

Intersectional Perspectives on Teaching: Women of Color, Equity, and Computer Science

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Abstract—As high school computer science course offerings have expanded exponentially over the past decade, persistent gaps in terms of race and gender have remained a key characteristic in computer science classroom learning opportunities. This study aims to learn from the perspectives and knowledge of seven women of color who are high school computing teachers. Using ethnographic methods and data collected from professional development observations and interviews, this study examines how the intersectional identities and embodied experiences of these educators can inform efforts at broadening participation in computing for students. The findings of this study point to the importance of not playing it safe, commitment to teaching in historically underserved communities, intersectional identities and impact on teaching, and critical hope as key tenets in these teachers' standpoints towards broadening participation in computing. While some of these tenets can inform other educator's pedagogical efforts at broadening participation in computing, the embodied, gendered, and racialized nature of these findings highlight the need to prepare a diverse teacher cadre as part of building authentic opportunities to learn for all students.

Keywords—intersectionality, equity, broadening participation in computing (key words)

I. INTRODUCTION

Despite a great number and variety of efforts to address the participation gap in computer science (CS), it continues to persist. This gap is especially profound at the intersections of race and gender. Women of color currently constitute 39% of the female-identified population in the United States, however, only 7% of all high school students taking Advanced Placement Computer Science in 2017 were girls of color [14] and women of color make up just 10% of bachelor's degrees and 5% of doctorates in computing [14]. Among all women employed in computer and information science occupations, only 12% are Black or Latinx women; in 177 Silicon Valley firms, less than 2% of all workers are Black, Latinx, or Native American/Alaska Native women [14].

In a democratic country, it is especially imperative that girls and women of color have access to the study of, and employment in, any field that brings them satisfaction. It is equally important that they have access to positions with agencies to define and shape the field of computing, which currently exercises immense influence over most aspects of our lives. While multiple research-based interventions have been forwarded which focus on recruiting girls of color to computing, most of these are single sex, out of school programs, which aim to influence girls' confidence and belongingness in computing [17]. There is a scarcity of research that examines the experience of CS teachers, who are women of color; research that centers their perspectives in grappling with their teaching practices and role in the educational experience of their students. The research questions guiding this work are as follows: *How do women of color understand and approach their role as CS teachers based on their unique standpoint? How do their intersectional identities impact their teaching praxis?*

The aim of this study is to center the voices of CS teachers whose lived experiences as women of color give them a unique perspective regarding the interplay of teachers, students, families, race, gender, CS, community demographics, and school culture. We employ the theoretical frameworks of feminist theories, and in particular standpoint theory, to analyze and elevate the values and praxis of these teachers in order to gain a better understanding of how to support CS education that embraces marginalized students.

II. THEORETICAL FRAMEWORK

Within literature on professional development and curriculum, the centering of Eurocentric perspectives is prevalent with little attention paid to those teachers who exist outside of the mythical identity norm [13] of white, middle class male. This is especially prevalent within the field of CS as white males tend to dominate this space both in industry and education [4, 19]. While moving toward a centering of teacher voice is vital within this literature, it becomes a question of

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whose voice is centered and what questions and conclusions can be drawn. In this, we position this paper within a conceptual framework of Feminist Standpoint theory [11, 18] as a way to counter the common narratives highlighted within the literature [7]. As Alutiiq scholar, Sabzalian argues in her description of feminist standpoint theory, “Particular social locations, given their asymmetrical relationship to power, are epistemically advantageous as they can enable clearer insights into dominant conceptual frameworks and social reality” [15]. Specific to this research project, intersectionality becomes particularly effective in illustrating the experiences of women of color that are “not subsumed within the traditional boundaries of race or gender discrimination as these boundaries are currently understood” [6]. This framework undergirds the analysis of this study, as we understand “that systems of race, social class, gender, sexuality, ethnicity, nation, and age form mutually constructing features of social organization, which shape Black women’s experiences and, in turn, are shaped by Black women” [2]. We further draw on the work of Crenshaw [6] who offers intersectionality theories as a way to include intragroup differences. Thus, Feminist Standpoint theories, grounded in notions of intersectionality, offer a generative way to better understand how women of color within CS understand their role, as students [9], and as teachers and change agents.

Prior research in Black feminist literature on the significance of relationships points to the importance of personal accountability and collective responsibility, speaking not only to the importance of one’s relationship to their community, but also the accountability held for each individual within that community [2, 3]. Thomas and colleagues discovered that for Black women in computing, “many of them continue, or persevere, on their journey, because they do work that has some focus on human interactions, which allows for them to give back to their communities and make the world a better place” [18].

III. METHODOLOGY

This study took place during a five-day Exploring CS Professional Development delivered on a college campus with participants staying on site for the duration of the professional development (PD). The PD brought together a diverse group of teachers from different regions of the US who planned on teaching the introductory course the following year or had taught this course the year prior. As our study and research questions are undergirded by standpoint theory and the perspective that CS teachers who are women of color have a unique experience where race, gender and CS intersect, we employed field observation and participant interviews as data collection methods. Across three teacher PD classrooms with 24 teachers each, 1-2 researchers observed teacher learning and listened to educator discourse around race, teaching, and CS education over the course of the week. Researchers took field notes in PD and met daily to share notes and their observations from the day.

