



CS 10K Project: Transforming High School Computing for a 21st Century Workforce

Jan Cuny
February 15, 2012



Computing is everywhere. It is transforming our lives.



With computing, we can dream big.



The Future of Computin:g <http://www.nytimes.com/indexes/2011/12/05/science/> 3

Computing is the new literacy.

... the ability to make digital technology do whatever, within the possible, one wants it to do -- to bend digital technology to one's needs, purposes, and will, just as [we now] ... bend words and images.

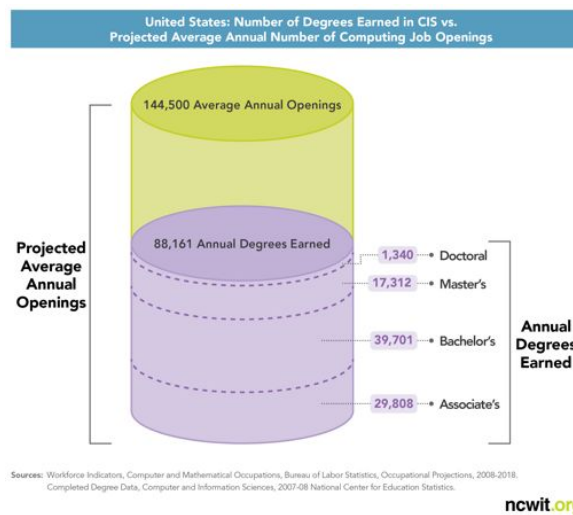
—Marc Prensky, Edutopia, 1/13/2008

We face three significant and interrelated challenges in maintaining a robust U.S. IT workforce.

1. Underproduction
2. Underrepresentation
3. Lack of a presence in K-12 education

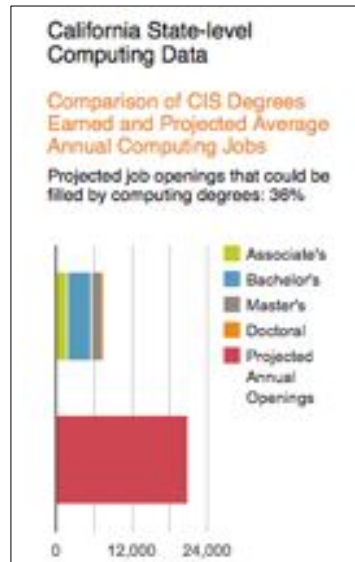
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We are significantly underproducing postsecondary computing degrees.



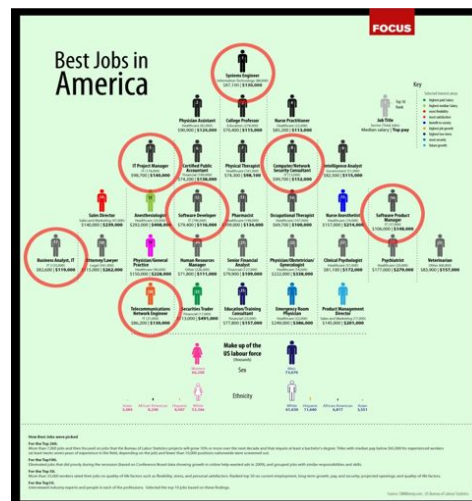
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California is expected to experience a shortfall.



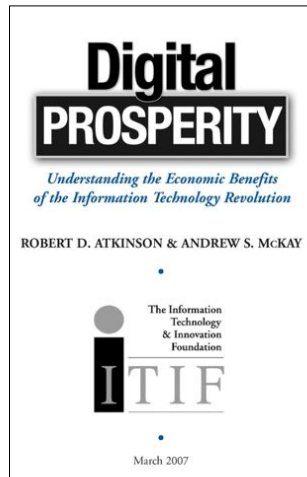
Data: BLS and NEC; Slide: NCWIT

And they're good jobs.



