

Disrupting Colorblind Teacher Education in Computer Science

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Funding: This material is based upon work supported by the National Science Foundation under Grant No. CNS-1241284.

No potential conflict of interest is reported by the authors.

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As new efforts seek to expand computer science education across the globe, there has been a widespread effort to prepare school teachers for teaching computer science to culturally and racially diverse students. This effort to center diversity and equity is notable as computer science courses are typically homogenous in terms of race and gender, making the need to center diversity in teacher education spaces. This paper reports on an ethnographic study in the United States that describes how teachers dialogue around issues of race and computer science education in a residential week-long professional development workshop. Drawing from the dialogue of a geographically, racially, and culturally diverse group of teachers, this article describes how teachers evade, deflect, center, and reflect on racially-explicit discourse around teaching computer science. Grounded in vignettes from two teacher classrooms, this research study considers how culturally responsive computing and critical race theory can illuminate the ways in which teachers discuss race and culture in computer science professional learning environments. The study's findings demonstrate features of long-term professional preparation that can surface colorblind ideologies and help teachers move towards a culturally responsive pedagogy to teaching computer science.

Keywords: computer science education; culturally responsive computing; broadening participation

Introduction

The field of computer science (CS) has recently entered the core of the school curriculum after being relegated to an enrichment subject for a homogenous group of students for years. In just the past few

years, multiple countries have adopted curriculum standards, prepared teachers, and infused computer science education in schools in an effort to bring computer science to a broader group of students. In the United States, these efforts were propelled forward by an attempt to bring CS to all students, which has prioritized moving computer science into all classrooms through a commitment of federal funds to support computing education research and teacher preparation. First introduced to the nation in 2016, this federal initiative seeks to increase opportunities for all students to learn computer science, and as Obama noted, “in the coming years, we should ...[be] offering every student the hands-on computer science and math classes that make them job-ready on day one” (Smith, 2016). Similar efforts, such as England’s Computing at Schools **community** and the new **National Computing Programme of Study in England** (Sentence & Cxizmadia, 2017), have **aligned with** this call for computer science for all, yet this movement presents two broad challenges for teacher education. First, while K-12 schools have been quick to adopt new courses and curriculum to achieve these goals, teacher education programs seldom offer pre-service preparation coursework or certification programs that are typical for other academic subject areas taught in schools (Lang, et al., 2013). Without this pre-service experience for teachers to learn computer science teaching methods and the landscape of computer science education, this work of preparing teachers to meet the educational

demand falls to professional development workshops for in-service teachers (Franke, et al., 2013).

The second challenge concerns the historical and pervasive racial and gender inequities in computer science education that are particular to the United States. Compared to other subject areas in schools, computer science courses typically enrol the fewest girls and boys of color. Course offerings are unevenly distributed across schools, even within the same districts, with low-income schools and schools serving students of color at a disadvantage for offering computer science (Goode, 2007). When computing courses are offered at schools with large numbers of students of color, a disproportionate number of White and Asian boys enroll in the course (Margolis, Estrella, Goode, Holme, & Nao, 2017; Martin, McAlear, Scott, 2015). The College Board's data on course exam participation and performance captures the nationwide breadth of these inequities. The College Board currently offers two Advanced Placement (AP) courses in computer science, including the legacy AP CS A course, focused on Java programming, and the new AP CS Principles course, a breadth-based approach to computing which was designed explicitly to attract more diverse students to computer science and was first offered in 2016-17. Yet, the combined Advanced Placement course exam participation numbers from these AP courses show that only 26% of exam-takers were girls and just 20% identified as American Indian, African American or Black, or Latinx. Further, an examination of pass rates reveals more disturbing disparities.

White and Asian boys, for instance, pass the AP CS A course with a score of 3 or higher at two times the rate of girls of color (Goode, Flapan, & Margolis, 2018). In other words, broadening participation in computing requires more than a diverse set of students enrolling in courses, but also requires attending to the learning needs of all students in the class.

Given the scope of the equity issues in computer science, it is evident that a colorblind approach to reforming schools will not suffice in breaking this legacy of historical exclusion in the field. Rather, research shows that without explicitly addressing issues of inequities linked to race and opportunity, school reform initiatives fail to achieve the goals of desegregation and instead perpetuate the racist myth of 'separate and equal' (Cochran-Smith, 1995; Wells, 2014; Bonilla-Silva, 2013). Further, preparing teachers to examine their own belief systems, recruitment strategies, gatekeeping roles, attitudes on who belongs in computer science, and capacity for engaging in culturally responsive practices becomes essential for rejecting a colorblind approach to preparing teachers to teach CS to all students.

This paper reports on how purposeful integration of dialogue around race and computer science education in a professional development workshop can surface race-based discussions and lead to teachers' increased capacity to teach racially diverse students without defaulting to a colorblind pedagogy. In addition to preparing high school teachers for teaching introductory computing concepts

using an inquiry-based pedagogy, the Exploring Computer Science (ECS) professional development (PD) program is designed to facilitate dialogue around issues of equity and inclusion in computing classrooms and infuses instructional activities meant to develop educators' culturally responsive teaching practices. The study described in this paper employs an ethnographic approach to understanding the following question: How and when do teachers dialogue around issues of race and equity in relationship to teaching and learning computer science?