In addition to the week-long observations, we also asked a number of teachers to participate in interviews outside of PD hours. To answer the research questions in this paper, we

selected 7 interviews for analysis, all from women of color. The participants were selected with the aim of examining a

TABLE I PARTICIPANTS

Participant	Teaching Location	Self-Reported Race/Ethnicity	School Site Description
Jennifer	South Carolina	African American	Alternative school, majority black students
Rachel	New York	Latina/Latinx	Majority Latinx students
Nadia	Texas	Indian	Majority Latinx students
Carmen	Connecticut	African American	Career Technical school, 30% Latinx students
Malia	Texas	Half Tongan, half Japanese	Majority Latinx students, all ELLs
Jodi	Oklahoma	Taiwanese	~50% Native students
Ciara	Texas	African American	Talented and Gifted school, diverse students

diversity of experiences: location, teaching experience, school demographics, background in computing, etc. While there are many other intersecting identity categories, for the purposes of this paper, we focused specifically on race and gender.

The seven teacher participants of this study, as shown in Table 1, teach in five different states and all work in schools with large numbers of students of color. The chosen teachers had less than five years of teaching experience and were all novice CS teachers with the majority entering teaching from an outside field. We enacted a grounded theoretical form of analysis by developing a thematic code list and identifying subsequent sub codes based on the following themes: not playing it safe, teaching communities, intersectional identities and impact on teaching, and critical hope [1, 16].

IV. FINDINGS

A. Not Playing it Safe

Many of the teachers gave us examples of what we are calling “not playing it safe”. They spoke out about the injustices they see in their schools and how they are dealing with them. Jodi said “in professional development I speak up talking about equity, talking about diversity, questioning those things that people are more so uncomfortable to talk about.” Rachel also talked about pushing back against other adults in her school. Her feeling is that “I don’t care if you like it or not, it’s not about you, it’s about the kids.”

These teachers also spoke about their experience during this PD week and how they are not playing it safe in this environment either. Nadia was the most outspoken on this topic. She told us that the white people in her group were not talking about the more difficult issues, they stayed surface level. She said “they just wouldn’t get into the nitty-gritty; they just want to stay on the searches to talk about statistics” and “they just want to stay safe; they did not want to dig any deeper.” These teachers also included their students in their efforts to not play it safe with examples like Jennifer noting the implementation of restorative circles in her class in an alternative school setting. “I know we’re talking about Exploring CS, but being in an alternative school environment, you have to deal with the other issues before you can get into ECS.” Nadia said, “we talk a lot about how race and power play

into a lot of the inequities that we see in the world, especially in science.”

B. Choosing to Teach in Specific Communities

Many of the teachers we interviewed went through alternative teacher preparation programs, in part because of their focus on underserved schools. For instance, many of the teachers conveyed that they were drawn to Teach for America because of their desire to impact educational experiences of students. They expressed a commitment to giving back to students from their own communities as well as underserved students in general. As shown in Table 1, many of the teachers work in schools where they do not share the same race/ethnicity with the large populations of students of color. Nonetheless, these teachers spoke of wanting to be role models for their students, being agents of change, and offering perspectives and encouragement from a standpoint of solidarity and shared lived experiences as women of color. Malia stated: “That’s why I went into engineering because I was like, little Tongan girls need to see this, too. Little Pacific Islander kids need to see that we’re all here trying to do things.” Similarly, Jennifer spoke of her commitment to being an agent of change: “I worked at a law firm and [I was] seeing the school to prison pipeline and I said, ‘Who’s going to do something about this?’ It is really up to us as individuals. We can’t look for somebody else to do it.”

Beyond their commitment to teach at particular schools, teachers enthusiastically described their commitment in working with particular student groups with similar educational backgrounds to their own. Rachel shared her understanding of her students’ experiences and appreciation of working with English language learners (ELLs): “I found my love for bilingual Spanish. Those are my kind of kids. I love working with kids who [have] behavioral issues. This year I took on an English Language Arts class myself, all special education and all ELLs. I think the constant reminder that there’s somebody that came from where I came from, that can do what I can do, has been really powerful.” She added: “Me and you, we’re both ELL students. I was an ELL student, you’re an ELL student, I understand.”

These participating teachers embodied a commitment to improving educational equity on micro and macro levels, a desire to impact their local classrooms and systems at large. Malia stated: “I want to affect those that are directly in front of me at a micro level,” while Jodi expressed: “I think my root is in trying to do service and not perpetuating the system that we are living in.” Several teachers talked about future work in policy and leadership roles at some point in their careers. Of note, most of these teachers did not enter the profession to teach CS, but they took up CS education as a bigger project of supporting and empowering underserved students. This is reflected in their efforts to support students more holistically, rather than focus on CS content.

