CS for All: An Intersectional Approach to Unpacking Equity in Computer Science Education

Structured Poster Session
AERA 2019
Session Goals & Guiding Questions

● How are we defining “equity” in our efforts and research focused on ensuring all students receive high-quality computer science education?

● How are our projects addressing issues of inequity that youth, educators, administrators, or parents face in the current “CS for All” movement?

● How can we inform teacher practice through our work, with attention to intersectionality, multimodality, and the diverse voices of the “CS for All” movement?
Today’s Agenda:

● 11:50 - 11:53 - Session welcome and goals
● 11:53 - 12:05 - Short poster introductions
● 12:05 - 12:30 - Poster walk 1 (half the presenters share their work)
● 12:30 - 12:55 - Poster walk 2 (the other half their share posters)
● 12:55 - 1:10 - Discussant Karen King shares reflections
● 1:10 - 1:20 - Audience Q&A
Translanguaging as a frame for more equitable computer science learning

Chris Hoadley, Sara Vogel, Laura Ascenzi-Moreno, and Kate Menken, with Jasmine Ma, Marcos Ynoa, and Sarah Radke

Culturally sustaining pedagogy as a tool to promote the participation of emergent bilinguals in computer science. We consider three types of literacy in our designs: bilingual community literacies, disciplinary literacies, and computer science literacies. We ask, “What conversations are this code a part of?”

Practice Goals: Supporting public middle school teachers to integrate computer science into bilingual classrooms across subjects We leverage the languaging repertoires students bring through the lens of translanguaging.

Research Goals: Relate the concepts of translanguaging and literate programming to the teaching and learning of computational literacies.
Toward Using Virtual Identities in Computer Science Learning for Broadening Participation

Sneha Veeragoudar, Maya Wagoner, Dominic Kao, Danielle Olsen, Laurel Carney, Aziria Rodriguez, D. Fox Harrell

Motivation
Our research sought to discover best practices for using avatars to enhance performance, engagement, and STEM identity development for diverse public and high school computer science students.

Theoretical Background
From the learning sciences: Critical pedagogy, Constructionism, Computational Literacy, and Exploring Computer Science Curriculum
From research on virtual and physical identities: Blended Identities and Stereotype Threat

Methods
Qualitative user studies involved eliciting student-generated themes, questions, challenges, and goals with an anti-deficit ideological stance on students and their achievement. We developed a custom platform called MazeStar, that allowed students to explore their own ideas by creating customized games while learning about human-computer interaction, web design, privacy, coding, debugging, and more.

Computational analysis involved systematically exploring the impacts of different avatar types (such as distinctions between anthropomorphic vs. non-anthropomorphic avatars, user likeness vs. non-likeness avatars, and other conditions) in crowd-sourced studies with over 10,000 participants.

Workshops & MazeStar
We ran 4 workshops in informal and public school settings.
Cohort 1: Public middle & high school students, day long workshop at MIT.
Cohort 2: Public middle & high school students, day long workshop at MIT.
Cohort 3: STEAM-class students from Boston public school, weeklong workshop plus MIT tour
Cohort 4: STEAM-class students from Cambridge public high school, weeklong workshop plus MIT tour

Top Figure: Mazzy, a game central to MazeStar in which students learn fundamentals of coding.

Middle Figure: P1. Dr. Harrell facilitating with student participants.

Bottom Figure: Student-made game in MazeStar (student-selected theme was social media critique).

