

# SIGCSE Special Session on Revolutionizing the Culture of Computer Science

Noah Salzman  
Amit Jain

Boise State University  
1910 University Drive  
Boise, Idaho 83725  
1-208-426-5726  
noahsalzman@boisestate.edu  
ajain@boisestate.edu

Venkat N. Gudivada

East Carolina University  
College of Engineering and  
Technology  
Greenville, NC 27858  
1-252-328-9693  
gudivadav15@ecu.edu

Mary Lou Maher  
Celine Latulipe

University of North Carolina,  
Charlotte  
9201 University City Blvd.  
Charlotte, NC 28223  
1-280-426-1899  
m.maher@unc.edu  
clatulip@unc.edu

Ann Q. Gates  
Sarah Hug

University of Texas, El Paso  
500 West University Avenue  
El Paso, TX 79968  
1-915-747-7689  
agates@utep.edu  
hug@colorado.edu

## Categories and Subject Descriptors

• **Social and professional topics** → **Professional topics** → **Computing education** → **Model curricula** • **Social and professional topics** → **Professional topics** → **Computing profession** → **Employment issues** • **Social and professional topics** → **Professional topics** → **Computing profession** → **Codes of ethics**

## Keywords

Culture; gender; social justice; diversity; change theory; industry; students; faculty.

## 1. SUMMARY

This session will explore the role that academic institutions and computer science departments can play in creating a revolutionary, real, and lasting change in the culture of computer science to create and promote an inclusive culture that values diversity and promotes social justice.

## 2. OBJECTIVE

The fact that women and members of other groups are not well represented in either education or professions related to computer science is well documented [1], despite years of purported effort and much lip service. Research has shown that popularly held notions accounting for this are inaccurate or simply false [2]–[4]. Instead, the expression of biased social values is asserted to account for the observed fact that women and members of other groups experience pressures impeding their choices and either never choose to pursue or cease their pursuit of careers in engineering and computer science [2], [5], [6].

The objective of this special session is to discuss the role of academic institutions and computer science departments in propagating positive, revolutionary change to this culture, and how it can be done.

## 3. OUTLINE

The participants in this special session are computer science departments who are recipients of the NSF IUSE: Revolutionizing Engineering and Computer Science Departments (RED) grant and

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

*Conference '10*, Month 1–2, 2010, City, State, Country.

Copyright 2010 ACM 1-58113-000-0/00/0010 ...\$15.00.

DOI: 10.475/1234

are working to radically transform computer science education and to propagate this revolution to other computer science departments and fields. The institutions represented in this session are the University of Texas El Paso, the University of North Carolina Charlotte, East Carolina University, and Boise State University. Each team will give a short presentation on their efforts to promote inclusion and transform the culture in their departments, followed by a 30 minute participatory discussion during which ideas can be discussed and panelists can answer questions.

UTEP's RED project, "A Model of Change for Preparing a New Generation for Professional Practice in Computer Science," aims to cultivate socially conscious connectedness among students, faculty, and industry that creates an understanding and appreciation for the cultural contributions of diverse students in computer science. Recruitment and retention of Hispanic students in the computing fields has historically been challenging. As an example of UTEP's efforts to create an inclusive environment is the development of modules used to prepare teaching and instructional assistants. The modules recognize cultural nuances (or biases) that may influence students or faculty in a negative manner. The purpose of the effort, thus, is to disseminate how individuals may contribute to developing a more open and welcoming learning environment and recognizing individuals' linguistic and cultural differences as assets rather than deficits. As such, positioning students using an asset-based mindset can contribute to formation of a positive self-identity.

At the University of North Carolina, Charlotte, The Connected Learner project seeks to transform undergraduate education through a pedagogy that emphasizes learning from peers, learning through service to the community, and learning from real world problems in the profession. The research team includes faculty from CS and Organizational Science Departments, ensuring a multidisciplinary approach to organizational change. The project has transformed the introductory CS courses by using lightweight teams and active learning, resulting in students' perception that they feel part of a community [7], [8]. Student data shows that we have achieved significantly higher levels of retention of under-represented groups in the students participating in team-based, active learning classes [9]. Students are exposed to service learning courses after completion of the introductory courses that enable them to develop leadership skills in community service activities. The capstone experience engages students in team-based projects on real world problems or internships that enable students to reflect on the relationship between their courses and their experience in the profession. We are studying communication, self-efficacy, and identity as students transition from lightweight teams to project based teams. We continue to build a vibrant community of engaged

faculty through Summer Institutes for Active Learning, with more than 24 faculty participating thus far.

At East Carolina University, Programmers to Professional Software Engineers aims to transform undergraduate Computer Science (CS) education through a set of complementary approaches. They include transform programming-centric computer science education approach to a systems-oriented and software engineering-centric one using open-source software, development of non-course-centric curriculum, infusing professional skills development processes into the entire curriculum, and dramatically increasing retention and graduation rates through inclusive pedagogy and personalization of teaching and learning[10]. We are currently developing personalizable teaching and learning materials for two senior-level courses: Information Retrieval, and Database Management Systems. We use a topic-driven approach to producing teaching and learning materials, which can then be composed to generate personalizable instruction. We are also automatically generating questions for assessing student learning.

