CSTA Computer Science Education
Advocacy Toolkit

Introduction

The materials in this toolkit are based on the *ISTE Advocacy Toolkit—Making the Case for Educational Technology* which can be viewed at the ISTE website: http://www.iste.org These materials should serve as a guide only and be modified as appropriate to support individual state and local advocacy efforts.

Acknowledgements

CSTA would like to thank the members of the planning committee for the first CSTA Leadership Cohort Workshop for drafting the materials.

Debbie Carter
Bergen Community College

Jill Kaminski
Chaparral High School

Kathy Larson
Marist College

Ann Shen
The Bishop Strachan School

Don Slater
Carnegie Mellon University

Fran Trees
Drew University

We would also like to thank the members of the planning committee for the second CSTA Leadership Cohort Workshop for reviewing and revising the materials.

Renee Ciezki
Ironwood High School

John Harrison
Princess Anne High School

Stephanie Hoeppner
Clermont Northeastern High School

Deepa Muralidhar
Northview High School

Computer Science Teachers Association
Association for Computing Machinery
2 Penn Plaza, Suite 701
New York, New York 10121
csta.acm.org

This material is based upon work supported by the National Science Foundation under Grant No. DRL-0733379. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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Making the Case for Computer Science to Computer Science Teachers

Who are Computer Science Teachers?

Teachers of computer science come from many different backgrounds. Some have majored in or have a strong background in computer science, but many others have been drafted (usually from math or business) to teach computer science. Veteran computer science teachers may remember when students were clamoring to take any and all computer-related courses; the primary purpose of an introductory computer science course was to filter out those who were unlikely to be highly successful in higher-level courses. In times past, teachers didn't have to give much thought to recruiting or the need to appeal to a wider audience than the Caucasian and Asian young men in their courses.

Even teachers who are quite comfortable with their own mastery of computer science might not know how to convey its practical value to students. We need to convince teachers of the broad value of computer science, and give them points to use with others whom they need to convince (including students, parents, and guidance counselors).

Our students deserve the opportunity to prepare to compete in a technologically advanced, globally competitive marketplace. Providing a comprehensive computer science curriculum is our primary means to create a cohesive competitive environment for our children and to respond to the current state of globalization and offshoring of software and related services.

Some teachers have a voice in the development and evolution of the curriculum in their school or district, while others have limited influence, but all teachers have a stake in the outcomes. Through membership in CSTA, all teachers can lend their voices to a strong national advocacy organization for computer science education.

What Do Teachers Need to Know?

Every child in every classroom, every teacher in every school, and every person in every community is affected by technology, and the roots of technology were founded by innovative computer scientists. Skills mastered while studying computer science enable students to analyze, synthesize, and evaluate information, to articulate problems, and to develop solutions, thereby helping to prepare them for the competitive world in which they live.

Thoroughly researched and documented talking points for computer science teachers are available in the accompanying document “Talking Points for CSTA Teacher Leaders and Advocates: Preparing Students for 21st Century Opportunities Through Computer Science Education”

What Can Individual Teachers Do?

Computer science teachers have varying degrees of influence over the curriculum at their schools or districts. Textbook replacement schedules can delay changes in the curriculum. However, portions of the *ACM Model Curriculum for K-12 Computer Science* can be used to enhance existing courses, and resources are available to supplement existing materials.

CSTA has developed *Objectives and Outlines* documents to accompany levels II and III of the *ACM Model Curriculum for K-12 Computer Science*. Each topic is articulated through focus areas and sample activities (Verno, 2006 and Madden, 2007). Topics include careers in computing, models of intelligent behavior, programming, ethical and social issues, networks, Web page design, limits of computing, and discrete math. Materials to supplement each topic have been collected in the CSTA Source: A Web Repository of K-12 Computer Science Teaching and Learning Materials, available free to CSTA members. The repository also provides resources that are independent of a particular curriculum level, including: equity issues (related to gender and under-represented minorities), promoting computer science to students and parents, computer clubs, and general classroom strategies (CSTA Source).

FAQ for Making the Case with Teachers

Be prepared to effectively answer the following questions when making your case. Use the resources referenced herein to help you find the answers, along with other resources available on the CSTA (csta.acm.org) and ACM Education Policy Committee (http://www.acm.org/public-policy/education-policy-committee) websites.

1. How can I broaden the scope of my introductory computer science course beyond programming? (Our district-approved textbooks don't cover these topics and/or they're outdated.)
2. How can I attract a broad range of students to my computer science courses without lowering my expectations for student achievement?
3. What can I say to students who aren't planning to major in computer science so that they understand why they should take computer science courses? What other academic areas would be enhanced by a computer science course?
4. Haven't most computer science-related jobs been offshored?

Making the Case for Computer Science to Local Administrators

Who Are Local Administrators?

Building administrators are individuals in administrative roles at school sites: principals, assistant principals, deans of students. Local administrators have a great deal of direct contact and influence with teachers and students. These individuals set the goals for the building; their attitudes and philosophies permeate the entire school. If computer science is high on their priority list, then computer science curricula will be implemented in their buildings.

What Do Local Administrators Need to Know?

Every child in every classroom, every teacher in every school, and every person in every community is affected by technology and the roots of technology were founded by innovative computer scientists. Skills mastered while studying computer science enable students to analyze, synthesize, and evaluate information. These skills allow students to express their ideas in ways that will prepare them for the competitive world in which they live.

Thoroughly researched and documented talking points for district and local administrators are available in the accompanying document "Talking Points for CSTA Teacher Leaders and Advocates: Preparing Students for 21st Century Opportunities Through Computer Science Education"

What can Local Administrators Do?

Local administrators are in a position to implement and support a strong curriculum for computer science because they oversee curriculum, instruction, technology and finances for their schools.

FAQ for Making the Case with Local Administrators

Be prepared to effectively answer the following questions when making your case. Use the resources referenced herein to help you find the answers, and other resources available on the CSTA (csta.acm.org) and ACM Education Policy Committee (www.acm.org/Public-policy/education-policy-committee) websites.

