

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

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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

Critical Gaps in Understanding

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)

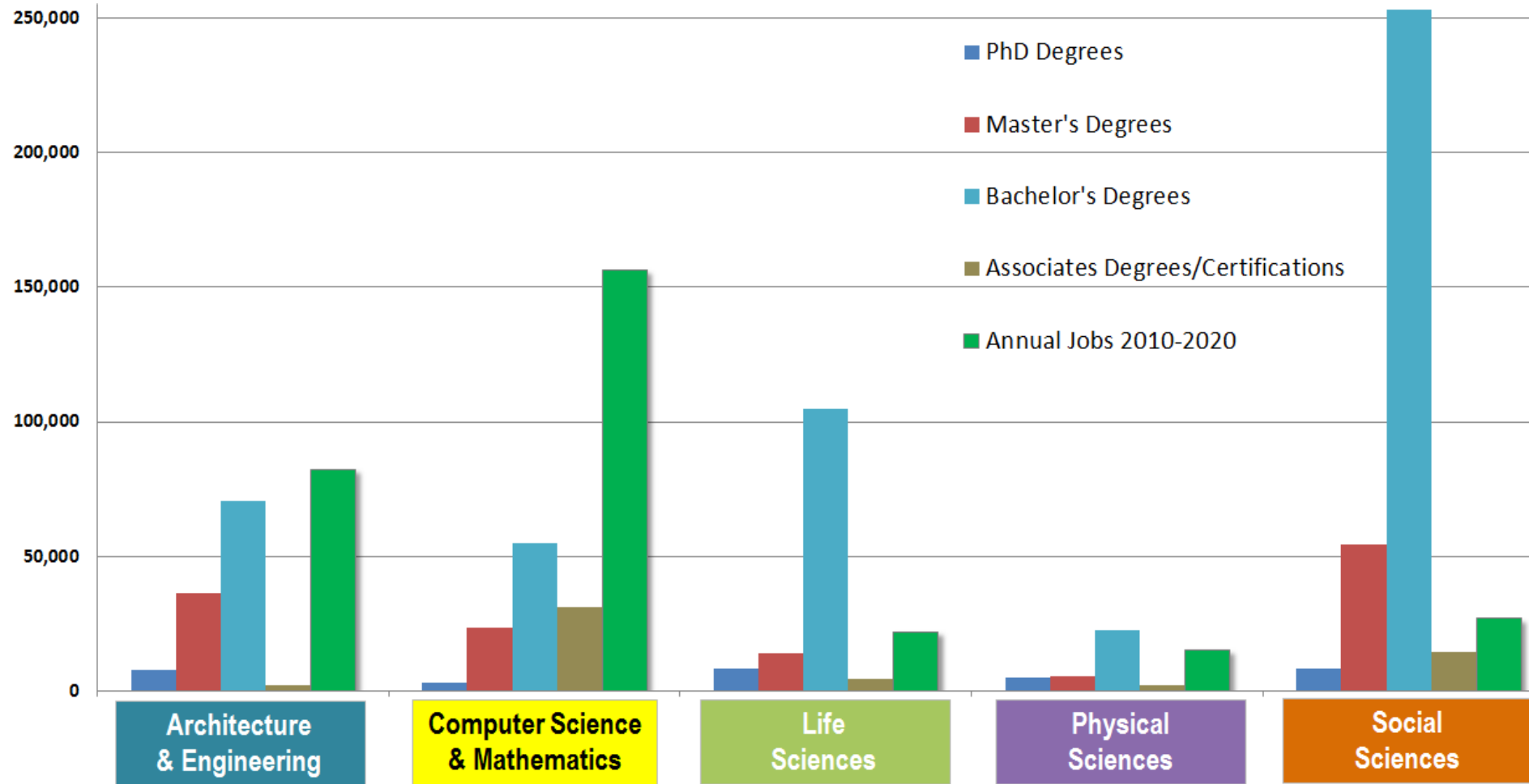
Computer Literacy: The ability to use various software applications (often called “point and click education”)