At Boise State University, The Computer Science Professionals Hatchery seeks to transform undergraduate education by replicating the best elements of a software company environment, layering in moral, ethical, and social threads with entrepreneurship and professional skills. We developed a 1 credit Foundational Values course for first-year students where case examples of bias in interpersonal and corporate interactions and bias as reflected in the products of computing professions are analyzed in a series of team-based activities guided by rubrics based on the social-justice theories of John Rawls [11]. To date, this course has been taken by 232 students, and preliminary evaluations and interviews suggest that participation in the course has helped students to recognize issues of bias in computer science and be more willing to confront bias when they see or experience it. This course will provide a consistent and usable scaffold of values and practices, further strengthened over the course of their undergraduate studies through the integration of ethics and social justice content throughout the CS curriculum, with which students will become agents of change in the culture of computer science education and professional practice.

At the conclusion of the presentations by the four RED teams, we will transition to a question and answer session followed by a group discussion of how to best approach achieving cultural change in computer science departments to include and support a diverse range of students. This discussion will be facilitated as a Think-Pair-Share, where session attendees will be asked to reflect on cultural issues and how these issues were addressed at their institutions, followed by a small group discussion and concluding with sharing and discussion with the entire group.

#### 4. EXPECTATIONS

The intended audience is members of computer science departments and any others who are interested in improving the culture of computer science. Attendees should learn about the latest research and approaches for creating lasting and meaningful changes in the culture of computer science.

#### 5. SUITABILITY FOR A SPECIAL SESSION

As one of NSF's Top 10 Big Ideas, the INCLUDES (Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science) program focuses on making STEM education and career pathways more inclusive across the U.S. [12]. With the demographic shifts in the U.S., it is

essential that the composition of the computing workforce is more reflective of the U.S. population, in particular because of the impact of diversity on discovery and innovation. The goal of this session is encourage participants to begin their own thought processes on how they can approach the issue of cultural transformation within the context of their own institutions, and begin to build a community of like-minded practitioners committed to making computer science a more inclusive discipline.

#### 6. Acknowledgements

In addition to the listed authors, the following additional members of the CS RED project teams will participate in this session: Boise State University: Timothy Andersen, Amit Jain, Dianxiang Xu; East Carolina University: Qin Ding, Nasseh Tabrizi and Mark Hills; University of North Carolina, Charlotte: Audrey Rorrer, Larry Mays, Steven Rogelberg; University of Texas, El Paso: Elsa Villa, Martine Ceberio, Salamah Salamah, Natalia Villanueva Rosales, Christine Convertino.

#### 7. REFERENCES

- [1] C. Hill, C. Corbett, and A. St. Rose, "Why So Few? Women in Science, Technology, Engineering, and Mathematics," American Association of University Women, Washington, DC, 2010.
- [2] S. J. Ceci, W. M. Williams, and S. M. Barnett, "Women's underrepresentation in science: Sociocultural and biological considerations," *Psychol. Bull.*, vol. 135, no. 2, pp. 218–261, 2009.
- [3] J. S. Hyde, S. M. Lindberg, M. C. Linn, A. B. Ellis, and C. C. Williams, "Gender Similarities Characterize Math Performance," *Science*, vol. 321, no. 5888, pp. 494–495, Jul. 2008.
- [4] S. S. Silbey, "Why Do So Many Women Who Study Engineering Leave the Field?," *Harvard Business Review*, 23-Aug-2016. [Online]. Available: <https://hbr.org/2016/08/why-do-so-many-women-who-study-engineering-leave-the-field>. [Accessed: 18-Aug-2017].
- [5] J. Goglin, "Women Are Opting Out of IT, Here's How to Bring Them Back," *Ensono*, 15-Jun-2017. [Online]. Available: <https://www.ensono.com/insights/women-opting-out>. [Accessed: 18-Aug-2017].
- [6] S. Stockdale, "The myth of the 'cool tech girl' and why she's dangerous," *Code Like A Girl*, 16-Jun-2017. [Online]. Available: <https://code.likeagirl.io/the-myth-of-the-cool-tech-girl-7868fa63769b>. [Accessed: 18-Aug-2017].
- [7] M. L. Maher, C. Latulipe, H. Lipford, and A. Rorrer, "Flipped Classroom Strategies for CS Education," 2015, pp. 218–223.
- [8] C. Latulipe, N. B. Long, and C. E. Seminario, "Structuring Flipped Classes with Lightweight Teams and Gamification," 2015, pp. 392–397.
- [9] C. Latulipe, A. Rorrer, and B. Long, "Longitudinal Data on Flipped Class Effects on Performance in CS1 and Retention after CS1," in *Proceedings of the 49th ACM Technical Symposium on Computer Science Education*, 2018, pp. 411–416.
- [10] V. N. Gudivada, "Cognitive Analytics Driven Personalized Learning," *Educ. Technol.*, vol. 57, no. 1, pp. 23–31, 2017.
- [11] J. Rawls, *A Theory of Justice*, Rev. ed. Cambridge, Mass: Belknap Press of Harvard University Press, 1999.
- [12] "NSF's 10 Big Ideas - Special Report | NSF - National Science Foundation." [Online]. Available: [https://www.nsf.gov/news/special\\_reports/big\\_ideas/includes.jsp](https://www.nsf.gov/news/special_reports/big_ideas/includes.jsp). [Accessed: 21-Aug-2018].