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Ignorance is bliss: White Male Privilege and the Reproduction of Gendered-Racism in Computer Science Education

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Ignorance is Bliss: White Male Privilege and the Reproduction of Gendered-Racism in Computer Science Education (Work in Progress)

Introduction

Undergraduate degrees in computer science increased over the last 10 years from 42,459 degrees earned in 2013 to 114,751 degrees earned in 2023, but this growth has not been equally distributed across the population. For example, the number of CS bachelor's degrees earned by Asian students grew more than fivefold from 2013 to 2023, while the number earned by Black students increased by a factor of only 2.3, undershooting the overall growth rate of 2.7. Over the same period, white men's share of degrees earned decreased from 49.6% to 34.9% [1]. Despite the decrease in representation, our study finds that computing environments are more favorable to white men as compared to other students.

More often than not, research on STEM equity focuses on the participation and experiences of groups who have been historically disadvantaged — both within and beyond STEM. While this line of inquiry is important, we argue that it is equally as important to understand the experiences of groups who are *advantaged* by the very systems, practices, and norms that serve as an impediment for other groups. Toward this end, we conceptualize racism [2] and sexism [3] in computing as systems of advantage that ultimately benefit white males, rather than singular acts or events of prejudice towards women and groups of color. With significant investment in broadening participation in computing fields over the last two decades [4], documenting and understanding the persistence of a system and culture that benefits white men can help identify ways to disrupt the current norms and practices in an effort to more efficiently and authentically expand participation to more groups.

Drawing on the tradition of Critical Whiteness Studies (CWS), the current paper aims to highlight the often invisible patterns and structures that produce and reproduce white (and male) privilege in computing pathways and experiences. Accordingly, this research centers four main research questions:

1) In what ways are white males advantaged in pre-college computing experiences?
2) How do race and gender advantage white males in the decision-making process for selecting computing as a college major?
3) How do white males benefit from systemic racism (and its intersections with sexism) in their navigation and understanding of college computing environments?
4) In what ways are white males advantaged in computing identity formation?

This work is part of a larger, mixed methods study: *Researching Early Access to Computing and Higher Education (REACH): Understanding CS pathways with a focus on Black women*. This research project is designed to investigate the relationship between students' computing experiences in K–12 and higher education within a framework to assess equity across multiple sectors of education. As part of this study, computer science majors at three institutions in Maryland and eleven institutions in Texas were invited to participate in an online survey. The survey explored students' current college experience, pre-college experience, sense of computing identity, and demographic information. Data from the survey was examined by race and gender with a focus on Black women.

Our early analysis finds that despite white men making up a smaller share of computer science majors, they still have more positive experiences, perceptions and self identity than other students, particularly Black women.

Theoretical Framework

We center our research within the theoretical frameworks of Critical Whiteness Studies (CWS) and intersectionality. CWS interrogates how whiteness serves as a determinant of social power. Towards this end, whiteness is understood as a structure of dominance that controls and limits racialized people in any particular space [5], while simultaneously — and seemingly invisibly — privileging and conferring advantage to white people [6]. As a framework, CWS places emphasis on exposing and deconstructing the racialized power dynamics that produce and reproduce white supremacy and privilege, by centering white people at the forefront of confronting their own complicity in maintaining systems of racial inequality [7], [8].

The concept of white privilege is central to the CWS framework. McIntosh [9] describes white privilege as an "invisible weightless knapsack of special provisions, maps, passports, codebooks, visas, clothes, tools and blank checks." White privilege refers to the unearned and (often) unacknowledged advantages that white people experience as the result of systemic racism and white supremacy. These privileges stem from structures, institutions, and practices that favor white people over those from other racial groups [10]. White privilege is not about personal guilt, but rather about the broader social and institutional dynamics that afford white individuals certain benefits, primarily unconsciously, at the expense of non-white individuals/groups. Examples of white privilege include: freedom from racial discrimination (e.g., white people are less likely to be discriminated against based on their race in the areas of housing, employment, education, and policing), representation (white people are more likely to see their racial identity and experiences reflected positively in leadership, media, and cultural narratives), and access to resources (due to the historical legacies of slavery, Jim Crow, and backlash to the Civil Rights Movement, white people have greater access to wealth, education, and political influence) [9]. In the context of STEM, white privilege is evidenced by the systemic and often unconscious ways that white norms, perspectives, and experiences are considered the default in STEM fields.

