Wilson, ACM director of public policy.

"Many studies have looked at what computer science teachers are doing in the classroom and much of that is fantastic," Sudol said. "These teachers are enthusiastic and often generate their own class materials. But that's never going to do more than create bubbles of excellence in the country as a whole. So we needed to take a look at what was

happening from the top down."

Sudol found that 14 states, including Georgia, Ohio, Massachusetts, Oregon and Florida, have adopted between 50 and 100 percent of the model standards. But that left two-thirds of the states with few, if any, computer science standards at the secondary level. Pennsylvania, Michigan and 12 other states, along with the District of Columbia, have no secondary computer science standards.

The number of secondary schools offering introductory computer science courses dropped 17 percent from 2005 to 2009 and the number offering Advanced Placement (AP) computer science courses dropped 35 percent in that time period. Stehlik noted that the low demand caused the College Board, which administers AP curricula, to eliminate the AP Computer Science AB test that examined advanced computer science topics such as algorithms and data structures. The AP Computer Science A test, which deals mostly with programming, remains available.

Scientific organizations and non-profits such as the ACM, CSTA and the Computing Research Association, along with corporations such as Microsoft and Google, have formed a non-partisan advocacy coalition, Computing in the Core, www.computinginthecore.org, to work for stronger K-12 computer science education. Among the policy initiatives it supports is the Computer Science Education Act, which was introduced this year by U.S. Rep. Jared Polis, D-Colo., and would provide federal grants to states to improve computer science programs and support computer science teachers.

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