Work in Progress: The Role of Student Backgrounds in Understanding Racial Disparities in Computing

Fatima Glovena Fairfax, Duke University

Fatima G. Fairfax is currently a PhD student at Duke University in the Sociology department. Her research focuses on the intersection of measurement and equity, with special attention to the role of measurement in mitigating or perpetuating racialized harm in digitized, automated, and technological processes. She is interested in these processes within healthcare and in the education system. Fatima is currently supported by the NASEM Ford Foundation Pre-doctoral Fellowship. Prior to starting at Duke, she worked for New Profit, a venture philanthropy firm, as a manager on the Measurement and Evaluation team. She received a B.A. in Sociology from Harvard University in 2018.

Jabari Kwesi, Duke University
Elyse McFalls, Duke University

I am an undergraduate student at Duke University studying statistics and sociology. I am interested in applications of advanced statistics in social sciences.

Reagan Lenora Razon, Duke University
Alexandra Thursland, Duke University
Dr. Crystal E. Peoples, Duke University

Dr. Crystal E. Peoples is a Postdoctoral Research Associate with the Alliance for Identity-Inclusive Computing Education (AiiCE) at Duke University. Her research interests include the areas of racism and racial inequality, social networks, higher education, and science and technology studies. Peoples received a B.S. in Mathematics from Longwood University in 2012, an M.S. in Sociology with graduate minors in Mathematics and Statistics from Iowa State University in 2015, and a Ph.D. in Sociology from Duke University in 2022.

Shaundra Bryant Daily, Duke University

Shaundra B. Daily is a Cue Family professor of practice in Electrical and Computer Engineering & Computer Science at Duke University and Levitan Faculty Fellow, Special Assistant to the Vice Provosts. Prior to joining Duke, she was an associate professor with tenure at the University of Florida in the Department of Computer & Information Science & Engineering. She also served as an associate professor and interim co-chair in the School of Computing at Clemson University. Her research focuses on the design, implementation, and evaluation of technologies, programs, and curricula to support diversity, equity, and inclusion in STEM fields. Currently, through this work, she is the Backbone Director for the Alliance for Identity-Inclusive Computing Education as well as Education and Workforce Director for the Athena AI Institute. Having garnered over $40M in funding from public and private sources to support her collaborative research activities, Daily's work has been featured in USA Today, Forbes, National Public Radio, and the Chicago Tribune. Daily earned her B.S. and M.S. in Electrical Engineering from the Florida Agricultural and Mechanical University – Florida State University College of Engineering, and an S.M. and Ph.D. from the MIT Media Lab.

Dr. Alicia Nicki Washington, Duke University

Dr. Nicki Washington is a professor of the practice of computer science and gender, sexuality, and feminist studies at Duke University and the author of Unapologetically Dope: Lessons for Black Women and Girls on Surviving and Thriving in the Tech Field. She is currently the director of the Cultural Competence in Computing (3C) Fellows program and the NSF-funded Alliance for Identity-Inclusive Computing Education (AiiCE). She also serves as senior personnel for the NSF-funded Athena Institute for Artificial Intelligence (AI). Her career in higher education began at Howard University as the first Black female faculty member in the Department of Computer Science. Her professional experience also includes Winthrop University, The Aerospace Corporation, and IBM. She is a graduate of Johnson C.

Smith University (B.S., ’00) and North Carolina State University (M.S., ’02; Ph.D., ’05), becoming the first Black woman to earn a Ph.D. in computer science at the university and 2019 Computer Science Hall of Fame Inductee.

Eduardo Bonilla-Silva, Duke University
Brean Elizabeth Prefontaine, Duke University

Dr. Brean Prefontaine is a postdoctoral researcher at Duke University working with the Alliance for Identity-Inclusive Computing Education (AiiCE). Her research currently focuses on (1) the policies and practices impacting computer science students from marginalized identities and (2) how informal STEM environments can provide a space for students to develop a physics identity, and STEM identity more broadly. She earned her B.S. in Physics from Drexel University and her M.S. and Ph.D. in Physics from Michigan State University. Before starting at Duke, she worked for Horizon Research, Inc. as an external evaluator for STEM education projects.

