Positionality and Belonging: Analyzing an Informally Situated and Culturally Responsive Computer Science Program

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ABSTRACT

In recent years, there has been increased attention on promoting access to computer science among all students. Our study seeks to address the underrepresentation of racially minoritized youth in computer science by offering a culturally responsive after-school coding club at a local public library that serves a racially and socioeconomically diverse community. We analyzed facilitator interviews and student focus groups using qualitative data analysis with a focus on facilitator positionality and culturally responsive frameworks. Findings suggest facilitator positionality helped establish affirming, near-peer relationships with participants and situated facilitators as advocates for expanding and diversifying computer science. Additionally, the culturally responsive frameworks helped students to feel a sense of belonging in both the informal learning environment and in the field of computer science.

KEYWORDS

Computer Science, Culturally Responsive Pedagogy, Belonging, Positionality, Libraries

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1. Introduction

In recent years, there has been increased attention on promoting access to computer science among all students. This interest is motivated by a number of factors, including economic opportunities afforded in computing careers, society's reliance on technology, and the importance of broadening participation in computing among females and racially minoritized youth [1, 21]. While much of the work on computer science education is situated in K-12 schools, informal learning environments such as libraries, are also emerging as spaces that can engage a diverse set of learners in computing programs [12].

In fact, libraries have started to generate interest as designed learning spaces that seek to develop and enact programs that engage youth in computing [11].

This study is situated in a larger effort to broaden participation of minoritized youth in computer science and to offer culturally responsive computer science programming in informal settings. The project team consists of undergraduate computer science facilitators, as well as community and university support personnel (Figure 1). Our culturally responsive approach to computer science utilizes culturally relevant pedagogy [9] and culturally sustaining pedagogy [18] in order to create programs that serve underrepresented minoritized and female youth. In our work, we follow four distinct strategies aligned with culturally responsive frameworks: 1) research-based computer science practices for teaching and engaging a diverse population of youth; 2) practices that build on the knowledge and assets of communities; 3) undergraduate computer science students as facilitators and near-peer mentors; and 4) culturally responsive interactions between facilitators and youth underrepresented in computer science. In this paper, we focus on the latter two strategies.

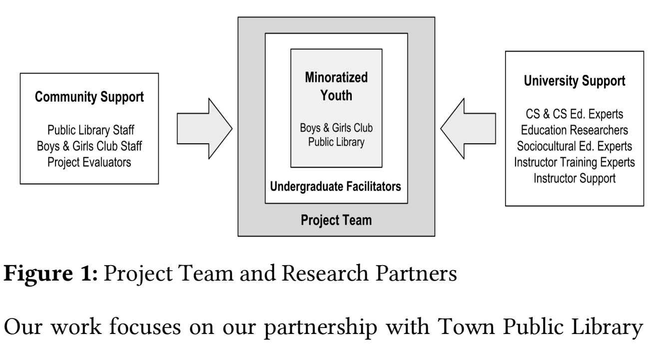

Figure 1: Project Team and Research Partners

Our work focuses on our partnership with Town Public Library (TPL), a local library that serves a racially and socioeconomically

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diverse community. In this paper, we consider the ways in which facilitator positionality and use of culturally responsive frameworks shape program outcomes. Our analysis is shaped by the following research questions:

1. How has facilitator positionality and computing identity been shaped by personal experiences in CS?
2. How do facilitator positionality and culturally responsive frameworks impact the design and delivery of community-based CS programming?

2. Theoretical Framework

Positionality has its roots in feminist theory, which seeks to understand the numerous shifting and intersecting identities of each individual [14]. Educators are positioned by factors such as age, gender, race, and lived experiences [7]. The positionality of our facilitators, as a part of our project team (Figure 1), warrants scrutiny because community affiliations, organizational roles, and personal identities influence the process and findings of our community-based research and computer science programming [16, 10]. Part of facilitator positionality is their computing identity. Computing identity is shaped by individual experiences in computer science [5] and constantly being reformed through interactions with others [4]. Computing identities are culturally situated [5] and should therefore be understood intersectionally, recognizing that students experience computer science in classed, gendered, and racialized ways [13, 20].

