csta Voice

International CS Education

The Voice of K–12 Computer Science Education and its Educators

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# CSTA – An International Community

**Margot Phillipps**

**CSTA IS COMMITTED** to building an international computer science (CS) education community because we believe that educators in all countries can gain from broad discussions of issues that affect us. As educators, we often believe that the challenges we experience are limited to our schools, districts, or countries. The truth, however, is that the challenges we face are common to many schools in many countries, and we can be more effective in addressing these problems if we work together.

While countries may differ significantly in the extent to which they recognize the link between a strong *continued on page 2*

**CSTA**
**wishes to thank**
**Tami Lapidot**

Manager of "Machshava" - the Israeli National Center for Computer Science Teachers, Haifa, Israel, for her help creating the ***CSTA Guide to Establishing a CS Teachers Association.***



## CSTA – AN INTERNATIONAL COMMUNITY

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high school CS education program and the long-term economic and technological health of the nation, they share common challenges in curriculum, teacher registration, and student interest. Educators in countries such as Israel who have already fought the battles and successfully established CS in the curriculum can inform the work of others. Educators in countries such as mine (New Zealand) can learn from, and piggyback off, the strides made elsewhere.

In many countries, the national focus on science and mathematics education seems to ignore CS entirely. In Scotland, for example, the government is placing a major emphasis on science education and this emphasis is being reflected in a new national curriculum. Unfortunately CS is found under technology and not under science (but at least it is there!).

The situation in the U.S. is very similar. President Obama recently announced a $250 million effort to improve science and mathematics instruction to improve U.S. competitiveness with economic rivals. Unfortunately there has been no official recognition of the critical role that computing plays in innovation across all areas of scientific and mathematical endeavor.

The countries that are widely known for their successful high school CS programs (such as Israel and Lithuania) typically have had a central government agency with the political will and desire to see that the fundamental requirements for high school CS education are met. This is not to say that such countries can relax. Education systems will almost certainly have more competing demands than can be funded, and changes in governments and bureaucracies often mean changes in goals, ideologies, and methodologies as well.

Most countries have a scarcity of teachers with both sufficient pedagogical skills and the content knowledge to be highly effective CS educators. The policies regarding teacher certification/registration vary greatly from country to country and impact the availability of qualified CS educators. Addressing this issue is both necessary and costly. Attracting CS graduates into teaching when typically higher salaries are to be gained elsewhere, is a world-wide challenge. Training existing teachers requires expensive professional development.

Student streaming or tracking is another factor that may impact CS teacher shortages. Countries such as the U.S. and

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**CSTA Voice** is a publication of the Computer Science Teachers Association.

**CSTA Voice** is a quarterly publication for members of the Computer Science Teachers Association. It provides analysis and commentary on issues relating to K–12 computer science education, resources for educators, and information for members. The publication supports CSTA's mission to promote the teaching of computer science and other computing disciplines.

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New Zealand do not officially stream students by vocational interest in high school by assigning them to either an academic school or a technical or trade school. But this kind of streaming is common practice in many European and Asian countries. If a school system is attempting to offer all things to all children there will almost certainly be a gap between the number of suitably qualified teachers and the number necessary. Where more general IT education is offered to those streamed into the vocational and trade schools and CS is available only to those in the academic schools, it is likely that fewer CS teachers will be required.

Teachers, schools, and countries around the world face common problems related to CS education. Providing a quality CS education for all students in all countries will be immensely easier if we work together to promote CS as a vital and necessary discipline by sharing our strategies, stories, and successes.

## CS in India

*An Attractive Field for Women*

**Roli Varma**

**THE NATIONAL SCIENCE FOUNDATION** (NSF) reported that despite women's increased participation in most major science and engineering fields, the proportion of computer science (CS) bachelor degrees awarded to women in the U.S. dropped from 37% in 1985 to 22% in 2005. In distinct contrast with women in the United States, women in India have been increasing their presence in CS since 1990. According to government statistics for 2003, women in India received 32% of bachelor engineering degrees and 55% of bachelor CS degrees.

This may be surprising in light of the fact that women in India have little to no early exposure to computers or time using them as tools. In 2008, the World Bank ranked India 160th in the world with a per capita income of $950, making ownership of a computer a luxury which few can afford. As a result, young women are unlikely to have used computers until they are admitted to a university. This lack of early exposure, however does not appear to deter them from pursuing CS as a career.