Qualitative Study Results
Analysis yielded four characterizations of the relationships between students and their virtual identities, which are (Harrell et al., 2018):
(1) Strategic Investment, Students invested effort to ensure that their avatars resembled themselves and described emotional attachments to their avatars, but also claimed to be emotionally disinvested in avatar features that they were unable to customize adequately due to limitations of the avatar creator
(2) Avatar-as-Tool Investment, Students who use avatars strictly instrumentally (and not for identity play) still see the type of avatar as likenesses of their physical-world identities in terms of the types of tools or playthings they appropriate to their social category
(3) Avatar as Self-Esteem Measure, Students consistently suggested that a desire to create a non-likeness avatar reflected a lack of self-esteem
(4) Judging Context Appropriateness, Students strongly preferred avatars that they deemed suited to the game genre/fictional virtual world at hand -- they also associated preferences for genres/fictional world types with their physical world identities

Acknowledgments & Citations
We acknowledge the support of the National Science Foundation under grant number 542970.

We will report on a Mixed-Methods study involving 94 teacher participants in a week-long computer science professional development program. Using a mixed-methods design (pre-and post-PD surveys + classroom observations in 3 classrooms), we inquired:

- How and when do teachers talk about race in computer science professional learning settings?
- How does teachers’ knowledge and efficacy around equity in computer science develop from participating in an equity-focused professional development program?
- How might a teacher’s sense of agency and resistance offer space to rupture silence and traditional objective discourse in order to engage in raced conversations?
Study of access and outcomes from advanced placement coursework in the Chicago Public Schools

CAFÉCS: Steven McGee, Randi McGee-Tekula, Jennifer Duck, Lucia Dettori, Andrew Rasmussen, Erica Wheeler, Ronald Greenberg

CPS has supported 45,000 students taking ECS in 7 years with equal access and outcomes.

How well do AP CSA and AP Computer Science Principles support equitable access and outcomes by race?

What factors might explain differences in outcomes by race?

- Differences in preparation?
- Differences in school quality?
Using Research-Practice Partnerships to Bolster Computer Science Education: Challenges & Opportunities for Equity

• Definition of Equitable CS education
• How RPPs can leverage contexts to build equity in CS for All
  • Building human, social and institutional capital
  • Increasing absorptive capacity
• Outcomes from our RPP
• Recommendations for early RPPs
Research Questions:

1. What makes a critical difference in students’ learning and engagement in introductory CS high school classes for historically underrepresented students?

2. What roles do identity and agency have in CS learning and engagement?

2018-19 Research in the Los Angeles Unified School District

- Research-Practice Partnership
- Pre/Post-Surveys
- In-depth Ethnographic Research in 4 focal classrooms

Preliminary Findings - Student Pre-Surveys

~3,000 respondents

Nearly 30% of students describe a desire to use computer science to address social and political issues in the community
The last mile of CS for All is how teachers act within the classroom.

One challenge is with conditional inclusive ideologies, gaps between what a teacher says about equity and what they actually do.

We explored this in small online practice spaces with CS teachers, followed by facilitated discussion.

Rosa: “I mean, it’s nice that there are more girls than guys in this class, but that doesn’t change the fact that mostly nerdy white dudes and Asian dudes work in computer science.

Rosa: "Sure, there may be women in tech, but they’re still mostly white women.”

1. What decisions do teachers make?
2. What beliefs of bias support or interfere with enacting equitable teaching?

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Scaling up Equity with E-Textiles: *Stitching the Loop* Unit Results in Exploring Computer Science

Justice T. Walker, Debora A. Fields, Yasmin B. Kafai, Tomoko M. Nakajima, Debora Lui, Joanna Goode, Jane Margolis, Gayithri Jayathirtha and Mia Shaw

<table>
<thead>
<tr>
<th>Survey Construct</th>
<th>Example Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confidence</td>
<td>I think I am very good at figuring out how to fix things that don’t work.</td>
</tr>
<tr>
<td>Fascination</td>
<td>I want to learn as much as possible about computer science.</td>
</tr>
<tr>
<td>Creativity</td>
<td>I can make things that are of interest to me in computer science.</td>
</tr>
<tr>
<td>Value</td>
<td>Knowing computer science is important for me in the future.</td>
</tr>
</tbody>
</table>

