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Problem Statement

It is no secret that computer science (CS) is not diverse. 81 percent of students who graduated with a Bachelor's degree in 2016 identified as male, 48 percent of those who graduated with their degree are White, 24 percent are Asian, and the next highest group to graduate with their CS degree are non U.S. residents which made up 12 percent \cite{zweben20182017}. Even informal learning opportunities for CS, like summer camps, workshops, clubs, and hackathons are unequally distributed \cite{McGill_2015, Decker_2016, Ross_2020}. Unsurprisingly, most of the kids that show up to these outreach programs are white boys \cite{McGill_2015, Decker_2016}. There are a few literature reviews that look at past computer science outreach programs and both found similar things. The findings are that most of the prior literature is not focused on increasing participation from girls, people of color, or of low SES \cite{McGill_2015, Decker_2016}. One aspect that could be causing the unequal distribution of informal CS outreach programs is recruiting. Who shows up to the program? Almost all of the research done on computer CS outreach explains that they recruited participants \cite{McGill_2015, Decker_2016}. However, few papers describe how they recruited their participants \cite{Bruckman_2009, DeWitt_2017, Wolz_2011, Doerschuk_2007, Chen_2019CodeCamp}. To our knowledge, nothing is known on the how's or if's recruitment practices shape who shows up to informal CS learning opportunities. This raises three questions:

1. What recruiting practices are CS informal learning programs using?
2. What is the cultural competency of these recruitment practices?
3. How do these recruiting practices influence who shows up to camp?

Background Literature and Annotated Bibliography

Zweben, S. and Bizot, B. 2017 CRA Taulbee Survey. Computing Research News, 28, 5 (May 2016).

A survey that is conducted in the U.S., every year, by the Computing Research Association that collects data about the previous academic year. The survey collects gender, racial, and ethnic demographic information about graduate and undergraduate students who graduate with a degree in CS. Then, they also include information about what jobs these students go on to get.

Monica M. McGill, Adrienne Decker, and Amber Settle. 2015. Does Outreach Impact Choices of Major for Underrepresented Undergraduate Students? In Proceedings of the eleventh annual International Conference on International Computing Education Research (ICER '15). Association for Computing Machinery, New York, NY, USA, 71–80. DOI:https://doi.org/10.1145/2787622.2787711

A study that conducted a survey to gauge the long-term impact of outreach activities have on choice of undergraduate major. One of the main focuses of the study was to determine the racial and gender difference in participation in computing activities prior to college. They used a quantitative method approach that followed a descriptive design in order to investigate undergraduate students' perception of how their participation in computing activities prior to college contributed to their decision to major in CS related major.

Adrienne Decker, Monica M. McGill, and Amber Settle. 2016. Towards a Common Framework for Evaluating Computing Outreach Activities. In Proceedings of the 47th ACM Technical Symposium on Computing Science Education (SIGCSE '16). Association for Computing Machinery, New York, NY, USA, 627–632. DOI:https://doi.org/10.1145/2839509.2844567

A systematic literature review that identifies, evaluates, and synthesizes results of published work relating to k - 12computer outreach programs. They aimed to answer what populations are studied, what the interventions of each study was, what the study design was of the prior work, and what the outcome was of each program. They sifted through 3949 papers that were published on the topic between 2009 - 2015. They report that 49% of the studies were designed to increase gender or ethnic diversity. Then the paper outlines a couple of call to actions on how to better conduct studies that deploy a CS related outreach program.

Monique Ross, Zahra Hazari, Gerhard Sonnert, and Philip Sadler. 2020. The Intersection of Being Black and Being a Woman: Examining the Effect of Social Computing Relationships on Computer Science Career Choice. ACM Trans. Comput. Educ. 20, 2, Article 9 (May 2020), 15 pages. DOI:https://doi.org/10.1145/3377426

An intersectional study that draws upon social influence, standpoint, and intersectionality theory. The goal of the study is to identify the difference experiences between women, black women, and black men have in the computing field and what is important to them when it comes to whether or not they enjoy CS and will continue in CS. The study draws upon a national survey that was deployed across 118 colleges in the U.S. They answer how the social influences are different across these groups, what effect the social influences have on CS aspirations, and in what context are black women likely to experience important social influences.