One recent study conducted by the author, with funding from the NSF, uncovered many cultural factors that may be contributing to their greater interest in CS as a field of study and a career option. She interviewed 60 female undergraduate students majoring in CS at four universities in India. The study revealed that one answer lies in women's pre-university training in mathematics. Unlike women in the U. S., Indian women have little anxiety about CS at the university level because they consider themselves very strong in math and logical thinking.

The study revealed that this confidence is often grounded in rigorous teaching practices and high expectations for student performance. As one study participant noted, "My math teacher pushed me so hard that I even cried sometimes. But, now I thank him. Actually, he pushed everyone in the class very hard. He really cared how we did in math. He would not let us off the hook."

> Globalization and liberalization of the Indian economy have also increased women's participation in CS by making male-dominated engineering fields lucrative to women.

Globalization and liberalization of the Indian economy have also increased women's participation in CS by making male-dominated engineering fields lucrative to women. Government efforts to strengthen the information technology (IT) industry has enabled India to emerge as a "soft-power" and one of the wealthi-



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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.

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Letters to the Editor are limited to 200 words and may be edited for clarification.

### CS IN INDIA

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est economies in the developing world (with a GDP growth rate of nearly 9.5% in 2008). The IT industry is expected to provide high-end jobs to a large number of qualified people in the coming years, which makes CS attractive to the younger generation, including women.

Unlike the U.S., where women have opportunities to choose from multiple career options, women in India have fewer career choices. CS is especially attractive because it is a means for women to secure financial rewards, gain prestige, and secure economic independence as career-oriented professionals. Stereotypes also play a role in women's career choices as, in India, people who work in IT are seen as smart and bright, rather than as geeky or anti-social. According to a study participant: "Computer scientists are considered very intelligent, very tactful, code decrypting, and everything like that. So they are respected everywhere."

In India, there is also a perception that a career in CS is consistent with social expectations for women, allowing women to marry and have children while they pursue their careers, and protecting them from the outside environment, which is seen as unfriendly to women. As another participant noted, "You get white-collar jobs, sit in an office, and do the work. That is what parents want for us. They do not want us to go to the factory and work with some men in the field."

For many women in India, CS is also seen as a path to equality and freedom. As one student said, "I became interested in CS because other branches were having few jobs. From the beginning I did not like the challenges which society places on girls—that after a certain age you are not supposed to study. So, I wanted a field which can make you independent."

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# ICT in Turkey

*Integration in K–12 Schools*

**M. Yasar Ozden, Cengiz S. Aşkun**

**AS IN MANY OTHER COUNTRIES**, Information and Communication Technologies (ICT), particularly the integration of ICT in education, has gained increasing political attention in Turkey during the last two decades and as a result, ICT education has become a catalyst for considerable change. Political leaders have begun to see ICT as a means for creating new roles for students and teachers and as a way of achieving several economical, sociological, and pedagogical goals.

From 1998 to 2007, Turkey's Ministry of National Education (MoNE, 2005) undertook a series of major changes intended to integrate ICT into the Turkish education system. To support ICT's new central position in education, the Ministry declared that:

- Every school would have IT hardware and software and a secure and fast Internet connection.
- All students, teachers, directors, staff, and parents and would have access to IT resources.
- Schools would offer IT courses.
- Computers would be provided in a ratio of 21 computers per 500 students, including at least two computers with Internet and intranet connection per teacher work area and at least one computer for the guidance services, libraries, and administration offices.
- Software and in-service training courses would be provided to ensure that the school staff was prepared to teach with the technology.

To achieve these goals, the MoNE initiated the Basic Education Project (BEP). This project was aimed at raising the basic educational level of Turkey to the standards of developed countries. Actions were taken to improve interest and quality in basic education and to turn primary schools into learning centers for the public.

The project budget was approximately 700 million U. S. dollars and funded by local sources, the World Bank, and the European Union. With this funding, 93% of the primary schools in Turkey were connected

Unfortunately, and in spite of positive feedback from the computer teachers and the extensive amount of work done to integrate ICT in education, MoNE decided to change the computer courses' status to elective and reduce the time allocation to one hour each week.

to the Internet through DSL and equipped with computers, LCD projectors, printers, and other necessary hardware and software (Özdemir, 2009).

During this same period the Higher Education Council of Turkey, through the National Education Development project, worked to redesign the curriculum in schools of teacher education (STE) to ensure that teachers were trained to use ICT effectively in the classroom. One of the major components of this project was to establish a computer education and instructional technology department within every STE.