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Introduction and Motivation

The purpose of this work-in-progress paper is to understand how students' experiences discussing race shape their attitudes toward privilege in computing and, through these insights, shed light on the challenges in establishing inclusive computing environments. International movements such as #BlackInTheIvory and #ShutDownSTEM [1], [2] have demanded that science, technology, engineering, mathematics (STEM), and computing fields change to foster inclusivity. Despite this, there is a persistent underrepresentation of Black, Indigenous, Latinx, and other marginalized groups in computing [3], [4], [5]. Research has shown that student experiences of racial microaggressions [6], [7], [8], differential racialized interactions [9], [10], stereotype threat [11], [12], [13], [14], and a lack of culturally responsive curricula/practices [15], [16], [17], [18], [19] play a crucial role in the composition and climate of computing spaces. These findings call for more radical approaches to directly confronting systemic racism [20], [21] to address these deeply rooted issues.

This study explores how undergraduate computing students perceive racial inequities, emphasizing colorblind racism [22], [23], to understand their views on race neutrality and inequalities. Adopting an intersectional lens [24], it seeks to identify factors that shape these perceptions by focusing on the frequency of race-related conversations before college. Previous work demonstrates that family discussions about race impact students' understanding of race, and these impacts vary across racial and ethnic backgrounds [25], [26], [27]. K-12 education also contributes to racial socialization with research exploring the wide spectrum of teachers' attitudes towards race and the need to cultivate welcoming peer interactions regarding race [28], [29], [30]. Further, research has shown that undergraduate white men exhibit the lowest awareness of how race and gender influence their experiences in STEM, whereas women of color acknowledge a significant impact of both race and gender on their STEM pursuit. As such, the findings of this study, looking at the relationships between pre-college discussions of race and perceptions of advantage in computing, could inform policies and practices that effectively address computing's persistent lack of racial diversity.

Positionality Statement

Our interdisciplinary research team recognizes that our social positions and identities shape this work. The team has three faculty members, two postdoctoral researchers, two doctoral candidates, and three undergraduate students. Domains of expertise span computer science, electrical engineering, physics, public policy, sociology, and statistics. As a racially diverse team, including four women of color, our backgrounds contrast with the landscapes of many computing environments today. We recognize our privileged statuses as academics and seek to mitigate biased perspectives.

Methods

This research asks how the frequency of conversations about race with different groups prior to college correlates with undergraduate computing students' perceptions of advantages or disadvantages related to gender, race, and other marginalized identities in computing. "Advantage" refers to privileges or prescribed benefits that students perceive a racial group as having, as it pertains to navigating computing internships and job opportunities [31]. Participants

were 552 students from 50 unique institutions. 46% (n = 254) of the sample identified as a man, 46.6% (n = 257) as a woman, and 7.4% (n = 41) as non-binary or gender non-conforming. Most identified as white (36.8%, n = 203) or Asian (36.4%, n = 201), consistent with national surveys of the computing discipline [3]. The other races represented included Black or from the African Diaspora (7.1%, n = 39), Latinx or Hispanic (4.7%, n = 26), Middle East and North African (MENA) (1.4%, n = 8), and Native American or American Indian (0.8%, n = 4), while 12.9% (n = 71) identified as two or more races. Most respondents (80.1%, n = 442), spent their formative years in the U.S., followed by India (3.8%, n = 21), Canada (2.2%, n = 12), and China (2.2%, n = 12). Out of the total respondents, 18.3% (n = 101) have a disability or chronic condition, and 22.8% (n = 126) are first-generation college students. Most respondents attend a Predominately White Institution (PWI) (97%, n = 535), 2% (n = 11) attend one Historically Black College and University (HBCU), and 1% (n = 6) attend a Tribal College and University (TCU).

This work is part of a more extensive study on how computing undergraduates comprehend, perceive, and experience race. A quantitative instrument was developed and tested in fall 2022 and spring 2023 (see [32] for more in-depth details about the instrument, recruitment strategy, and factor analysis). Two survey questions were analyzed for this paper:

1. Before college, how often did you discuss race and/or racial discrimination with your immediate family, three closest friends, people in gathering places, classmates, and teachers?
2. Please note how much advantage, in terms of internships and job opportunities, you think there is for being the following in computing: a woman, a non-binary person, a Black person, a Native or Indigenous person, a Latinx person, and a person with a disability.

Response options for the first question were a 3-point Likert scale consisting of “rarely,” “about half of the time,” and “most of the time.” Responses were re-coded to a binary of frequent discussion (about half the time, most of the time) and infrequent discussion (rarely) for each group of discussants. Response options for the second question were a 5-point Likert scale ranging from “none at all” to “a great deal.” Responses were re-coded on a binary of ample advantage (a moderate amount, a lot, a great deal) and minimal advantage (none at all, a little). The presented results focus on discussions of race in classroom and familial settings and perceptions of advantage for historically marginalized racial groups. Data were disaggregated by the participant’s race and gender.