**Survey Results**

<table>
<thead>
<tr>
<th>Survey Construct</th>
<th>Pre-survey (SD)</th>
<th>Post-survey (SD)</th>
<th>Demographic Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confidence</td>
<td>15.04 (2.20)</td>
<td>15.54 (2.40)*</td>
<td>None</td>
</tr>
<tr>
<td>Fascination</td>
<td>12.58 (2.33)</td>
<td>12.89 (2.307)*</td>
<td>None</td>
</tr>
<tr>
<td>Creativity</td>
<td>9.6 (2.00)</td>
<td>10.03 (1.81)*</td>
<td>None</td>
</tr>
<tr>
<td>Value</td>
<td>6.33 (1.31)</td>
<td>6.27 (1.36)</td>
<td>Gender**</td>
</tr>
</tbody>
</table>

Note *p<0.05, **p<0.001
Better Data, Better Progress: Methods for Measuring Inequities in CS Education

Jayce R. Warner, Carol L. Fletcher, Lisa S. Garbrecht

Framework for assessing progress towards equity in CS education.

A Disparity Index to quantify inequities in a way that is comparable across subpopulations.

\[
DI = \frac{\text{rate}_{\text{all others}}}{\text{rate}_{\text{underrep group}}}
\]
# Identifying Barriers and Opportunities for Broadening Computing Participation among Underrepresented High School Students in CA

Julie Flapan, Allison Scott, Sonia Koshy, Alexis Martin, Frieda McAlear

## CURRENT DATA

| (+) | CS availability and enrollment increases |
| (-) | Race, gender and SES gaps remain |
| (+) | Intro CS is most integrated |
| (-) | AP CSA is most segregated |

## PROMISING STRATEGIES

- CA Strategic Implementation Plan
- Policies: CS Teacher Credential, CS Director
- District-level implementation
- Teacher training and preparation

## PERSISTENT BARRIERS

- Teacher training, quality and development
- Matriculation from Intro -->AP CS P-->AP CS A
- Passage rates in AP CS

## A THEORY OF CHANGE

Policy, Coalition-Building, Capacity-Building: K-12, Capacity-Building: Higher Ed, Research and Communications
12:05 - 12:30:
- Hoadley, Vogel, Ascenzi-Moreno, & Menken, with Ma, Ynoa, & Radke
- Denner & Green
- Veeragoudar, Wagoner, Kao, Olsen, Camey, Rodriguez, Harrell
- Goode, Runninghawk Johnson, Ivey, Skorodinsky, & Ryoo
- McGee, McGee-Tekula, Duck, Dettori, Rasmussen, Wheeler, & Greenberg

12:30 - 12:55:
- Ryoo, Margolis, Estrada, Tanksley, Guest-Johnson, Mendoza
- Robinson & Reich
- Walker, Fields, Kafai, Nakajima, Lui, Goode, Margolis, Jayathirtha and Shaw
- Warner, Fletcher, Garbrecht
- Flapan, Scott, Koshy, Martin, & McAlear
Discussion

Dr. Karen D. King

National Science Foundation
IDENTITIES AND INTERSECTIONS

KAREN D. KING
DISCUSSANT

The comments here reflect the opinions of the speaker and not the federal government.
MY IDENTITIES

• Tall*
• Black
• Woman
• Cisgender
• Heterosexual
• Child free
• Middle aged
• Gen X
• Middle Class*
• 4th generation college graduate
• Homeowner
• Landlady
• Physically abled*
• Mathematician*
• Statistically literate*
• CS adjacent
• Educational Researcher*
• (Former) teacher*
• Funder*
• Dancer
• HBCU graduate
• English-speaker
• Homeowner
• Monolingual
SOME THEMES ON INTERSECTIONS AND IDENTITIES

- “avoid stereotypical, tokenized or monolithic group identities” (Robinson & Reich, 2019)
- Diversity vs. equity vs. inclusion
- Oppression, power, and identity
- Identities as fixed or changeable
- How do we represent the complexity of identities we have?
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Audience Q & A