Preparing Teachers for Culturally Responsive Computing

A qualitative study examining the racial and gender gap in high school computer science classrooms discovered two dimensions explaining differences in participation: structural opportunities and belief systems (Margolis, Estrella, Goode, Holme, & Nao, 2017). Structurally, the study discovered that disparities in access to course availability, course credit, prepared teachers, and curricular resources influenced students' opportunities to learn computing in school. Importantly, the study also determined that educator belief systems play a prominent role in serving as a gatekeeper for students who did not demonstrate the visible "preparatory privilege" associated with prior, informal computing experiences. As one educator in the study described, "You either have it or you don't." The findings that emerged from this research illustrate the direct

impact of these racialized and gendered belief systems on learning opportunities for students.

The gatekeeping effects of educator belief systems points to the urgency in preparing teachers with supports to develop their own capacity to effectively attract and teach culturally diverse students. Building off of the theoretical constructs of culturally responsive pedagogy (Ladson-Billings, 2009), this study draws from culturally responsive computing (Eglash, Gilbert, & Foster, 2013; Goode & Margolis, 2011; Scott, Sheridan, & Clark, 2014) to examine how teachers dialogue around race and computing. Culturally relevant computer science education incorporates the experiences and perspectives of diverse groups of students (Kafai, Searle, Martinez, & Brayboy, 2014; Scott, Sheridan & Clark, 2014). Moreover, culturally relevant computing aims to enhance student identity and encourages a critique of inequity in computing (Eglash, Gilbert, Taylor, & Grier, 2013). While these principles inform the pedagogical knowledge and skills necessary for broadening participation in computing, it is also imperative that educators have a sense of the school-wide structures and systems that contribute to inequities (Margolis et. al., 2017; Martin, McAlear, & Scott, 2015).

Teachers talking about race

Critical race theory serves as a useful frame in addressing the multifaceted, historically constructed, and deeply embedded structures of power relations as they play out in educational reform

in computer science. Gillborn (2007) points out that systematic advantages for White students are based in a form of tacit intentionality of power-holders which perpetuate white supremacy through the taken-for-granted privileging of white interests that often go unexamined when creating educational policies. In his scholarship on education policies and the rhetoric of standards for all in England that continue to benefit dominant students, Gillborn argues that by placing race equity at the margins of reform, educational policies retain and extend race injustice that firmly remains at the centre of the reform.

In their comprehensive framework on centering race and racism in teacher education, Solorzano & Yosso (2001) use Critical Race Theory (CRT) to challenge the dominant and colorblind discourse on race and racism. They tell us that in teacher education, CRT can be used as a framework to examine the ways race and racism impact structures, discourses, and processes. A CRT of education has five themes: (1) the centrality and intersectionality of race and racism (racism intersects with other forms of subordination), (2) the challenge to dominant ideology (critique of societal inequality), (3) the commitment to social justice (offers a liberatory or transformative response to oppression), (4) the centrality of experiential knowledge (recognizes that experiential knowledge is legitimate), and (5) the interdisciplinary perspective (analyses race and racism in an historical and contemporary context). In teacher education, Solorzano and Yosso explain how CRT

asks questions about how educational institutions, discourses, and reforms both maintain and can interrupt racism, sexism, and classism.

Solorzano & Yosso (2001) point out the effects of deficit belief systems of educators, stating that “Whether through media or professional venues, racial stereotyping blames unequal outcomes on the students of color themselves rather than on society and its institutions” (p. 6). Again, we see students/individuals being blamed for failures rather than the institutions and social structures within which these individuals learn and function. Solorzano & Yosso also elaborate on how a discourse can blame the families and communities that students come from, deflecting the talk away from racism. “The cultural deficit model contends that minority cultural values, as transmitted through the family, are dysfunctional, and therefore cause low educational and occupational attainment” (Solorzano & Yosso, 2001, p. 6). This type of discourse allows teachers to not talk about race, rather they talk about the families and communities. In other words, this discourse is one that discusses race without explicitly stating anything about race.

Though there is not yet related scholarship in computer science education, the literature on teacher racial dialogue in other subject areas sheds light on how teachers talk about race and education in professional development settings. In mathematics professional development, Battey & Franke (2015) suggest that teachers’ use of journals can surface ideas and help educators be

more aware of the deficit ideologies that they might rely upon when thinking about students and race. They note that the journals provide a visibility to these belief systems, and the need to reconstruct or alter one's viewpoint can become more apparent and lead to dialogue and growth.