1. What is the impact of computer science education on student achievement? What does current research show?
2. How will comprehensive computer science education prepare students to compete globally in the 21st century?
3. How does computer science education affect overall achievement across content areas?
4. What successful models are out there? What resources are available?
5. What essential learnings and/or standards apply to various grade levels?
6. How do we recognize success? What are the key indicators?
7. What funding sources are available?
8. Will this affect drop-out and graduation rates?

9. Can or will this transform our current models of teaching and learning?
10. Can we truly say that we are preparing students for their careers if we ignore computer science education?

Making the Case for Computer Science to District Administrators

Who Are District Administrators?

District administrators include but are not limited to the superintendent, assistant superintendents, curriculum director, director of technology, director of instruction, and financial director. It is important to make the case to these district leaders so they can, in turn, advocate for computer science with the school board, public, policy makers, and school personnel. If computer science is high on their priority list, then it is likely to be a priority of the entire school district and a cohesive K-12 computer science curriculum can be implemented.

What Do District Administrators Need to Know?

Every child in every classroom, every teacher in every school, and every person in every community is affected by technology and the roots of technology were founded by innovative computer scientists. Skills mastered while studying computer science enable students to analyze, synthesize, and evaluate information. These skills allow students to express their ideas in ways that will prepare them for the competitive world in which they live.

Thoroughly researched and documented talking points are available in the accompanying document "Talking Points for CSTA Teacher Leaders and Advocates: Preparing Students for 21st Century Opportunities Through Computer Science Education".

What can District Administrators Do?

District administrators are in a position to support and promote a cohesive K-12 computer science curriculum to all stakeholders in the community, which includes the school board, the public, policy makers, school personnel, and students. They are also in a position to implement and support the curriculum because they oversee curriculum, instruction, technology and finances for the district.

FAQ for Making the Case with District Administrators

Be prepared to effectively answer the following questions when making your case. Use the resources referenced herein to help you find the answers, and other resources available on the CSTA (csta.acm.org) and ACM Education Policy Committee (www.acm.org/Public-policy/education-policy-committee) websites.

1. What is the impact of computer science education on student achievement? What does current research show?
2. How will a K-12 comprehensive computer science curriculum prepare students to compete globally in the 21st century?
3. How does computer science education affect overall achievement across content areas?
4. What successful models are out there? What resources are available?
5. What essential learnings and/or standards apply to various grade levels?

6. How do we recognize success? What are the key indicators?
7. What funding sources are available?
8. How will our implementation of a cohesive computer science curriculum educate our students in the importance of being competitive in this age of globalization?
9. Will we improve our current models of teaching and learning by promoting innovation and creativity?
10. Can we truly say that we are preparing students for their future education and their careers if we ignore computer science education?

Making the Case for Computer Science Education to Boards of Education

Who is the Board of Education?

A board of education is composed of elected representatives of the community or school district. In most communities anyone of voting age can run for a position on the board. The board's responsibility is to oversee educational policy and the district budget. The board must ensure that the district meets state educational standards and that district schools provide a safe and equitable environment in which all students can learn. The board also serves as an advocate for education within the community

What is the Key Work of School Boards?

School boards are primarily concerned with student achievement and they work to achieve consensus on what achievement means through community engagement. Most school boards function based upon framework of eight key actions that focus and guide their efforts to improve student achievement. Here are the eight key actions. [NSBA, 2008]

- Vision—Establish a clear vision of student achievement as a top priority of the board, educational staff, and community.
- Standards—Set clear standards for student performance.
- Assessment—Establish an assessment process that measures success at regular intervals.
- Accountability—Analyze data to determine what is effective and what is not, and use the data to make decisions, including change if necessary.
- Alignment—Align resources to focus on enabling students to meet the standards.
- Climate—Create a positive climate for student success.
- Collaborative Relationships—Build collaborative relationships with political and business leaders to make student success a top community priority.
- Continuous Improvement—Set the tone to create a culture of continuous improvement for student achievement.

How can the case be made to School Boards?

On its web site describing the eight key work areas, the National School Boards Association states

> "Demands on students are increasing as never before. The changing character of society and today's information and technology-based economy are driving new questions about what students should know and be able to do when they graduate. Expectations are rising, not just for students but for schools and communities too. If we want students to succeed, we need to take action.

> While the national conversation about student achievement often focuses narrowly on students' abilities to perform well on standardized tests, school boards must work to define achievement in ways that are meaningful to the communities they represent." [NSBA, 2008]

These words from the NSBA open the door for talking points to make the case for a K-12 Computer Science program.

Here are some suggestions for making the case for K-12 Computer Science education that utilize each of the key work areas for school boards.

- Vision
  - This area involves core beliefs, values, and goals. A school board expresses an eagerness to listen to the community and strives for a clear focus and direction as well as a constancy of purpose. To that end, remind the board that every child in every classroom, every teacher in every school, and every person in every community is affected by technology. The roots of technology were founded by innovative, imaginative computer scientists. To stay competitive in our global environment and in industry, we must adopt policies that foster innovation. A critical piece is attracting, educating, and retaining the best information technology talent, especially if it resides in our own back yards.
    - **You can help the board see that its vision should include a comprehensive computer science curriculum such as the one developed by the Computer Science Teachers Association (CSTA) for children in grades K-12.**
- Standards
  - Standards define what students should know and be able to do at key points in their school careers. In 2003 (updated in 2007), the Association for Computing Machinery (ACM) proposed a model curriculum for K-12 computer science that can be used to integrate computer science fluency and competency throughout primary and secondary schools.
    - **You can help the school board see that it is in a position to implement and support this K-12 model computer science curriculum. You need to convince the board members that it is not sufficient that students learn to use word processors and presentation software nor that they utilize the Internet for research. All students should have at least a basic understanding of the fundamental concepts underlying computing devices, data encoding, data transfer, security and privacy issues, and the rapid development of new technologies.**
- Assessments
  - Boards of education ensure there is a range of achievement targets assessed that represent what the local community feels are important educational outcomes. Student achievement in technology progresses through many varied levels, from learning how to turn a tool on and off, to gradually learning the finer details of its operation, to learning how the technology actually works, and finally controlling how it works. The last two items in this list are rarely addressed in schools, yet they are associated with activation of higher level thinking skills such as application, analysis, synthesis, and evaluation.
    - **You can help the board members understand that the development of higher level thinking skills is a critical goal for all students and is, therefore, an area of student achievement to be assessed. You can also**

help them see that studying computer science helps students develop strong logical thinking and problem solving skills that will serve them in every area of study.