Since 1998, a number of teachers graduated from these departments and were employed mostly by the MoNE to teach computer skills in elementary schools. The computer courses in these schools were originally offered two hours each week and were compulsory. In 2006 the curriculum for this course was redesigned for grades 1–8. In spite of positive feedback from the computer teachers and the extensive amount of work done to integrate ICT in education, MoNE decided to change the computer courses' status to elective and reduce the time allocation to one hour each week.

Unfortunately the focus on ICT education has not benefited the field of computer science (CS). There is no standard curriculum for CS education in Turkey. And although there was one CS course at the 9–12 level, it was discontinued this year. As a result there is no course offered to our students in regular high schools focused specifically on CS.

While recent developments are disappointing, other projects are underway that hold promise for the future.

- Education for the Future (in cooperation with INTEL) aims to train approximately 50,000 teachers over a three year period in computer literacy skills.
- Learning Center projects were launched by MoNE to provide access to ICT resources, certificate programs, and to create a learning community among the open education students.
- E-learning Education Portals projects established education portals providing educators, students, and parents with quality education on computer skills to reduce the digital divide.

While Turkey has made considerable progress in integrating ICT into education, disappointing setbacks have occurred and CS education has actually been diminished.

**References**

MoNE (2005). *National Education Policy Review Background Report*. Ankara.

Özdemir, S. (2009). The e-learning puzzle in Turkey: deja vu? In B. Olaniran (Ed.), *Cases on Successful E-Learning Practices in the Developed and Developing World: Methods for the Global Information Economy*: IGI Global Publishing.

## CSTA Member in the News: Susan Morrissett, Teacher of winner in the Siemens Competition

Neil Shah, Morrissett's student at Weaver Academy, placed second in the team category of the prestigious Siemens Competition in Math, Science and Technology with a project titled "Supercomputing Analytical Discovery of Plasma Instabilities in Fusion Energy Reactors." The Weaver Academy is part of Guilford County Schools in North Carolina.

## Meet the Authors

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Eugene has over 30 years of experience in the computer technology field, both as a teacher and as a business consultant. He is a member of the CSTA Leadership Cohort.

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Zuhair is a senior lecturer of CS in the IT Department of Al-Musanna College of Technology at the Ministry of Manpower.

## Out and About the Community

*High School Researchers in Arkansas*

**Vernard Henley**

Since 2006, high school students from all over Arkansas have selected research projects in hopes of being chosen to participate in a unique summer research opportunity with the High School Research Program (HSRP) at the University of Arkansas at Little Rock (UALR).

The HSRP was developed by Dr. Srini Ramaswamy (chair of the CS Department at UALR) to provide high school students an opportunity to be mentored for three weeks by UALR faculty in a research setting and to assist students in making sound decisions regarding pursuing education beyond high school. The free residential program also provides students with a preview of college life.

Megan Trett, who participated in 2008, says, "HSRP was a wonderful opportunity for me to attain hands-on experience when I worked on developing my project". Trett, now a freshman at the UALR majoring in computer science (CS), notes that participating in the program was a rewarding learning experience and she appreciated meeting the CS staff and discussing what programming languages were best for game programming along with which game engines would be best for building and animating 3-D models.

Blake Montgomery, a senior at the Arkansas School for Mathematics, Sciences, and the Arts, who attended the program in 2009 says, "The HSRP gave me the opportunity to work one-on-one with a professor at the University. My professor and I investigated the viability of a distributed system composed of PlayStation 3s."

Although the initial offering of projects in 2006 primarily centered on CS-based topics, Ramaswamy sought projects from other STEM disciplines to attract a more diverse group of students. As a result, 23% of the participants have been African-American students and 38% of the students have been female. Recruitment efforts were expanded to more areas of the state and after four years, more than 55 students have participated in the program.

In addition to increasing the participation of under-represented students, the program has also shown some highly encouraging results. After four years of engagement, 76% of the students who have so far graduated from high school elected to enter STEM disciplines upon entering college. Of the students who have entered college, 70% have opted to attend four-year colleges in Arkansas and 56% of that group entered the College of Engineering & Information Technology at UALR.

In addition to receiving valuable mentoring while conducting college level research, some students have also competed with their projects and won at regional and state science fairs in Arkansas. Most recently, a student participating in the 2008 HSRP advanced to the 2009 Intel International Science & Engineering Fair and placed fourth in the CS category.

Daniel Moix, CSTA Arkansas President, who has worked as the Dean of Student Life for the HSRP since 2007, acknowledges that participants, "have the opportunity to work with university faculty on real-world problems that don't come from a textbook or lab manual. From modeling facial parameter extraction to investigating carbon nanomaterials, these students are doing work that will inform our future and theirs."