C. Intersectional Identities and Impact on Teaching

Teachers commonly discussed how their race and gender identities impacted their teaching. As these participants have first-hand experience of systemic oppression and institutionalized racism throughout their own schooling and

career journeys, this situates them with a particular standpoint by which to understand and deconstruct the barriers they see in their schools. During interviews, discussions of systemic racism typically moved toward ideas of creating change. For instance, Carmen reported how she speaks honestly with her Black students regarding the reality of being Black in the United States. As a Black woman with experience working in technology, Carmen feels that she is able to help students see that it is not only white males who are able to do CS. Comments she has overheard, such as “that there’s no place for people of color in CS,” further motivate Carmen in supporting her students of color in becoming proficient in CS. She believes change will happen by “help[ing them] to... become the people, the citizens that they should be, the better people I know that they can become”.

This motivation to break down barriers specific to traditionally marginalized identity categories in CS was also discussed by Malia who works hard to empower her students through breaking the stereotypes of who is viewed as a scientist. As a student, seeing women scientists empowered Malia, and because of this experience she wants to offer the same representation for her students.

Teachers also discussed the impact of their identity on their students as mentors. When discussing how her identity impacts her students, Jennifer noted, “I think it makes a difference because all of my students are Black students so I can talk to them as Black mother and I can build a different type of relationship with them, I think. The relationship that I have with them is a little different than some of the other teachers and so with that, especially in that environment... I can command more from them.” This role based on Jennifer’s intersecting identity categories was echoed by Rachel who discussed how her Latina identity has provided representation for her students and helps her connect with her students’ families. She noted that her identity allows students to see her in a different light in their acknowledgment that “this educator speaks my native language, understands my culture, knows what I’m going through, understands my parents.” These examples speak to the importance of having a teacher who matches students’ identities in the classroom because for students of color and females in CS, this does not often occur. In fact, a common theme across the interviews was that having a woman of color as their CS educator was, for many students, the first woman of color they had encountered in a classroom.

D. Critical Hope

Finally, we found that as a group, these teachers expressed sentiments of being critically hopeful in their perspectives around teaching CS and their aspirations for their students. Rather than gap-gazing [9] about under-representation in CS, these women of color share an asset-based projection of their students’ future experiences in CS, rooted in their own sense of responsibility to share knowledge with students. As Malia noted, “I think they are going to kill it...I know they already have this interest, and to be able to bring the opportunity to them, is going to be super powerful.”

Teachers situated their aspirations for themselves and their students within a school system plagued by educator bias and

structural racism. For instance, Nadia notes that she talks with her students about the inequities in the world and the connection to science, race, and power “a lot.” Nadia then guides her instruction, “to bridge that gap between what they think that they can’t reach and show them that it’s hands on, you can do it too, is something that I think is important, because that gives them power in their own hands to be like, ‘No, I can do this. I can use it to my advantage.’” For Nadia, being critically hopeful for her students requires her students to understand and be informed about inequities related to computing, while simultaneously providing students opportunities to learn CS.

Teachers also explained instances of having critical hope in the face of inequity and racial bias taking place more locally. For instance, Carmen described how she launched the first Advanced Placement course ever at her school, and other educators expressed deficit notions the mismatch of the advanced material and their perceptions of the low abilities of “those kids”. Carmen, adamant to counter these narratives, told her students about this prevailing attitude, saying “You are going to be the ones to prove them wrong, we’re going to do this together. We’re going to do this right. We worked our tails off all year.” Despite this school context of lack of support and low expectations, Carmen maintained her high expectations of her students and a critical hope they would “prove them wrong” and produce a counternarrative wherein students belong in advanced classes.

V. DISCUSSION

According to the teachers in this study, representation matters. They pointed out that it is imperative for students of color and girls to see people like themselves doing CS. They urged the importance of schools and teacher education programs be more intentional about recruiting teachers of color. The analysis of our observations and interviews revealed that teachers who are women of color bring an authentic and rich set of strategies to their engagement with CS students. They bring firsthand awareness of the intersection of race, gender, and CS and facilitate conversations about race and gender with colleagues and students.

This way of viewing and embodying teaching CS helps us to rethink the traditional notion of CS as being transactional, apolitical, and grounded in individual success and instead to revision a narrative of CS instruction that is grounded in relationships and radical honesty [5] where teachers move beyond transaction and toward a praxis of critical hope [8] and an ethic of love [12]. By thinking outside of traditional notions of individual success and toward community and collective success, this can move CS education to a space of revisioning in partnership with our students and with communities to catalyze change beyond the four walls of the classroom. While this revisioning and reimagining is possible for teachers of varying identities, this particular study demonstrates the particular subjectivity of female teachers of color within CS classrooms, a subjectivity that impacts their teaching practice in material and transformative ways.

VI. CONCLUSION

The current movement of CS education “for all” has focused almost exclusively on the inclusion of students of color, without a consideration of how teachers’ identities and lived experiences shape equitable learning opportunities in computing classrooms. This study revealed how women of color, in particular, approach their role as computing teachers with a sense of collective responsibility and a commitment to social justice. Given the importance of these teachers’ gender and racial representations as well as their lived experiences in driving their commitments to inclusion, this study highlights the importance of recruiting, retaining, and supporting women of color to be computing teachers in school classrooms.

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