Results

Question 1: Discussions of Race

We assessed how often respondents spoke about race to different social groups: classmates, family, and teachers before college. Overall, respondents reported that they spoke most about race with immediate family (39.3%, n = 217), followed by classmates (35.7%, n = 197) and teachers (29.9%, n = 165).

Disaggregation by race shows that Black, Native American/American Indian, and respondents who are two or more races expressed a higher likelihood of frequently discussing race with their immediate family with 53.8% (n = 21), 50% (n = 2), and 49.3% (n = 35), respectively. Black respondents were the least likely to report having frequent race-related discussions with classmates (20.5%, n = 8), compared to other racial groups. White respondents, in contrast, were more likely to say they frequently discussed racial topics with teachers (37.9%, n = 77). There

were no discernible patterns in discussions of race when disaggregated by both race and gender identities.

Question 2: Perceptions of Advantage

Concerning perceptions of advantage in terms of jobs and internships, Black people were perceived to have the most advantage in computing compared to other historically marginalized racial groups, with 36.6% (n = 202) of respondents reporting their having ample advantage. This was followed by Latinx/Hispanic people (35.5%, n = 196) and Native/Indigenous people (33.3%, n = 184).

26.9% of Latinx/Hispanic respondents (n = 7), attributed ample advantage to Latinx people in computing compared to 43.3% of Asian (n = 87), 38.5% of Black (n = 15), and 50% of MENA respondents (n = 4). Fewer Black respondents attributed ample advantage to Black people in computing (35.9%, n = 14) compared to Asian (44.3%, n = 89) and MENA respondents (50%, n = 4). However, more Black respondents reported ample advantage for Black people in computing than did Latinx/Hispanic (26.9%, n = 7), white (33%, n = 68), and respondents of two or more races (28.2%, n = 20).

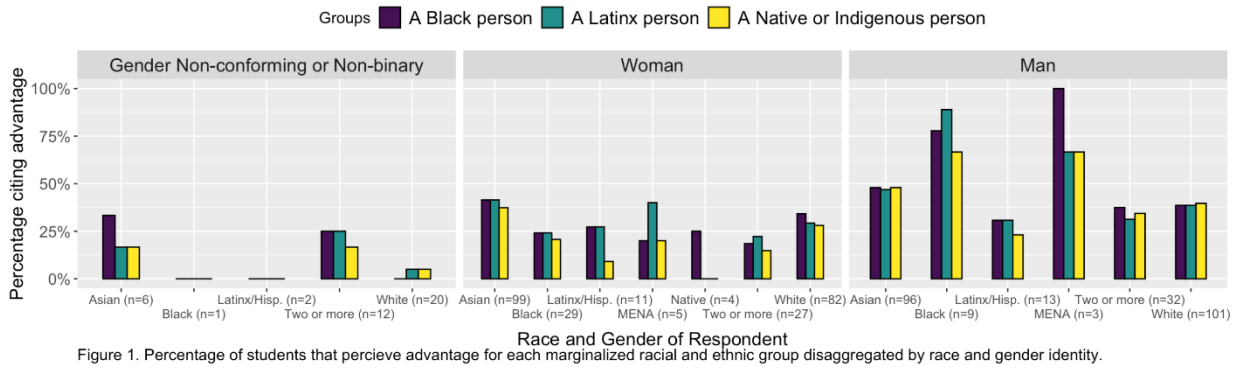

Figure 1. Percentage of students that percieve advantage for each marginalized racial and ethnic group disaggregated by race and gender identity.

As shown in Figure 1, across all racial groups, men, when compared to women and non-binary/gender non-conforming people, were more likely to report ample advantages for Black, Latinx, and Native/Indigenous people. MENA men, men of two or more races, Native American/American Indian women, white women, and Asian non-binary respondents were more likely to report that Black people have advantages in computing compared to Latinx or Native/Indigenous students. Meanwhile, more Black men and MENA women report that Latinx people have advantages compared to Black or Native/Indigenous people in computing. For most race and gender categories, an equal or smaller proportion of respondents reported that Native/Indigenous people have advantages compared to Black and Latinx people.

Associations Between Discussions of Race and Perceptions of Advantage

The possible connections between perceptions of advantage for marginalized identities in computing and pre-college discussions about race with various groups were explored. The results were disaggregated by race. However, data was omitted from MENA and Native American/American Indian respondents due to the small sample size of these groups.