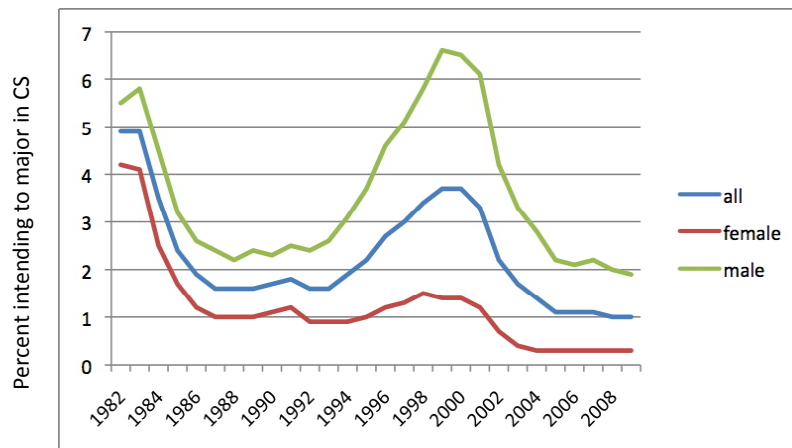
Slide: CNN Money

IT generates jobs.



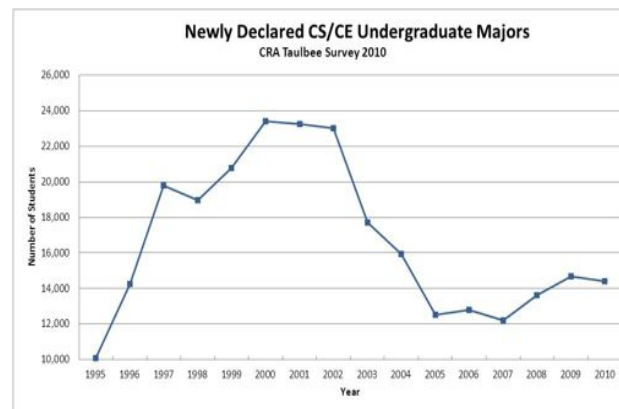
- US economy is \$2T larger because of the IT revolution since 1985
- IT is a job generator: IT jobs have grown 4x faster than non-IT jobs, and on average these jobs pay 75% more

Yet student interest in computing is very low.



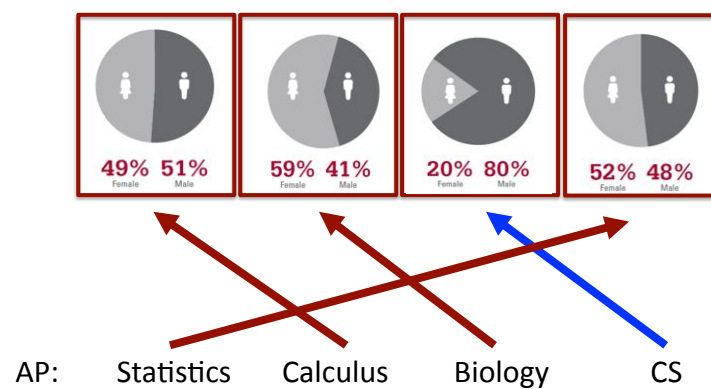
Data source: HERI, Slide: NCWIT

At the College level, we are seeing an increase in interest but it is not enough.



—Slide: CRA Taulbee Survey, 2010

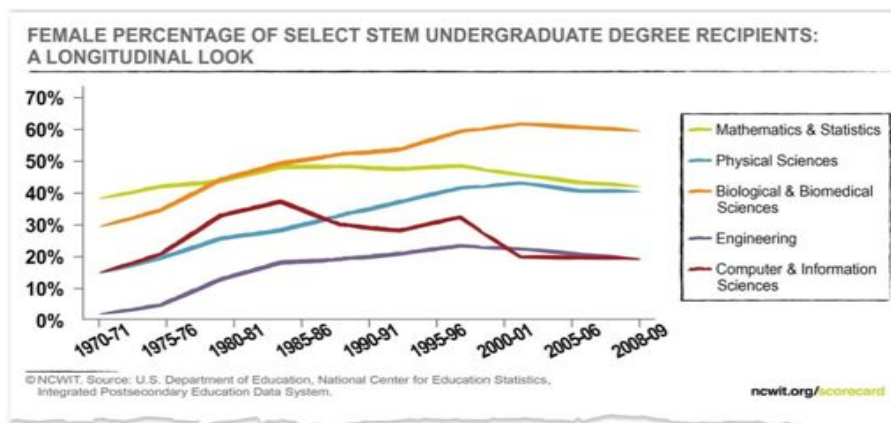
Computing has a long standing, significant underrepresentation of women.