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

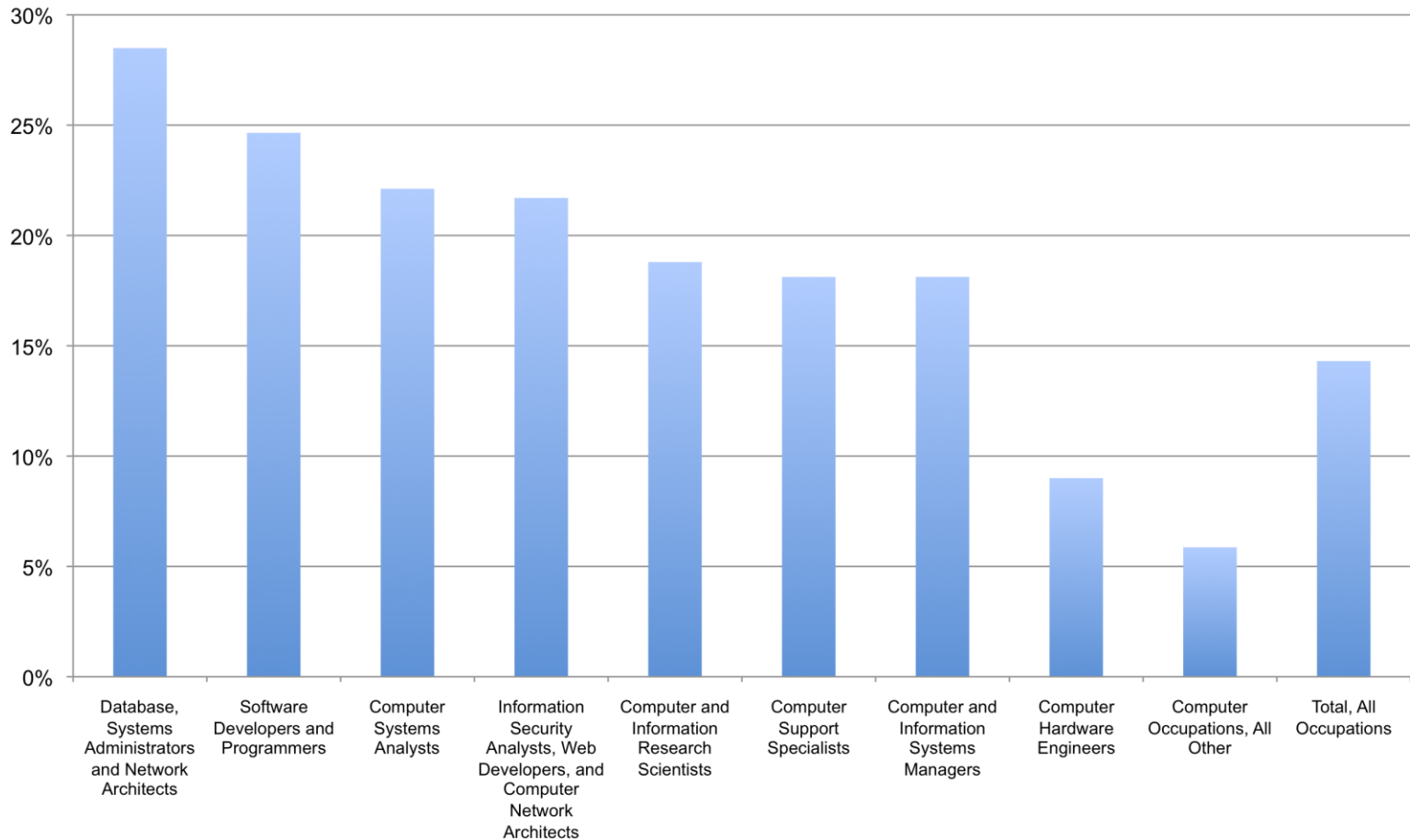
Race to the Future

- 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

Degrees and Jobs in the US