For additional questions regarding the program, please contact either Dr. Srini Ramaswamy (*srini@ualr.edu*) or Vernard Henley (*vwhenley@ualr.edu*).

## Podcast Corner

*Teach with Africa*

CSTA member Eugene Lemon spent eight weeks teaching computer science (CS) to 9th graders at the LEAP Science and Math School in Cape Town, South Africa. His work was sponsored through Teach with Africa (teachwithafrica.org), an organization working to break down the economic and social barriers to education through an exchange of teaching and learning. Lemon teaches at Ralph J. Bunche alternative education high school in Oakland, CA.

"Due to my life experiences I find satisfaction in working with students who face challenges in improving attendance, consistency in enrollment, and achieving core subject proficiency. I realized that the students the Teach with Africa program serves are at-risk young people, just like the students I've served during my teaching career."

Hear about Lemon's experiences teaching CS to students and teachers in South Africa in a CSTA Podcast at *csta.acm.org*.

*"Education is the most powerful weapon you can use to change the world." ~ Nelson Mandela*

## Curriculum in Action

*Experiences in the Middle East*

**Zuhair Saleh**

Computing is both a young discipline (when compared to other sciences) and a rapidly changing field. For this reason, our focus on how to effectively teach the discipline of computer science (CS) is frequently overshadowed by our efforts to deal with the technology itself. The recent worldwide report of falling enrollments and a lack of basic problem-solving skills in incoming students (Fletcher, 2009), however, is leading to increased attention on effective teaching.

While CSTA's Curriculum Improvement Task Force has made major contributions by examining pressing educational questions and providing resources for teaching CS, the observations of experienced educators must also play a key role in improving our teaching. The suggestions offered here are based upon my experiences in over two decades of teaching CS1 and CS2 courses at universities and colleges in the Middle East.

**1. Use educational software to teach algorithms**

The use of simplified program development environments (PDE) has proved to be effective. Scratch and Karel the Robot are examples of such environments. A system based on an assembly-like programming language called Al-Khwarizmi was used by the ministry of education in Iraq in an experiment in the mid 1980s with encouraging results. These systems rely on graphics and animation to attract students and improve their comprehension of fundamental CS concepts.

**2. Use a student-centered approach**

Investigate the interests of the students and divide the class into teams to work on projects selected from each group's interests. Group projects encourage team work, online research, leadership, and self-expression. Finding topics for such activities is easy since most fields involve CS technologies. Problems involving number theory and math problems are interesting and engaging when connected to the students' experiences.

**3. Incorporate electronic communications**
The Web has provided numerous opportunities to enhance CS education. Communication with students can be greatly improved by adding email and electronic chat opportunities to assignments. Scheduling response days and defining policies are clearly necessary here. Reduced paper handling and greater involvement of shy students are obvious advantages when students send queries and assignments electronically. Effective teaching strategies such as providing common remarks on student projects become easy with electronic communication tools.

**4. Use presentation tools**
Reuse lectures and discussions by preserving them with special preparation and delivery software. The prepared presentations can then be saved on any suitable medium and accessed from anywhere by both the teacher and students.

**5. Courseware on the Web**
Posting course material improves its availability and accessibility. The tools for this are now widely available. It is a good idea to post all course materials including the delivery plan and resources. Lectures can be posted as video recordings.

Today's students are part of the Nintendo and the Sony Play Station generation and they expect plenty of action in their learning environments. It is ironic that, with sophisticated and indispensible computing devices all around us, student interest in pursuing CS seems to be diminishing. Computers have become ubiquitous precisely because they are designed to be user-friendly. Maybe it is time to make CS education more student-friendly.

**Reference**

Fletcher, H.L.G. & Lu, J.J. (2009). Human Computing Skills: Rethinking the K–12 Experience. *Communications of the ACM*, 52 (2), 23-25.

# College Connection

*The University of Guelph*

**Editor's note:** *This dialog with Julia Baldwin, Computer Science (CS) Liaison Officer at the University of Guelph is a continuation of our series of interviews with CSTA institutional members. Please share with your students these details about the CS programs at the University of Guelph.*

**CSTA:** Tell us about the University of Guelph.
**Baldwin:** The University of Guelph is located in Guelph, Ontario, Canada, about an hour southwest of Toronto. Students can earn a Bachelor of Computing with a major in software engineering or CS. At the graduate level, students can earn a Master of Science or Ph.D. in CS.

