IN THE NEXT ISSUE OF THE VOICE

Computer Science Careers

Resources to Boost Computer Science Skills

A CSTA and IBM Partnership

Robin Willner

For IBM, it is critical that students begin learning the skills they'll need for potential computer science (CS) careers at a young age, so last April, IBM and CSTA joined forces to provide teachers with free access to CS resources in an effort to improve teacher expertise and help students acquire necessary skills for jobs in the 21st century.

The new IBM/CSTA learning materials are designed specifically for high school classrooms. These tools include modules to introduce object-oriented programming and Web design principles into everyday CS, math, and science classes, and a professional development module that can be used by teachers to improve their teaching. Using the techniques outlined in this module, teachers can lead a series of group exercises that teach students how to collaborate with each other and solve complex problems. These advanced skills are becoming more relevant to the information technology field and every workplace, as tough business issues are increasingly being resolved by groups of people in collaborative working environments.

The resources, which adhere to the curriculum standards contained in the *ACM Model Curriculum for K–12 Computer Science*, were designed and tested by computer science teachers and members of CSTA. They can be downloaded directly from the CSTA (*csta.acm.org*) and IBM Academic Initiative (*ibm.com/university*) Web sites. Since the launch in April 2006, the resources have received close to 500 hits from the IBM site alone.

During the school year, IBM will publicize the resources among high school math, science, and CS teachers through the network of Community Relations managers world-wide. Tens of thousands of IBM employees who volunteer through the On Demand Community program will also be asked to help introduce the resources to high school teachers. On Demand Community is a first-of-its kind initiative to encourage and sustain corporate philanthropy through volunteerism by providing employees with a rich set of IBM technology tools designed to help non-profit community organizations and schools.

The IBM/CSTA partnership received extensive media coverage, including an AP wire story with more than 60 pickups, plus articles in *ComputerWorld* and *InformationWeek*.

Improving public schools around the world is IBM's top social priority. To achieve this goal, IBM implements a number of strategic initiatives that draw on advanced information technologies, the best minds IBM can apply, and partnerships with experts around the world.

In April 2006, more Americans were employed in IT than at any time in the nation's history.
Eric Chabrow
www.informationweek.com/showArticle. jhtml?articleID=185303797

csta Voice

Repairing the Pipeline

Dr. Jim Aman

Like many universities facing decreasing enrollments in computer science (CS), Saint Xavier University (SXU) is working with CSTA to increase awareness of CS among prospective students and to improve the teaching of high school CS teachers.

SXU is a leading comprehensive university in Chicago. Our Computer Science Department has five faculty members and offers undergraduate degrees in CS and computer studies, and a Master of Applied Computer Science. Although computer-related professions "are expected to be among the fastest growing through 2014," the number of people pursuing degrees in CS has been declining for a decade (*Occupational Outlook Handbook, 2006-07 Edition*). Over the past eight years, our CS enrollments have declined about 40%. SXU and other colleges are struggling to understand why and to reverse the trend.

A keynote address by Robb Cutler and Chris Stephenson at the 2006 SIGCSE Symposium affirmed what many of us at the college level have long believed: the "pipeline" of students is damaged. Whether because of the press hyping the false dangers of outsourcing, ignorance on the part of families concerning CS careers, or some other cause, the leakage is draining high school CS classrooms and is reflected in enrollments at the college level. Cutler and Stephenson offered hope for reversing the trend by identifying and addressing the real causes.

In the summer of 2006, SXU began taking action. Our department sponsored JETT and TECS workshops that drew teachers

> ## We feel the workshops and the admissions criterion will add value to high school computer experiences.

from five states. We have also made plans for additional workshops next year.

As per the suggestion of Maria Klawe (former ACM president), we met with our Assistant Provost for Admissions to enlist the help of our Admissions staff. They were not at all aware of the pipeline-related problems of teacher certification gaps, the impact of *No Child Left Behind*, and the public misperception of computing professions–all of which contribute to fewer CS students at all levels. As a result of this meeting, the following statement was added to the University's admission crite-

ria: "In addition, completion of a high school computer science course is considered an indication of academic well-roundedness." This statement is prominently placed in the undergraduate catalog's admissions section, appears on recruiting material, and is now a criterion when considering an application.

We feel the workshops and the admissions criterion will add value to high school computer experiences. They alert a student to the importance our university places on computing knowledge. We hope these steps help high schools by providing support for their CS courses and educating guidance counselors as to the career potential of computing.