—Credits: College Board

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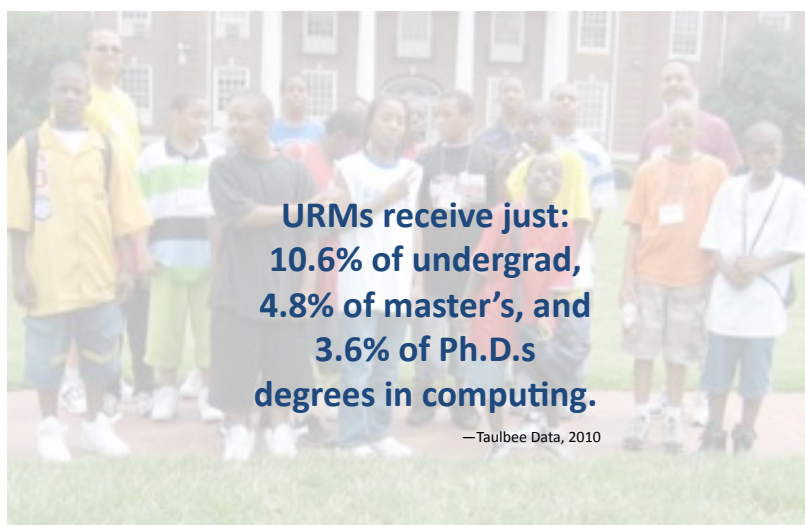
The underrepresentation of women in computing continues through college.



—Credits: NCWIT

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And computing has a long standing underrepresentation of minorities.



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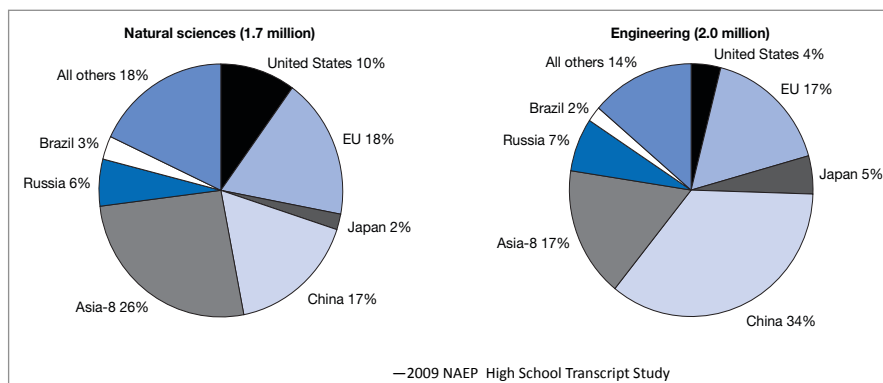
Computing does not have much of a presence in K-12.

The percentage of U.S. high school students taking STEM courses has increased over the last 20 years across all STEM disciplines *except* computer science where it dropped from 25% to 19%.

