

# Bringing Grades K-5 to the Mainstream of Computer Science Education

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## Categories and Subject Descriptors

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Design, Experimentation, Human Factors

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Computer Science Education, K-5 Curriculum, Elementary School, Code.org, Scratch, ScratchJr, Outreach, Professional Development

## 1. SUMMARY

As awareness of computer science education grows in the general public, it is important to showcase computer science education as accessible for all grades K-12 and beyond. As panelists present the projects and research they've been conducting, we will highlight three overarching topics:

- The importance of K-5 computer science education to educators of all grade levels,
- Thoughts on why K-5 has traditionally been less prominent in the computer science education landscape, and
- Strategies on how we, the computer science education community, can promote K-5 computer science education as worthwhile as 6-12+ computer science education.

Barriers to why K-5 computer science education is not as prominent as that in grades 6-12, such as scarcity of wide-spread curriculum or scarcity of research, will lead to panelists presenting how their work is rectifying this imbalance. This session's panelists are pioneers and important thought leaders in the K-5 computer science education field. Panelists in this session are either producing research in the K-5 computer science education field or working at a large scale to promote or increase participation of K-5 students in computer science.

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## 2. Code.org's commitment to K-5 (Katie Apone)

On September 5, 2014, Code.org launched three new computer science courses for K-5 students. Code.org's vision is that every student in every K-12 public school have the opportunity to learn computer science. Part of Code.org's mission is to broaden participation of women and underrepresented students of color, and early exposure to computer science education has been identified as an important factor for female students who go on to choose computer science as a career [1]. Not only does Code.org create curriculum for grades K-5, but it actively promotes and encourages the integration of computer science in elementary school by offering free professional development opportunities around the nation.

*Katie Apone is the K-8 Program Manager at Code.org.*

## 3. Tufts University (Marina Bers)

Marina Bers heads the interdisciplinary Developmental Technologies research group. Her research involves the design and study of innovative learning technologies to promote children's positive development. She co-developed the ScratchJr programming language in collaboration with Mitch Resnick from the MIT Media Lab and Paula Bonta, from the PICO company. ScratchJr is a free app funded by the National Science Foundation, the Code to Learn Foundation and a very successful Kickstarter campaign.

*Marina Umaschi Bers is a professor at the Eliot-Pearson Department of Child Development and an adjunct professor in the Computer Science Department at Tufts University.*

## 4. Harvard Graduate School of Education (Karen Brennan)

Given the centrality of computing in modern life, everyone should have access to computer science education—and that learning should not be delayed to high school or college. Computer programming can serve as a compelling introduction, enabling the exploration of computer science concepts in a grounded, personally meaningful context. To support this exploration in the K-5 classroom (and beyond), the ScratchEd Team at Harvard has been developing a model of professional learning for teachers working with the Scratch programming environment. The model—which includes an online community, face-to-face gatherings, and curriculum—has enabled tens of thousands of teachers to work with Scratch [2]. Karen Brennan will share some of the challenges unique to bringing programming to the K-5 classroom.

*Karen Brennan is an Assistant Professor of Education at Harvard University. She directs the ScratchEd project.*

## **5. University of California, Santa Barbara (Diana Franklin)**

Computing is becoming ubiquitous, and the next generation needs to have a new level of fluency with computational thinking in order to become innovators. Elementary school is a critical time to expose, engage, and excite all students about computing. To support this, our team is investigating two important questions. First, how do elementary school students with a variety of backgrounds learn computing concepts? Second, what environment (language, curriculum, tools) are needed to make computing successful for a broad cross-section of classrooms. Diana Franklin will share some of the successes and challenges in bringing block-based visual language curricula to 4th-6th grade classrooms.

*Diana Franklin is teaching faculty at the University of California at Santa Barbara. She and Danielle Harlow co-developed LaPlaya and KELP CS, a new tool and curriculum tailored to 4th-6th grade students.*

## **6. University of Illinois at Urbana Champaign (Maya Israel)**

There is a growing movement to integrate computing and computational thinking in K-5 instruction with an emphasis on including students with diverse learning needs including English language learners, students with disabilities, and students living in poverty. Despite this momentum, many teachers have either naïve or incorrect conceptions about how to teach computing, especially to students with limited computing experience or with academic challenges. Maya Israel will share findings from a year-long mixed methods study investigating how elementary school teachers with limited computer science experience in a high-need school integrated computational thinking into their instruction, with a focus on engaging with diverse learners. Data

related to implementation structures, overcoming instructional barriers, and strategies for including diverse learners will be presented.

*Maya Israel is an Assistant Professor of Special Education at the University of Illinois, Urbana Champaign. She heads the computing research initiative within the Office of Mathematics, Science, and Technology Education (MSTE).*

## **7. Code.org (Pat Yongpradit, Moderator)**

As a national voice on K-12 computer science education, Pat Yongpradit's knowledge of the landscape allows him to facilitate a meaningful discussion among panelists. Throughout his career as a high school computer science teacher, he inspired students through authentic, project-based learning experiences, and implemented initiatives to broaden participation in computer science among underrepresented groups.

*Pat Yongpradit is Director of Education at Code.org.*

## **8. Intended Audience**

This special session is designed for all educators interested in broadening participation in computer science teaching, including elementary school educators. Educators of all grade levels can benefit from promoting K-5 computer science education, as it builds a pathway of students to continue learning computer science throughout their educational careers.

## **9. REFERENCES**

- [1] "Women Who Choose Computer Science—What Really Matters," Google Corp. May 26, 2014, <http://static.googleusercontent.com/media/www.google.com/en/us/edu/pdf/women-who-choose-what-really.pdf>
- [2] Brennan, K. (2013). Learning computing through creating and connecting. *IEEE Computer, Special Issue: Computing in Education*. doi:10.1109/MC.2013.229