- Accountability
    - Accountability for school boards means analyzing data to determine what is effective and what is not. Data is often disaggregated to assess success for all students. While other countries have designed and implemented national computing science educational programs in order to better prepare their students for the increasingly competitive global economy (CSTA, 2005), computer science in the United States is at a crossroads. The United States Department of Labor's Bureau of Labor Statistics predicts that during the ten-year span 2006-2016, six of the top nine fastest growing occupations will involve computer science.
        - **Show the board members data analysis or projections involving computer science.**
        - **Call attention to employment opportunities in the local area that require an understanding of computer science. To keep young people in the community, the district should prepare them for the current and future job markets.**
- Alignment
    - Boards of education are concerned about aligning resources with goals. Resources include curriculum, staffing, training, books and materials, technology, and supplemental services. They must also focuses on aligning community and budgetary resources to enable students to meet standards.
        - **Talk about involving community businesses and parents as partners in reviewing curriculum to meet the future needs of the community. Budgetary concerns are of major importance to those who elect the Board of Education.**
        - **Convince the Board of the vital need to provide a comprehensive computer science curriculum in order to meet the changing standards of a modern data-collecting society.**
        - **Ask if there *is* a clearly sequenced computer science curriculum across the spectrum K-12.**
        - **Ask if technology is fully integrated into the curriculum, equitably distributed, and if staff members are trained not only to use technology to enhance instruction but also to instruct students about how technology works.**
- Climate
    - School boards need to create a climate that supports the philosophy that all children can learn at high levels and empower staff to meet the needs of all students. For Boards of Education climate includes community relationships and respectful, cooperative board meetings as well as the school climate. For our purpose, the idea is to foster a positive educational atmosphere, encouraging all students to investigate and learn about aspects of computer science. One implication is that faculty, staff, and guidance counselors also need to understand computer science as an academic discipline and as a career path.
        - **Offer to help the board plan staff development workshops in computer science topics for non-teaching staff and possibly parents as well.**
- Collaborative Relationships
    - School boards want to create collaborative partnerships with municipalities, community and political organizations within the state, and other child-centered organizations. As a body that bridges the educational and working world, the Board should urge business

and industry leaders to open their doors to students in observer and internship programs in computer science.
    - **Urge the Board to enlist the help of knowledgeable parents and local business and industry experts for these workshops.**
    - **Encourage the board to allow teachers to take advantage of this expertise by inviting guest speakers into their classrooms.**
    - **Encourage the board to build partnerships with local business and industry so that students will realize there are job opportunities waiting for them in the community.**
- Continuous Improvement
    - The Board of Education sets standards for performance, benchmarks processes, collects data and feedback, makes data-driven decisions, rewards success, eliminates failures, and reassesses and recalibrates standards based on data. It is up to the Board to set the tone to create a culture of continuous improvement and responsiveness to societal needs. It is the Board's responsibility to measure "customer" satisfaction and make program adjustments.
        - **Talk about the changing nature of the world in terms of instant communication and the significance of data collected in every aspect of professional and personal lives. It is essential that they not ignore a vital field of study simply because it is unfamiliar to a large portion of the current adult voting population.**
        - **Urge the Board members to be pioneers, to be ahead of the ball, and to require, along with the other essential content areas, a comprehensive computer science curriculum for all children in grades K-12.**

Making the Case for Computer Science to the Community

What Are the Sectors of the Community?

From parents, to members of the PTA, to civic groups, to voters, community support for school computer science initiatives is essential. When community members ask, "Why should schools invest in computer science?" you should be ready to explain and demonstrate the essential role computer science plays in preparing young people for work and citizenship in the 21st century.

Why Should Members of the Community Care?

Introduction

Every child in every classroom, every teacher in every school, and every person in every community is affected every day by computer science. Today's economic standing and future economic development rests on decisions we make today. Learning computer science enables students to analyze, synthesize, and evaluate information and express ideas in compelling ways that will prepare them for the demands of the 21st century. Research conclusions indicate that student achievement is positively affected through learning experiences that are engaging, equitable, and authentic.

Student Achievement

- Computer Science prepares students to succeed in an increasingly complex, information-rich society.
- Computer Science encourages students to think about the use of resources that are more readily available to them on a daily basis (people resources and information resources).
- The skills developed in the computer science classroom helps prepare students for the information-rich workplace of the 21st century.

Benefit to the Community

- A workforce that has the computational thinking skills developed in a good computer science program is critical to assuring the economic well being of a community.
- Computer Science education must start in our K-12 schools.
- A quality public school system is integral to attracting skilled workers to a community.
- Computer Science education in schools can help students develop higher-order thinking skills and interpersonal skills such as collaboration and communication that are necessary in the modern workplace.
- The use of technology can encourage more students to enter the fields of math, science, and technology.
- Many corporations now suffer from a culture in which domain experts and technology experts do not know how to communicate with each other, creating systemic breakdowns of systems and communication. A workforce that has skills in computational thinking will help bridge this gap.

Parent and Community Involvement

- A good computer science program assures parents that their children are being prepared for tomorrow's marketplace, giving them incentive to support and engage in the education of their children.
- Computer Science education (especially in courses with a service learning component) can provide opportunities for students to become involved in the support of community centers for the poor, the elderly, and other disenfranchised members of the community.