—2009 NAEP High School Transcript Study

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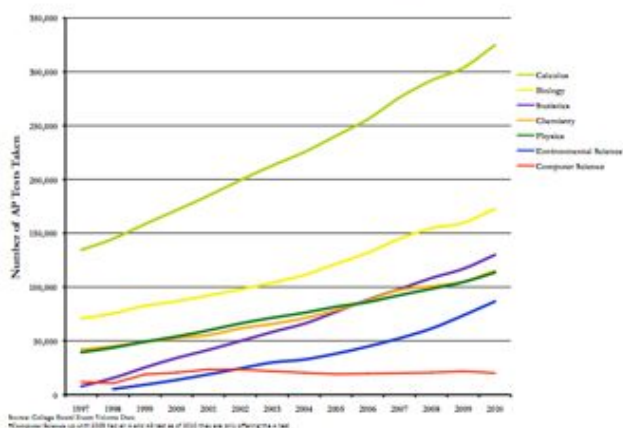
What are we thinking?



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The CS AP test has the lowest participation of any STEM discipline.

AP Test Taking in STEM, 1997-2010

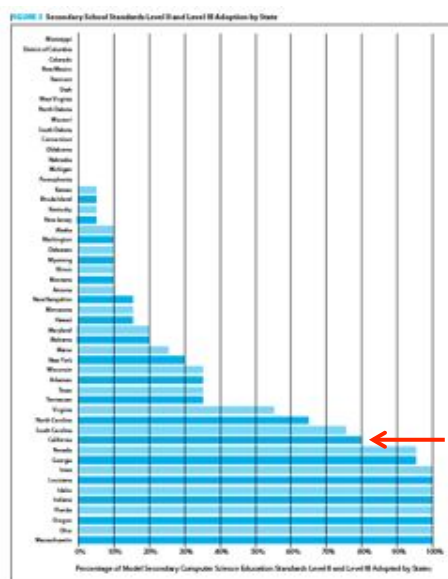


In 2010, Senior participation:
 340,551 AP Calculus
 250,003 AP Biology
 142,910 AP Statistics
 22,176 AP CS A

—College Board

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As a nation, we need to do better.



Source: CSTA, *Running on Empty*, 2011

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The President's Council of Advisors on Science and Technology believes the need for better computing education particularly in high schools is "urgent."

Computer-related courses should aim not just for ... a deeper understanding of the essential concepts, methods and wide-ranging applications of CS. Students should gain hands-on exposure to the process of algorithmic thinking and its realization in ... a computer program, to the use of computational techniques for real-world problem solving, and to ... pervasive computational themes as modeling and abstraction, modularity and reusability, computational efficiency, testing and debugging, and the management of complexity.

— *Prepare and Inspire: K-12 Education in Science, Technology, Engineering and Mathematics (STEM) for America's Future*, 2010

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High school is key.



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The **CS 10K Project** aims to transform computing in high school.



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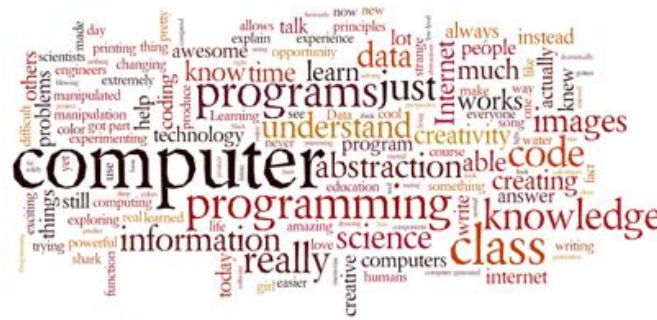
The CS 10K Project centers on a new CS AP course, called *CS Principles*.

Why AP?

- Often the only CS course that carries college prep credit
- Attractive to students & schools
- 2,000 CB-audited teachers
- Single point of national leverage
- Fidelity of replication

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CS Principles is focused on the fundamental concepts of computing; it is rigorous but engaging, accessible, and inspiring and focuses on problem-solving.



—Word cloud taken from a HS student blog about the course.

“Seriously, why doesn’t everybody take computer science??”

—CS Principles Student

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The computing community supports the development of the CS Principles course, and has moved it past milestones.

2009-2010

✓ Course framework

2010-11

- ✓ Pilot I: Five colleges

✓ College Survey

✓ College attestation/support

2011-12

Pilot II: ~20 colleges, ~40 high schools

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Many schools will want an introductory (preAP?) course such as Exploring Computer Science (ECS).

