The Political Landscape: Advocating for Computer Science

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Pilgrims in the Flat Land

• Impact of Globalization and IT
  – Globalization means access to world-wide talent
  – IT enables efficient knowledge exchange at high speed

• Policy maker focus: Attracting jobs in the new flat land
  – States now have to compete against the global talent pool for jobs
  – Developing 21st Century workforce skills through education

• Major reports have argued countries need to depend on an innovation-focused workforce to succeed:
  – National Academies’ Rising Above the Gathering Storm
  – ACM’s Job Migration Task Force

CCSC-MW Conference
Policy Response: Strengthen STEM Ed.

- Rare wave of bipartisanship on education:
  - Republicans and Democrats celebrate passage of America COMPETES Act
  - Improving Science, Technology, Engineering and Mathematics (STEM) education has been a plank in all the major Presidential candidates

“Keeping America's brainpower advantage is the single best way in a global economy to keep good jobs from going overseas to China, India and other fast growing countries. Congress will enact no more significant piece of legislation this year.” (Senator Lamar Alexander R-TN)
How and whether CS fits into STEM isn’t always clear, particularly in the K-12 system

Points of confusion:
- Organization of how CS fits into curriculum
  - Can be a technology, math, or even business credit depending on the school
How CS Fits Into the Curriculum

Source: 2007 Computer Science Teachers Association National Secondary Computer Science Education Survey

- Elective: 43%
- CS: 24%
- Business: 19%
- Math: 9%
- Other: 6%
STEM Ed. & Computer Science

• How and whether CS fits into STEM isn’t always clear, particularly in the k-12 system

• Points of confusion:
  – Organization of how CS fits into curriculum
    • Can be a math, technology, science or even business credit depending on the school
  – Technology literacy vs. fluency vs. computer science

• Federal policy (such as the No Child Left Behind Act) seeks clear organization, which has unanticipated impacts on CS ed.
CS’s Role on the Frontier

- CS is a critical driver of Information, Technology and Communications sectors that are vital to economic growth
Information, Technology and Communications (ITC) Industries Contribution to the US Economy:

ITC's Percentage of Total Gross Domestic Product (GDP) and GDP Growth

"Although the ICT sector represents a small share of the overall U.S. economy (about 4 percent), it has contributed significantly to U.S. economic expansion. According to the Department of Commerce's Bureau of Economic Analysis (BEA), the ICT sector accounted for about 11 percent of total economywide value-added growth in 2004."


Source: Bureau of Economic Analysis Data
CS’s Role on the Frontier

• CS is a critical driver of Information, Technology and Communications sectors that are vital to economic growth

• CS develops skills sets -- critical thinking and analysis, creativity, design, and segmentation of complex problems -- that not only drive innovation but fuel the ITC engine and other parts of economic growth

• Filling the pipeline with talent is critical to addressing the workforce challenge
The Future Workforce -- The College Pipeline:

Computer Science (CS) and Computer Engineering (CE) Degree Production & New Majors

Source:Compiled from the Computing Research Association annual Taubee Survey of Ph.D. Granting Computer Science and Computer Engineering schools
The Future Workforce -- The High School Pipeline:

AP Mathematics and Science Exams 1997-2007

Number of AP Tests Taken

- Calculus
- Biology
- Statistics
- Chemistry
- Physics
- Environmental Science
- Computer Science

Source: College Board Exam Volume Data
Female Participation in AP Science Tests

1997 and 2007 Participation Rates

- Total AP Tests
- Biology
- Environmental Science
- Statistics
- Chemistry
- Calculus
- Physics
- Computer Science

1997 Female Participation Rate
2007 Female Participation Rate

Complex and Dynamic Policy Environment

- Decision making is widespread:
  - ~14,000 school districts, +97,000 secondary and elementary schools
  - 50 Governors (plus DC and territories)
  - 50 Chief State School Officers
  - 50 state legislatures
  - Federal policy makers
    - House and Senate Education Committees
    - House and Senate Science Committees
    - Various Federal Agencies (Department of Education and the National Science Foundation)
    - Diversity of Federal laws governing education
  - Numerous private education organizations with differing missions, agendas, ideologies
Complex and Dynamic Policy Environment

• Rough distribution of power:
  – Federal Government: learning standards
  – States and locals: state testing standards to meet broad learning standards, curriculum and graduation requirements, certification requirements for teachers

