Why a new Computer Science Supplementary Authorization?

Commission on Teacher Credentialing
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Why CS is a Story

- Most of the STEM jobs in the next ten years will be in computer science
- Fewer than half the people we need for these jobs are in the pipeline
- A fundamental knowledge of computing is critical for today's youth in a world where computers are ubiquitous
- Parents and administrators often think kids are learning computer science in schools when they are not
- We are often teaching basic "literacy" while students in the rest of the world are ready for the future

http://csta.acm.org/Communications/sub/Reports.html
What is Computer Science?

“Computer Science (CS) is the study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society.”

- CS is not Educational Technology, Computing/Digital Literacy, Information [& Communication] Technology (IT or ICT), nor is it simply coding/programming

- CS builds students’ computational and critical thinking skills, which enables them to create—not simply use—the next generation of computing technology innovations

- CS provides fundamental knowledge needed to prepare students for the 21st Century and equips them with lifelong skills they can use in a wide variety of fields of study and occupations
Variety of “computing-related” courses taught in California:

- 2453 Computer Science
- 2454 Computer lab
- 2455 Web design
- 2458 Other Computer Education
- 2470 AP Computer Science A
- 2471 AP Computer Science AB
- 4603 Business & electronics communications
- 4604 Networking
- 4605 Web site development
- 4606 Graphics and media technology
- 4615 Information processing
- 4618 Telecommunications
- 4633 Information systems management
- 4649 Other information technology

“I teach knowledge and skills for…”

<table>
<thead>
<tr>
<th>Category</th>
<th>Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>“ Users of Technology”</td>
<td>87.8%</td>
</tr>
<tr>
<td>“ Enablers of Technology”</td>
<td>39.0%</td>
</tr>
<tr>
<td>“ Creators of Technology”</td>
<td>33.1%</td>
</tr>
</tbody>
</table>

December 2012 CDE Survey of 187 teachers of “computing-related” courses, by Gary Page, CDE

NOTE: Some teachers teach more than one course, taught to different knowledge and skills.
Teacher Preparation through Supplementary Authorizations

**Computer Concepts & Applications Supplementary Authorization**
- Software evaluation and selection
- Hardware operation and functions
- Classroom uses of computers

Focus is on how to **use** computers as tools or **enable** other users
Introduces little more, if any, than the technology requirement in all of today’s teaching credentials

**Proposed Computer Science Supplementary Authorization**
- Programming
- Data structure and algorithms
- Computer hardware and organization
- Software design
- Impacts of computing

Focus is on how to **create** new applications or technology
Modeled after CSTA and ISTE curriculum recommendations for K-12 Computer Science
We consider it critical that students be able to read and write and understand the fundamentals of math, biology, chemistry, physics.

To be well-educated citizens in today’s computing-intensive world, students must also have a deeper understanding of computing fundamentals.

CSTA standards represent the body of knowledge for the CS discipline as it applies to K-12.

Standards shape expectations for teacher preparation and authorization.

http://csta.acm.org/curriculum/sub/K12Standards.html
Learning Outcomes organized by Strands

- Computational Thinking
- Community, Global, and Ethical Impacts
- Collaboration
- Computers and Communication Devices
- Computing Practice
Standards Organized by Levels

Mapping between CSTA standards and:
- STEM Cluster Topics
- Common Core State Standards
- Partnership for 21st Century Skills
- Next Generation Science Standards (underway)
1M more CS jobs than students by 2020

$500 billion opportunity

1.4 million computing jobs

400,000 computer science students

Infographic Source: Code.org
1.4 million computing jobs in the U.S. between 2010 and 2020 – more than all other STEM fields combined

CA Employment Projections

49% of all STEM jobs in California will be in computing by 2018

Source: “Help Wanted: Projections of Jobs and Education Requirements through 2018” Georgetown Center on Education and the Workforce

CURRENT DATA:
80,807 open computing jobs (as of 2/15)
growing at 4.1x the state average
5,127 computer science graduates (2014)

Completed Degree Data, Computer and Information Sciences, 2012-2013 National Center for Education Statistics.
Exposure to Computer Science in HS Matters

- Students who take high school computer science are 8 times more likely to major in CS in college
- Google employee survey found that:
  - 98% of the college CS majors reported exposure to CS prior to college, (45% of non-CS majors)
  - CS majors were more likely than non-majors to have had a CS class in high school
  - CS majors were more likely to have known that CS was a possible career path when they were in high school

California needs quality K-12 CS education to fill the state’s employment gap and to address the digital divide
I made some edits to this slide, Julie, to reduce the text. I hope you don't mind. Please ignore them if you prefer what was there before.