Tools for Making the Case to the Community

Connect with the Community: Hold an Open House for Community Members

Checklist: Get the Word Out

- Posters in the community
- Flyers in the book bag.
- Community bulletins on local television.
- Flyers in grocery bags, placemats at restaurants
- Personalized invitations (e.g., civic leaders, Rotary Club or Jaycees, senior citizens, local business people)

Types of Showcases

- Looping video in a public place showing student projects.
- Public student demonstrations of the use of computer science in everyday life.
- Posters of activities done by students in the community (e.g., computer workshops for senior citizens).

Agenda for the Open House

- Welcome by students, teachers, and district leaders, spelling out rationale for the open house
- Showcases that focus on success of past computer science initiatives
- Presentation of new initiatives
- Request for support
- Q & A: Position teachers around the building to answer questions and to show passion for computer science and its effects on student achievement

Getting the Attention of the Community: Community Outreach Through the Media

Key Components

- Deliver a clear and simple message to parents and the community.
- Present in a personalized manner to ensure the message is heard.
- Leverage the power of one or multiple media outlets.

Message

- Knowledge of computer science will be a differentiating factor in your child's ability to succeed in the modern global and digital society.
- Supplement this message with personal stories of children's success through the use of computer science in their education. Stories could:
    - revolve around students who have used computer science to turn around past academic failures, and
    - illustrate how students can explore topics in ways not possible within traditional classrooms.

Examples of Personalized Messages

- "I was a high school student who was disinterested in school. I was often truant, and when I did go to class, I was disruptive. Mr. Jones, my guidance counselor, introduced me to the Alice programming language. It allowed me to explore my creativity as well as taught me valuable problem solving skills. I was able to learn at my own pace and build confidence in my ability to learn. I graduate this year and will be attending my first choice college."
- "Our school needed a new way to calculate scores at the year end Sports Day. My class was given the task of creating a program that the athletic department could use. It was difficult at first because there were many factors to consider, but once we got started, it was hard to stop until we were able to present the school with the finished program. Besides being able to put this experience on my resume and college applications, the sense of accomplishment that I felt was incomparable to anything else I have done."

Leverage the Media

- Know your local reporters, and provide them with compelling stories and pictures that will make them want to cover you in their publication or broadcast. Go beyond issuing press releases:
    - Call with an idea for a story based on an example of how computer science has positively affected your students.
    - Provide a story that showcases data or give data that backs up a story highlighting the positive effects of computer science on student achievement.
- Highlight computer science successes in regular print pieces that the school or district mails to the home. Again, specific illustrations with pictures of children will provide a more compelling image than text descriptions of computer science programs.
- Use teachers in community messaging to show a partnership (rather than competition) between classroom instruction and computer science.
- Tie your messages to current events in your community.

Use Student-Created Materials

Goal of Using Student-Created Materials

- Materials created by students are genuine and compelling. Use artifacts of learning as well as direct messages from students about the power of computer science to make the case to the community.
- The products/materials themselves are the message.
- Gives students an audience to receive their work; gives their ideas credibility and power.

Types of Student-Created Materials

- Signs
- Posters
- Flyers
- PowerPoint presentations
- Student projects
- Video
- QuickTime movies
- Newsletters
- Digital video
- Slideshows
- Postcards
- Electronic postcards

The Messages Students Should Convey

- This is the way we use computer science in our class/school.
- How I will use this knowledge when I am an adult.
- Computer Science is a big part of my life and will increasingly be so in the future.
- Knowing computer science allows me to learn in a new or different way, which empowers me.
- I am an expert in a current level of computer science.

Examples

- A class newsletter is created on a regular basis by the students using computer science.
- Movies or slide shows can be set up to run in a public display at the school. These can be used to profile student/class work.
- Give students the task of finding solutions to real problems within the school—such as creating a program to keep track of ticket sales for a school performance.

Making the Case for Computer Science to the Corporate Community

Why is it Important to Make the Case to the Corporate Community?

From local businesses to multinational companies, the corporate community has an integral and growing interest in the future of computer science. Companies keeping pace with the changing world need only look at the amount of data they accumulate and analyze to confirm the increasing complexity of the modern market. Tools to collect and manage this increasing complexity need to be refined and developed. Workers who can build these tools, who understand how to interpret and derive real meaning from all of this information, are needed for the success of the enterprise. Help business leaders see how their support of computer science not only assists today's students but ultimately ensures their success in the marketplace of the future.

What do Business Leaders Need to Know?

Introduction

Every child in every classroom, every teacher in every school, and every person in every community is affected every day by computer science. Today's economic standing and future economic development rests on decisions we make today. Computer science enables students to analyze, synthesize and evaluate information and express ideas in compelling ways that will prepare them for the demands of the 21st century. Research conclusions indicate that student achievement is positively impacted through learning experiences that are engaging, equitable, and authentic.

Student Achievement

- Computer Science prepares students to succeed in an increasingly complex, information-rich society.
- The skills developed in the computer science classroom helps prepare students for the information-rich workplace of the 21st century.

Benefit to the Corporate Community

- A workforce that has the computational thinking skills developed in a good computer science program is fundamental to assuring the economic well being of the community.
- A quality public school system is integral to attracting skilled workers to a community.
- Computer Science education in schools can help students develop higher-order thinking skills and interpersonal skills such as collaboration and communication that are necessary in the modern workplace.
- The use of technology can encourage more students to enter the fields of math, science, and technology.

- Many corporations now suffer from a culture in which domain experts and technology experts do not know how to communicate with each other, creating systemic breakdowns of systems and communication. A workforce that has skills in computational thinking will help bridge this gap.

