Addressing Key Concerns in K-12 Computer Science Education

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Agenda

• Identifying the Issues that Affect K-12 and College/University

• Key Concerns: AP CS, NCLB, and Teacher Certification

• CSTA: Mission and Objectives

• CSTA Resources and Solutions

• Working Together
Why We’re in Trouble as a Discipline

- Computer science teachers feel isolated within their schools and districts
- Administrators do not understand that computing is a scientific discipline just like physics and biology (Texas example)
- There is no consistency in computing curriculum requirements from state-to-state, district-to-district, or even in some cases, school-to-school
- There is no consistency in teacher certification requirements from state-to-state
- Computing teachers do not receive the professional development they need to keep their teaching and technical skills current
- There is a disconnect between K-12 CS educators and their college/university colleagues
- Administrators, legislators, and congressional committees do not understand the link between supporting K-12 computer science education and economic/workplace issues (the national discourse example)
Why Enrollment Is Dropping

- Students and their parents do not understand the incredible scope of educational and career opportunities that computing provides.

- Students want to be part of a discipline that is solving real problems, and they do not understand that computing is at the root of all of the new sciences.

- Students’ schedules as so jammed packed that they do not have time to take elective courses.

- The emphasis on standardized testing in core areas is pulling emphasis, funding, and good teachers away from computer science.
Student Misconceptions

• By the time students come to college, their ideas about computing are already well-formed and here is what far too many have decided:
  – There are no jobs in computer science because they are being outsourced
  – Computer science is about sitting in a cubicle and writing code for 18 hours
  – Computer science is a male field
  – Computer science has nothing to do with solving real-world problems
  – Computer science is about designing computing games
  – Computer scientists have no life
  – Computer science is too hard
The Life of a High School CS Teacher

• Class sizes
• The number of teaching periods per day
• Requirement to teach students of vastly different learning levels in a single class
• Requirement to teach all students, not just those who like or are good at computer science
• Feeling like the only CS teacher in the world
• The battle for respect
• The battle for funding
• Playing politics
AP Computer Science Exams

Number of A and AB Exams Written, 2001–2005

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AP Test Takers By Gender

- Male: 85%
- Female: 15%
AP Test Takers by Race/Ethnicity

- White
- Asian American
- Hispanic
- African American
- First Nations
- Not Stated
- Other
The Truth About AP

• The College Board determines the content of the AP exam based upon surveys of universities and colleges
• When demand, applications, and enrollments were high, the APCS exam served as a convenient gate keeper
• While other AP exams represent exemplary high school courses, the AP CS exam is equivalent to a second year data structures course
• While other disciplines are able to scaffold knowledge and skills with multiple courses throughout K-12, the AP CS course is often the only CS course students can take
The Impact of NCLB

• This year, the No Child Left Behind legislation was implemented in high schools

• Under this legislation, federal funding is withdrawn from schools where students fail to reach specified performance levels on standardized tests in math and reading

• The result:
  – Non-core courses are being cancelled
  – Funds are being withdrawn from other programs
  – CS teachers are being pulled out of their classrooms to teach remedial mathematics (the Los Angeles example)
The Teacher Certification Mess

• CSTA research indicates that:
  – Certification requirements vary enormously from state to state
  – Many states require CS teachers to hold multiple certifications with CS as a secondary to some other discipline
  – Some states require CS teachers to take and pass praxis exams in other disciplines (math, business, vocational technology)
  – Teachers are ill-informed as to the requirements in their own state
  – Many DOE people responsible for certification are ill-informed as to the requirements in their own state (primarily because they do not know what computer science is)
  – In some states where there are clearly-stated requirements, there is no way for them to be met (the Florida example)
PA Snippets

• Any teacher with a mathematics or business endorsement can teach computer science at any educational level (elementary, middle, and secondary)

• In the 2005-2006 school year the College Board had 149 high school teachers listed as teaching AP CS (both A and AB) and 108 teaching AP CS A only

• CSTA has 281 high school CS members in PA, indicating that there are also a significant number who teach a non-AP CS course in high school
What Is CSTA’s Mission?

