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**OBJECTIVES**

- Why care about Computer Science education?
- A definition of Computer Science
- Computer Science standards for K-12
- The Model Curriculum for K-12 Computer Science
- What is the CSTA?
- The CSTA Source:  Web Repository
- Computer Science Teacher Certification
- Professional Development
- Support from High School teachers - 10 ways to help
- Support from Colleges and Universities - 10 ways to help
- What YOU can do!

CSTA:  Computer Science Teachers Association
WHY CARE?

- Anticipated shortage of qualified candidates for 1.5 million computer and IT jobs by 2012
- HS CS programs disappearing in US but are new requirements in other countries
  
  *(Source: The New Educational Imperative: Improving High School Computer Science Education, 2006)*

- Force engagement with issues relating to CS education

CSTA: Computer Science Teachers Association
The United States, a nation once proud of its leadership in education, is sitting quietly on the sidelines while other countries make improvements to ensure their high school graduates will be ready to meet the demands of tomorrow’s high-tech society.

Source:
The New Educational Imperative: Improving High School Computer Science Education, 2006
WHY CARE?

The lack of adequate computer science education in high schools is another major factor contributing to the dire state of computer science enrollment in colleges.

"Almost no place is looking at computer science as on par with learning physics or mathematics, which it should be“ (Stanford Professor Eric Roberts).

Source:

CSTA: Computer Science Teachers Association
"There seems to be a sense in the curriculum in K-12 that technology is still PowerPoint and the Web."

(Robert Appelman, associate professor in the Instructional Systems Technology Department in Indiana University's School of Education).

Source:
1999
• Discussion at NECC; Can ACM provide support for HS CS education?

2000
• ACM K-12 Task Force
• First CS & IT Symposium

2002
• Task Force Meets
• HS CS Teacher Survey, OO needs
• JETT Project

2003
• ACM Model Curriculum for K-12 Computer Science Education

2004
• HS CS Teacher Survey, issues

2005
• CSTA established

CSTA: Computer Science Teachers Association
“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.”
WHAT IS COMPUTER SCIENCE?

- Programming
- Hardware design
- Networks
- Graphics
- Databases and information retrieval
- Computer security
- Software design
- Programming languages

- Logic
- Programming paradigms
- Translation between levels of abstraction
- Artificial intelligence
- Limits of computation
- Applications of IT and IS
- Social issues
KEY ISSUES IDENTIFIED BY RESEARCH

- Shrinking pipeline
- Underrepresented populations
- No national curriculum standards
- Inappropriate and ineffective teacher certification
- Teachers feel isolated and in need of community
- No opportunities for skills upgrading
- A feeling of disconnect between K-12 CS educators and their college/university colleagues
- Need for improved public understanding of CS

CSTA: Computer Science Teachers Association
KEY ISSUES IDENTIFIED BY RESEARCH

- Ubiquity of computers in the world
- Rapid evolution of CS as a discipline
- No strong voice to educate administrators, legislators, and congressional committees about the link between supporting K-12 computer science education and international economic issues

CSTA: Computer Science Teachers Association
WHY DO WE NEED CS STANDARDS?

- Consistency
- Resources
- Teachers
  - What should I teach?
  - Am I prepared to teach this content?
  - What teacher certification do I need?
- Students and parents
  - What will I learn?
  - Will this help me in college?
- Administrators, teachers, and students
  - What is the difference between technology and Computer Science?

CSTA: Computer Science Teachers Association
A Model Curriculum for K-12 CS


http://csta.acm.org/Curriculum/sub/K-12ModelCurr2ndEd.pdf
Goals of the Model Curriculum

- Introduce fundamental concepts of CS to all
- CS worthy of curriculum credit
- Secondary level computer courses for interested students
  - Work force
  - College
- Help ensure work-place readiness of US graduates by providing computing standards
A MODEL CURRICULUM FOR K-12 CS

Recommended Grade Level

K-8

Level I - Foundations of Computer Science

9 or 10

Level II – Computer Science In the Modern World

10 or 11

Level III – Computer Science as Analysis and Design

11 or 12

Level IV – Topics in Computer Science

Figure 1. Structure of a K-12 Computer Science Curriculum

CSTA: Computer Science Teachers Association
LEVEL I

Foundations of Computer Science
Grade K-8

- Foundational concepts
- Basic skills in technology + simple algorithmic thinking ideas (NETS standards as guide)
- Hands-on activities
- Modules in science, mathematics, and social studies