Tools for Making the Case to the Corporate Community

Personal Stories

- Goal: Establish an emotional connection with the audience
- Strategy:
    - Be brief, concrete, and accurate
    - Focus on value to the community and on how business contributed to the outcome
    - Use a story that is replicable
- Framework:
    - Convey the public relations value of the story
    - Make the connection between educational outcomes and the corporate role

Fact Sheet/Talking Points

- Goal: Convey relevance and importance; provide facts for advocates to pass along to others
- Strategy:
    - Frame initiatives or programs in context of the business audience's goals
    - Present face-to-face with tangible handouts to distribute
- Framework:
    - Emphasize the relevance of computer science to the audience as well as society as a whole
    - Give background on the current state of computer science; include statistics and facts
    - Explain the implications of computer science on the health of the economy and the community

Position Paper

- Goal: Define importance of computer science
- Strategy:
    - Explain existing computer science and the role it plays in schools
    - Address future needs
    - Identify what you want from the business community
- Framework:
    - Start with a short introduction
    - Include specific examples, facts, and statistics
    - Emphasize the need for students to have computational thinking skills
    - Emphasize workforce development as a major goal of education
    - Include how you want the business community to be involved

PowerPoint Presentations

- Goal: Provide an introduction and overview to the business community of the initiatives or projects, and lay the groundwork for ongoing collaboration
- Strategy:
    - Face-to-face interaction
    - Combine data and facts with personal stories
    - Provide a clear call to action

- Framework:
    - Open with a scenario that business audience can relate to
    - Engage the business audience by asking their perception of the skill sets needed by the workforce of the future
    - Back up points with facts and statistics
    - Give a clear vision of what success looks like
    - Provide next steps (e.g., form a taskforce; meetings to discuss concrete plan)

Making the Case for Computer Science to Policy Makers

Who Are the Policy Makers?

Policy makers include local government officials and state departments of education as well as state and national legislators. These leaders represent constituents' interests on the local, regional, state, and national levels and are in the position to drive policies that directly affect computer science education.

What Do Policy Makers need to know about Computer Science Education?

Government labor forecasts clearly indicate that we are not producing enough computer science graduates to meet the needs of industry or to compete in an increasingly global economy.[1] We need to teach students from all disciplines how computers actually process information. Even if we are not aware of it, computers are part of almost every aspect of our lives (banking, health care, shopping, travel, etc.) and it is vital that we understand their capabilities and their limitations. All students need a basic level of knowledge about how computers actually work and how to use computers safely and securely.

Computer Science education in America sorely needs attention

- Employment in professional, scientific, and technical services will grow by 28.8 percent and add 2.1 million new jobs by 2016. Employment in computer systems design and related services will grow by 38.3 percent and add nearly one-fourth of all new jobs in professional, scientific, and technical services[2]
- Although 66% of American high schools offer Advanced Placement courses, fewer than 15% of American high schools offer Advanced Placement Computer Science courses.[3]
- Fewer college students are enrolling in computer science courses, and fewer graduates with computer science degrees are going on to earn their Ph.Ds.[4]
- Minority students are dramatically underrepresented in K-12 computer science coursework. For example, fewer than 4% of Advanced Placement Computer Science exam takers in 2008 were African American and fewer than 7% were Latino.[5]
- Women are also underrepresented in computer science.[6] For example, fewer than 17% of Advanced Placement Computer Science exam takers in 2008 were young women.[7]

Computer Science benefits all students

- Computer science teaches students how to be innovative and solve problems—essential skills for students to be college- and career-ready.
- We need to teach students from all disciplines how computers actually process information. Even if we are not aware of it, computers are part of almost every aspect of

our lives (banking, health care, shopping, travel, etc.) and it is vital that we understand their capabilities and their limitations.
- All students need a basic level of knowledge about how computers work and how to use computers safely and securely.

FAQ for Making the Case with Policy Makers

Policy makers are busy people and everyone wants a piece of their time. When approaching a policy maker, plan a targeted campaign. Your address should be short, memorable, and results-oriented. Deliver compelling data that makes your case and ask the policy maker for a specific action related to your campaign. Tell him or her how you can help.

The following is a list of questions to keep in mind before making a presentation to or meeting with policy makers. Customize questions and answers for each particular setting.

1. What data or research is available to show the importance of computer science to the local/state economy and to job seekers? (Bureau of Labor Statistics, ACM Educational Policy Committee website)
2. What is in it for the local municipality or state? How will a specific computer science initiative help accomplish overall local or state mission/goals/activities?
3. Specifically, what do you want the policy maker to do in terms of computer science education (e.g., support for curriculum initiatives, support for policy initiatives, support for certification and standards)?
4. What is the time line? How does it coincide with the budget cycle, planning process, and programs?
5. What are key indicators for success of a specific initiative?

Resources

- *Supporting Teachers and Pursuing Excellence in K-12: A Guide for Policy Makers*
- CSTA Research: http://csta.acm.org/Research/sub/CSTAResearch.html
- External research: http://csta.acm.org/Research/sub/ExternalResearch.html

[1] Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2008-09 Edition, retrieved from http://www.bls.gov/oco/ocos110.htm
[2] Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2008-09 Edition, retrieved from http://www.bls.gov/oco/ocos287.htm
[3] AP Report to the Nation, College Board, 2009
[4] 2005-2006 Taulbee Survey
[5] AP Report to the Nation, College Board, 2009
[6] National Center for Education Statistics, Trends in Educational Equity of Girls and Women, 2004
[7] AP Report to the Nation, College Board, 2009

Tips for Working with Legislators

Find the Right Legislators[1]

- Spend time and effort on legislators who have power—on the right committee, in positions of leadership, have special knowledge and an interest in technology or the STEM disciplines. It is important to work with a player when you want something done. If your desire is a budget amendment, look for legislators on financial committees, preferably high-ranking members likely to be on conference committees.
- At the same time, keep your eyes on the newcomers. Evaluate them for potential. Are they interested in computing? What are their committee assignments? Do they appear to be on leadership tracks? Do you know someone who can help you reach and influence them? Every powerful chairman was once a freshman. And, freshmen are usually easier to befriend and will remember that you liked them when.