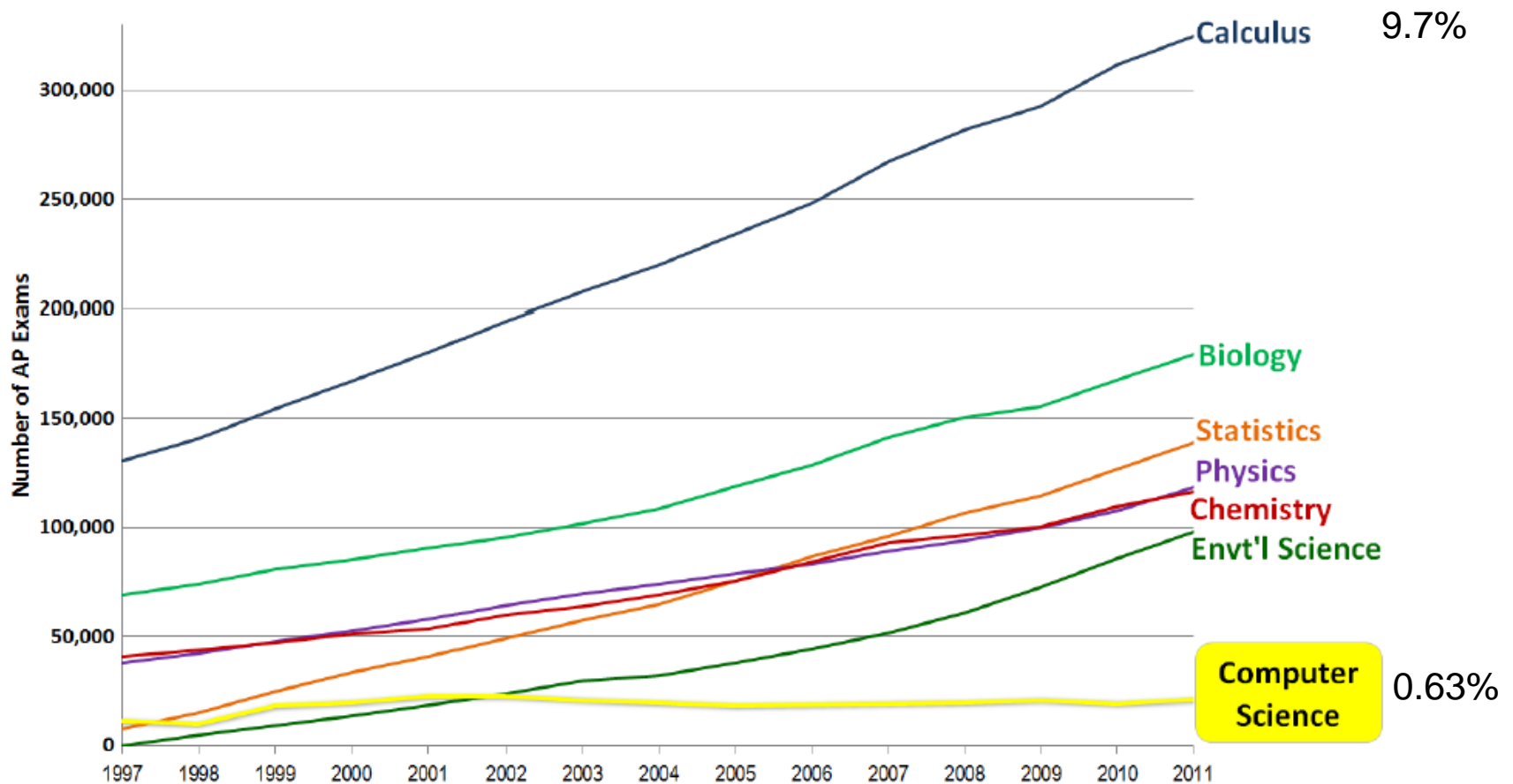
Where the Jobs Will Be: Projected job growth in Computing Fields 2010-2020



Source: Bureau of Labor Statistics Employment Projections 2010 - 2020, Feb. 1, 2012