CSTA: Computer Science Teachers Association
LEVEL II

Computer Science in the Modern World
Grade 9 or 10

- Introduction to computer science
- Computers and their place in the modern world
- Effective use of computers
- Integrating technology with emerging interests

CSTA: Computer Science Teachers Association
LEVEL II GOALS

Computer Science in the Modern World
Grade 9 or 10

• Prepare students for a technological world
• Acquire fundamental understanding
  - Operations of computers: Hardware, Software, Operating Systems, etc.
  - Computer networks
  - The Internet
  - Algorithmic problem-solving
• Expose students to computing careers
• Discuss ethical issues

CSTA: Computer Science Teachers Association
1. Principles of computer organization and components
2. Algorithmic problem-solving
3. Components of networks
4. Organization of Internet elements
5. Fundamental hierarchy and abstraction in computing
6. Mathematical elements of computer science
7. Computer models of human behavior
8. Utility of computers and algorithms in the modern world
9. Ethical issues of computers and networks
10. Careers in computing

CSTA: Computer Science Teachers Association
LEVEL III

Computer Science as Analysis and Design
Grade 10 or 11

- One-year elective; earns curriculum credit
- Emphasis on scientific/engineering aspects of computer science
- Focus
  - Mathematical principles
  - Algorithmic problem-solving/programming
  - Software/hardware design
  - Networks
  - Social impact
- Explores interest in computing sciences as a profession/major

CSTA: Computer Science Teachers Association
LEVEL III

1. **Fundamentals**: style, abstraction, correctness, efficiency
2. **Simple data structures** and their uses
3. **Discrete math**: logic, functions, and sets in CS
4. **Usability**: web pages, interactive games, documentation
5. Elements of **hardware design**
6. Characteristics of compilers, operating systems, and networks
7. **Limits** of computing: computationally “hard” problem? unsolvable problem?
8. Principles of **software engineering**: projects, teams, life cycle
9. **Social issues**: intellectual property, professional practice
10. **Careers** in CS, Engineering, IT

CSTA: Computer Science Teachers Association
Topics in Computer Science
Grade 11 or 12

Topics of personal interest
- In-depth understanding
- Special skills

Elective
- AP Computer Science
- Projects-based course
- Courses leading to Industry Certification

Fluid Offerings based on current technology

CSTA: Computer Science Teachers Association
LEVEL IV - EXAMPLE COURSES

- Desktop Publishing
- Presentation Design
- Multimedia
- Graphics
- Design and Development of Web Pages
- Web Programming
- Emerging Technologies
- Animation
- Networking Technologies
- Simulations
- OOP
- Effective use of Applications

CSTA: Computer Science Teachers Association
LEVEL IV - IMPLEMENTATION

- Local district with existing faculty and equipment

- In conjunction with college
  - At local school
  - On college campus
  - Via distance education

- College credit may be available
  - Tech Prep / Articulation
  - Dual Credit / Concurrent Enrollment
  - Challenge Exams
  - CLEP Tests
  - AP Tests
ENDORSEMENTS

CSTA: Computer Science Teachers Association
USING THE MODEL CURRICULUM

- GA curriculum standards, Business and CS
- NH competencies for vocational programming
- CS standards for elementary/H.S. (Diocese, FL)
- Resource in writing state curriculum
- National curriculum for South African schools
- Advocate a national CS curriculum in Taiwan
- Topics guidelines for 2-year college core classes
- Increase problem solving in K-12 Math curriculum
- Outreach activities for K-8 students
- Develop the competencies and skill sets for the FL Teacher Certification Examination in K-12 CS

CSTA: Computer Science Teachers Association
The Computer Science Teachers Association supports and promotes the teaching of computer science and other computing disciplines at the K-12 educational level.
WHAT IS CSTA?