If interest for CS can be rekindled in K-12 education, then the numbers of students studying the discipline and, ultimately, moving into high-demand and high-paying careers will increase. These are small steps on our part, but we hope the effects will be great.

Build it—Trust it—Use it

Dr. Gary L. Newell

The Build it—Trust it—Use it (BTU) project brings together Northern Kentucky University faculty from the departments of social work and computer science, in partnership with social service agencies (Centro De Amistad and Su Casa), the Latino and Multicultural Center for Regional Development, and area businesses to develop and provide an innovative program designed to expose participating Hispanic families to computing technologies via a hands-on curriculum model.

The $250,000 project is funded as part of the NSF "Broadening Participation in Computing" program intended to significantly increase the number of students who are U.S. citizens and permanent residents receiving post secondary degrees in the computing disciplines. Initially, its emphasis will be on students from communities with longstanding under-representation in computing: women, persons with disabilities, and minorities.

Faculty and students at Northern Kentucky University will team up to serve as leaders of twelve-week workshops. Offered after hours and on weekends at a local Hispanic community center and on the university campus, these bilingual workshops will introduce middle school students and their parents to computer hardware and software. The program will engage Hispanic professionals from local corporations to serve as mentors in the program. Program teams analyze participant attitudes toward IT before and after each workshop.

The BTU project is designed to provide the Hispanic community with a portal into the information technology domain which is both cognizant and respectful of their cultural values and expectations. It will provide hands-on experience and training in the design, construction, and use of computing technology along with the requisite knowledge to ensure its safe and appropriate use.

Each family will be provided with the computer components necessary to construct a personal computer from scratch. Through guided, bi-lingual instruction, each family will gain the essential knowledge necessary for understanding the basic inner-working of the machine and its key software components. At the end of the program, each family will then take home a fully-functional DELL computer system whose operation they understand and trust. These families will also be introduced to a variety of uses for their new system including communication, employment assistance, as well as standard office software and system security products.

A total of 30 families will participate through the summer of 2007. The project researchers, Gary Newell, Kevin Kirby, and Holly Riffe will gather data relevant to the participants' perceptions of computing. Further information about the project is available by contacting the principal investigator at *newellg@nku.edu* or by calling the Department of Computer Science in the College of Informatics at Northern Kentucky University.

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Computer Science Teachers Association

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The editorial board of the *CSTA Voice* is dedicated to ensuring that this publication reflects the interests, needs and talents of the CSTA membership. Please consider sharing your expertise and love for computer science education by contributing newsletter content.

Potential writers for the *CSTA Voice* should send a brief description of the proposed article, estimated word count, statement of value to members, author's name and brief bio/background info, and suggested title to the editor at: *cstapubs@csta.acm.org*. The final length, due date and title will be negotiated for chosen articles. Please share your knowledge.

Volunteer today!

acm

ACM founded CSTA as part of its commitment to K–12 computer science education.

Making Computer Science Minority-Friendly

Roli Varma

The U.S. Bureau of Labor has projected that between 2002 and 2012, science and engineering occupations will grow by 26%, and approximately 78% of this increase is projected to be in computer-related occupations. While the information technology (IT) sector is expanding, women and non-Asian minorities are under-represented in U.S. IT education as well as in the IT workforce. Women make up 51% of the U.S. population, but comprise about 27% of computer scientists and mathematicians. Similarly, African Americans/ Blacks, Hispanics, American Indians and Alaska Natives make up 25% of the U.S. population, but comprise less than 8% of computer scientists and mathematicians.

An interest in factors that lead to under-representation of women and non-Asian minorities in computing education at the undergraduate level, led to a qualitative study with women and men in different ethnic and racial groups who had decided to major in computer science and computer engineering (CS/CE) fields in minority-serving institutions in 2004-2005. Interviews were conducted with 150 students, divided into groups of 30 (15 female and 15 male) majoring in computer science or computer engineering at one of seven institutions and belonging to one of the following five major racial and ethnic groups namely: Caucasian/White, African American/Black, Hispanic, Asian American, and American Indian.

The following discussion focuses on one major finding related to students' pre-college education, which causes students to consider leaving CS/CE during college.