White supremacy culture and privilege is embedded across society and organizations when standards of whiteness are normalized [2]. Across the United States, this culture of white racial dominance permeates most organizations, especially educational settings. Past research has found that studies of higher education tend to neglect racist institutional norms and often ignore the impact of whiteness on student experiences [6], [11]. Studies have found that white racial ignorance on college campuses further marginalizes students of color across college settings [12]. Within STEM departments, color evasiveness and white supremacy culture contribute to the systemic exclusion of students of color [13]. Simultaneously, these departments privilege white students (particularly males) by fostering a greater sense of belonging in STEM educational spaces and allowing students to navigate these spaces oblivious to racial dynamics, without consequence to their overall trajectory in the program [10].

Individuals' and groups' experiences with systemic oppression (and privilege) are not shaped by one social identity alone; rather, experiences with oppression and privilege reflect the interplay of multiple identities at once. Toward this end, intersectionality offers a productive framework for understanding how white males benefit from both white *and* male privilege in STEM spaces broadly, and computing environments more specifically. This approach allows us to explore not only the impact of race or gender but also the impact of the intersections of these social identities. Intersectionality posits that one's identity is not only created from race, gender, and other identifiers, but the overlap of those identifiers creates unique experiences that can only be understood by interrogating the intersection [14], [15].

Existing research suggests that STEM experiences vary greatly by race and gender. Women and racialized minorities are more likely to report experiences with discrimination and microaggressions in STEM environments [16] and less likely to feel like they belong [17], [18]. More specifically, Black women experience gendered racism through negative stereotyping about their STEM intelligence and aptitude [19], have fewer opportunities in schools to participate in computer science activities [20], are less likely to receive encouragement to pursue computing pathways from their teachers and school personnel [20], and are less likely to enroll in computing programs in college [21]. These experiences directly impact women's and racialized minorities' trajectories and ability to thrive in STEM broadly and computing specifically. Furthermore, this research undergirds our argument that more research needs to focus on the intersectional experiences of white males. Existing research primarily centers an intersectional analysis of disadvantaged social identities while neglecting to analyze the intersectional experiences of privilege. We argue that the latter is equally important to dismantling the systems of power that perpetuate these outcomes.

Intersectionality also asks researchers not to focus solely on the ways individuals adapt in the face of oppression, but instead to understand the systems and structures that are oppressing them [14], [15]. For example, solutions to the CS participation gap that solely focus on adding more courses to elementary and secondary schools do not acknowledge or dismantle the systemic and structural barriers of United States society that are purposely designed to block the path of some, while encouraging others [14], [22], [23]. In order for efforts to broaden participation in computing to be more targeted and effective, it is imperative that researchers in CS education do more to account for the intersecting systems of oppression that privilege white males at the expense of other demographic intersections — especially Black women.

A core guiding premise of intersectionality is the acknowledgement that domains of power construct and reinforce social inequalities and hierarchical positions based on race, gender, and other identities and influence the ways individuals and groups experience these inequalities [14], [24]. The four domains of power — structural, disciplinary, cultural, and interpersonal — can be separately understood; however, they are also interconnected in the ways they work to perpetuate white male privilege (Figure 1). Framing our research and findings through the lens of the domains of power aligns with the frameworks of both CWS and intersectionality. Likewise this approach supports a deeper understanding of the invisible advantages that white males enjoy as a result of systemic racism and sexism in computer science. In order to disrupt these social systems, we must first acknowledge their largely unseen dimensions at the interpersonal, cultural, disciplinary, and structural level, for it is the invisibility and the denial of white male privilege that ultimately reinforce the systems and structures that maintain white male dominance in computing.

