U.S. CS Education in 2018: How Google Sees the CS Environment

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Head of Computer Science Education Strategy
Agenda

- Why CS education
- History and key players
- Chris’s predictions
- Google’s CS Education efforts in 2018
“We need more people working on important technological problems... to make people’s lives better”

Larry Page, Google I/O 2013
Why computer science is critical

- Education must include a focus on the future. We need to prepare our students to design and build the tools the rest of the world will use and to solve critical problems.

- Computing power and knowledge is foundational to innovation and advancement in all areas of work and life.

- Countries around the globe are working to ensure that they are prepared for the new knowledge and innovation-driven economy.
Where the STEM jobs will be (projections 2012-2022)

- Computing & Mathematics
- Engineering
- Social Sciences
- Life Sciences
- Physical Sciences

Fragmented and isolated interventions need a holistic approach for implementation.

Sustainable Teacher Professional Development

Teacher Pipeline & Pre-service Teacher Preparation

Content and pedagogy for diverse student populations.

280,000 annual STEM job openings

- Replacement Jobs: 51%
- Newly Created Jobs: 67%

Replacement Jobs:
- 8%
- 7%
- 5%

Newly Created Jobs:
- 18%
- 4%
- 4%
- 7%
Job openings versus degrees (2012-2022)

Sources: Degree data are calculated from the National Science Foundation (NSF), Science and Engineering Indicators 2014, available at [http://www.nsf.gov/statistics/seind14/]. Annual jobs data are calculated from the U.S. Bureau of Labor Statistics (BLS), Employment Projections 2012-2022, available at [http://www.bls.gov/emp/]. STEM is defined here to include non-medical degrees and occupations.
A global focus on future skills

- Computing power and knowledge is foundational to innovation and advancement in all areas of work and life
- All industries/fields need these skills
- Countries around the globe are working to ensure that they are prepared for the new knowledge and innovation-driven economy
- Students need to be prepared to contribute to society in ways that support and improve the general good
Success is the result of many meaningful steps in the right direction
Quick trip through history

- 1993 ACM publishes the *Model High School Computer Science Curriculum*
- 1998 Alice IDE launched
- 1999 Advanced Placement CS moves from Pascal to C++
- 2000 ACM and ISTE launch first K-12 CS symposium
- 2003 ACM forms K-12 Computer Science Education Task Force, and
- 2003 Advanced Placement CS moves from C++ to Java
- 2003 ACM publishes the *ACM Model Curriculum for K-12 Computer Science* (revised in 2006)
- 2003 Margolis and Fisher publish *Unlocking the Clubhouse*
Quick trip through history cont...

- 2004 ACM forms the Computer Science Teachers Association
- 2004 CSTA grows CS&IT Symposium into annual conference
- 2006 Scratch IDE released
- 2006 CSTA launches regional chapters in US and Canada (currently >54)
- Margolis’ *Stuck in the Shallow End* published
- 2011 ACM and CSTA launch CS EdWeek
- 2011 CSTA publishes the *CSTA K-12 Computer Science Standards*
- 2013 Code.org launches with first Hour of Code
- Code.org and CSTA work to change CS education policy in 25 states
Issues being addressed

- Better programming tools for younger programmers
- Learning standards
- A new Advanced Placement course that is still rigorous but also more engaging for all students (launching in 2016-17 school year)
- More and better professional development for teachers
- Improved relationships between secondary and post-secondary educators
- Increased focus on diversity issues in computing
Looking to the future
Chris’ predictions

- Continued focus on the development of state-level standards and curricula
- CS will continue to be a high priority but we will start to see some push back
- More efforts will be made to get administrators on board
- Informal CS programs will continue to be needed but the target audience will shift to districts that are less advanced in formal CS education
- Growing realization of how difficult it is to implement a solid and sustainable CS program
- Push for more and better assessments
- More focus but continuing confusion around computational thinking
All of our work in CSA education is data-driven
Learnings from Google Gallup research

**What**
Two-year comprehensive landscape research surveying **awareness, perceptions, opportunities, and limitations** in CS education for K-12

**Who**
<table>
<thead>
<tr>
<th>Count</th>
<th>Role</th>
<th>Grade</th>
<th>Race</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,672</td>
<td>students</td>
<td>7-12</td>
<td>(228 Black, 310 Hispanic)</td>
</tr>
<tr>
<td>1,677</td>
<td>parents</td>
<td>7-12</td>
<td>(197 Black, 264 Hispanic)</td>
</tr>
<tr>
<td>1,008</td>
<td>teachers</td>
<td>1-12</td>
<td></td>
</tr>
<tr>
<td>9,805</td>
<td>principals</td>
<td>K-12</td>
<td></td>
</tr>
<tr>
<td>2,307</td>
<td>superintendents</td>
<td>K-12</td>
<td></td>
</tr>
<tr>
<td>16,469</td>
<td>total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Learnings from Google Gallup research

84% of parents say CS is at least as important as required classes like math, science, history, and English.