**CSTA:** What draws students to your program and what keeps them there?
**Baldwin:** A supportive environment is a key aspect of our program. Faculty members are committed to providing a solid foundation in the first year, paving the way for success in year two and beyond. We strongly believe in the "personal approach" to education. Professors are accessible to students in all stages of the program, and we take pride in an ethic of support rather than competition.

**CSTA:** What skills can students acquire before college that will help them succeed in your program?
**Baldwin:** A good work ethic and the ability to work effectively in team environments will help students thrive. An analytical approach to problem solving will help students succeed in their academic goals. The ability to balance the various aspects of university life is important as well.

**CSTA:** What cool careers are your graduates prepared for?
**Baldwin:** Our graduates are in high demand as professionals in the software development industry at a variety of different companies including IBM, Microsoft, RIM, and thousands of other smaller organizations.

**CSTA:** What topics will students study?
**Baldwin:** Students will study software development, CS theory, networking, hardware, and databases. In addition, they will learn critical skills in communication and collaboration. Our faculty has a strong background in many cutting-edge areas of CS, including artificial intelligence, bioinformatics, and ubiquitous systems.

**CSTA:** Tell us a bit about the social environment of the CS program.
**Baldwin:** Our students are actively involved in two student organizations, which run events and information nights for the students. The program is one that encourages collaboration and sharing of ideas, just like the collaboration seen in the software industry. The ethic of support helps them to achieve great things.

**CSTA:** What distinguishes your school and/or program from others?
**Baldwin:** Our school offers a supportive environment, a focus on communication and management skills, as well as a rigorous academic program. Students can also study a second area called an "area of application" which they use to complement their CS knowledge. This second area can often be upgraded to a minor, developing a breadth of knowledge not seen in other CS programs.

**For more information visit:** *www.uoguelph.ca*.

## SHOW ME THE NUMBERS

CSTA Members Reside in 102 Countries

**CSTA MEMBERSHIP BY CONTINENT**

| | |
|---|---|
| North America | 6,147 |
| Asia | 775 |
| Europe | 189 |
| Oceania | 142 |
| Africa | 136 |
| South America | 40 |
| **TOTAL** | **7,429** |

**Source:** Computer Science Teachers Association, 2010

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

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## MARK YOUR CALENDAR

**SIGCSE Technical Symposium**
March 10–13, 2010 in Milwaukee, Wisconsin
*www.sigcse.org/sigcse2010*

**Consortium for Computing Sciences in Colleges (CCSC: Southwestern)**
March 26–27, 2010 in Thousand Oaks, California
*www.ccsc.org/southwestern*

**Consortium for Computing Sciences in Colleges (CCSC: Mid-South)**
March 26–27, 2010 in Searcy, Arkansas
*www.ccsc-ms.org*

**Consortium for Computing Sciences in Colleges (CCSC: Central Plains)**
April 9–10, 2010 in Parkville, Missouri
*www.ccsc.org/centralplains*

**Consortium for Computing Sciences in Colleges (CCSC: Northeastern)**
April 16–17, 2010 in West Hartford, Connecticut
*uhaweb.hartford.edu/ccscne*

**Consortium for Computing Sciences in Colleges (CCSC: South Central)**
April 23–24, 2010 in Austin, Texas
*www.sci.tamucc.edu/ccsc*

**ISTE 2010 (International Society for Technology in Education)**
June 27–30, 2010 in Denver, Colorado
*center.uoregon.edu/ISTE/2010*

**Project GUTS / Supercomputing Challenge Summer Teacher Institute**
July 11–24, 2010 in Socorro, New Mexico
*challenge.nm.org/sti*

**CS & IT Symposium**
July 13, 2010 at Google Headquarters, Mountain View, California
*www.csitsymposium.org*

**African-American Women in Computer Science Scholarship**
July 20, 2010 deadline
*www.cis.famu.edu/~aawcs*

**2010 High School Research Program**
July 11–30, 2010 in Little Rock, Arkansas
*technologize.ualr.edu/?page_id=79*

**USA Science & Engineering Festival Expo**
October 23–24, 2010 in Washington, D.C.
*www.usasciencefestival.org*

## RESOURCES

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

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**Page 3:** University of New Mexico *www.unm.edu*
**Page 4:** The Middle East Technical University *www.metu.edu.tr*
**Page 4:** National Education Policy Review Background Report (Turkey) *digm.meb.gov.tr/uaorgutler/OECD/OECD_onrapor_INGMart06.pdf*
**Page 5:** Siemens Competition *www.siemens-foundation.org/en/competition.htm*
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