Non-Asian minority students are much more likely to have gone to disadvantaged elementary, middle, and high schools. About 48% of the students interviewed believed that their high schools did not prepare them "at all" for CS/CE education at the under-

> **About 48% of the students interviewed believed that their high schools did not prepare them "at all" for CS/CE education at the undergraduate level, and another 37% talked about being prepared "moderately."**

graduate level, and another 37% talked about being prepared "moderately." Among these students, women in every ethnic and racial category except Asian American complained about the lack of preparation in high school. Furthermore, large numbers of non-Asian minority students reported gaining access to computers for the very first time in their junior or senior year of high school. In fact, students from every non-Asian minority category had less early exposure to computers than their Caucasian/White and Asian American peers. Nevertheless, males among all ethnic and racial groups reported having had simple access to a home computer or their own computer while growing up and said they enjoyed a greater level of access more often than did females.

The difficulty of CS/CE curricula was the single most common reason cited by women and men who had seriously considered leaving. However, within that group, women were one third more likely than men to find CS/CE study excessively difficult. Comparing different ethnic and racial categories, African American/Black, Hispanic, and American Indian women were much more likely to cite difficulty as a reason to leave CS/CE study than were their Caucasian/White counterparts, with Asian American women complaining about difficulty least often.

This suggests that high school teachers need to understand that computer literacy is similar to English and mathematics. They need to teach basic introductory courses in computing especially to women and minorities. Surfing the Internet and using office applications do not prepare students to participate in the technical computing field.

Making Computing Accessible

Sheryl Burgstahler, Ph. D., Richard Ladner, Ph. D.

The University of Washington is taking the lead in addressing the under-representation of people with disabilities in the computing field with a new alliance focused on raising awareness and creating opportunities.

While there is wide recognition that innovation in computing requires a diverse workforce of qualified computing professionals, data from the Computing Research Association shows the number of newly-declared computer science (CS) majors declined 32% from 2000 to 2004. This shortage of qualified professionals in computing fields is due in part to the under-representation of some groups, including individuals with disabilities.

Also, while advancements in assistive technologies have provided greater access to computers, inaccessible design of facilities and software, web pages, and distance learning courses continues to erect barriers for people with disabilities.

The goal of the newly established National Alliance for Access to Computing Careers (AccessComputing) is to increase the representation of people with disabilities in a wide range of computing careers, including computer science, information systems, software development, computer engineering, systems management, and teaching.

Our AccessComputing objectives are:

- increase the number of students with disabilities successfully pursuing undergraduate and graduate degrees and lifelong careers in computing fields,
- increase the capacity of postsecondary computing departments to fully include students with disabilities in computing courses and programs, and
- create a nationwide resource to help students with disabilities pursue computer fields and to help computing educators and employers, professional organizations, and other stakeholders develop more inclusive programs and share effective practices.

To support these objectives, AccessComputing is providing several activities for students with disabilities, including:

An E-mentoring community of high school and college students with disabilities that includes computing professors, postsecondary students, and other adult mentors in computing fields to encourage, advise, and share opportunities in computing fields, and to assist students with transitions between academic levels and from school to work.

College transition and bridge academies and workshops at postsecondary institutions nationwide where students with disabilities learn about careers in computing, practice self-advocacy skills, explore options for internships and jobs, and meet computing professionals with disabilities.

Research and industry internships within computing fields for postsecondary students with disabilities in which a staff member works with each supervisor and student to identify appropriate accommodations in order to improve the participant's opportunity for success and to strengthen the institution's capacity to work successfully with individuals with disabilities.

The Department of Computer Science and Engineering and DO-IT (Disabilities, Opportunities, Internetworking and Technology) at the University of Washington (UW) are lead partners for AccessComputing. They are supported by Gallaudet University, Microsoft, the NSF Regional Alliances for Persons with Disabilities in STEM (hosted by the University of Southern Maine, New Mexico State University, the University of Wisconsin–Madison, and the UW), and SIGACCESS in the project. The Alliance is funded by the National Science Foundation.

For more information visit:
www.washington.edu/accesscomputing.

Meet the Authors

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Jim is a past president of the Consortium for Computing Sciences in Colleges (CCSC). He was recently appointed the CCSC Board's liaison to CSTA.

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Charmaine teaches computer science at Roosevelt High School, Dallas. She is an active member of TCEA, TACS SIG, and CSTA.

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Sue is an educator and psychologist involved in CC4G developing topics and training teachers.

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Gary specializes in research in the areas of artificial intelligence and computing education.

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John became a teacher after 30 years in the computer industry.

Roli Varma
Professor and Regents Lecturer, School of Public Administration, University of New Mexico, Albuquerque
Roli's research focuses on women and minorities in IT and new immigrants in science and engineering.