Build Relationships with Legislators

- Offer invitations such as visits to schools with special computer science projects that are meaningful to them—perhaps the school is in the legislator's district; perhaps the project's focus relates to the legislator's business or personal interest; perhaps it's a thank-you—and showcase the legislator at the same time. How about a picture for the next campaign brochure or an article and photo in the local newspaper or an invitation to speak at a function including parents?
- Visit the legislator in the home district or capitol office now and then; bring some information, a knowledgeable person, or a constituent with you. Cultivate office staff. Provide ready contact lists for office staff to get information about a computer science project or a school or an individual. Let the staff know how you can help them. The staff and legislator should like and trust you.

Be Specific and Simple at the Same Time

- If lobbying for or against a specific piece of legislation, make sure you inform the legislator of exactly what you want done. Rather than just saying you don't like a bill, say, "Please vote against the bill when it comes to your committee next week." Remind the legislator just before the meeting. If you want an amendment, provide the amendment language. Try to be at the meeting where the amendment will come up. Inform the bill patron that you are seeking the amendment; with luck, the bill patron will consider your amendment friendly. Try to speak with the person who drafted the bill in the first place. This person usually is listened to by legislators.
- Most importantly, be right about your information. Provide an accurate and brief summary of the good and bad in legislation that is understandable to the average person. Technology tends to scare people. If the legislator trusts you, he or she will work to achieve your result without having to understand the details of the bill. And, if you are asking legislators to do something that will be unpopular with their party, important constituents, or a major special interest group, be upfront and tell them. If significant backlash is likely in their case, consider finding another legislator to do what you want. Make it as easy as possible for legislators to help you and make sure they understand how doing what you want will benefit them.

Writing a policy brief

Policy makers seldom have the time to read through all the literature related to a specific policy question. To make well-informed decisions, they rely on short, tightly written briefs that quickly and cogently relay the important policy facts, questions, and arguments about an issue.

Characteristics of a Good Policy Brief

A policy brief must advance a persuasive argument in a concise, clearly organized fashion. A policy brief does not include a lengthy analysis or review of the literature.

General Outline for a Policy Brief

Introduction:

- Begin with a brief **overview** and **state the problem or objective**.
- Map where your argument will take the reader and **explicitly outline your thesis**.

Recommendations:

- Clearly state your **recommendations** up front.

Background:

- Outline brief history or **background** relevant to the theme.

Analysis:

- **Constructively criticize** arguments, ideologies, and the quality of technical evidence.
- Use **evidence** from literature and other sources to support your perspectives and advance your recommendations.

Conclusion:

- Conclude with a **persuasive argument** and **summary statement**.

Note: Place recommendations and most effective evidence in sidebars or boxes. However, be sure not to overuse such graphics and sidebars.

[1] Excerpted from SETDA's National Leadership Institute Toolkit 2003, contribution from Judith Singleton, Fairfax County Public Schools

Making the Case for Computer Science to Education Associations

What are Education Associations?
How Can They Support Computer Science?

Education associations are groups that bring together a subset of the education community to achieve a common mission, purpose, or set of goals. These organizations usually provide direct service to a group of members through publications, research, professional development, and conferences. They are mission-driven and advocate for their association's goals with policy makers and the corporate community. When associations add their voice to the call for computer science, the message carries further and resonates more deeply. Enlisting cooperation from other associations to support computer science can be a powerful tool for getting the attention and support of stakeholders and influencers.

FAQ for Making the Case with Education Associations

The following is a list of questions to keep in mind before making a presentation to, or meeting with, individuals from education associations. Customize questions and answers for each particular association.

1. What data or research is available to show the importance of computer science to the economy and to job seekers? (Bureau of Labor Statistics, ACM Educational Policy Committee website)
2. What is the link between computer science and the discipline represented by the educational association to whom you are speaking?
3. What is in it for the association? How will a specific computer science initiative help the association accomplish its mission/goals/activities?
4. Specifically, what do you want the particular association to do in terms of computer science education (e.g., support for curriculum initiatives, support for policy initiatives, joint activities)?
5. What is the time line? How does it coincide with the budget cycle, planning processes, and programs of the association?
6. What are key indicators for success of a specific initiative? If the association supports a specific program, how will its members know that it has made a difference in regards to its goals?

Making the Case for Computer Science to the Higher Education Community

Why Is it Important to Make the Case to the Higher Education Community?

From community colleges to research institutions, the higher education community has an integral and growing interest in the future of computer science. Students facing the rapidly changing technological landscape need the tools and skills to become contributing members of the modern competitive workforce, as well as the future leaders who will help design the solutions to the increasingly complex problems their world will be confronted with.

Tools to collect and manage this increasing complexity need to be refined and developed. Workers who can build these tools, who understand how to interpret and derive real meaning from all of this information, are needed for the success of the enterprise. You can help the leaders of higher education see how their support of computer science will assist today's students and contribute to the solutions to what may now seem to be intractable problems.

What Do Higher Education Leaders Need to Know: Talking Points for Computer science[1]

Introduction

> Every child in every classroom, every teacher in every school, and every person in every community is affected every day by computer science. Today's economic standing and future economic development rests on decisions we make today. Computer science enables students to analyze, synthesize, and evaluate information and express ideas in compelling ways that will prepare them for the demands of the 21st century. Research conclusions indicate that student achievement is positively impacted through learning experiences that are engaging, equitable, and authentic.

Benefit to the Higher Education Community

- Students who have developed their thinking skills in a rigorous and engaging computer science program are more likely to choose to study computer science in college or university and to do well in post-secondary computer science courses.
- Computer science education must start in our K-12 schools.
- A quality public school system is integral to attracting skilled workers to a community.
- Computer science education in schools can help students develop higher-order thinking skills and interpersonal skills such as collaboration and communication that better prepare them for success in all areas of study, not just computer science.
- It encourages more students to enter the fields of math, science, and technology.
- Many schools are cutting back or even eliminating their computer science programs, because of this, fewer students are emerging with an interest in pursuing computer science.

Tools for Making the Case to the Higher Education Community

Personal Stories

- Goal: Create a positive emotional response to your message
- Strategy:
    - Be brief, concrete, and accurate
    - Focus on value to the community
    - Focus on how higher education contributes to a positive outcome
    - Use a story that is replicable
- Framework:
    - Convey the public relations value of the story
    - Make the connection between ideal uses of computer science, educational outcomes, and the role of higher education, both in research and in the training of students.

