Computer Science Education: What You Should Know About This National Imperative

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Executive Director
A Little CSTA Context

• An international membership organization of 13,750 members
• 41 chapters in the U.S. and Canada
• Develops and publishes the de facto national standards for K-12 CS education
• Provides professional development for teachers
• Conducts and publishes research
• Provides classroom resources and CS promotional materials
Believing that students are learning computer science because there are computers in schools is like believing they are learning chemistry because there are beakers in the cupboard.

Just because your kids are using the technology, doesn’t mean they understand it or are capable of creating it.
Tool Users vs Tool Builders

- Using technology tools is an important skill; however it is not where innovation happens
  - Flying a plane is not the same as designing a plane
- We need technology “tool builders” to create the tools that will solve problems and improve lives
- Computer science creates tool builders
Computer Science is Distinct from Literacy

Computer science is the study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society. (ACM Model Curriculum)

Computer Literacy: The ability to use various software applications (often called “point and click education”)

Educational Computing/Educational Technology: The use of computers to support learning across the curriculum
Race to the Future

• The future of science, of innovation, of solutions are all grounded in rigorous computing

• Other nations have committed to ensuring that their children build the tools of the future while we continue to educate our children to be simply tool users (the UK example)

• Educating students for the jobs of the past is a recipe for both economic and social disaster

• While educational policy is state driven, we ignore the national impact at our peril:
  — Cyber security
  — Critical skills and employability gaps
  — Jobs we cannot fill
  — Tools we will never build and problems we will never solve
Where the Jobs Will Be:  
Projected job growth in Computing Fields 2010-2020

- Database, Systems Administrators and Network Architects: 30% growth
- Software Developers and Programmers: 25% growth
- Computer Systems Analysts: 20% growth
- Information Security Analysts, Web Developers, and Computer Network Architects: 15% growth
- Computer and Information Research Scientists: 20% growth
- Computer Support Specialists: 15% growth
- Computer and Information Systems Managers: 15% growth
- Computer Hardware Engineers: 10% growth
- Computer Occupations, All Other: 5% growth
- Total, All Occupations: 10% growth

High School Advanced Placement
Exams 1997-2011

- Calculus: 9.7%
- Biology
- Statistics
- Physics
- Chemistry
- Envt'l Science
- Computer Science: 0.63%


Calculus represents the combined data of Calculus AB and BC. Physics represents the combined data of Physics B, C: Electricity and Magnetism, and C: Mechanics. Computer Science represents combined data of Computer Science A and B.
National School Enrollment and APCS Exam Participation by Race and Gender

<table>
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<th>Enrollment</th>
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Findings: Standards

FIGURE 3  Secondary School Standards Level II and Level III Adoption by State

http://www.acm.org/runningonempty/fullreport.pdf  2010
Standards: Running on Empty

Running On Empty: The Failure to Teach K–12 Computer Science in the Digital Age

- Examines current learning standards in core subject areas in every state
- Shows that roughly two-thirds of the country have few computer science education standards for secondary school education, and most states treat high school computer science courses as simply an elective

- Includes state-by-state standards report cards keyed to CSTA computer science standards
CS and Social Justice

• Students from minority homes are far less likely to be exposed to computer science knowledge in their home environment

• Schools with high numbers of underrepresented minority students are far less likely to have access to rigorous computer science courses in schools

• Access to this privileged knowledge has become the social justice issue of the 21st century
Equity: Addressing Core Equity Issues

• An in-depth look at the barriers in our educational system
• Practical recommendations for solutions to address core equity issues
• Comprehensive recommendations for each stakeholder group
• Practical, achievable suggestions for working together to ensure that all students have the opportunities that rigorous computing provides
Computer Science and the Core

• The absence of computer science from the “core” has widespread negative consequences:
  – Ignored in conversations about improving student performance (the MSP example)
  – Damaging and sometimes crazy policy decisions
    • Assessment in Ohio
    • Certification in FL
  – CS does not count for graduation so our best and brightest students cannot take it
Which Courses Count and Who Can Take Them

• Because computer science is an “elective” rather than a “core” course it is becoming increasingly difficult for students to fit it into their schedule.

• This situation is exacerbated by the trend to increase the number of math and science courses students must take in order to graduate (when CS is counted as neither)

• Computer science courses are often classified as a “technology credit” rather than an “academic credit”
What About Maryland

• Tremendous variety exists among school systems and among high schools within school systems in terms of the opportunities available to study computer science

• Computer science is less likely to be offered in rural or urban schools

• Girls and under-represented minorities are less likely to take computer science. Higher percentages of minorities and lower percentages of girls taking an intro computer science course than the nationally reported averages.

• The majority of high school computer science courses are in CTE

• Computer science courses count toward graduation as an elective
New K-12 Computer Science Standards

- Introduce fundamental CS concepts to all students, beginning at the elementary school level.
- Present CS at the secondary school level in a way that can fulfill a CS, math, or science graduation credit.
- Encourage schools to offer additional secondary-level CS courses that will allow students to study CS in more depth and prepare them for entry into the workforce or college.
- Increase the availability of rigorous CS for all students, especially those who are members of underrepresented groups.
Student Perspectives and Messaging

• Lack of knowledge about discipline and what it involves

• Lack of knowledge about the opportunities it provides.

• What the fact that it doesn’t count for graduation say to students

• What courses are called really matters
Local Success vs. National Disaster

• In the last few years the commitment to improving computer science education has resulted in pockets of excellence:
  — New tools (Alice, Scratch, Kodu, Phrogram, Bootstrap…)
  — New curricula (Exploring Computer Science, Media Computation…)
  — New ways of thinking about equity and engagement

• If we are going to achieve a true renaissance in CS education in K-12 we need to make both curriculum and policy changes at the state and national level and we need rigorous informal education programs to fill the gaps
THANK YOU!

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