Baxter, Diane, 9/17/2014
Access to CS Courses Has Fallen

Enrollment (+15%)

Teacher Assignments (-51%)

Source: Dataquest, California Department of Education
California has one of the lowest AP CS participation rates in the United States.
Only 13% of Schools Offer AP CSA
All California High Schools (2013-14)

<table>
<thead>
<tr>
<th></th>
<th>Schools</th>
<th>Teachers</th>
<th>Test Takers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td>175 (13%)</td>
<td>184</td>
<td>3980</td>
</tr>
<tr>
<td>Private</td>
<td>54</td>
<td>62</td>
<td>984</td>
</tr>
<tr>
<td>Total</td>
<td>229</td>
<td>246</td>
<td>4964</td>
</tr>
</tbody>
</table>

Source: The College Board
56% of Schools Offer No CS Course
California Public High Schools (2013-14)

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Schools</th>
<th>Teachers</th>
<th>Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP &amp; IB Comp. Science</td>
<td>121 (9%)</td>
<td>122</td>
<td>177</td>
</tr>
<tr>
<td>Comp. Science</td>
<td>148 (11%)</td>
<td>177</td>
<td>404</td>
</tr>
<tr>
<td>Comp. Programming</td>
<td>122 (9%)</td>
<td>144</td>
<td>261</td>
</tr>
<tr>
<td>Comp. Op. / CS</td>
<td>328 (25%)</td>
<td>431</td>
<td>1015</td>
</tr>
<tr>
<td>One or more of the above courses</td>
<td>581 (44%)</td>
<td>780</td>
<td>1857</td>
</tr>
</tbody>
</table>

Source: CBEDS database
# California Course Adoption

<table>
<thead>
<tr>
<th>UCOP Approved Course</th>
<th>2012-13</th>
<th>2013-14</th>
<th>2014-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP Computer Science</td>
<td>281</td>
<td>349</td>
<td>376</td>
</tr>
<tr>
<td>IB Computer Science</td>
<td>11</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>CS:Principles</td>
<td>1</td>
<td>3</td>
<td>32</td>
</tr>
<tr>
<td>Exploring CS</td>
<td>55</td>
<td>67</td>
<td>75</td>
</tr>
<tr>
<td>Other CS</td>
<td>173</td>
<td>188</td>
<td>194</td>
</tr>
<tr>
<td>Computer Programming</td>
<td>191</td>
<td>191</td>
<td>207</td>
</tr>
</tbody>
</table>

**Totals:** 712 810 895

Source: UCOP Approved Course List (updated: 8/25/2014)
New Computer Science Courses

Both designed to fill the gap in courses leading to AP CS and committed to democratizing computer science by increasing learning opportunities at the high school level for all students, with a specific focus on under-represented students.
The NSF CS10K Project:
10,000 computer science teachers in 10,000 schools

Exploring Computer Science
An inquiry-based introduction to the breadth of CS. Designed to appeal to all students, with special attention to women and students of color.

California: UCOP “g” credit and CTE approved. Program Status may be possible through UC Davis Center for C-STEM Center.

Computer Science Principles

The College Board will offer a new AP test for CSP in 2016-17.

http://cs10kcommunity.org
New Computer Science Courses

Exploring Computer Science
Introductory College Prep & CTE
- Curricular Units:
  - Problem Solving
  - Human Computer Interaction
  - Web Development
  - Introduction to Programming
  - Data Analysis
  - Robotics
- prepares students to take
  - CS Principles as well as Web Design, Graphics, Robotics, Game Design, Data Science, …

Computer Science: Principles
New AP course organized around 7 BIG IDEAS:
- Computing is a creative activity
- Abstraction reduces information and detail to facilitate focus on relevant concepts
- Data and information facilitate the creation of knowledge
- Algorithms are used to develop and express solutions to computational problems
- Programming enables problem solving, human expression, and creation of knowledge
- The Internet pervades modern computing
- Computing has global impacts

www.exploringcs.org  www.csprinciples.org
ECS Curriculum Mappings by SRI Education

- CA state learning standards
- Common Core
- CA CTE standards
- CSTA standards
- ISTE/NETS standards
- ... and working on NGSS

SRI is also developing assessment instruments

pact.sri.com
ECS Expansion in California

SoCal (UCLA, LAUSD+OC)  Northern California (SCU)
CSP Expansion in California

NSF Pilots in California

COMPASS - San Diego
Support for Computer Science
Supplementary Authorization

- CSLNet: It is urgent that California build capacity within K-12 schools to expand CS education and this must include strengthening and expanding the computer science teaching workforce. We support the proposed modifications to the Supplementary Authorization as an important step in that direction and urge the CTC to approve the recommendations.

- Sweetwater UHSD: Our schools are committed to expanding opportunity for all our students. Providing kids with quality learning experiences in CS is central to that mission. We will not succeed unless SA in that field is examined and significantly revised at the State level.

- TechNet: Addressing the gap between skilled computer science graduates and growing computer science job opportunities begins with our education system and action on appropriate policy.

- UC Riverside: As an approved provider of the current SA in CC&A, UCR looks forward to the opportunity to comply with future regulatory changes that would follow approval ... We are in full support of the proposed revisions which reflect an updated and relevant curriculum with a focus on broader preparation inclusive of full K-12 CS education.

- Code.org: The biggest barrier to meaningful expansion of computer science in K12 is a lack of qualified teachers. To address the gap, Code.org is partnering with 60+ school districts across the country, training inservice teachers to become computer science teachers. We are investing substantial resources to partner with a number of California districts...