Fact Sheet/Talking Points

- Goal: Convey relevance and importance; provide facts for advocates to pass along to others
- Strategy:
    - Frame initiatives or programs in context of the higher education audience's goals
    - Present face-to-face and provide informative and concise handouts
- Framework:
    - Give background on the current state of K-12 computer science and how it impacts higher education computer science programs; include statistics and facts

Position Paper

- Goal: Define importance of K-12 computer science
- Strategy:
    - Explain what it is and the role it plays in schools
    - Address future needs
    - Identify what you want from the higher education community
- Framework:
    - Start with a short introduction
    - Include specific examples, facts, and statistics
    - Include how you want the higher education community to be involved in promoting K-12 computer science

PowerPoint Presentations

- Goal: Provide an introduction and overview to the higher education community regarding the initiatives or projects, and lay the groundwork for ongoing collaboration
- Strategy:
    - Face-to-face interaction
    - Combine data and facts with personal stories
    - Provide a clear call to action
    - Be concise, succinct, and direct
- Framework:
    - Open with a scenario that the higher education audience can relate to
    - Back up points with facts and statistics
    - Give a clear vision of what success looks like
    - Make a clear call to action
    - Provide next steps (e.g., form a taskforce; plan ongoing meetings to discuss concrete implementation plan)

Introducing the Stakeholders to their Future Students

The Tech-Savvy Millennials[1]

Who Are the Millennials?

- Young people born between 1982 and 2000
- 70 million strong – 27% of America's population

How Computer Science Affects Today's Students

- Technology is allowing today's students to be ultra-communicators and multi-taskers.
- They are not just using technology in different ways, they are approaching their lives and their daily activities differently because of technology.
- The way that students are using technology gets more sophisticated as they get older but do not under-estimate younger childrens' capacity for using technology meaningfully.
- 54% of students in grades 7-12 know more of their friends' IM screen names than their home phone numbers.
- 67% of students in grades 7-12 go online first to research a topic they are studying.
- 81% of the students said that losing access to the Internet would impact their personal lives and their schoolwork.

Values of the Millennials

- 96% get along with their parents' values.
- 75% share their parents' values.
- 78% believe religion is important.
- 60% engage in community service.
- 80% think it is cool to be smart.
- Today's students are high achieving and goal oriented; they are also highly stressed and feel pressured to succeed.
- 86% say their generation will produce the next Bill Gates; 67% say they know the next Bill Gates; and 24% say they could be that person.

Student Characteristics: Implications for K-12 Education

> Today's students want to use all kinds of technology to help them learn **collaboratively**, at their **own time and place**, and through structured activities that allow for **creativity and self-expression**. **These students have great ideas on how technology should be used in school and they want to be more involved in technology discussions and issues at their schools.**

[1]Statistics taken from a PowerPoint presentation at NetDay's Speak Up Day 2003, "Millennials: Who are Today's Students? (From CoSN's 9th Annual D-12 School Networking Conference)."

Creating an Effective Elevator Pitch

Definition of an elevator pitch: You find yourself in a situation where you unexpectedly are in contact with someone who could be very effective in raising support for computer science education (e.g., a legislator you've been trying to meet with for months). You have less than a minute to make a positive impression on this person. To make the most of this moment, it is critical that you have prepared a pitch in advance.

Settings in which to use an elevator pitch:

- Elevator
- Cocktail party or other social setting
- Buffet line
- Airport waiting room
- Conference

General Tips and Strategies

Frame the elevator pitch around the point of view of the person to whom you are speaking. Center your pitch around a problem this influential person can help solve. Speak *his or her* language. Use plain, simple English—not jargon. You want to pique the person's interest and leave him or her wanting to know more.

- Be passionate.
- Be concise and succinct.
- Practice, practice, practice!

General Outline for an Effective Pitch

Introduce yourself and make a compelling case:

- Introduce yourself and quickly describe your role and expertise in computer science.
- State the case you wish to make, using powerful details that are important to the listener (e.g., the gap between available jobs and people with computer science skills; the need to remain competitive in the global economy, and the need to be innovation leaders in high tech).
- Back up your argument with data or research that supports your claims (BLS statistics on the increase in jobs in the computing field).
- Suggest how the listener can resolve the problem.
- Explain how you can make his or her job easier.

Just before the elevator door closes and your 30 seconds are over:

- End with some kind of call to action—a future meeting or a phone call to continue the conversation. Ask for a business card and supply one as well.

Talking Points for CSTA Teacher Leaders and Advocates: Preparing Students for 21st Century Opportunities Through Computer Science Education

Every child in every classroom, every teacher in every school, and every person in every community is affected by technology, and the roots of technology were founded by innovative computer scientists. Skills mastered while studying computer science enable students to analyze, synthesize, and evaluate information, to articulate problems, and to develop solutions, thereby helping to prepare them for the competitive world in which they live.

Our students deserve the opportunity to prepare to compete in a technologically advanced, globally competitive marketplace. To accomplish this, we must adopt policies that foster innovation. To this end, policies that improve our ability to attract, educate, and retain the best information technology talents are critical. Educational policy and investment are at the core (Aspray, 2006). Providing a comprehensive computer science curriculum is our primary means to create a cohesive competitive environment for our children and to respond to the current state of globalization and offshoring of software and related services.

While other countries have designed and implemented national computer science educational programs in order to better prepare their students for the increasingly competitive global economy (CSTA, 2005), computer science in the United States is at a crossroads.

The United States Department of Labor's Bureau of Labor Statistics assembles data forecasting demand for future job categories. They predict that during 2006-2016, six of the top nine fastest growing occupations during this time period involve computer science. Their report states:

> "Employment in professional, scientific, and technical services will grow by 28.8 percent and add 2.1 million new jobs by 2016. Employment in computer systems design and related services will grow by 38.3 percent and add nearly one-fourth of all new jobs in professional, scientific, and technical services…Management, scientific, and technical consulting services also will grow at a staggering 78 percent and account for another third of growth in this supersector. Demand for these services will be spurred by the increased use of new technology and computer software and the growing complexity of business."