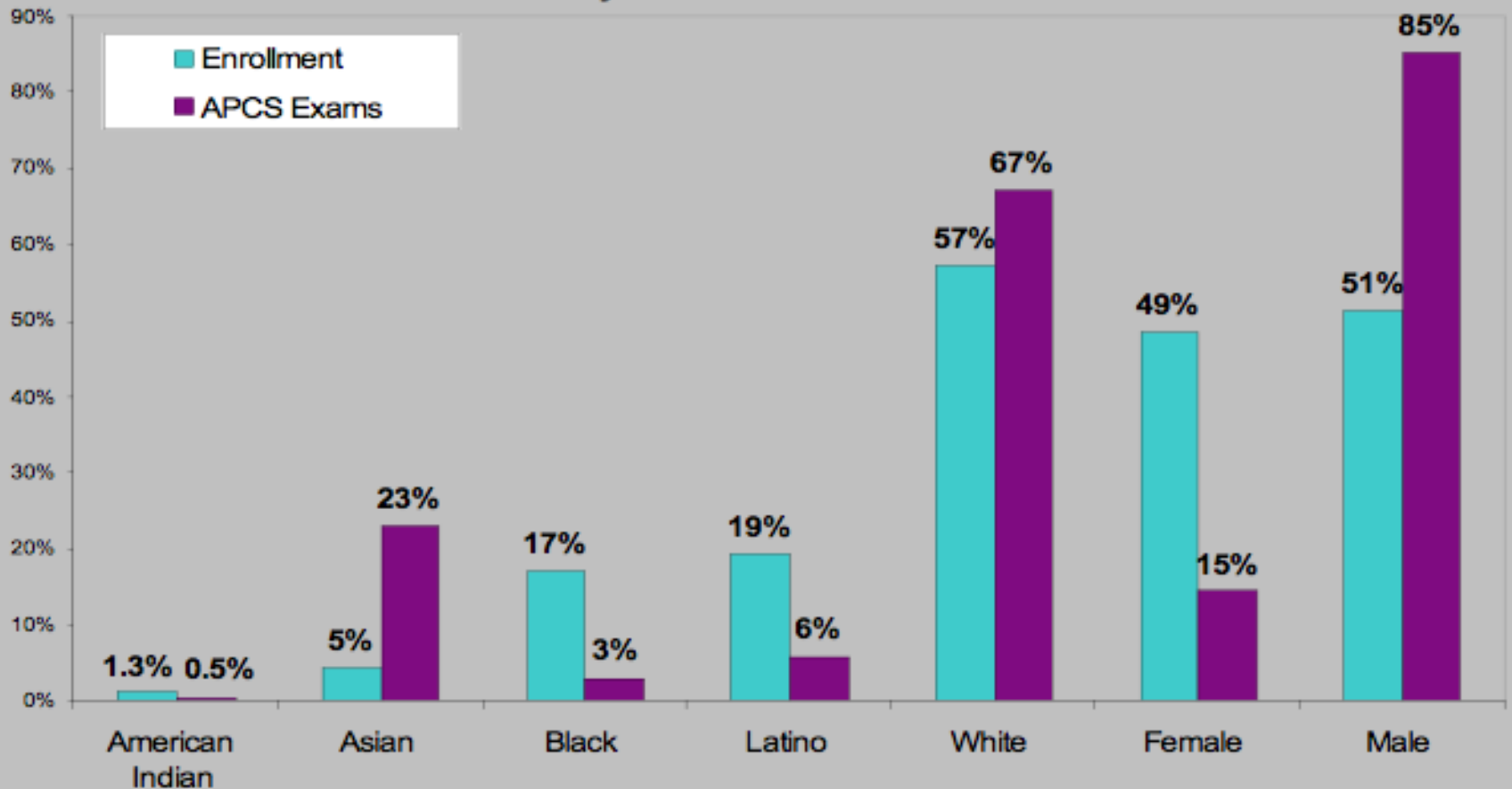
High School Advanced Placement

Exams 1997-2011



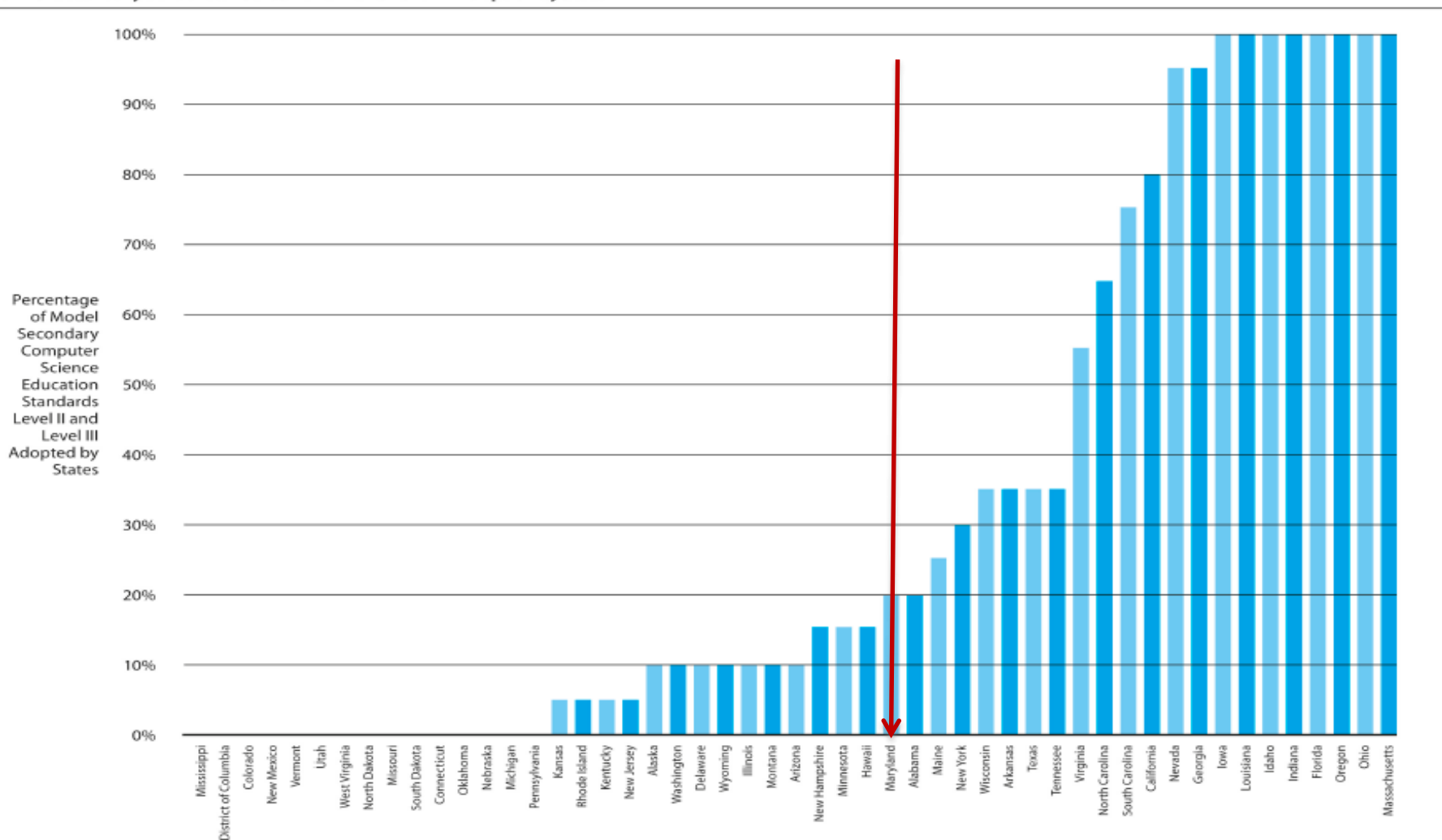
Source: College Board, Advanced Placement (AP) Exam Data 2011, available at <http://professionals.collegeboard.com/data-reports-research/ap/data>. Calculus represents the combined data of Calculus AB and BC. Physics represents the combined data of Physics B, C: Electricity and Magnetism, and