Segall & Garrett's (2013) research study on White teacher discourse describes how White teachers tend to ignore race and, at times, in fact work hard to maintain ignorance of race. This attempt to maintain ignorance can often be found in the form of colorblind discourses. These discourses are the "discursive practices they use to simultaneously discuss and avoid race" (p. 266). The authors identify three components common among "colorblind" discourses: (1) Evading discourses, (2) individualistic discourses, and (3) deflection discourses. Evading discourses are a refusal to 'see' race, and therefore are a denial of the power relations embedded in those differences. Individualistic discourses place the success or failure at schooling on the individual rather than the institutions and social structures the individual is forced to operate within. Deflection discourses attempt to deflect racism by clinging to other marginalizations such as gender or ability. The study's authors described how teacher's discursive practices work to simultaneously discuss and avoid race, and how this affects teacher education. They discuss how these practices interact with, and attempt to ignore issues of power, positionality, and subjectivity. "Ignorance works not simply as a form of not knowing but as an active desire to not know,

to ignore, and to forget” (p. 268). They point out that White teachers come from a position of privilege, and how teachers use the privilege should be taken into consideration. “What should be equally considered are the mechanisms through which teachers use privileged positions - for example, whiteness, middle class - to insert race into the discussion without having to name it explicitly, as well as the ways in which such positions are used to avoid mentioning the “Other,” while, at the same time, always having the Other as the topic of discussion” (p. 286).

Given these constructs of critical race theory and the need to disrupt colorblind ideologies and confront racism, It is important to consider how learning opportunities for educators can deepen their understandings and skills around race, equity, and inclusion. Bianchini et al. (2015) investigated four types of professional learning strategies for their ability to produce generative, or not, conversations about equity: teacher research, personal experiences, reform-based instructional practices, and examinations of school/state/national data. They found that conversations around the examination of educational data were most generative for exploring equity issues, possibly because teachers were talking about multiple kinds of diversity and the intersection of the categories, as well as how teacher actions and school policies produced those disparate patterns. “Conversations facilitated as part of the examination of school/state/national data strategy were the most generative for exploring equity issues. We identified two themes in these

conversations that made them so. One, teacher participants regularly considered multiple kinds of diversity (e.g., gender, race, ethnicity, and socioeconomic status) as well as the intersection of these categories (e.g., Latinas) when examining, describing, and attempting to explain student enrolment, course taking, and achievement data. Two, teachers routinely discussed how teacher actions and school policies contributed to the production of the disparate patterns they found in the data, rather than pointing to perceived deficiencies in students, their parents, and/or their communities” (p. 595-596).

Taken together, this set of literature on critical race theory and strategies for productive teacher learning informs how we might think about fostering teacher dialogue in computer science professional learning communities. Given that computer science has the unique distinction as **one of** the most segregated (in terms of race and gender) academic subject in United States schools (**Author, et.al., 2017**) and that the computing industry is both visible in the media and filled with White **and Asian** men, we suspect that computer science offers a unique and important setting to examine a national cohort of teachers’ discourses around race and education.

Methodology

This study took place in a week-long, residential professional development workshop designed to prepare teachers to instruct the Exploring Computer Science (ECS) course at the high school level.

The course was designed to broaden participation in computing with three areas of foci: inquiry-based teaching and learning, a breadth-based foundational approach to computer science content, and an equity orientation towards curriculum and pedagogy in the classroom. Since the course was first developed and piloted in Los Angeles Unified in 2008, the ECS program has prepared over 2000 teachers through professional development workshops. A national cadre of teacher leaders have been prepared to serve as facilitators for this program. An estimated 50,000 students each year are enrolled in ECS, with research showing that the demographic enrolment rates of students are aligned with demographic school enrolment rates.

The ECS PD is a two-year program, beginning with a five-day summer institute, followed by four quarterly PD experiences, and then concluding with a second summer Institute. In this study, some of the teacher participants were returning for their second summer, while others were in the first week of their preparation. First and second year teachers were mixed together and randomly placed in one of five concurrent classrooms for the week. One central characteristic of ECS PD workshop is the rehearsal-based model of teacher preparation. Teachers are divided into small groups and assigned one of eight curricular lessons to “deliver” to other teachers in the classroom during the week. After each lesson, significant time is invested in debriefing the lesson, the instructional strategies, equity and inclusion considerations, and connecting the

content to high school students. This teacher-learner-observer model allows for teachers to move beyond learning content in a vacuum or talking about improving instruction, and actually allows for teachers to engage in public pedagogy and receive peer support and feedback about teaching (Goode, Margolis, & Chapman, 2014). In this PD, teachers also read and discuss the *Stuck in the Shallow End: Education, Race, and Computing* (Margolis, et al, 2017) book over the course of two days and discuss how race and racism operates in computer science classrooms. This reading includes data on inequities in computer science education, which, according to Bianchini et. al (2015), has the potential to produce generative conversations around race and equity. The PD is intentionally designed to surface and infuse conversations around equity and inclusion throughout each lesson and utilizes journal writing and small group discussion to help support this dialogue.