60% of administrators & teachers agree CS should be required when available.
Learnings from Google Gallup research

But access is not universal yet

40% principals report having CS classes with programming/coding, increasing from 25% in Year 1
Learnings from Google Gallup research

BLACK & HISPANIC students are 1.5x & 1.7x more likely than White students to be very interested in learning CS.

Yet...

BLACK students have less access to CS classes in school.
BLACK & HISPANIC students have less exposure to computers.
Learnings from Google Gallup research

Boys receive more encouragement than girls

1.5x likely to be told by teacher they would be good at CS
1.7x likely to be told by parent they would be good at CS
2x likely to see someone like them doing CS in the media

GIRLS less aware of CS opportunities on the Internet and in the community
&
BOYS more likely to have learned CS and to learn on their own
Learnings from Google Gallup research

less than

3 in 10 parents have expressed support for CS to school officials
### Lack of trained teachers, testing requirements, low demand

<table>
<thead>
<tr>
<th>Category</th>
<th>Issue</th>
<th>Percentage (Principals)</th>
<th>Percentage (Superintendents)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teachers</strong></td>
<td>There are no teachers available at my school/in my district with the necessary skills to teach computer science.</td>
<td>63%</td>
<td>74%</td>
</tr>
<tr>
<td></td>
<td>There is not enough money to train or hire a teacher.</td>
<td>55%</td>
<td>57%</td>
</tr>
<tr>
<td></td>
<td>There are no teachers available to hire with the necessary skills to teach computer science.</td>
<td>13%</td>
<td>33%</td>
</tr>
<tr>
<td></td>
<td>We have to devote most of our time to other courses related to testing requirements, and CS is not one of them.</td>
<td>50%</td>
<td>55%</td>
</tr>
<tr>
<td></td>
<td>There are too many other courses that students have to take in order to prepare for college.</td>
<td>25%</td>
<td>36%</td>
</tr>
<tr>
<td></td>
<td>There is not enough demand from parents.</td>
<td>44%</td>
<td>48%</td>
</tr>
<tr>
<td></td>
<td>There is not enough demand from students.</td>
<td>41%</td>
<td>48%</td>
</tr>
<tr>
<td><strong>Curriculum</strong></td>
<td>We do not have sufficient budget to purchase the necessary computer software.</td>
<td>41%</td>
<td>51%</td>
</tr>
<tr>
<td><strong>Demand</strong></td>
<td>We do not have sufficient budget to purchase the necessary computer equipment.</td>
<td>32%</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>We do not have the necessary computer software.</td>
<td>32%</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>We do not have the necessary computer equipment.</td>
<td>31%</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>There is not enough classroom space.</td>
<td>20%</td>
<td>28%</td>
</tr>
<tr>
<td><strong>Technology &amp; resources</strong></td>
<td>Internet connectivity is poor at my school/in my district.</td>
<td>9%</td>
<td>14%</td>
</tr>
</tbody>
</table>
Google’s CS work in 2018
What Google brings to the table

- A global brand
  - We can use our power for good
- A leading technical employer
  - We can identify current and future workforce needs
- Outstanding computer scientists
  - We can draw upon collective knowledge and strengths
- A real commitment to diversity
  - We are making a real effort to walk the talk
Google’s goals for CS education

- Creating opportunities for all students
- Building equity of access
- Growing the potential workforce
- Advancing the global economy

Being a good partner
Key elements we’ve identified

- Sustainable Teacher Professional Development
- Standards-based Assessment & Teaching Resources
- Content and pedagogy for diverse student populations
- Teacher Pipeline & Pre-service Teacher Preparation
Questions we ask ourselves

- What needs to be done (and isn’t already being done or should be done better)?
- What is being done but is under-resourced?
- What are we good at?
- What resources can we commit?
- Where do we have credibility?
- When will the new DOE funding begin impacting CS in schools
Critical challenges we see

- Lack of access to rigorous computer science education
- Profound and complex issue of underrepresentation
- Confusion about what computer science is and is not
- A lack of relevant, high-quality, innovative professional development
- A system obsessed with high-stakes testing
- Dysfunctional teacher preparation and certification systems
- Poorly paid teachers who are not treated as professionals
- Administrators who have many more pressing concerns and may not be as informed/supportive as we would like
What we are working on right now

- Sustainable professional development: CS4HS, CT MOOC for Teachers
- Content and pedagogy for diverse audiences: CS First, Applied Digital Skills, EngageCSEDU, Applied Computer Science
- *Teacher pipeline: conference sponsorship
- *Pre-service teacher education: funded research
- Student pipeline: Careers with Code, IgniteCS, Technical Development Guide
- Improving CS teaching and learning: CS Capacity, conference sponsorship
- CS image/representation: CS in Media

* Means watch this space
What I would like Google to do more of

- Improving understanding of how students learn CS
- Capacity and community building
- Educator leadership development
- Convening critical conversations
- Addressing the deprofessionalisation of teaching and teachers
- Supporting the development of young faculty
How can we best help you?
thank you!

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