Broadening Participation in Computing: It Starts before College

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The computing community in the U.S. faces three significant and interrelated challenges in workforce development.

• Underproduction of degrees
• Underrepresentation
• Lack of a presence in K-12
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Projected Annual Underproduction

United States: Number of Degrees Earned in CS vs. Projected Average Annual Number of Computing Job Openings

Projected Average Annual Openings

86,161 Annual Degrees Earned

22,808 Associate’s
28,791 Bachelor’s
36,701 Master’s
5,340 Doctoral
144,500 Average Annual Openings

CS & CE Majors

BS Total Enrollment - Avg. Majors per US CS Dept.

—CRA Taulbee Survey, 2011

% Intended CS majors

— Data source: HERI, Slide: NCWIT
• Underproduction of degrees
• Underrepresentation ➡️
• Lack of a presence in K-12

2010 AP Gender Gap

—College Board, 2010
Female % of STEM Undergrads

In 2010, underrepresented minorities

– Received just 10.6% of the bachelor degrees, 4.8% of the masters, and 3.6% of the PhDs.

– Only 49 of 1,620 Ph.D.s were awarded to African Americans or Hispanics.

—CRA Taulbee Survey, 2011
• Underproduction of degrees
• Underrepresentation
• Lack of a presence in K-12
  • No research base
  • Not taught in most schools

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

—2009 NAEP High School Transcript Study
High School Participation in AP STEM Disciplines

Seniors, in 2010:
- 194,784 took AP calculus
- 134,871 took AP biology
- 109,609 took AP statistics
- 14,517 took AP CS A

—Data: College Board, 2010 Slide: CSTA

Education issues in K-12 disproportionately affect students from the underrepresented groups.
Computing Education for the 21st Century

GOAL: Increase number and diversity of K-14 students and teachers who develop and practice computational competencies, so that students have the necessary interest and skills to pursue degrees in computing and computationally-intensive fields
High School is key.

Why High School?

- We need to do *much* better there
- Without the HS piece, anything we do for middle school will be lost.
- Without the HS piece, anything we do at the college level will be insufficient.
CS 10K Project

Develop effective new high school computing curricula and get that curricula into courses taught in 10,000 schools by 10,000 well-prepared teachers by 2015.

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
CS Principles

- Engaging, accessible, inspiring, rigorous
- Focused on the fundamental concepts of computing (Computational Thinking)

Timeline

2009-2010
- ✔ Course framework

2010-11
- ✔ Pilot I: Five colleges
- ✔ College Survey
- ✔ College attestation/support

2011-12
- – Pilot II: Official & Unofficial
Exploring Computer Science

- LAUSD, Jane Margolis
- Piloted ECS 08/09
- ~25 LAUSD schools 11/12
- 2000 students, 40% female, 81% URMs
- Spreading in CA, CCEAN
- Complete, detailed curriculum & lessons plans on CSTA site
- Collaboration with CENS
- “G” credit and CTE credit
- Also taught in San Jose & Oakland, Chicago

ECS & CS Principles Pilot Sites 2011-12
CS 10K Project

- Additional course curricula, materials, models
- Standards & assessments
- Teacher preparation $\times 10,000$
- Entrée into schools

Beyond NSF’s mission and resources
BPC Alliances (BPC-A)

• 13 Alliances
• Large regional or national collaborations that aim to decrease underrepresentation

Focus: students with disabilities

– individual students
– faculty members who need help in accommodating students
– departments in making more accessible and welcoming environments
– the computing community in building awareness
Focus: statewide (Massachusetts) transitions in K-20 pipeline.

CRA-W/CDC
Focus: research experiences and mentoring at university, graduate and research levels nationally.
Focus: providing resources and advocacy nationally
  – clearing house
  – resource center
  – a spokes group
  – convener
Thanks!

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