This study benefits from the inclusion of a national sample of diverse computer science teachers in a week-long ethnographic study. While most professional development workshops take place in regional settings, this study occurred in a unique setting - a residential all-comer's ECS PD which attracted 122 teachers from 29 states and the District of Columbia. Of these teachers, 53% identified as female, and 46% identified as male. Ethnically, 12% of the participants identified as Latinx; and racially, 5% of participants identified as American Indian/Alaska Native, 7% identified as Asian, 13% identified as Black, and 73% of teachers identified as White.

One third of the teachers had attended ECS PD the prior year, and the remaining teachers were attending ECS PD for the first time. Notably, the teachers in this sample represent a higher proportion of teachers of color than the U.S. teaching force, where 79% of teachers are White, 8% are Black, 9% are Latinx, and Native Americans are few (US Department of Education, 2016). These low rates of Black, Latinx, and Native American teachers as compared to the proportion of these groups in the general population reflects patterns in educational disparities for these historically underserved groups in the United States.

To capture the dialogue and practices of these participating teachers around race and computing, we drew from multiple data sources. In two classrooms, researchers observed the entire week's PD and documented the conversations and pedagogical activities related to race, gender, and equity. To avoid disrupting the dialogue in the classroom, researchers took notes on paper. Whenever possible, researchers attempted to include direct quotations from teachers related to discourse on race or equity. Because of the residential and intimate nature of the PD, some of these conversations spilled out of the classroom and into the hallways or the dining hall, in which case the researchers wrote up their notes after observing or talking with teachers. The field notes were transcribed each day and discussed extensively with the research team to identify emerging themes. This qualitative data collection

was supplemented with pre- and post-PD surveys in which teachers reflected on their knowledge and skills related to teaching for equity.

In our analysis, we organized the week's field notes around 'critical conversations' in which conversations that centred on race and culture emerged during the workshop. The field notes were then coded using themes concerning racial discourse, colorblind discourse, paradigms of equity, and teacher agency in addressing educational inequities. We also coded based on teachers' race, gender, geographical teaching location, and years of experience with ECS. As patterns emerged in each of these areas, we then inspected interactions between various codes to see how they influenced each other.

Because there is much evidence that the positionality of researchers impacts the data collected and analysed, we offer our own statements of identity as a racialized researcher in this space.

Goode is a White woman, a former high school computer science teacher in a diverse urban high school, and the lead developer of the ECS curriculum and PD program. Due to her close proximity to these materials, she participated in the design and analysis of the study alongside the co-authors but did not collect observational data. Johnson identifies as White and Native American, of Oglala Sioux descent. She is a former middle and high school math and science teacher, a former academic advisor for undergraduate students seeking Earth and Environmental Sciences degrees, and is currently pursuing a PhD focusing on social justice

issues for Indigenous peoples within the educational systems of the United States. Sundstrom is a doctoral candidate in Education Studies, a former elementary school teacher and assessment developer, and a mother to two biracial children in a suburban working-class community. She is a former teacher in a predominantly Black and Latino community.

Findings

We share three instances of how and when dialogue around race became central to the professional learning of teachers. The three vignettes that follow are composed from field notes and are illustrative of how race as curriculum in a professional development setting takes place in the classroom, during breaks, and over the course of time. The first vignette focuses on a two-part teacher discussion that took place around common reading focused on race, education, and computing. The second vignette showcases how an ethnocomputing cornrow braiding lesson surfaced dialogue around race. The final vignette more broadly captures how notions of race and colorblindness bubbled up organically throughout the week across a variety of curricular conversations. Together, these three vignettes reveal key moments when teachers engaged in professional learning around race and computing throughout the week.

Teacher dialogue on race and computer science education

In an effort for teachers to wrestle with equity and access issues in schools, two consecutive days involved learning activities around the

Stuck in the Shallow End book. The first night the teachers were assigned homework to read the introductory chapters about why the low numbers of computer science students in high school are rooted in structural inequities and educator belief systems around student suitability for the subject. Teachers were asked to write a journal entry on their thoughts of this research on the under-representation of students of color. While most participants completed this homework, the content and depth of the entries varied tremendously. The next day the teachers shared their journals and engaged in a silent round-robin reading of each of their group member's responses, jotting down notes or questions on stickie notes in reaction to their colleague's reflections. After one more night of homework and jigsaw reading one of three chapters presenting high school case studies, small groups of teachers shared out on the themes of each case study to the whole group using poster paper. At this point, on a Wednesday, with more trust and community built amongst participants, a more substantial whole-class discussion took place in both classrooms on the issues raised in the book, and how they related to teachers' own school communities.

Teachers varied in their spoken perspectives about the dual role of structural systems and belief systems in shaping opportunities for students of color to learn computer science. One teacher suggested, "I have so little experience, so I can't answer if the metaphor holds." A rural teacher from a predominantly white community talked about the racial demographics of his community

and noted “I really can’t control this aspect (pointing to race).” Another teacher noted that “hallways are split by content so it’s not about race” and dismissed the effects of racial segregation in school. Another teacher argued she didn’t have control over enrolment demographics because her students come to her with set schedules. A teacher with a visible disability argued that “there aren’t very many people in my group, but I’ve fought through it and I’m fine.” He seemed to be suggesting that students should just fight through racial barriers, too. These comments worked to actively avoid and deflect discourse around race and education.