• Makes it challenging to decide where to target advocacy and education
NCLB & STEM

• Basic No Child Left Behind requirements
  – Testing of Math, Reading and Science
  – States measure schools’ “adequately yearly progress” in Math and Reading
  – “highly qualified teachers” teaching core courses

• Other NCLB Provisions:
  – Math, Science Partnerships -- focused improving teaching through development, curriculum and pedagogy research
  – Technology Education:
    • Grants to states and local districts to use technology in the classroom
    • Requires all students be “technology literate” by 8th grade
NCLB, STEM & CS

- NCLB has three practical impacts on Computer Science
  - Focus of core course and testing requirements means that electives, like CS, are starved for resources
  - Focus on technology literacy confuses the role of computer science education and what critical thinking skills students are taught
  - Because of CS’s disparate organization, it isn’t clear that teachers actually qualify to programs like Math, Science Partnerships.
Policy Agenda for The Computing Community

- ACM’s Education Policy Committee:
  - Formed in 2007 to give the computing community a voice in public policy debates about STEM education

Membership:
- Robert Schnabel, Chair, Indiana University
- Fred Chang, University of Texas
- Joanna Goode, University of Oregon
- J Strother Moore, University of Texas
- Mark Stehlik, Carnegie Mellon University
- Chris Stephenson, Computer Science Teachers Association
- Eugene Spafford, ex officio, Purdue University (Chair of ACM's US Public Policy Committee)
- John White, ex officio, Chief Executive Officer, Association for Computing Machinery

CCSC-MW Conference
EPC’s Mission

- At the K-12 level, educating decision makers that computer science curriculum is focused on conceptual knowledge such as algorithmic thinking

- At the K-12 level, ensuring that rigorous computer science classes count toward a student’s core graduation requirements in math or science areas

- Improving opportunities for computer science teacher professional development within federal and state programs

- Ensuring that federal education research programs have an appropriate focus on computer science

- Strengthening Science, Technology, Engineering and Mathematics (STEM) education and ensuring computing is part of these discussions

- Advocating for programs to improve the current diversity of the computing workforce
EPC’s Engagement

- **Goal -- rigorous CS should count!**
  - ACM EPC is lobbying the National Council of Teachers of Mathematics to endorse the position that rigorous computer science (level 3/4) should be considered and counted as legitimate math credit in all high school curriculum.
  - Achieve, Inc. endorsed having AP Computer Science count as a “capstone” course for mathematics credit

- **Goal -- ensuring representation in professional development and research**
  - Recognition of discipline in National Science Board Report on improving STEM education
  - Pushing NSF education research toward accepting more proposals from the computing community

- **Goal -- improve equity programs**
  - COMPETES contains a provision that allows NSF to continue funding successful equity programs
On the Horizon

- Continuing Outreach:
  - Policy Makers
  - Agencies
  - Groups and Businesses
  - Community
- Workshop bringing together top schools computing and education schools focused on improving k-12 computer science education research
- Framing a Federal legislative response to address these issues
- Engaging in states where we can make a difference
- Educating the community about the issues and resources that may be available to them to improve CS education
What College Faculty Can Do

- Learn how to advocate effectively for K-12 computer science:
  - Reach out to key education stakeholders who need to understand how computer science contributes to student achievement and choice (principals, district superintendents, dept. of education staff)
  - Reach out to key political stakeholders who need to understand how computer science contributes to the local economy
  - Find every possible opportunity to reach out to and mentor K-12 teachers
  - Build/collect a repository of resources that make the case for computer science
  - Join/partner with a national organization that promotes and supports K-12 computer science (such as CSTA)
  - Form/join local groups (such as CSTA chapters) that will help identify state and local issues and address local needs and concerns
Conclusion

• Without considering computer science in K-12, you can’t develop a policy response to the 21st Century economic challenges
Where the Jobs Will Be:

Conclusion

• Without considering CS, you can’t develop a policy response to the 21st Century economic race

• Face tremendous challenges in educating policy makers and outside organizations about the nature and appropriate role for computer science

• Need continued engagement by our community:
  – societies
  – IT companies that depend on an innovative workforce,
  – teachers that are on the ground
  – parents that care about ensuring children are ready to compete in the 21st Century