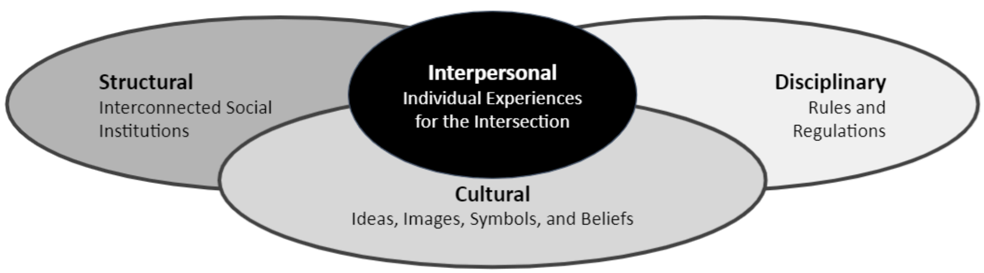

Figure 1. Domains of Power

Applying this lens to the analysis allows for an understanding of the data in the context of formal classroom environments and informal opportunities for exposure to computing at both the K–12 and higher education levels, thereby expanding our knowledge of how the computing space centers both whiteness and masculinity as normative [25].

Positionality

The REACH study team includes researchers with expertise in evaluation, policy, education, and sociology, and includes depth in qualitative and quantitative methods. Our team is also diverse in personal experience and identity, including gender, racial identity and disability status. Our positionality influenced how we explored the data available to us and framed our observations. We recognize that our ages, political beliefs, social classes, races, ethnicities, genders, religious beliefs, previous careers, and current roles in our organizations and on this research team impacted how we conducted the research and analyzed the results [26]. Individually and collectively, we reflectively discussed and confronted our assumptions and biases while interpreting the survey data in the context of our larger study.

Methodology

This paper draws on data collected through the Pursuing Advancement in Higher Education-CS (PATH-CS) survey of pre-college computing experiences. The PATH-CS survey was designed for use with computer science majors to better understand the pre-college computing experience and its connections to their decision to pursue a computing major and to their experiences and sense of identity in the field [27]. All students in computing majors at eleven schools in Texas and three schools in Maryland were invited to participate in the PATH-CS survey. Schools included community colleges, non-flagship state universities and Historically Black Colleges or Universities (HBCUs) in each state.

There were a total of 764 survey responses across the 14 schools and two states. Table 1 provides the response rate by state and demographics. The larger study will make more use of intersectional data, but for this work in progress we are particularly interested in white men and Black women:

Table 1. PATH-CS Survey Respondents

	Maryland (n=468)	Texas (n=296)	Total
Institution type			
Community college	61	18	79
HBCU	32	29	61
Four-year university (non-HBCU)	375	249	624
Gender*			
Man	238	153	391
Woman	119	81	200
Non-binary, gender non-conforming, or other	14	11	25
Unidentified	97	51	148
Race/Ethnicity **			
American Indian or Alaska Native	1	3	4
Asian	105	35	140
Black	84	25	109
Hispanic or Latina/o/x	16	57	73
Middle Eastern	2	4	6
Native Hawaiian or Pacific Islander	-	-	-

White	121	84	204
Another race	1	-	1
Multiple races	40	40	80
Unidentified	98	48	146
Intersectional identities explored in this paper***			
White men	108	75	183
Black women	39	13	52
* Participants were offered 6 options for gender and the option not to identify. For the purpose of this analysis responses were aggregated into four categories. Only those who identified as a "man" or "woman" are included in the aggregate identities of "white men" and "Black women" respectively. ** Participants were offered 17 options for race/ethnicity including the option to provide an identity not listed and an option not to identify. For the purpose of this analysis, responses were aggregated into 6 options [27]. *** We categorized "white men" and "Black women" to include participants who selected "white" or "Black," respectively, regardless of whether they also selected additional racial/ethnic categories (in which case they appear in the "multiple races" category in this table).			

Data were initially analyzed using descriptive statistics in order to identify appropriate testing methods. We applied chi-square tests (substituting Fisher's exact tests with Monte Carlo simulated p-values where chi-square assumptions were not met) to better understand the presence of these relationships. Magnitude and direction of the relationship was ascertained by comparing the group averages for scores where possible (e.g. ordinal questions with response options such as "strongly agree/disagree"), and inspection of response patterns where not (e.g. binary or nominal questions with response options such as "yes/no"). We initially focused on comparing Black women's experiences with those of the other students, and on comparing Black women in Maryland with those in Texas. However, due to the small number of Black women respondents (particularly in the Texas sample), we chose to widen our scope to other comparison groups. We found that the male students in our sample, and especially the white male students, stood out in particular in their responses.

