

# igniteCS: Addressing Undergraduate CS Retention

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## 1. SUMMARY

Retention and attraction of undergraduate women in computer science has remained remarkably low over the past decade despite an increase in demand for computing jobs; fewer than 15% of the Bachelor's degrees in Computer Science and Computer Engineering in 2014 were earned by women [6]. In spring 2015, Google piloted a program, igniteCS, to address the retention problem in diverse student populations at the undergraduate level [1, 2, 4]. Using a near-peer model grounded in current research [3, 5], college students created programs to teach CS to middle and high school children, many of whom were also from underrepresented CS backgrounds. The college students were able to work toward a common goal and become mentors. Through voluntary pre-service, in-service, and post-service surveys, we found that the college mentors—of whom ~75% were from groups underrepresented in CS—were more interested in a CS career, felt more prepared for a CS career, felt more confident in their CS abilities, and were better able to make connections between CS and other interests after completing their mentoring program. Google funded ten Association for Computing Machinery-Women (ACM-W) chapters across the US and one in Puerto Rico, reaching more than 150 university students. This panel consists of students from three of the pilot schools.

## 2. ERIN MINDELL CANNON (moderator)

Erin is a program manager for Google's EngEDU team, where she helps develop quality education tools and resources to advance new approaches in computer science education. Erin developed the igniteCS project which is aimed at addressing critical retention issues at the undergraduate level. By collecting longitudinal data on igniteCS' current and future iterations, Google hopes to better understand the retention challenges facing underrepresented groups in computer science and find ways to tackle them directly. By understanding and collaborating with other effective interventions, Erin hopes to help build a holistic approach to attracting and retaining underrepresented students in CS at the undergraduate level. Other programs that Erin has led on the Google Education team in the past include Computer Science for High School (CS4HS), which provides professional development training program for k-12 teachers of computer science and Call to Code—a national coding competition for students in Ireland aged 13-18, which just finished its second year.

## 3. PRIYA CHAWLA

Priya founded and is serving as the President of the ACM-W

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chapter at UC, despite many roadblocks faced during its inception. Priya has been able to help grow the philanthropic and community initiatives at the university through collaborative partnerships.

In spring 2015, the ACM-W chapter used their igniteCS funding to create their own community service initiative to help a local area high school. Some of the challenges in creating a sustainable program included creating an inclusive volunteering program for all UC students, attracting volunteers, and enhancing the value of mentoring for students in underprivileged school districts. Through planning and coordination, her chapter initiated a program with Hughes STEM High School where they developed the Bearcat Coders program, which allows for UC to tap into their longstanding partnership with Hughes through the support of the UC Center of Community Engagement. Overall, the program was a success; the UC ACM-W chapter was awarded the "International 2015 ACM Student Chapter Excellence Award for Outstanding Community Service" and was the only ACM-W chapter and American chapter to receive and excellence award this year.

Currently, volunteers from UC tutor and mentor 9th-11th grade students at Hughes during their IT/CS programming and web development classes. Because of igniteCS mentoring, there has been an increase in retention of high school students in the IT/CS Pathway program. There has also been interest from some volunteer undergraduate students to switch into CS majors and minors.

## 4. KATHERINE LO

Katherine Lo is a doctoral student in Informatics at the University of California, Irvine. Her research examines the dominant narratives that motivate diversity initiatives in technology and how they are differently enacted in practice (e.g., scholarship programs, coding camps, student affinity groups). She serves as a graduate advisor to UC Irvine's Women in Information and Computer Sciences (WICS) undergraduate organization.

With WICS, Katherine led the development and execution of a three-week program of technology workshops at La Quinta High School in Garden Grove, CA. This program comprised two-hour workshops with primarily high school underclasswomen. WICS collaboratively designed a program that addressed occupational pathways, personal interest and accessibility. Workshops featured activities around exploring interdisciplinary career paths in technology, combined crafting and coding projects using Makey Makeys and Scratch, and an introduction to Python. Undergraduate students of WICS served as mentors and instructors during the workshops, with each undergraduate committing to a team of four to five high school girls.

WICS mentors took notes and collected extensive feedback throughout the workshop series from high school students' mentees. They met for one to two hours after each workshop to reflect on its execution, discuss challenges and failures, consider different forms of evaluation, and adjust curriculum as they

progressed. These sessions for reflection, combined with the extensive time dedicated to developing the workshops, provided ample opportunities for mentorship between graduate and undergraduate students and bolstered the sense of camaraderie and commitment within WICS.

Guidance for details of implementation beyond curriculum would be a valuable resource to assist students in programs like igniteCS. The most daunting obstacles of starting the workshops were balancing the time commitment limitations of undergraduate students with the time commitment required for a program that is impactful for the high school students, developing productive relationships with high school district facilitators and extensive administrative obligations.

In 2016, Katherine is facilitating two workshop series through igniteCS, the first at Kennedy High School in Richmond, CA with college students from UC Berkeley, Mills College, and Contra Costa Community College, the second at La Quinta High School in Garden Grove, CA, again with WICS. She will study how the programs can be situated differently to these communities, both of which are economically underserved and hold a high density of ethnic minorities.

## 5. HALEY ADAMS

Camp Codette was created to devise a dynamic educational program that would expose young women to the basics of computer science and inspire them to pursue it further. Haley and her team provided an array of activities that included working with Lego Mindstorm, Makey Makey, 3D printing, Scratch and App Builder. The camp was hosted for three one week sessions over summer recess on the campus of Rhodes College in Memphis, TN and was geared towards middle school girls. The program had tremendous success in maintaining engagement by varying instructional sessions and including outdoor activities. Mentors implemented a project-based approach, to encourage creativity and independence among participants.

As with any pilot program, Camp Codette faced unanticipated issues. Some students were not able to work with the prepared materials exactly as they were presented, which meant improvising. Other campers came from households without computers and were not able to continue practicing at home; these students were at a disadvantage due to limited computer access.

Camp Codette faces additional issues as it moves into its next iteration. It is currently only active during the summer. It will be necessary to maintain more continuous contact with the students,

otherwise previous campers are liable to lose interest after time has passed. The transitory nature of the program also makes it difficult to track any tangible success.

It should be noted that this group was not economically diverse, perhaps because due to the enrollment fee and the need for private transportation to campus. Scholarships were available and to some extent utilized, but the low turnout of kids from low socio-economic backgrounds is telling. While making the program free might solve some issues, it would make it impossible for the camp to remain self-sustaining.

Opportunities like igniteCS are imperative to areas in the South that have a dearth of computer science education. The majority of students in these areas never realize what programming is or that it is a viable interest to pursue due to a complete lack of exposure. This becomes even more apparent for young women, who face more deterrents than just ignorance.

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