- CSTA is a limited liability organization under the auspices of ACM
- CSTA is a membership organization
- CSTA is an advocacy organization
- CSTA is a provider of professional development opportunities for teachers
- CSTA is a provider of research
- CSTA is a provider of resources
**Scope of CSTA**

- **Impact Areas:**
  - high school (all aspects of CS education)
  - middle school (to help teachers introduce problem solving and algorithmic thinking)
  - college/university (to provide better support and transitions for high school teachers and students)
  - industry (supporting CS education and teachers)

- **Who Can Join?**
  - high school teachers
  - middle school teachers
  - elementary school teachers
  - college/university faculty
  - industry folks
CSTA SUPPORT FOR MODEL

- Disseminating Model
  - Teachers
  - State legislators
  - State curriculum specialists
  - School district curriculum administrators
- Working with curriculum specialists to develop resources
- Working to build a national repository of learning materials aligned to the Model
- Working to provide professional development opportunities for teachers
- Advocating for the importance of K-12 computer science education at the national level
CS INSTRUCTION COULD BE THIS

CSTA: Computer Science Teachers Association
OR THIS

CSTA: Computer Science Teachers Association
LET’S MAKE IT INTERESTING AND EXCITING

CSTA: Computer Science Teachers Association
RESOURCES

- Exciting resources provided by teachers.
- You can access the resources
- You can share your resources

Let’s pool our best resources to excite students to learn about computers and perhaps to explore a computing career!

CSTA: Computer Science Teachers Association
RESOURCES: GENERAL

- CSTA Website
- Certification
- Curriculum
- Professional Development
- Advocate Blog
- CSTA Source: Web Repository
- Virtual Binders; Research
- Careers
- Publications - Voice
- Podcasts
- Downloadable Resources
RESOURCES: MODEL CURRICULUM

- **Level I -- Foundations of CS**
  - ISTE has resources available
  - Task Force beginning work

- **Level II -- CS in the Modern World**
  - Objectives and Outlines document
  - CSTA Source: Web Repository

- **Level III: CS as Analysis and Design**
  - Objectives and Outlines document
  - CSTA Source: Web Repository

- **Level IV -- Topics in CS**
  - AP: resources available
  - Projects-based: with college/university
  - Industry certification: resources available

CSTA: Computer Science Teachers Association
CSTA SOURCE: WEB REPOSITORY

- Searchable database for K-12 teaching and learning
  - Instructional materials
  - Lesson plans
  - Other resources
- Seed content from TECS and JETT
- Submitted by high school and college educators
- Reviewed by a team of expert educators
- Collected for the first time in one place
- Accessible to CSTA members
CSTA SOURCE: WEB REPOSITORY

- Classifications match the ACM Model Curriculum
  - Activities for Levels I to IV
  - Syllabi
  - Multi-topic assessments
- Cross-level resources
  - Promoting CS
  - Clubs
  - Equity
  - Classroom strategies
- CSTA link: http://csta.villanova.edu/
CSTA SOURCE: WEB REPOSITORY

CSTA K-12 Repository >
CSTA K-12 Repository >
Level 3: Computer Science as Analysis and Design >
L3 A: Topics >
L3 A 01: Fundamental ideas about the process of program design & problem solving >

Browse by Title

Jump to: 0 1 2 3 4 5 6 7 8 9 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
or enter first few letters: Go!

Showing items 1-5 of 5.

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<tr>
<td>Aug-2004</td>
<td>Interactive Development Environments</td>
<td>Edwards, Stephen; Barnette, Dwight; Fox, Ed</td>
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<td>28-Mar-2003</td>
<td>Object-Oriented Programming</td>
<td>Trees, Fran</td>
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<td>Aug-2004</td>
<td>Unit Testing</td>
<td>Edwards, Stephen; Barnette, Dwight; Fox, Ed</td>
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TEACHER EDUCATION
TEACHER CERTIFICATION

FRANK & ERNEST

OOPS! MAYBE WE'D BETTER MAKE THE CHICKEN FIRST...

CREATION DEPT.

E-mail: FandEBobT@AOL.COM © 1995 by NEA, Inc.