C: Mechanics. Computer Science represents combined data of Computer Science A and B.

National School Enrollment and APCS Exam Participation by Race and Gender



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



- 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

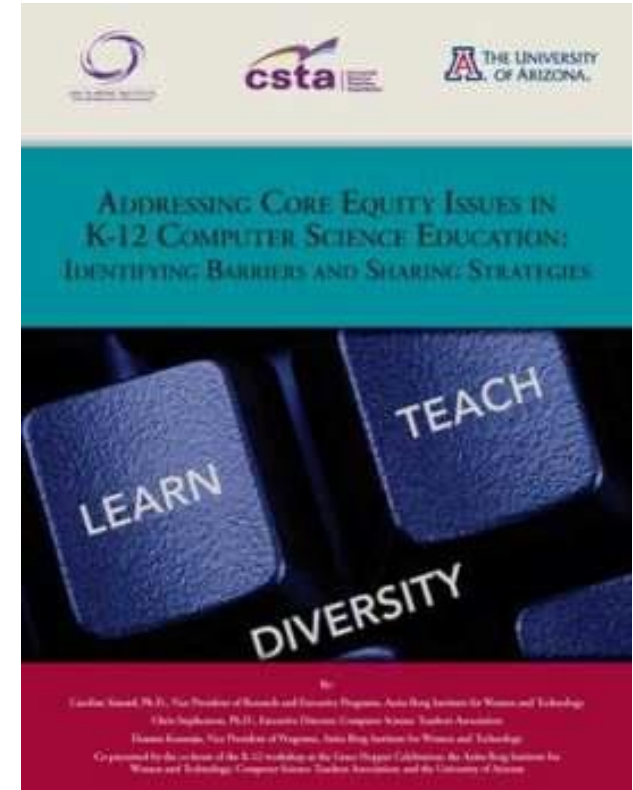
- **Includes state-by-state standards report cards keyed to CSTA computer science standards**