Anita DeWitt, Julia Fay, Madeleine Goldman, Eleanor Nicolson, Linda Oyolu, Lukas Resch, Jovan Martinez Saldaña, Soulideth Sounalath, Tyler Williams, Kathryn Yetter, Elizabeth Zak, Narren Brown, and Samuel A. Rebelsky. 2017. Arts Coding for Social Good: A Pilot Project for Middle-School Outreach. In Proceedings of the 2017 ACM SIGCSE Technical Symposium on Computer Science Education (SIGCSE '17). Association for Computing Machinery, New York, NY, USA, 159–164. DOI:https://doi.org/10.1145/3017680.3017795

An after school summer camp designed to increase participation from girls, black students, and students from a low socioeconomic status in computer science. The curriculum followed a constructivist approach and focused on student learning while also bringing in

university faculty to talk about their jobs. This research is based off of the literature review that was discussed above. The goal of the camp was to increase the self efficacy of underrepresented students and they successfully did so.

Ursula Wolz, Meredith Stone, Kim Pearson, Sarah Monisha Pulimood, and Mary Switzer. 2011. Computational Thinking and Expository Writing in the Middle School. ACM Trans. Comput. Educ. 11, 2, Article 9 (July 2011), 22 pages. DOI:https://doi.org/10.1145/1993069.1993073

Goal of this paper was to improve 7th and 8th grade students' attitudes about computational thinking and programming since people who are good at math and computational thinking are stereotypically more likely to be CS people. The after school club introduced interactive journalism and Scratch programming language to change these students' perceptions. They conducted a yearlong assessment of the students and teachers. They assessed the teachers confidence in their ability to teach computational thinking.

Peggy Doerschuk, Jiangjiang Liu, and Judith Mann. 2007. Pilot summer camps in computing for middle school girls: from organization through assessment. SIGCSE Bull. 39, 3 (September 2007), 4–8. DOI:https://doi.org/10.1145/1269900.1268789

A summer camp designed to improve retention of girls in computer science. The paper outlines teaching techniques, how to work with local schools, and how to fund and conduct the camp. Then they outline which activities the participants liked and did not like, as well as, some other guidelines on how to conduct a study on a CS summer camp. They also provided a pre and post session questionnaire that was used to assess student learning.

Yesheng Chen, Zhen Chen, Shyamala Gumidyala, Annabella Koures, Seoyeon Lee, James Msekela, Halle Remash, Nolan Schoenle, Sarah Dahlby Albright, and Samuel A. Rebelsky. 2019. A Middle-School Code Camp Emphasizing Digital Humanities. In Proceedings of the 50th ACM Technical Symposium on Computer Science Education (SIGCSE '19). Association for Computing Machinery, New York, NY, USA, 351–357. DOI:https://doi.org/10.1145/3287324.3287509

Developed and offered a summer camp that is based off of the digital humanities. Digital humanities is a way to attract students who generally are not interested in CS and the short-term goal of the camp was to see how digital humanities would affect students' interest and self-efficacy in computing. They measured and compared survey responses between boys and girls using a five-point likert scale.

Methods

To answer our research questions, we conducted semi-structured interviews with 14 informal CS learning programs across the state of Washington. Our framework for this investigation was Cultural Competency.

Sampling

We used three sampling methods to construct our list of programs to contact. By deploying multiple sampling techniques we were able to contact a more accurate and diverse list of informal CS programs.

One of the sampling methods was to draw upon our prior knowledge of local informal CS learning programs in the community. Our prior knowledge consisted of a community of educators and K-12 advocates who either ran CS programs themselves or knew of others who did. This method resulted in the first eight programs added to our list to contact.

Another sampling method was to contact third party vendors and ask them for the contact information of any CS programs in the state of Washington. Third party vendors are online websites that advertise a wide variety of preexisting after school activities and programs. We discovered through our local sources that informal learning programs sometimes use third party vendors to advertise their program which is why we contacted the vendors directly. This method resulted in four new programs that were added to our list of programs to contact.