Other teachers brought up how they believed that home technology access issues were the central cause of racial inequities in computer science. Several teachers highlighted access to technology as central to the discussion, noting that in their rural communities, there was a lot of poverty and no computers at home. One teacher suggested that along with a lack of Internet at home, parents’ inexperience with technology also contributed to this racial divide. This same teacher also noted these patterns go beyond race, and that only 2 of his 70 students the prior year were girls. Another set of teachers suggested a variance in interest amongst students of color in pursuing computer science. A teacher from a Native American reservation suggested that students in her school not only suffered from a lack of technology but also from a lack of interest because of isolation and lack of perceived relevance. Another White teacher pointed to his urban, African American students and said

that there is “no interest because kids are interested in things they know about.” In this discussion, many of the teachers articulated deficit and colorblind language to describe “these kids” and the family obstacles preventing more students of color from participating in computer science. Yet, as another teacher added to these previous comments, “in the book, the lack of access is framed as a lack of student interest by educators”. This teacher noted how students might hold limiting views of themselves, and then described how school staff reinforce these perspectives.

The discussion then moved to how structural obstacles detailed in the book had commonalities to their own teaching and lived experiences. Teachers described how systemic problems regarding access, funding, scheduling, tracking, and resources prevented more students of color from learning computer science. Many teachers in the classroom brought up the gatekeeping role of administrators and counselors, noting that “administrators decide if classes were worth offering, and counselors not guiding diverse range of students into CS”. Importantly, we witnessed that dialogue around race and computing primarily initially focused on access and recruitment, and rarely connected the themes to personal beliefs or possible biases. In talking about these structural issues, racial terminology was often evaded, and teachers relied on verbiage such as “the commuter students”, “them” and “those students” as euphemisms for talking about African American, Latinx, and American Indian students.

Only one teacher during this initial discussion raised the effects of pedagogy on issues of racial equity in computer science. This teacher noted that she was struck in the book by how teachers served as 'informal gatekeepers' through their teaching practices that made for an unsupportive and discouraging learning environment for students of color and girls. She pointed out that while it looked like surface level integration, the classroom climate exposed deeper racial divisions in computer science learning.

The facilitator paused the conversation, and asked teachers to take a few moments to individually journal and reflect on, "What is your role as a teacher for CS for All efforts?" At this point, a series of self-reflective comments entered the subsequent discussion. One returning teacher said, "Our role is to check our own belief systems." She described how she had set pre-requisites for ECS enrollment, and her principal challenged these prerequisites and reminded her that this was supposed to be a CS for All Course. The teacher shared how this conversation required her to also reflect on her own pedagogical practice to assess her inclusive teaching practices. Another returning White teacher spoke about the word inclusivity and how inclusion must be intentional, stating that it's not enough for students to be in the room, but they need to be heard as well. Another experienced White teacher noted, "some of us teachers are blinded by our personal experiences, our personal privilege and so we miss many of the barriers students face." Almost all teachers who

expressed individual agency in addressing the CS for All movement during this discussion were returning, second-year teachers.

Finally, a young Black woman closed the conversation by sharing her story about being a Black female in an undergraduate program. She highlighted the importance of support networks in making her successful once she was in the program. She suggested role models and other supports were essential for not only getting students of color into computer science classrooms, but successfully retaining them and effectively teaching to their cultural needs.

Taken together, this vignette exposes the challenges in connecting ideas of race, computer science, and education to the individual pedagogical practices of teachers. While some teachers evaded the conversation pleading ignorance or relegating the inequities to colorblind notions of geography, class, or gender, others acknowledged the deep structural issues and acknowledged their existence. Only a few teachers expressed individual agency and explicitly talked about how their own role as educators could disrupt these inequities and bring more inclusive learning experiences to students of color.

Cornrow braiding: infusing race in the curriculum

Given the cultural dimensions of computing lessons infused in the curriculum, teaching computer science requires the capacity to navigate and facilitate conversations around race, culture, and computing within the context of equity-focused curricular materials.

The Exploring Computer Science curriculum features ethnocomputing instructional activities based on Culturally Situated Design Tools, which provide an explicit racial and cultural context in learning about modelling and simulation (Eglash & Bennet, 2009). Key components of culturally relevant teaching involve centring culture and difference and establishing pedagogical connections between content and culture (Gay, 2010). Preparing teachers to deliver these lessons goes beyond technical knowledge. The lessons address real, complex cultural topics; multiple opportunities exist for expanding discussions of race and equity in computer science.

The cornrow curves lesson, built using the CSDT design tool, was taught during the afternoon on day two of the professional development. The teachers had a day and half to start getting to know each other, to figure out personalities and begin friendships. They talked through portions of *Stuck in the Shallow End* and had completed two of the lessons from the curriculum. A level of trust between and among the teachers and facilitators had begun to be built. Posters that the teachers created hung along one wall, filling most of that space, and the room was warm. The lesson for the afternoon was centred on the problem-solving process and the topic was “Cornrow Curves.”