- Piloted ECS 2008/2009
- This school year in ~25 LAUSD schools
- 2000 students, 40% female, 81% URM
- Complete, detailed curriculum & lessons plans on CSTA site (csta.org)
- College prep & CTE credit
- Also San Jose, Oakland, Chicago



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ECS & CS Principles are taking the country by storm.



To be successful, we'll need lots beyond the teacher training.

- New CS Standards
- Changes in teacher certification
- Changes in the crediting of CS courses
- CSTA Chapters
- Pre- and in-service teacher professional development
- Ongoing teacher support: Coaching, mentoring, communities of practice

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NSF can catalyze the CS 10K Project but the project as a whole is outside of NSF's mission and resources.

NSF can support the development of

- Curricula, materials, models
- Standards & assessments
- Teacher preparation
- Pilots

Beyond NSF's mission and resources

- Scale teacher preparation to 10,000
- Entrée into 10,000 schools

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We'll need the entire computing community to get involved.

- High school teachers
- Academic departments at universities and community colleges
- Individuals: students, faculty, professionals
- Companies and Foundations

CCEAN



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CSWeek: Computing in the Core's comments on these issues are at the end of this piece.

CSWeek: Computing in the Core argues national frameworks for math and science

http://www.gwaps.org, gain random players to collect valuable information for training computer algorithms in a side effect of game play. Because the two players get points when their answers match, the accuracy and the fun increase with each game!'"/>

CS BITS & BYTES
National Science Foundation

in celebration of US Education Week 2011, NSF is rolling out CS Bits & Bytes, a one-page weekly newsletter for the classroom highlighting innovative computer science research. Sign up at: [www.nsf.gov/csbytes](#)

Human Computation

Did you know? When you sign up for an email account or buy tickets to a concert online, you may be having to decipher text from thousands across the world? In fact, people just like you helped to decipher 25 years of The New York Times in less than three months. Digitizing text allows computers to search all of the information in a written document, making it easier to find what you want.

MUST SEE!

You help out whenever you are asked by a website to decide more than one sequence of slightly distorted characters. **Human or computer?** One of the words is used as a security measure to make sure that a response is generated by a real person, rather than by automated software (people are good at detecting those things, computers are not). This practice is called CAPTCHA which stands for Completely Automated Public Turing test to tell Computers and Humans Apart. The other word is a reCAPTCHA and is an image of a word from text that automated software was unable to recognize. Lots of people design the reCAPTCHA and the word is translated by the wisdom of the crowd.

Making use of the wisdom of a crowd. Digitizing text is just one example of a problem that can be solved by harnessing the combined power of humans and computers that would be impossible for either to solve alone. This field of "Human Computation," often called "Crowdsourcing," was pioneered by Professor Luis von Ahn of Carnegie Mellon University. His work uses human skills and abilities in a novel way to solve larger scale computational problems.

In addition to creating reCAPTCHA, Professor van Ake has also developed a number of "Games With A Purpose" or "GWAPs". These captivating games, available at [http://www.gwaps.org](#), gain random players to collect valuable information for training computer algorithms in a side effect of game play. Because the two players get points when their answers match, the accuracy and the fun increase with each game!

The basic idea relies on the wisdom of a crowd: if multiple people agree on a solution, then that solution is probably correct. A popular example is the ESP Game ([http://www.gwaps.org/competition/esp/](#)), where players are shown the same image and must independently generate tags, tags that match become labels for the image. ESP Game players have generated millions of labels that help internet image search engines.

[www.nsf.gov/cise/csbytes/](#)

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by Vivian Stepp - 01.12.12
On December 5, 2011, I joined five other winners of the NCWIT Award for Aspirations in Computing at the White House, in an event honoring the Girls and Women... [more](#)

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Join other technical women at the 5th annual She's Geeky Unconference, Jan. 27-29 [more](#)

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Thanks!

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