CSTA: Computer Science Teachers Association
Recent Research - 2-year project completed in 2006
In many states it is nearly impossible to determine what the requirements are to teach CS
Limited teacher education programs in CS
TEACHER EDUCATION PROFESSIONAL DEVELOPMENT

Computer Science and Information Technology Symposium (CS & IT)

- Annual event
- Full-day
- Relevant topics
- Interactive sessions
- HS teachers

CSTA: Computer Science Teachers Association
Teacher Enrichment in Computer Science (TECS)

- Pedagogically-oriented programs
- Model Levels II-IV
- Community building
- Hosted by Colleges and Universities
- Planning group includes grade 6-12 teacher, college students, College faculty member

- Must include
  - Equity
  - Ethics
  - Careers
  - Problem Solving
  - Classroom activities

CSTA: Computer Science Teachers Association
Java Engagement for Teacher Training (JETT)

- Pedagogically-oriented programs
- HS teachers
- Focus on Java and OO concepts
- Online Java Repository
- Community building
- Hosted by Colleges and Universities
9 WAYS TO HELP TEACHERS

The New Educational Imperative: Improving High School Computer Science Education, 2006

1. Review your current computer science curriculum to determine whether it provides sufficient opportunities for students to gain the knowledge and skills they need to succeed in an increasingly computerized world.

2. Ensure that your courses are both academically rigorous and welcoming to all students.

3. Model life-long learning - take advantage of relevant professional development opportunities.

4. Lobby for funding for computer science courses, equipment, and materials.

5. Lobby for your program -- speak to parent groups, other teachers, and individual students about computer science.

CSTA: Computer Science Teachers Association
9 WAYS TO HELP TEACHERS

The New Educational Imperative: Improving High School Computer Science Education, 2006

6. Help dispel the myth that there are no job opportunities in computer science.

7. Work with school counselors to ensure that they are providing your students with accurate and appropriate information.

8. Create opportunities to meet with computer science teachers from across the district so that you can share resources and strategies.

9. Become a member of a professional association, such as CSTA, that provides curriculum models, support materials, mentoring, and community.

CSTA: Computer Science Teachers Association
**10 WAYS TO HELP COLLEGE FACULTY**

*The New Educational Imperative: Improving High School Computer Science Education, 2006*

1. Support HS CS education - require entering students to have at least 1 CS course
2. Provide different entry points based on computing experience
3. Interact with local HS teachers - invite them to the college, speak at local schools, send students to speak at local schools
4. Provide details as to anticipated CS skills for incoming students
5. Start student-to-student (college-to-HS) mentorship programs, particularly for female and minority students

CSTA: Computer Science Teachers Association
10 WAYS TO HELP COLLEGE FACULTY

The New Educational Imperative: Improving High School Computer Science Education, 2006

5. Create and support professional development opportunities for teachers

6. Provide info about computer careers and computing education to counselors, teachers, students

7. Ensure that Schools of Education are preparing teachers to teach CS

9. Help schools obtain new technology resources by working together on grant applications

10. Read and share the Model Curriculum for K-12 Computer Science Education

CSTA: Computer Science Teachers Association
CSTA
- Supports CS education for K-12
- Advocates on behalf of K-12 CS educators
- Standards for curriculum and certification

Why?
- Declining enrollment despite career opportunities
- Need to force the US Educational system to recognize computing education as necessary for today’s students
What can YOU do?

- Be aware that the problem begins in elementary school
- Open a dialogue with a local school (college faculty) or your school administration (teachers)
- Provide / take advantage of professional development opportunities for teachers
- Join CSTA... It’s FREE! 😊
  - Stay up to date on CS “happenings” in K-12
  - Volunteer to assist on a project
Acknowledgements

Works Cited


Provide Help at the Beginning and we all will see the Rewards at the End!

<table>
<thead>
<tr>
<th>Anita Verno</th>
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<td>• Member of the Board of Directors</td>
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<td>• Curriculum Chair</td>
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CSTA: Computer Science Teachers Association
CSTA stands for Computer Science Teachers Association.
What is the CSTA?

An organization dedicated to K-12 CS education: Advocates, Standards, Resources
What can you do to encourage uniform CS standards?

Professional Development, Open a dialogue, Join CSTA

CSTA: Computer Science Teachers Association
What is the URL for the CSTA?

http://csta.acm.org
What resources are available?

Model
- Objectives and Outlines documents

Research
- Certification database
- Virtual binders

CSTA Source: Web Repository

Blog
Podcasts
Career information
and much more...

CSTA: Computer Science Teachers Association