Limitations

A limitation of the chi-square and Fisher's exact tests used in the analysis is that they cannot indicate which of two distributions is greater, only whether they differ. The p-values given here are those produced by these tests, indicating, when less than 0.05, that the pattern of white men's responses to a question was significantly different from the pattern of other students' responses. The assessment of which group typically gave the "higher" response was conducted separately, by assigning numerical scores to the response options and comparing each group's mean score, and by visual assessment of the response distributions. Because the response data are categorical, not numerical, this was the best means available to compare them across populations.

Additionally, while Fisher's exact tests are useful for side-stepping situations that violate chi-square test assumptions, they are limited in other ways. The test is computationally expensive for contingency tables larger than 2×2, so Monte Carlo simulation of p-values is used to make computation feasible. This simulation can lead to inconsistencies. One testing round on a fixed random seed was used for this work; however, multiple rounds producing an aggregated p-value could improve confidence. Exploratory runs did not indicate large differences in p-value, however.

Preliminary Results

Pre-College Experiences (RQ1)

White men reported a different distribution of types of computing activities participated in before college than other students; most notably, they were much more likely to have participated in computing independently (i.e., not in school or through an extracurricular program) ($p < 0.001$). The white men in the sample also had higher rates of participation in in-school CS courses, in out-of-school CS-focused activities, and in computing activities overall, though these differences did not rise to the level of significance. We saw strong evidence that the white men had different experiences in these pre-college activities than the other students in the sample. Regarding in-school CS courses, the most common type of activity reported on, white men were more likely to report that they "enjoyed many of the activities" ($p = .023$) and "enjoyed learning about computers" ($p = .008$) as compared to other students, and were more likely to report having been interested in computers before participating in the activities ($p = .005$). In addition to this enjoyment and interest, they were more likely to report that they "felt like a welcomed part of the group participating in activities" ($p = .012$).

Decision to Major in Computing (RQ2)

The survey included several questions about students' reasons for choosing a computing major. As only computing majors were included in the study, we cannot draw any direct conclusions about what factors affect this decision. However, we are able to make observations about the different groups within the surveyed population.

The most common reason given for majoring in computing was "I am interested in the topic," with 83% of white men and 71% of other students selecting it. This was a significant difference with $p = .003$. Similar questions saw similar splits; white men were more likely than their peers to select the responses "I enjoy coding and creating technology" ($p = .001$), "I like to solve problems" ($p = .029$), and "I learned to code on my own" ($p = .002$). White men were also more likely than other students to select "It is important for my career aspirations" ($p < .001$) and "I was told that I would be a good computer scientist" ($p = .005$). Conversely, white men were less likely than other students to cite “giv[ing] back to my community” as a reason for majoring ($p = .001$).

College Environments (RQ3)

White men in the sample were consistently less self-conscious than other students in their computing environments, around a range of attributes including race/ethnicity ($p < .001$), gender ($p < .001$), accent or speech ($p = .002$) citizenship status ($p < .001$), and socioeconomic status ($p < .001$). These trends are similar in non-computing environments as well, though somewhat less pronounced.

White men also seemed to be less sensitive to the social dynamic in the environment than other students, reporting lower incidence than their peers of hearing negative remarks from peers or faculty concerning every group they were asked about, including “students from other countries” ($p < .001$), “non-native English speakers or students who speak with an accent” ($p = .009$), “students from low-income families” ($p = .005$), “women” ($p < .001$), “women of color” ($p < .001$), “students from particular racial/ethnic groups” ($p < .001$), “students from the LGBTQIA+ community” ($p < .001$), and “students with disabilities or medical conditions” ($p < .001$).

Computing Identity (RQ4)