Robin Willner
VP for Global Community Initiatives, IBM
Robin is responsible for implementing IBM's philanthropic activities worldwide.

Out and About the Community

Attracting Students to CS—Middle School Holds the Key

John Osborne, Teacher, Advanced Technology

By the time students enter high school, they have already made many decisions about their future careers. To insure that students consider computer science (CS) careers and to build a vibrant CS program in our high schools, I believe that we must excite middle school students about technology and prove to them, especially girls, that CS is not a "geeky" thing.

I learned valuable lessons and gained insights from implementing an Advanced Technology class at Windemere Ranch Middle School in Dublin, CA. My experiences reinforced my belief that an appropriate middle school technology course is a key to student enrollment in high school CS.

After retiring from the computer industry, I began work toward a Designated Subjects Vocational Credential. I was hired to teach technology at Windemere Ranch Middle School as a new teacher in a brand-new school. At the same time, a statewide initiative to replace what used to be called "shop courses" with technology classes offered a unique opportunity for me and the new school. The goal of the technology initiative is to encourage all students, boys and girls, to take courses that can lead to an interest, and perhaps a career, in technology.

In addition to helping the principal select furnishings and equipment for the new technology classrooms, I ordered *TechCenter21* learning modules from Applied Educational Systems (AES) in aerodynamics, aerospace, alternate energy, CO2 race cars, construction and CAD, electronics, environmental management, graphic design, lasers and fiber optics, manufacturing and automation, and others. Additionally, I developed a module on 3D animation and on digital music.

Over 40 students showed up on the first day of school to a room that was still under construction in terms of equipment. To accommodate the over enrollment, the district added another section and I taught an additional class period. The end result was two classes of 32 students each.

The first semester presented many challenges. In retrospect, I realize that many of the problems were brought on because I had not yet designed a course or developed a teaching style suitable for middle school students. After I rewrote and fine-tuned the 3D animation module and modified the purchased modules, student learning increased and they enjoyed the quick pace and wide variety of technology subjects.

I came to realize that the typical middle school student has the attention span of a barnyard chicken; you get their attention for only a very short time. I gradually learned to tailor the lessons into short bursts of learning followed by a learning transfer activity.

Many students returned the second semester with a high interest in games, which prompted me to develop modules that introduced programming concepts. Students were highly motivated to program their own game creations and experimented with *Stagecast* and *CeeBot*. Both proved to be within their grasp and spurred them to want more programming opportunities.

I have formed some opinions that I believe are useful in teaching technology to middle school students.

• They readily grasp technology and programming concepts. The trick is to present these concepts to them when they are ready and let go when they are not.

• Girls are very concerned about the "geeky" stereotype.

Overcome this by emphasizing the social and communication aspects of technology and through team projects.

• Girls seem to perform better in larger groups than do boys.

Technology at Windemere Ranch Middle School is taught in a three-year sequence. Sixth graders attend a six-week Introduction to Technology course, which I use as a recruiting opportunity. Seventh graders take Advanced Technology, which is primarily based on the AES modules and is an elective that competes with many other courses. Next year, students in Advanced Technology II will learn CS concepts through game design and programming using *Stagecast*, *CeeBot*, *Alice*, and C#.

By the time my students enter high school, they will have a base of knowledge in CS and be capable of more advanced study than if they had waited until high school to begin their technology education. Send comments to *JOsborne@srvusd.net*.

Bits and Bytes

Promotion Strategies from Colleagues

Editor's note:
CSTA members were invited to submit their best CS promotion and recruitment strategies. This is a sampling of the ideas submitted.

The first year I taught Advanced Placement Computer Science (AP CS), I depended on the counselors to place students in my class. Fifteen students began the course but only 9 remained by second semester. I had to teach a double-roster class (with 20 Visual Basic students in the same room) to make up the numbers.

By May, I decided to do some recruiting on my own. I obtained the list of all students (males and females) who qualified to enroll in AP CS. I sent invitations to 175 students stating that they were receiving the invitation because they qualified for AP CS. I pointed out the benefits of taking AP CS including having an edge in college admission or job interviews and the extra point for GPA computations.

The invitation indicated that students would work in small groups and I included pictures of non-traditional CS students working together. The invitation clearly stated that the course is not for computer nerds. I described AP CS as a course on problem solving by computing and that students only needed logic and math skills to succeed.

This method of recruiting has worked well so far, with more than 47 students enrolling the second year in a class that has room for 35. This class is also more diverse, as 36% are female and 30% are Hispanic or African American/Black.