Students' computing identities are related to their sense of belonging in computer science. Goodenow [6] defines belonging as an individual's perception of acceptance, respect, inclusion, and support. When students lack a sense of belonging, it impacts their connection to a space, their academic motivation, and their psychological wellbeing [15]. Research suggests that a strong sense of belonging in computer science can help students overcome self-doubt and persist in the study of CS [23]. Facilitators with underrepresented gender and racial identities offer a unique mentorship opportunity by adjusting expectations of what a computer scientist is like [2]. Facilitators can also increase belongingness by interacting with students in a culturally affirming way that acknowledges, values, and incorporates the students' cultural backgrounds [19].

3. Methods

In this section we describe the methodology guiding this work.

3.1. Context

In this work, we examine the semester-long *Coding Club* offered at TPL for one hour after school on alternating Mondays and Tuesdays. TPL functions as an unofficial bus stop and waiting area for students from nine charter schools across a district in a Mid-Atlantic state. The librarians struggle to engage these youth in traditional library activities, often finding them a stressful and disrupting presence. The *Coding Club* was relaunched to target these bus-riding students after a successful pilot program the previous semester. The *Coding Club* was facilitated by undergraduate computer science students (Table 1) from a local *Research University* (RU) and undergraduate computer science students from the *State's Technical and Community College* (STC).

Pseudonym	Gender	Race	University	Year
Yasmine	Female	Black	State Technical College	Freshman
Anthony	Male	Black	State Technical College	Sophomore
Chloe	Female	White	Research University	Freshman
Logan	Male	White	Research University	Freshman
Mark	Male	White	Research University	Senior

Table 1: Undergraduate Facilitator Demographics

As a part of their training, the RU undergraduate facilitators participated in a three-session culturally responsive training, during which they were encouraged to reorient themselves toward their students by adopting an affirming attitude, to intentionally learn about their students, and to develop a sociocultural consciousness [9, 17, 19]. While these undergraduates do not intend to become teachers, they are computer science experts interested in expanding access and participation in computer science by engaging diverse youth. The two STC facilitators were unable to attend the culturally responsive training sessions as they were not enrolled in the RU facilitator program. However, they were introduced to our culturally responsive approach during a one-hour orientation meeting prior to facilitating any *Coding Club* sessions.

3.2. Participants

There were two groups of facilitators from the university-library partnership (Table 1). RU provided three undergraduate computer science majors who were paid to be *Computer Science Ambassadors* for the TPL *Coding Club*. The library provided two undergraduate computer science majors from STC who were also working as paid computer aids at TPL.

Throughout the duration of the *Coding Club* a total of 25 students attended at least one session, nine of whom were able to participate in our focus group. Demographic information for all participants is shown on Table 2.

Race/Ethnicity		Gender		School		Grade		Attendance	
Black	5	Female	7	Charter	4	9^{th}	4	1-2 sessions	5
Latinx	3	Male	2	Military	5	10^{th}	4	3-4 sessions	1
White	1					11^{th}	1	5-6 sessions	2
								7+ sessions	1

Table 2: Focus Group Participant Demographics (N = 9)

All facilitators were invited to participate in the study. Additionally, school students who had attended at least one *Coding Club* session were invited to participate in a focus group (Table 2). Of those students, 9 were able to participate.

3.3. Data Collection and Analysis

Data were collected from three primary sources: (a) individual interviews with program facilitators (N = 5); (b) two focus groups with student participants (N=9); and (c) detailed observations of each session at the *Coding Club*. Additionally, student artifacts and meeting notes were used to ensure the reliability and credibility of the data set [8]. Data collection took place during year two of a larger NSF-funded study.

Data were analyzed with a focus on understanding how facilitator positionality and culturally responsive pedagogy impacted participant experiences. Our analytical approach was inspired by grounded theory [3] and open coding was used to develop a coding scheme from emergent themes [22]. The themes were categorized into two overarching categories: facilitator positionality and culturally responsive outcomes.

4. Findings

In this section we present the findings of our work.

4.1. Facilitator Positionality

Facilitators were influenced by the origins of their own computational identity and by their positionality within the computer science field.

4.1.1 Identity Origins. Facilitators expressed ties between their own experiences with computer science and their desire to engage youth in computer programming. For example, Anthony became a computer science facilitator to keep student interested in computer science: "I had interest in coding when I was younger and it kind of fizzled out. So, I wanted to get those kids who have an interest and help them keep it and keep it going." Anthony's own interests "snowballed and then fizzled out" after he became too busy in high school and "programming became a side project." He believes a program like the *Coding Club* could have kept him engaged in computer science. Chloe echoed a similar sentiment: "So, I felt it was . . . a good opportunity for me to teach kids what computer science is early and maybe, just maybe, they could be like me and want to be in this field in the future." Chloe originally became interested in computer science after watching a movie about coding with her father.