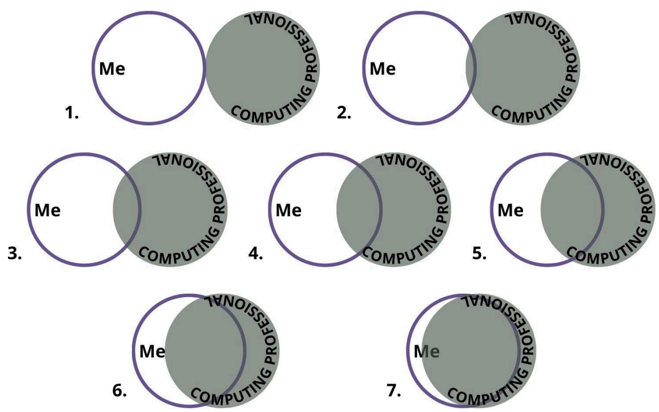

Figure 2. Computing Identity

The survey included three questions around computing identity. For each, participants were shown a range of seven images, each depicting two overlapping circles labeled “me” and “computing professionals.” The circles in the images ranged from barely touching (first image) to almost entirely overlapping (seventh image). For each question, participants were asked to select one image that best described an aspect of their computing identity. These were “the current overlap of the image you have of yourself and your image of what a computing professional is,” “the extent to which your knowledge of computer science concepts matches that of a computing professional," and "the extent to which you think others (such as your computing professors) see your identity as overlapping with a computing professional."

In order to reduce these three items so they could be analyzed jointly, we performed a factor analysis on the respondents who answered all three questions. This group contained 654 members, including 50 of the 52 Black women and 177 of the 183 white men in the dataset. Among the three variables there was one eigenvalue greater than one, suggesting by Kaiser's rule that we should use one factor. We ran the factor analysis in R, using the "varimax" rotation method. The analysis produced a factor with loadings 0.83, 0.81, and 0.72 on the self-image, knowledge, and others'-perception variables respectively. Its proportion of variance was 62%, and its alpha was 0.82. This provided a computing identity "score" that could be used to compare groups within the sample.

The derived computing identity score had an overall mean of 0 and standard deviation of 0.91. For the white men subgroup, the mean value was 0.21, significantly higher than for other students according to a two-sample two-tailed t-test ($p < .001$). We also note that despite a small sample size, Black women's scores were significantly lower than other students' with a mean of -0.29 ($p = .020$).

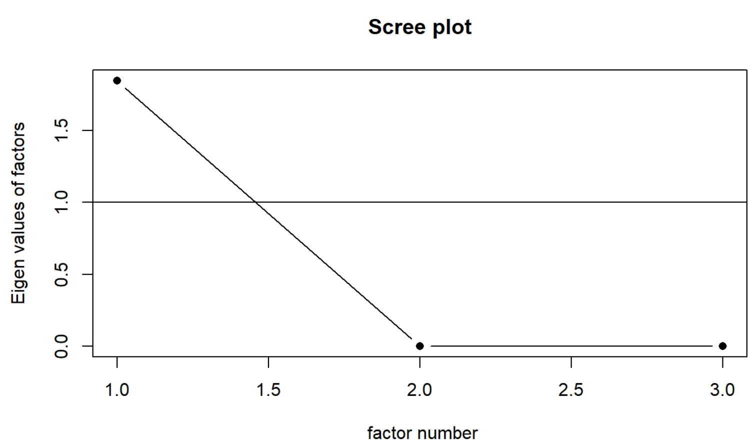

Figure 3. Scree plot produced by R for the computing identity factor analysis

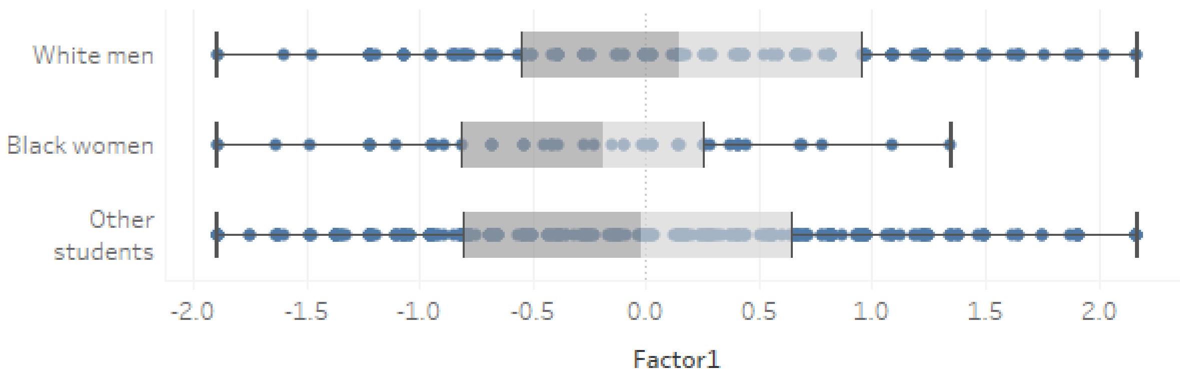

Figure 4. Box-and-whisker plot of the derived computing identity factor, showing white men (n = 177), Black women (n = 50), and students who are neither (n = 427)