One would assume that these optimistic predictions would result in increased enrollment in computer science at the high school and college levels, but in fact, the opposite has been true. American universities have seen steady and alarming declines in their computer science and engineering programs. Data from the Higher Education Research Institute at the University of California at Los Angeles shows that from 2000-2004, the percentage of students interested in majoring in computer science dropped by 60%, and in 2005 was 70% lower than its peak in the early 1980s (CRA, 2005).

Although the number of newly declared undergraduate majors at doctoral-granting computer science departments showed a slight increase in 2008 for the first time since 2000 (HED, 2008), high school computer science programs continue to experience decreased enrollment. The renewed focus on educational standards and accountability, particularly in English and math, has forced many schools to take resources away from computer science and other non-core courses (Stephenson, 2005). Survey data collected by the Computer Science Teachers Association shows that the number of schools offering introductory computer science courses decreased 5% between 2005 and 2007, and the number schools offering Advanced Placement (AP) Computer Science courses fell 10% in the same time period. To feed the already dismal situation, the College Board announced in April 2008 that it will no longer offer the Advanced Placement Computer Science AB Examination after May 2009. This may lead to more of a decrease in the already low number of computer science courses offered in the high schools.

Many people assume that since technology jobs are increasingly being offshored, few job opportunities are available, and so they seek careers that they deem to be in higher demand. In fact, current enrollments in computer science prepare less than half of the number of workers predicted to be needed in coming years (BLS).

To support an effective educational response to offshoring and a response of support for computer science education, general principles should be followed:

1. Evolve the computing curriculum at a pace and in a way that better embraces the changing nature of Information Technology.
2. Ensure the computing curriculum prepares students for the global economy.
3. Teach students to be innovative and creative.
4. Evolve the curriculum to achieve a better balance between foundational knowledge of computing on the one hand, and business and application domain knowledge on the other.
5. Invest to ensure the educational system has good technology, good curriculum, and good teachers (Aspray, 2006).

These general principles must be applied in a cohesive, seamless manner throughout the educational system. In 2003 (updated in 2007), the Association for Computing Machinery (ACM) proposed a model curriculum for K-12 computer science that can be used to integrate computer science fluency and competency throughout primary and secondary schools. This curriculum was developed in response to the need to provide academic coherence to the rapid growth of computing and technology, along with the need for an educated public that can utilize that technology most effectively to the benefit of mankind (Tucker, 2003).

What Are The Benefits To Students?

Computer science education is strongly based upon the higher tiers of Bloom’s cognitive taxonomy, as it involves design, creativity, problem solving, analyzing a variety of possible solutions to a problem, collaboration, and presentation skills.

Seymour Papert, creator of Logo and considered one of the world's foremost experts on how technology can provide new ways to learn, states: "In my vision, the child programs the computer and, in doing so, both acquires a sense of mastery over a piece of the most modern and powerful technology and establishes an intimate contact with some of the deepest ideas from science, from mathematics, and from the art of intellectual model building." Papert is also quoted as saying, "It is not using the rule that solves the problem; it is thinking about the problem that fosters learning” (Papert, 1980).

Computer science develops and extends logical thinking and problem-solving skills. Large problems must be broken down into smaller parts that can be solved individually, which is the basis for logical reasoning and problem solving techniques. These techniques can then be applied to real world problems, both mathematical and otherwise. Computer programming leads students to become self directed learners. The students discover their own way to solve a problem and the computer follows their implicit instructions (Martin, 1999).

Students who participate in high school computing classes and have previous experience with technology demonstrate improved readiness for postsecondary studies (Taylor, 1989; Franklin, 1987; Ramberg, 1986; Wilson, 2002; Kinnunen, 2007).

Students pursuing computer science majors at the college level are more successful if they have taken high school programming or literacy classes (Gal-Ezer, 2003; Wilson, 2002; Wilson, 2001; Ramberg, 1986; Kinnunen, 2007). There is a significant correlation between exposure to computer science concepts in high school and success in entry-level college courses (Franklin, 1987) and past research has shown that studying computer science contributes to the development of logical thinking skills (Ramberg, 1986).

What Exactly Would Students Study?

Computer science is a broad term that is used to describe various fields of study, including the following college majors:

- Electrical Engineering,
- Computer Engineering,
- Software Engineering,
- Computer Science,
- Information Technology, and
- Information Systems

But computer science has also grown to the point where it is the foundation for other disciplines and fields of study. "Engineering" is not only preceded by the terms "Electrical", "Computer", and "Software". There are civil engineers, architectural engineers, biomedical engineers, geological engineers, nuclear engineers, aerospace engineers, and environmental engineers who are all dependent on innovations in technology and computer science to move forward in their respective fields. Computer related careers are not focused on programming in cubicles cut off from society. Today's computer scientists work with medical imaging, biometric identification and authentication, bioinformatics, mobile devices, digital imaging, music and movies, animations, digital forensics, and with thousands of other applications.

Today's computer science graduates will use their developed problem-solving skills and analytical skills in specific contexts and for specific purposes in a specific environment. These are the individuals who will advance because our computer science curriculum has prepared them for the changing nature of this age of information technology. Our graduates will be able to move computer science to the next level with their innovations and creativity but only if our curriculum supports and nourishes them.

Computer science education is about teaching our students problem-solving and teaching our students how to learn. Today, many high schools and middle schools offer basic computer literacy courses that teach students how to use common software applications such as word processing

software and spreadsheets. These courses must be supplemented by courses that fall within the realms of information technology and computer science as specified in the *ACM Model Curriculum for K-12 Computer Science* referenced at the end of this document. We must prepare our students for the future. This preparation must be integrated throughout our K-12 curriculum and this must begin now.

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