Though many moments around race and computer science education sprouted up during the week, this particular lesson centred issues of race and computing and not surprisingly, surfaced the most teacher dialogue about race. As part of the workshop, a

group of teachers were tasked with teaching an ECS lesson about cornrow curves, as part of learning about problem solving and using design and modelling tools. Developed explicitly to engage students in ethnocomputing lessons, the cornrows activity is one of a selection of culturally situated design tools that engages students in learning African and Native American cultural and computational practices (Eglash & Bennett, 2009). In the workshop, a small group of teachers taught the lesson from the curriculum guide, with the remaining teachers in the role as “learners”, and two returning teachers who acted as “observers” for the lesson.

In the first ECS classroom in this study, after the teachers developed a “Whose cornrow is it anyways” online game, the group of educators debriefed the lesson and discussed how to modify the lesson for the classroom. One teacher noted, “the game was an engaging way to introduce the topic, because it might be a challenging topic.” A returning teacher noted that teachers last year were worried about teaching this lesson to White students, and her question was, “why?” At this point the two observer teachers, both returning after a year of teaching the course, admitted they had skipped the lesson from the curriculum last year. When asked why, one teacher noted that she didn’t feel comfortable teaching the lesson because it wasn’t “directly related to CS.” She said, “Knowing my students, I need to give them a why and connect it to CS. I just didn’t feel comfortable with my population because of them needed

to know the why.” For this teacher, skipping the lesson was attributed to her perceived lack of connection with computing.

At this point in the dialogue, a Black teacher noted that teaching this lesson was particularly important, noting, “For teachers who have more white students, there’s a piece of advocacy we’re trying to do. We’re not trying to thrust it on people, but integrate culture and technology.” Another Black teacher chimed in, noting he had also skipped the lesson the year before, stating that he was worried about parents at the school he teaches at in the Deep South. He noted that with a 30% Black population and 60% White population, he worried about “White kids taking home questions about cornrows and African American history, and there might be a repulsive or indifferent response [from parents].” Instead, his solution was to expand to other cultures not represented in his school, so as to be less controversial, --specifically, in this case, he used the Native American beadwork lesson.

A White first-year ECS teacher also noted that her hesitancy to teach this lesson was connected to the ‘bad history in my area’ related to the KKK in a rural community. She was concerned this lesson might reinforce negative stereotypes and could lead to insensitive cultural appropriation. “I don’t want to exacerbate the problem.” Another teacher, who noted her own sensitivities to being the only Jewish child in many of her own classrooms while learning about the Holocaust, noted she didn’t want to ‘offend anyone.’ When it was asked what could be offensive about this cornrows lesson

about a broader history and culture of African Americans, she was taken aback and said “I guess there is nothing offensive about it.”

Still, other teachers shared their own successful instructional strategies for dealing with some of their own discomfort in preparing to teach this lesson to students. For instance, a White returning teacher, who noted that his CS class had a 20% Black population, shared that he was initially concerned about teaching this lesson the prior year. He explained that he had about 20% African (immigrant) and African American student population in his class. The teacher explained how he checked in with these students in advance, and they were really excited about the lesson, excited to see themselves represented in the lesson, and they wanted to share knowledge with classmates and show them how to braid. This successful report helped counter the notion of fear and perception of controversy that other teachers in the classroom had expressed.

In the second PD classroom in this study, the teacher group in charge of presenting the Cornrows lesson opened with an introductory exercise which asked the teacher learners to write in their journals what they knew about cornrow braids, then to discuss with their table groups of four. One small learner group was composed of a younger Black woman, two middle aged Black women, and a middle aged White man. This group was a bit unusual in composition, as the overall demographics of the room were predominantly White. The man in this group came across as considering himself something of a computer expert. He had taught

computer science type courses for quite a few years and had some background and knowledge in computing. He often dominated conversations and always had something to contribute around both teaching and computing. The young Black woman had just finished her first year of teaching, and had earned a Bachelor degree in engineering before going into teaching. Both of the middle aged Black women had been teaching for a number of years, one of them in a mostly Black school.

During the time that the teachers were writing in their journals, the women in the group wrote for the majority of the time allotted, the man only briefly and then he seemed to be glancing at the others in his group. He tried talking with one of the women during this time, but they discouraged his attempt and kept writing. Once it was time to share with the group, the women dominated the conversation. Their knowledge about cornrow braids included that they take a long time to put in and take out, the braids must be done by someone who knows what they are doing and that not everyone or anyone can do them, that the proper style must be chosen for that particular person or they will not look right, and that braids can make it easier to care for hair. During this portion of the discussion, the man said almost nothing other than to ask a clarifying question or two. The women in the group contributed the knowledge. It then came time to share out with the whole room what the table groups had talked about. The man at this group immediately volunteered and shared what he had been hearing from the others in his group.

This was not a group decision, he simply was the first to volunteer and start talking.