Summary

These results help us to answer our research questions as they show a clear difference in the pre-college and current experiences among different demographic groups. Survey results reveal that for white men, as compared to other students, particularly Black women, the pre-college and college computing environments work well. White men were statistically more likely than the rest of respondents to report enjoying their pre-college computing classes and learning about computer science. They were also more likely to feel welcome in their classes than other respondents. White men were also less likely to report that their pre-college computing courses were mostly made up of boys and majority white, suggesting a lack of awareness of computing spaces as sites of racial and gender bias. These experiences may be part of the decision-making process for white men as they select a college major. Within the computing environment, white men are also less sensitive to the existing racism and sexism than other students, which may also be a protective factor influencing their retention and persistence in the field. Finally, these experiences may also contribute to the sense of belongingness that white men in computing report at a higher rate than other students, especially Black women.

Significance and Impact

Our larger study focuses on the experiences of Black women; however, our data suggest that we need to understand how the computing environment favors white men. In the context of domains of power (which overlap), we can understand the following:

Structural: there is a difference in participation in computing at both the pre-college and college levels. At the pre-college level we have open questions about how access to computing may vary across school systems and communities, and thus influence the participation of students in our sample. Even within a school context where computing is offered, guidance counselors and teachers may steer certain students into or away from computing [28], often encouraging white and Asian men into computing classes and ultimately computing majors. Our prior work has explored the ways in which Black women's embeddedness in supportive organizational structures outside the formal educational system plays a vital role in their pursuit of interests in computer science (CS). These organizations provide a sense of belonging and validation that is often lacking in traditional classroom settings, where Black women may feel marginalized. Our findings underscore the importance of access to these supportive networks, revealing how they serve as crucial platforms for encouragement and engagement in computing [20].

Cultural: For centuries white men have had access to higher education in ways that other groups have not. Although women now attend college at a higher rate than men, the environment continues to be one in which white men report feeling at home to an extent that others do not. We theorize that the white men's lack of awareness is a manifestation of white privilege. White men have the advantage of navigating computing spaces without the weight of racialization processes. In contrast Black women were more likely than the overall respondent pool to report that their classes were made up of boys and white students, and said they felt less belonging in the classes. Within their college majors, Black women are also less likely than other students in the sample to believe that others see their identity as overlapping with that of a computing professional and are more likely to say they have felt self-conscious about their race, ethnicity or gender while in their computing environments.

Disciplinary: Our prior work explores the ways in which students are subject to educational policies that promote access to higher education but may not address admissions into specific programs like computing. We found, for example, that for students attending 4-year colleges, the odds of enrolling in a computing program were about six times greater for men than women. We make the case that at a time where affirmative action and DEI policy are under attack, our findings undergird the continued necessity for and expansion of DEI initiatives, like affirmative action [21].

Ultimately, white privilege operates by ensuring that systemic barriers to success in STEM fields are less likely to affect white men. It creates a cultural and institutional framework where pre-college and college computing environments are designed with white males' experiences in mind. Our findings show that white males benefit from greater exposure to computing activities, higher societal expectations, better representation, and the absence of racial and gendered challenges that others face. If there are to be genuine efforts to redress disparities in computing, greater attention must be given to understanding the advantaged position of white males. Inequality is a two-sided coin — oppression on the one hand and privilege on the other [2]. As white males experience exposure, confidence, belongingness, and racial oblivion, Black women (for example) experience exclusion, doubt, isolation, and pervasive racial consciousness. White male's invisible advantages are gained at the expense of Black women's (and other groups') very visible disadvantages. Thus systemic change is only possible when male privilege is made visible — identified and acknowledged. Once the unearned advantage is made visible, white males who claim allegiance to equity must grapple with what steps they will take to lessen the “advantage” and contribute to more equitable outcomes in computing.

Future Work

Interrogating the pathways into and experiences within undergraduate computing can help identify ways to evolve the culture that privileges white men by making this privilege more visible to those that benefit. This study will continue to explore the connection between policy and experience for Black women in computing. Themes such as whiteness as the norm, white male privilege, critical consciousness, and how gender — in addition to race — influences belongingness in STEM are being explored as avenues to interpret the results.

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