Computing is increasingly important for exploring the world we live in, and learning about computers will be as fundamental as reading, writing, and arithmetic to the understanding of other disciplines as well. The five cover features in this issue zero in on inventive solutions to the diverse challenges facing computing education today.

**COVER FEATURES**

**GUEST EDITORS’ INTRODUCTION**

**30 Computing Education: Beyond the Classroom**
Mark Guzdial and Betsy DiSalvo
Computing is the new literacy, and teaching computing in a world where computers are ubiquitous demands new techniques and contexts for learning. As these evolve, so too will the student profile.

**32 Addressing the Full Range of Students: Challenges in K-12 Computer Science Education**
Maria Knobelsdorf and Jan Vahrenhold
While computer science is firmly established in higher education, introducing and maintaining CS as a regular K-12 subject remains a major challenge. From a pedagogical perspective, this requires adapting the curriculum to students at widely varying levels of cognitive development and training teachers to enable both knowledge construction and competency development.

**38 STEAM-Powered Computing Education: Using E-Textiles to Integrate the Arts and STEM**
Kylie Peppler
Incorporating novel, cross-disciplinary technologies such as e-textiles in computing education can broaden participation, particularly by women, and improve learning outcomes.

**44 The Porous Classroom: Professional Practices in the Computing Curriculum**
Sally Finch and Daniel Knox
Spaces that encourage the mix of academic instruction with practical professional experience beyond the traditional computing classroom can significantly increase students’ motivation to learn and to share their learning with others.

**52 Learning Computing through Creating and Connecting**
Karen Brennan
Despite increased cultural awareness of computing, programming remains inaccessible to many young people. In response to this challenge, MIT Media Lab researchers are developing Scratch, which combines an authoring environment for interactive media projects with an online platform for sharing those projects.

**60 The Case for Validated Tools in Computer Science Education Research**
Allison Elliott Tew and Brian Dorn
Measuring student learning in computer science education presents particular challenges, making objective assessment elusive to educators and researchers. Development and validation of the FCS1 and CAS tools demonstrate both the feasibility and benefits of validated assessment instruments in this discipline.

**PERSPECTIVES**

**68 Ultrascale Visualization of Climate Data**
Ultrascale Visualization Climate Data Analysis Tools Project Team
Collaboration across research, government, academic, and private sectors is integrating more than 70 scientific computing libraries and applications through a tailorable provenance framework, empowering scientists to exchange and examine data in novel ways.
RESEARCH FEATURES
78 An Empirical Study of a Chinese Online Social Network—Renren
Jianwei Niu, Jing Peng, Lei Shu, Chao Tong, and Wanjun Liao
Deeper knowledge of social networks’ structure and temporal evolution enhances data mining for both research and education purposes. An empirical analysis of a Chinese social network, Renren, shows that it follows an exponentially truncated power law in degree distribution, and has a short average node distance.

86 Providing Quality of Experience for Users: The Next DBMS Challenge
Rogério Luís de Carvalho Costa and Pedro Furtado
Quality-of-experience-oriented mechanisms, not currently available in traditional database management systems, allow a system to take into consideration user-specified requirements and to adjust its operations accordingly, based on user expectations.

COLUMNS
13 Computing Conversations
John C. Hollar: History of Computing
Charles Severance

17 Computing and the Law
Working with Your Legal Department
Brian M. Gaff and Alyssa Harvey Dawson

20 32 & 16 Years Ago
Computer, September 1981 and 1997
Neville Holmes

94 Identity Sciences
The Next Biometric Challenge: Medical Alterations
Karl Ricanek

97 Cloud Cover
PaaS: New Opportunities for Cloud Application Development
Beth Cohen

101 Science Fiction Prototyping
That Copernican Moment
Brian David Johnson

104 Out of Band
Toxic Cookies
Hal Berghel

124 The Errant Hashtag
For the Common Good
David Alan Grier

NEWS
22 Technology News
Storage Challenge: Where Will All That Big Data Go?
Neal Leavitt

26 News Briefs
Lee Garber

MEMBERSHIP NEWS
108 IEEE Computer Society Connection
110 Call and Calendar

DEPARTMENTS
6 Elsewhere in the CS
10 Letters
67 Computer Society Information
114 Career Opportunities

We welcome your letters. Send them to letters@computer.org. Letters are subject to editing for style, clarity, and length.