The next part of the lesson had the teachers reading in a jigsaw fashion about the history of cornrows. During the group discussion it was quite obvious that the people in the histories that were being talked about were Black people, both in the past and the present tenses. However, when White teachers in the room were talking, these people were referred to as “they” and “them” and “those people.” Not once did a White teacher name or directly reference color or race. In contrast, the Black women teachers in the room comfortably and quite often used the terms “Black people” and “African American.” The people of color in the room were much more likely to explicitly name color and race than White participants.

Toward the end of this lesson, a question was brought up about how teachers back in their classrooms could/should set up the groups in which their students would work. Should the teachers make sure that each group had a student that held prior knowledge about cornrow braids? Some teachers thought this would be a good idea so that each group would have someone to share at least a bit of knowledge. One Black woman brought up the issue of this strategy making that person, in effect, the representative for their race/color. This seemed to cause the room to become quiet and thoughtful, or perhaps quiet and unsure. The young Black woman in this group offered that “I sometimes feel this way, and I don’t like being a spokesperson for my race.” Interestingly, this same woman was the

most vocal in the group at bringing up racial issues, using racially explicit language, and sharing her experiences as a Black woman.

This vignette around cornrow braiding surfaced multiple dimensions of how teachers talk about race. There was a current of avoidance throughout these as many teachers articulated a fear of controversy, fear of parents, fear of offending someone, or articulated a reluctance to see the relevance of the activity to computer science. Though this lesson highlights Black historical and cultural knowledge and related computational underpinnings, racial dynamics between group members also revealed how a racial hierarchy of expertise amongst teachers was maintained when the least-involved teacher reported out the group's knowledge as his own. Taken together, these findings highlight that even when an ethnocomputing lesson is literally built into the student and PD curricular materials, teachers still approach the lesson and resulting dialogue with suspicion and hesitancy given the centrality of race. Yet, without cornrows at the centre of the lesson, this dialogue likely would not have surfaced.

A closing vignette: infusing race and equity into teaching practices

As a closing activity in the PD, groups created and shared posters that referenced various instructional approaches to equity, such as student-centred pedagogy and grouping strategies. One poster emphasized the importance of culture, creativity, and empowerment. Another poster depicted a network map, and the presenters

explained how different processes create equity at different levels, from classroom teaching to recruitment and enrolment at the school level. One teacher described how she intentionally put equity in the centre of the poster, because “it’s really important...it’s the glue.” She acknowledged the importance of recruiting people for a diverse CS world, but she said “It’s more than that...how you arrange groups, giving information in multiple ways, and having students feel safe and comfortable in the classroom.” Other teachers mentioned inclusion, as well as recognizing the real barriers that exist for students of color in CS courses.

During a conversation over the closing lunch, a group of teachers talked about the week and the insights they gained. One teacher described how she had been trained as a teacher during a time when colorblind approaches were standard. Explicit discussion of race was discouraged, and educators instead referenced generalized notions of equality and tolerance. She shared a story about the poster activity that morning. Their group was planning to depict racial segregation in student enrolment in CS courses, so she drew stick figure students that were separated by a barrier. She didn’t try to illustrate skin color in the pictures however. Then an African-American teacher stepped in and lightly coloured the faces to visually depict racial differences among the students. She didn’t feel comfortable with the idea of colouring in the student faces, and she was surprised when the other teacher did so. She acknowledged the impact of colorblind approaches in teaching and how it prevented

dialogue around race and culture. “We just didn’t talk about race,” she said, reflecting on her earlier experiences in education. Yet, here she was at lunch, beginning to pry open her own belief systems and examine how she was genuinely working to hone her knowledge and teach CS to all.

These closing moments highlight key features of teacher learning in the PD. First, while the professional learning activities intentionally featured race and culturally inclusive practices, much of the teacher discourse around teaching for inclusion offered more neutral “equity” language, though many of the instructional strategies offered are certainly supportive of students of color. Yet, as the lunchtime encounter reveals, the influence of other teachers instilling the importance of discussing race in PD appeared to plant seeds of possibility for other teachers whose primary experiences in educational discourse had been colorblind. It appears PD had given these teachers the opportunity to understand the importance of naming race and racism as they began exploring the implications of a critical race perspective. Given the importance of teachers in providing culturally responsive computing experiences to students, dismantling this colorblind ideology is a critical first step in teacher learning in this area.

Discussion

The outcomes of this study provide critical insights on how teachers dialogue around race and equity in the context of preparing to teach

computer science. A significant finding of this paper was the hesitancy in which many teachers, particularly White teachers, participated in conversations, pedagogical practices, and curricular activities that acknowledged race explicitly in computer science education. When race was central to Professional Development curriculum, such as in the *Stuck in the Shallow End* discussion or in the Cornrow Braiding lesson, a large group of White teachers employed colorblind discourse. Teachers' repeated use of the terms "my population", "that population", "anyone", "they", "them", "those people", and "urban students" denoted references to race and "the other", without referencing race directly. These evading discourses (Segell & Garret, 2017) might be explained as White teachers reflected on their own participation in the professional development around racial dialogue, saying that they did "not want to offend anyone" and being brought up in schools where "we just didn't talk about race." Or, as one teacher noted, she just didn't understand the connection of culture to computer science content.