After exhausting all of our local contacts and contacting third party vendors we turned to the web as our last sampling method. The internet gave us a way to find programs outside of our local community which was important because it allowed us to gain a better sample of the informal CS programs in Washington. Even with the help of the internet almost all of the programs on our contact list were based in the Puget Sound. The internet sampling method provided an additional 23 programs to our list.

The Participants

There were three criteria that the programs had to meet in order to be added to our list. The first criterion was that the programs had to be offered after school to kindergarten through twelfth grade students or some subgroup of that age range. The second criterion was that the programs had to have a location within the State of Washington. This meant that camps that were only offered online, in other states, or countries were not included. The third criterion was that the program had to offer at least one computer science related course.

Our final list of programs that we needed to contact was composed of 35 informal computer science learning programs. This is likely not a complete list but instead a representative list of informal CS learning programs that serve K-12 students in Washington state. We know this because some of the programs we found we were only able to find through the community of people we knew and they were primarily located in the Puget Sound. We tried to snowball this community into other locations of Washington by asking them to put us in contact with others.

To gather thorough data about what recruiting practices out of school learning programs are using, for RQ1, we could not only rely on what they said on their websites. We needed to

contact and interview the programs. We individually sent out the same recruitment email to all 35 programs on our contact list. The recruitment email included information about who the researchers are, why we are contacting them, what they study is about, what they will get out of the study, a link to our informed consent, and an estimate of how long the interview would take.

Once someone at a program filled out our recruitment survey, which included informed consent, we scheduled an 30-minute semi-structured interview. During the interview, we began by establishing rapport, then asked a question pertaining to the programs marketing and recruiting practices in hopes of uncovering the answers to RQ1. As the interviewee grew more comfortable the interviewer asked demographic questions about the programs staff and students. Specifically, asking questions about the gender and race of the staff and what the gender, race, and socioeconomic status was of the students. Then, the interviewer asked questions about what problems their program faces when it comes to broadening diversity. They followed that question by asking what their program does specifically to support diversity. The goal of these questions was two fold. One was to facilitate a conversation about why certain practices are deployed and some are not (RQ2). The other was to investigate what relation the practices might have in supporting diversity (RQ3). At the end of each interview there was time put aside for the interviewees to ask the interviewer any questions or share any thoughts they had.

Analysis

For the analysis of RQ1 was to use the themes that emerged from affinity diagramming to perform inductive qualitative coding on the interview transcripts. We segmented the transcribed interview data by when someone stopped talking to preserve context. Since we had 14 total participants, one researcher coded the even numbered transcripts and the other coded the odd numbered transcripts. After all the transcripts were coded according to themes, the researchers swapped transcripts and checked to see if they agreed with how their fellow researcher coded the data. Upon disagreement, the researchers met to discuss their interpretations and addressed the discrepancies in the application of the code set, then adjusted the coded data as needed.

When analyzing our second research question, how does a program's cultural competency influence the way they implement their recruiting and marketing practices, we analyzed the data through the lens of cultural competence. We use cultural competency as a framework to deductively code our data. We followed the definitions and characteristics laid out by Cross et al. when coding the data. Upon disagreement we met to discuss our interpretations and addressed the discrepancies in the application of the definitions and characteristics. After the discussion we adjusted the coded data as needed.

While the transcriptions were one source of data, we also had access to the programs websites as a second source of data. Therefore, we were able to observe whether or not the same results manifested themselves multiple times from our two different sources of data. Those results being the practices that occurred, how cultural competency influenced the implementations of the practices, and what the diversity of their camps were.

Our analysis of each website was similar to our analysis of the transcripts. Researchers went through each page of the website qualitatively coding the first two research questions, using the same themes. Each time a researcher coded a practice, an element of cultural competency, or point on the continuum of cultural competency they made note of where the practice occurred on the website in a spreadsheet. This allowed the researchers to check each other's work when they met to discuss why they coded the way they did. Upon disagreement the same approach was followed as stated above.