Francisca Olear
John F. Kennedy H.S., Granada Hills, CA

Several AP teachers in Georgia have increased student enrollment by sending a letter refuting the myths about computer science to all students who do well on the PSAT and inviting them to take the AP CS course.

An AP teacher in Georgia convinced 7 varsity cheerleaders to join the class and one of these students then went on to MIT. We also have had success incorporating LEGO robots with CS. One girl reported disliking a computer applications course but enjoyed robotics in an introductory programming course. She won at the local science fair with a robot and now wants to major in robotics.

Barb Ericson
Georgia Institute of Technology

Use the words "computer science" instead of "technology" when appropriate. In discussions about math and science, add "computer science" to the conversation.   *Robb Cutler*
The Harker School, San Jose, CA

Promote CS with facts that dispel the myths your students hear. Use the document at *cs.gettysburg.edu/~tneller/dept/docs/ CSCareerTrends.pdf* for quick facts and links to authoritative sources of career information.   *Todd W. Neller*
Gettysburg College, Gettysburg, PA

Equity Initiatives

CC4G in the UK—An Online Computer Club for Girls

Sue Nieland

IT and Telecoms industries in the United Kingdom (UK) are concerned that women represent less that 20% of the technology workforce. CC4G (Computer Clubs for Girls) was developed to address this imbalance by targeting girls at the age where they seem to lose interest in IT, between 10 and 14 years. Through CC4G, girls access a secure e-learning environment that is fun and relevant, and that challenges their perceptions about gender and careers.

CC4G is a government-funded program providing girls with a website-based club. The site is password protected, and offers 12 topics, written by educators with input from supportive employers. Club members undertake activities, tasks, and challenges that can only be completed using ICT. Embedded in the tasks are strategies that teach girls problem-solving, predictive reasoning, team work, and communication.

The suite of topics now provides over 60 hours of e-learning and 170 hours of girl-friendly projects. The themes include popular interests, such as the world of celebrity, dance, fashion, and design. The latest topic takes girls into the music industry, where they manage their own musicians, burn CDs, and make pop videos. Even crime scene investigation is made accessible in a topic where girls compare DNA and fingerprints, think about profiling, and find out how difficult it can be to be an eye witness. Each topic is clearly mapped to the curriculum for IT in England, Wales, and Scotland.

There is clear evidence that members are gaining in skills and knowledge as a result of their experience with the topics. Schools report members achieving higher in English, math and science, as well as in IT, than their non-member peers. Girls are also showing evidence of bridging their IT skills from the club environment, making use of software user experiences in other curriculum areas without prompting from the teacher.

Part of this success can be attributed to the use of the contexts to deliver skills, making girls far more likely to see the relevance of IT in other areas of their lives. Girls report helping older siblings with advanced use of IT and parents with spreadsheets and financial accounts. Parents, too, are excited by the club and often visit the website with their daughters to enjoy its content.

CC4G has been universally welcomed by employers, educators, government ministers, and girls themselves. Employers support the clubs by providing industry-standard specialist software, volunteers to help run clubs, and support for teacher training.

Jenny Wilkins, Head Teacher at The Skinners' Company School for Girls in England said, "The beauty of CC4G is the way it combines a fun, real-life structure for learning IT-related skills to the development of a whole set of wider transferable skills, from project management to teamwork and evaluation. The girls absolutely love going to CC4G and have been its biggest advocate within the school by spreading the word."

The consensus of opinion is that CC4G is achieving its aim, presenting ICT as friendly, fun, and meaningful to the members, and making them more likely to pursue further studies in ICT later in school. Girls who attend the club are also far more likely to consider a career in ICT as a result.

CC4G currently has a membership of more than 44,000 girls who are participating though 1500 schools. For more information on CC4G visit *www.cc4g.net* or contact us by email at *cc4ghelpdesk@e-skills.com*

Digi-Know

Digi-Know?—Membership has its Benefits

Charmaine Bentley

Did you know that your CSTA membership entitles you to email forwarding?

CSTA provides a flexible solution to managing your email in a changing world–one address that stays constant and will forward messages to your current address. By creating an ACM Web Account, you will be able to create your own acm.org email forwarding address. All mail sent to that *acm.org* address will be forwarded to an email address of your choosing.