The Computer Science Teachers Association is a membership organization that supports and promotes the teaching of computer science and other computing disciplines. CSTA provides opportunities for K-12 teachers and students to better understand the computing disciplines and to more successfully prepare themselves to teach and learn.
CSTA’s Goals and Objectives

Creating a community of individuals and organizations working together to address critical issues in K-12 computer science education.

• **Promote a Better Understanding of Computer Science**: Provide visibility, influence policy, and generate resources that illuminate computer science as an essential academic discipline.

• **Develop Research and Resources**: Conduct original research and serve as a direct-to-practitioner channel for the dissemination of research and resources that addresses current knowledge gaps.

• **Support National Standards**: Facilitate the implementation of national curriculum and teacher certification standards to support consistent excellence in learning and teaching.

• **Support Teacher Excellence**: Provide multiple levels of professional development to improve teachers’ technical knowledge and pedagogical skills.

• **Opportunities**: Promote computer science as a field of study and as a career destination that provides a wealth of opportunities to students regardless of their gender, race, or socio-economic status.
CSTA Curriculum Solutions

• **The ACM Model Curriculum for K-12 Computer Science**
  
  [Link](http://csta.acm.org/Curriculum/sub/ACMK12CSModel.html)

• Online resource materials to support the ACM Model Curriculum: The Outlines and Objectives Documents
  
  [Link](http://csta.acm.org/Curriculum/sub/ACMK12CSModel.html)

• **The New Educational Imperative: Improving High School Computer Science Education**: a comprehensive white paper bringing together U.S. and international research to provide practical solutions for achieving long-term systemic improvement
  
  [Link](http://csta.acm.org/Publications/Publications.html#dbottom)
CSTA Teacher Preparation Solutions

• JETT: Java Engagement for Teacher Training workshops offered in partnership with colleges and universities across the country (53 workshops for 650 teachers held to date)
  http://jett.acm.org/

• TECS: Teacher Engagement for Computer Science introductory CS workshops offered in partnership with colleges and universities across the country (11 workshops for 200 teachers held to date)
  http://tecs.acm.org/

• The annual Computer Science and Information Technology Symposium (professional development for over 700 teachers across the country). 8th CSIT Symposium: June 28th in Atlanta
CSTA Resources & Information

- The Teacher Certification database: a state-by-state list of computer science teacher certification requirements and contacts (now under construction)

- The CSTA web repository: A national repository of resources and learning materials (now under construction)
  
  http://csta.acm.org/Resources/sub/WebRepository.html

- National research initiatives providing cutting edge data on the state of K-12 computer science education
  
Resource & Information cont.

• Careers in Computing Poster (for high school and middle school classrooms): in partnership with ACM-W and ASCA
  http://csta.acm.org/Careers/Careers.html

• Careers in Computing Lesson Plan
  http://csta.acm.org/Careers/Careers.html

• The ACM Computing Degrees and Careers brochure and website
  http://computingcareers.acm.org
Resource & Information cont.

• The CSTA *Voice*: a quarterly newsletter focusing on key issues and resources for computer science educators
  
  [http://csta.acm.org/Publications/Publications.html#ptop](http://csta.acm.org/Publications/Publications.html#ptop)

• CSTA *Advocate*: a blog for discussion of key organizational issues and programs
  
  [http://blog.acm.org/csta/](http://blog.acm.org/csta/)

• CSTA Information brochure for policy-makers
  
  [http://csta.acm.org/About/sub/AdvocacyOutreach.html](http://csta.acm.org/About/sub/AdvocacyOutreach.html)
Why We Need to Work Together

• The pipeline issues begin long before they get to your doors
• Improvements to K-12 computing education will improve student preparation for college and university
• Most of us are not doing a good job of addressing equity issues in our discipline
• Improved communication channels means everyone is better informed
• K-12 teachers need you to understand their issues
• K-12 teachers need your support to keep their knowledge and skills current
• Your research can inform our work
• Our research can give you a better understanding of K-12 computer science
• There is more than enough work to do
Ways to Work Together

• Become an individual member

• **Have your department become an institutional member**

• Work on a CSTA volunteer committee (curriculum, equity, professional development, publications, policy, standards and certification)

• Host a JETT or a TECS workshop

• Offer to present at a CSTA event
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