4.1.2 Increasing Diversity. Facilitators emphasized the importance of increasing participation of underrepresented groups in computer science by engaging communities like TPL. Yasmine believes that increasing diversity in computer science will help expand impact to the larger public because she has seen the limitations of computer science within minoritized communities. She offered the example of an automated soap dispenser failing to recognize hands with darker skin. "If they had someone with darker skin helping with the design, then the soap would've come out." Chloe also hopes to disrupt computer science homogeneity. Chloe finds it challenging to get women interested in a "male oriented" field like computer science: "I feel like if you can get younger children, especially girls, to get into those fields it will shift the field to a different perspective in the near future."

4.2. Culturally Responsive Outcomes

By implementing culturally responsive frameworks, facilitators disrupted tensions, built relationships, and expanded access to CS.

4.2.1 Disrupting Tensions. Participation in the *Coding Club* altered how students experienced the library by disrupting tensions and reestablishing the library as a space where they belonged. The target audience for the *Coding Club* has a complicated history with the librarians that needed to be addressed. While establishing our partnership, librarians described these students as unruly "monkeys" that needed to be "pulled down from the trees." During our first *Coding Club* planning meeting, facilitators acknowledged and addressed these issues and intentionally chose to disrupt tensions, reestablishing the library as a welcoming and student-friendly space. Anthony noted one challenge was "just the fact that it's a library, so it's kind of the stigma about be quiet, just books, can't have fun, just read, do your homework." Facilitators sought to change the atmosphere and expectations of the space by personally inviting students to participate, acknowledging the students' desire to socialize and relax after school by frequently joking and laughing together.

4.2.2 Building Relationships. During focus groups, students stressed that their favorite part of the *Coding Club* was spending time with facilitators. Logan got to know the students by "get[ing] their own perspective" into their programs. One student spent several weeks developing a Harry Potter themed game, which she proudly showed off to the library staff. Facilitators also got to know students through discussions while coding together: "I had relationships, closer relationships to two of the kids. We had good conversations every time they came. And I think they were just excited to see me come back every week . . . So, I kind of liked having that bond with them" (Chloe). However, facilitators who did not share students' underrepresented gender and racial identities reported experiencing difficulty connecting with the students: "I wasn't always able to just, like, connect to the kids easily. I guess I didn't have that personality" (Logan).

4.2.3 Expanding Access. Facilitators increased access by engaging every participant in hands-on activities that increased their confidence in computer science. Facilitators never turned anyone away, even when they fell outside the intended audience. Chloe believes this allowed them to "spread [computer science] out to the community more, since it is more of a communal building rather than like a school." Facilitators offered hands-on engaging activities, which were more than just fun: "I think it's a way for kids to be introduced to something they might not be introduced to, that is going to have a large impact on the future" (Anthony). Students self-reported that they were between 80% and 90% confident with their computational abilities and could see themselves continuing to study computer science. While these percentages are far from precise, they do reveal strong self-confidence in computing. Even though students came in with very little computer science background knowledge, Chloe believes the facilitators "got them to a point where they could be a little bit more confident in technology."

5. Discussion & Conclusion

In this paper, we establish a connection between facilitator positionality and participant experiences at TPL. Results of our study suggest that our culturally responsive frameworks helped students to feel a sense of belonging in both the informal learning environment and in the field of computer science. Disrupting existing tension and building relationships between students and facilitators increased access for minoritized populations at TPL. These findings highlight the importance of understanding positionality and context for developing culturally responsive computer science programming, as the interactions between individual students and facilitators greatly impact program outcomes. Additionally, our knowledge of TPL, the TPL librarians, and our potential participants was foundational in designing the *Coding Club* learning environment and curriculum.

This project also considers how facilitator positionality helped them form positive, near-peer relationships with the students and positioned them as advocates for expanding and diversifying computer science. Facilitators should be selected with intentionality. Who they are and how they came to this work informs their pedagogical approach and significantly impacts the learning environment. However, additional research is needed to better understand the ways in which facilitator positionality impacts participant experience.

Our work is significant for creating a foundation for culturally relevant computing in informal learning environments and maker spaces. By continuing to examine the impact of positionality on facilitator-participant relationships, this research will improve the design of culturally relevant learning environments and culturally responsive facilitator training, which in turn can help broaden participation in computing.

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