In contrast, teachers of color in this professional development setting, particularly Black teachers, typically named - and in one case, shaded in the faces - of race directly, often in response to a colorblind discourse that was taking place in the setting around them. These teachers not only named race, local context, and the power structures that often-accompanied educational injustices, but they considered their own role in educating students and other adults on these issues and the impacts on their students. For these

teachers, talking about race in the classroom seemed to be an intentional and layered decision that involved considerations of teacher racial identity, student racial identities, and local culture and history. And yet, while the experiences and insights of teachers of color provide a rich resource of knowledge and counter-knowledge about race and schooling in teacher education spaces (Ladson-Billings, 2005; Cheruvu, Souto-Manning, Lenci, & Chin-Calubaquib, 2015), a participant in this study articulated the burden of being a spokesperson for race in PD.

Our focus of this study also probed *when* teachers engaged in race-based and colorblind discourses. Outside of the key conversations and activities noted in this paper, and across a set of six other lessons modelled by teachers which followed these initial discussions, conversations around race were less frequent. While discussions on inclusive teacher practices, student engagement, and ensuring equitable opportunities to learn arose in discussions and debriefs around other computer science lessons, these discussions often remained devoid of any explicit acknowledgement around race, power, or privilege specifically. Given that the rich conversations around race emerged from lessons that firmly centred race in the PD curriculum, the findings of this study spotlight the importance of intentionally centring race in PD learning in multiple lessons and activities. A single “equity” discussion is insufficient to surface more sophisticated and complex discussions. In this study, we witnessed that more general equity, access, or inclusion conversations around

pedagogical practices infrequently included overt dialogue about race or racism.

Lastly, this study suggests that long-term professional development in growing teachers' understandings and capacity around equity, race, and education is important to allow for teachers' own developmental growth around race, pedagogy, and education. We witnessed how some teachers became more vocal with their own growth in disrupting racial inequities in education, particularly around issues of race and teacher agency, after they had experienced teaching the course, reflected on the material, and continued their professional learning. The *Stuck in the Shallow End* discussion allowed for the insights of second-year teachers, who had already engaged in similar discussions the prior year in PD, to share "what works" for equity and inclusion in the classroom. While some first-year teachers relied on structural and student deficiencies to explain the homogeneity of computing, a sizeable cadre of second-year teachers reinforced the significant and ongoing gatekeeping effects of counsellors and teachers. As one returning teacher recommended, teachers needed to be advocates in this work, guided by focus, intention, and examination of pre-requisites. The reflection and growth in knowledge of equity-based principles articulated by second-year teachers on their surveys was also significantly different than first year teachers. While first year teachers exhibited the most growth in self-reported confidence in inquiry-based pedagogy, second

year teachers exhibited the most growth in their understanding of equity in the context of teaching computer science.

These findings suggest that short-term professional development sessions, particularly those that include only first-year CS teachers, might never reach the same level of professional, race-focused discussions without experienced teachers in the room. In the cornrows lesson, the discussion of “should I teach this?” was raised by second-year teachers, for some had skipped the lesson, while others shared their own uncertainties, strategies, and stories of success in teaching this race-focused activity. Having the experiential knowledge garnered from teaching the curriculum allowed the classroom of teachers to discuss these topics with more confidence and honesty than if none of the teachers had yet encountered the lesson before in a classroom context. Though these second-year teachers made up less than half of the overall ECS teachers in PD, they were notably more eager to dialogue and demonstrate pedagogy knowledge focused on race, culture, and equity. These findings bolster our knowledge that changing teachers’ belief systems happens over time, highlighting the value added of having overlapping cohorts of teachers in PD.

The major limitation to the generalizability of this study is the analysis and discussion of race is unique to the socially and historical construction racial and ethnic categories that operate to classify people in the United States. Duplicating this study of colorblind discourse in international PD contexts, with other racial and ethnic

social group considered particular to the local region, would help determine if the findings of this study can be generalized to a more global population.

Conclusion

Providing opportunities for all students in computer science education is a formidable task, given historical patterns of participation and exclusion in computing classrooms. As efforts to scale computer science education are penetrating school across the globe, many professional development programs assert increased diversity and representation as a central goal of this educational movement. Using a framework of culturally responsive computing education, this study demonstrated how and when teachers employ colorblind or race-based dialogue in their professional learning in a PD for a course designed to broaden participation in computing. The study demonstrated that while many White teachers initially evade or deflect racially explicit language, teachers of color more likely infused language into the conversation. Further, teachers who repeated the workshop for a second year after a year teaching the course demonstrated a more willing and sophisticated ability to talk about the relationship between race, culture, pedagogical practices, and their own belief systems. Taken together, this study highlights the importance of engaging diverse teachers in long-term, multi-cohort learning opportunities to catalyse dialogue around race and

computing that has potential to transform learning opportunities for all students.

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