

JOURNAL REPORTS: TECHNOLOGY

Should All Children Learn to Code by the End of High School?

Supporters say coding know-how is good for students in an increasingly digital world. Opponents say public schools shouldn't serve as job-training sites for tech companies.

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At every high school, students are required to show proficiency in certain subjects to graduate. Now there's a push to include computer coding as one of those subjects.

The idea is that such a skill will be invaluable in a world that increasingly runs on computer technology. What's more, many companies report shortages of workers with programming skills.

Nearly 20 states have already passed legislation requiring public schools to make computer-science classes accessible to high-school students, according to Code.org, a nonprofit founded by tech investors that says coding and other computer skills should be seen as essential in the 21st century.

Critics don't like the fact that many of the leading advocates have direct ties to the tech industry—companies that would arguably benefit most from a bigger pool of job applicants with software-writing skills.

They also argue that adding a coding requirement for graduation is at odds with the very purpose of public education, and its focus on humanistic values.

Prof. Robert Sedgewick at Princeton University argues that proficiency in coding is good for students and society in the 21st century. Larry Cuban, a professor emeritus of education at Stanford University, says public schools should not be turned into job-training sites for tech companies.

YES: It Fosters Creative and Logical Thinking

By Robert Sedgewick

There is no question all students should learn how to code by the end of high school. Educators around the world are recognizing this reality.

Teaching students to code introduces them to logical thinking, as well as fostering creativity and problem-solving skills. It encourages experimentation, develops persistence and promotes collaboration. Learning to think as a coder gives one a valuable set of strategies for understanding a variety of situations that one will encounter later in life—particularly those who are working outside of tech. A more code-literate set of Iowa Democrats might have been able to foresee problems with the poorly designed app that contributed to the recent fiasco in the Iowa caucuses.

Then there's the societal benefit: Our technology-driven economy needs coding-literate citizens who are competitive, astute and discerning in the global marketplace of ideas, opportunity and commerce.

Some critics say there is no research proving that learning to code carries such benefits. But I'm not aware of any research showing that each and every thing taught in math, science, English, history and foreign language offers more benefit than coding.



I would agree that one purpose of public education should be to develop proud, literate, humane citizens who give back to their communities. But can one claim to be proud of not understanding how one's phone or the internet works? Can one claim to be literate without being able to understand even the simplest piece of code? Can one be humane and ignore the role technology can play in addressing the problems of the developing world?

Today's reality is that many community values and the development of many aspects of one's character cannot be addressed without a basic understanding of technology. Values like security, privacy and honesty are threatened precisely because most citizens do not

What do you think?

understand technology sufficiently well to be able to push back.

Big Issues in Technology

Should all children learn to code by the end of high school?

A Yes

B No

Our public-school curriculum, as ever, needs to evolve to stay relevant. Making room for coding and computer science may not even require any reductions in teaching of other subjects. In fact, I believe the opposite is true: Having coding-literate students will enhance the teaching of many other subjects. For instance, students in biology can search for patterns in genomes; in physics they can simulate the motion of planetary bodies; in math and science they can study large data sets or write programs to control robots and drones.

Perhaps the most important reason to integrate coding and computer science into the K-12 curriculum is to eliminate gender-based and economic equality gaps. Coding needs to be a standard component in public-school curricula, not just an enrichment program for the well-to-do.

The drive to democratize coding literacy is led by concerned individuals who, instead of acting in their own self-interest, understand that coding is a critical skill for the 21st century. It is not vocational training any more than English is vocational training for journalists or economics is vocational training for business executives. I have personally taught thousands of teenagers coding and computer science (and many more online). Only a fraction of them work in tech companies—the rest have gone into a broad variety of careers, feeling empowered to face technological challenges. Coding literacy is not limited to Silicon Valley companies and IT departments. It is becoming a necessity in such sectors as health care, social assistance, business services, construction, entertainment, politics and manufacturing.

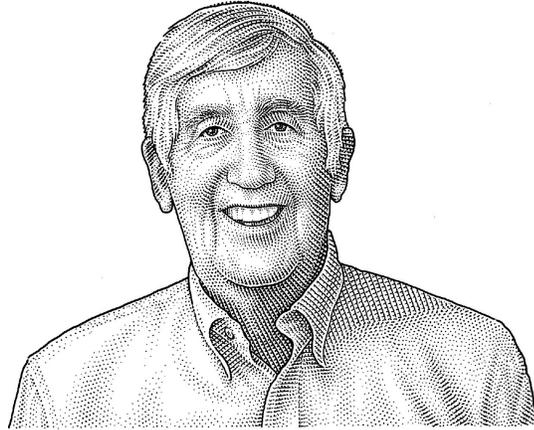
The basis for education in the last millennium was reading, writing and arithmetic. Now, it is reading writing and computing.

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NO: Public Schools Shouldn't Cater to CEOs' Needs

By Larry Cuban

There is no way that children should be required to learn coding in high school.



I understand that the rationale is that learning to program software will make students logical, critical thinkers, creative, technically literate and independent. But similar assertions are made on behalf of learning math, English, history and science by those who prize and teach those subjects.

The claims about coding are based on anecdotes and beliefs, not any research or evidence that I have seen. I have yet to find a body of research suggesting that students transfer what they learned from coding to all of the above cognitive domains.

Would boosters of coding propose to make room by requiring less math, science, English, history or foreign language? The alternative, adding to a curriculum already crowded with required courses and frequent testing, puts an unnecessary burden on students.

America's public schools should not exist to serve Silicon Valley CEOs' need for programmers. Turning tax-supported schools into job-training sites for high-tech firms corrupts the very purpose of public education.

Yet that is exactly what is happening here. This is not the first time powerful commercial interests have sought to reshape public education to suit their own ends. In the early 20th century, pushed by industrial groups, the federal government helped states fund vocational training to prepare high-school students for manufacturing work. Across the nation, school districts added requirements in high school for classes in industrial and agricultural skills, and home economics, and established separate vocational schools. The imposition of those requirements for years served to undermine the broader cultural goals of public schools—such as social mobility, individual development and civic engagement.

The new push for required vocational training comes from advocacy groups supported by the deep pockets of wealthy donors and technology companies. The biggest advocates are high-tech CEOs. Theirs is a vision of public education in which coding and computer science become as important as reading, writing and arithmetic, starting in kindergarten and continuing all the way through college.

The stark self-interest mirrors the motivations of the manufacturing industry a century ago. Then as well as now, the rationale was that such preparation would help millions of students enter all kinds of occupations.

But that's not really the case. Let's look at some data about the job market. The U.S. Bureau of Labor Statistics estimates that computer and information-technology jobs will grow to roughly

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five million in 2028, up from 4.5 million in 2018. Those future jobs will represent only about 3% of the roughly 171 million workers the U.S. economy is expected to employ in 2028. Far larger growth, again according to the Bureau of Labor Statistics, is expected in health care and social assistance. Employment in the sector is expected to increase by nearly four million jobs to more than 23 million by 2026.

There is an intimate connection between strong schools and a strong economy. But preparing youth for jobs is just one of the goals Americans want for their schools. The more important goals are to develop proud, literate, humane citizens; reinforce community values; and to help students fulfill their individual potential.

If the primary purpose of public education is seen as giving young people the knowledge and skills necessary to gain successful entry to the labor force in an information-driven economy, then say goodbye to public schools that cultivate civic and social responsibilities. Say hello to corporate and social elites who would reshape our schools in their own parochial interest.

Dr. Cuban is professor emeritus of education at Stanford University. He can be reached at reports@wsj.com.

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