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

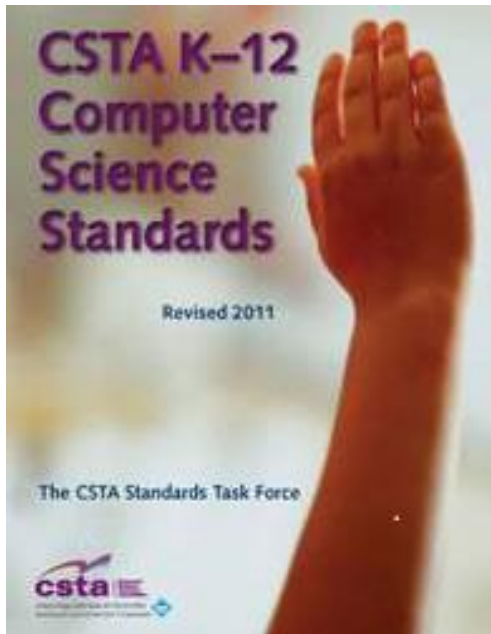
Which Courses Count and Who Can Take Them

- 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 work force or college
- Increase the availability of rigorous CS for all students, especially those who are members of underrepresented group.

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

Posters and Brochures

IMAGINE YOUR FUTURE in COMPUTING

Do you want to help build the next generation of mobile phones, try media players, and even high-tech stuff? Or create new and more advanced medical tools? That's **Computer Engineering**.

Learn to design digital hardware and software including communications systems, computers, and devices such as phones, MP3 players, DVDs, alarm systems, x-ray machines, and even laser surgical tools.

Do you enjoy finding better ways to get things done using computers? Are you interested in understanding how computers can make businesses work better? That's **Information Systems**.

Design the next eBay auction site or iTunes music store! Business and computing overlap in major ways and you might be the next successful entrepreneur.

Do you love to solve puzzles? Invent new ways of using computers? Or exchange theories about new ideas? That's **Computer Science**.

Design and build software, or solve real-world problems using robotics, computers, enhanced vision, digital forensics, and other innovations.

Do you see the big picture? Can you imagine whole new virtual worlds and experiences? That's **Software Engineering**.

Develop computer games or software systems to solve critical applications. Software applications are made up of many smaller programs carefully designed together.

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<http://csta.acom.org>

Explore your interests in computing. Your high school may have classes and clubs. Talk with your guidance counselor and your school's computing or technology teachers to learn more about the opportunities ahead.

A high-tech world calls for **inspired and talented people**. Jobs in technology are growing and offer **big salaries**. Technological advances are creating **new jobs every day!**

For more information visit <http://computingcareers.acom.org>

Computer Science and Sports: Better. Faster. Smarter.

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Computer Science Education Week

Computer Science is the study of computers and computational systems. It is the study of the principles, design, and use of computers and computational systems. It is the study of the principles, design, and use of computers and computational systems.

WORLD OF OPPORTUNITIES in computing

MEDICAL INFORMATICS

LEARN
Computer Programming
Database Management
Medical Terminology
Pharmacology
Medical Coding

JOBS
Electronic Medical Records Specialist
Medical Records Security Officer
Medical Researching Professional
Health Records Administrator
Health Information Technician

MOBILE APPS

LEARN
Computer Programming
Web Development
Animation
Entertainment Design

JOBS
Pixel Programmer
Mobile Application Developer

COMPUTER MAPPING

LEARN
Computer Programming
Geo-databases and GIS Systems
Cartography

JOBS
GIS Technician
Cartographic Technician
Photogrammetrist
Computer Mapping Specialist
Weather Forecaster
Mapping Analyst

CYBER FORENSICS

LEARN
Computer Forensics
Networking and Operating Systems
Data Recovery

JOBS
Computer Forensic Technician
Security Technology
Data Recovery/Forensic Specialist
Computer Security Specialist

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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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