Create an ACM Web Account for Email Forwarding
1. Visit CSTA at *csta.acm.org*
   - On the CSTA home page under "Membership Information" on the left menu, select "Manage Your CSTA Account".
   - On the next screen select "Click here to manage your CSTA Account." This can be reached directly at *https://campus. acm.org/public/clientfunctions/acmorg.cfm*.

2. Select "Create an account."
   - Follow the link at the bottom of the next screen, "Are You a CSTA Member?" Fill in the requested information to create an ACM Web Account.
   - You will be asked to verify your email address by responding to an email message sent to your current address. After answering the security question, you can select a username and a password.

You may change the options for your email forwarding account by returning to the ACM Membership page and selecting "Review/Update your Spam Filtering Options" information and selecting the "Tag and Forward" option. Select the "Review/ Update Your Contact Information and Email Information" choice on the ACM Membership page to change the email address to which your email is forwarded.

SHOW ME THE NUMBERS
A Brain Drain
2004 Intel Science and Engineering Fair Finalists
% of finalists who were female in each division:

52% Biochemistry	23% Mathematics	11% Computer Science

SOURCE: Revolutionizing the Face of Technology, National Center for Women & Information Technology *www.ncwit.org/pdf/2006_NCWIT_Statistics.pdf*

Voice

Computer Science Teachers Association
2 Penn Plaza, Suite 701
New York, NY 10121-0701

We're on the Web! *http://csta.acm.org*

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MARK YOUR CALENDAR

Celebrate Computer Science Education Day
December 8, 2006
sws.lhps.org/computerscienceed

CSTA Nominations Due
January 15, 2007
Use the nomination form delivered with this issue of the *Voice*

Texas Computer Education Association (TCEA)
February 5-9, 2007 in Austin, Texas
www.tcea.org/
Charmaine Bentley, CSTA Board, "What is Computer Science?"

SIGCSE 2007
March 7-10, 2007 in Covington, Kentucky
www.cs.potsdam.edu/sigcse07/index.shtml

Innovation and Technology in Computer Science Education (ITiCSE)
June 23-27 in Dundee, Scotland
iticse2007.computing.dundee.ac.uk/

National Educational Computing Conference (NECC)
June 24-27 in Atlanta, Georgia
center.uoregon.edu/ISTE/NECC2006/about_NECC/future_NECCs.php

Innovation and Technology in Computer Science Education (ITiCSE2007)
June 25-27, 2007 in Dundee Scotland
iticse2007.computing.dundee.ac.uk/

Computer Science and Information Technology (CS & IT) Symposium
June 28, 2007 in Atlanta, GA
www.iste.org/symposia/csit

History of Programming Languages (ACM SIGPLAN)
June 9-16, 2007 in San Diego, California
research.ihost.com/hopl/

Advanced Placement (AP) Annual Conference
July 11-15 in Las Vegas, Nevada
www.collegeboard.com/apac/2006/2007/index.html

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Computer Science
Teachers Association

CS & IT Symposium

June 28, 2007
Atlanta GA

http://www.iste.org/symposia/csit

JETT and TEC workshops

jett.acm.org/
tecs.acm.org/

RESOURCES

Here's more information on topics covered in this issue of the *CSTA Voice*.

Page 1: IBM Community Relations *www.ibm.com/ibm/ibmgives*
Page 2: *Occupational Outlook Handbook, 2006-07 Edition* www.bls.gov/oco/
Page 2: JETT Workshops *jett.acm.org/*
Page 2: TEC Workshops *tecs.acm.org/*
Page 3: Build it - Trust it - Use it *cs.nku.edu/btu.html*
Page 5: AccessComputing *www.washington.edu/accesscomputing*
Page 6: Applied Educational Systems *www.aeseducation.com*
Page 7: Gettysburg College *www.gettysburg.edu/*
Page 7: Computer Clubs for Girls *www.cc4g.net*
Page 7: CSTA *csta.acm.org/*
Page 7: ACM *www.acm.org/*
Page 7: National Center for Women & Information Technology www.ncwit.org

Other recommended resources:
- *Great Principles of Computing Curricula, Peter Denning*
  Viewpoint: Computational Thinking, Jeannette Wing
  ACM Digital Library *http://portal.acm.org/portal.cfm*

- *Towards 2020 Science*
  research.microsoft.com/towards2020science/downloads/T2020S_ReportA4.pdf

- National Center for Educational statistics
  nces.ed.gov/fastfacts/display.asp?id=71

Visit CSTA Web Repository

Searchable instructional materials, lesson plans, and more!

csta.acm.org/Resources/
sub/WebRepository.html