For immediate family discussions, white respondents who frequently discussed race were more likely to perceive ample advantage for being a Black (39.5%, n = 32), a Latinx (35.8%, n = 29), and a Native/Indigenous person (34.6%, n = 28) in computing compared to white respondents

who discussed race infrequently (Black: 28.7%, n = 35; Latinx: 28.7%, n = 35; Native/Indigenous: 34.6%, n = 28). Respondents of two or more races who had frequent race-related discussions with family members were also more likely to attribute advantages to being a Black person (31.4%, n = 11) or a Native/Indigenous person (28.6%, n = 10) compared to those who had infrequent discussions (Black: 25%, n = 9; Native/Indigenous: 19.4%, n = 7).

In contrast, Black and Latinx/Hispanic respondents who had more frequent discussions of race with their immediate family perceived less advantage for Black people (33.3%, n = 7 and 16.7%, n = 2 respectively) and Latinx people (33.3%, n = 7 and 25%, n = 3 respectively) compared to those who had infrequent discussions (Black: 38.9%, n = 7 and 35.7%, n = 5; Latinx: 44.4%, n = 8 and 28.6%, n = 4 respectively). Black respondents who had frequent racial discussions with immediate family were also less likely to perceive Native/Indigenous people as having advantage (25%, n = 2) compared to those that did not (32.3%, n = 10). Perceptions of advantage for Black, Latinx/Hispanic, and Indigenous people in computing did not appear to be impacted by how often Asian respondents discussed race with their immediate family.

For discussions with teachers, white respondents who frequently discussed race were more likely to perceive advantage for Latinx people (35.1%, n = 27), compared to those who had these discussions infrequently (29.4%, n = 37). For Black respondents, those who had frequent racial discussions with teachers were also more likely to perceive advantage for Black, (57.1%, n = 4), Latinx, (50%, n = 4) , and Native/Indigenous people (42.9%, n = 3) compared to those that did not (Black: 31.3%, n = 10; Latinx: 34.4%, n = 11; Native/Indigenous: 28.1%, n = 9).

Conversely, Latinx/Hispanic respondents who frequently discussed race with teachers were less likely to attribute advantage to Latinx and Black people (12.5%, n = 1 for both), compared to other Latinx/Hispanic respondents (33.3%, n = 6 for both). Similarly, respondents of two or more races who frequently talked about race with teachers were less likely to perceive advantages for Black (8.3%, n = 2), Latinx (8.3%, n = 2), and Native/Indigenous (4.2%, n = 1) groups compared to those with infrequent discussions (Black: 38.3%, n = 18; Latinx: 36.2%, n = 17; Native/Indigenous: 34%, n = 16). Perceptions of advantage for Black, Latinx, and Native/Indigenous people in computing did not appear to be impacted by how often Asian respondents discussed race with their teachers.

For classmate discussions, Latinx/Hispanic respondents who frequently discussed race were more likely to attribute advantage to a Native/Indigenous person (33.3%, n = 4) compared to those with infrequent discussions (0%, n = 0). Furthermore, Black respondents who had frequent conversations about race with classmates were more likely to perceive advantages for Black (50%, n = 4) and Latinx people (50%, n = 4) than Black respondents who rarely engaged in those conversations (Black: 32.3%, n = 10; Latinx: 35.4%, n = 11). Asian respondents were similarly more likely to report more advantages to Black (49.2%, n = 32) and Latinx (47.7%, n = 31) people in computing when they noted frequently discussing race with classmates compared to those who did not (Black: 41.8%, n = 57; Latinx: 41.1%, n = 56).

In contrast, respondents of two or more races who had frequent racial discussions with classmates were less likely to perceive advantage for Black (17.2%, n = 5), Latinx (20.7%, n = 6), and Native/Indigenous (13.8%, n = 4) people compared to those who did not (Black: 35.6%, n = 15; Latinx: 31%, n = 13; Native/Indigenous: 31%, n = 13). Black respondents who discussed race with classmates were also less likely to perceive advantage for Native/Indigenous people (25%, n = 2) compared to other Black respondents (32.2%, n = 10). White respondents'

perceptions of advantage did not appear to be impacted by how often they discussed race with classmates.

Discussion

The findings reveal complex dynamics in how conversations about race before college correlate with perceptions of advantage for marginalized groups in computing. Several key differences were revealed when results were disaggregated by race, gender, and their intersections, and with whom respondents discussed race. First, identities and their intersections matter. Comparisons across gender reveal critical differences in perceived advantages for marginalized racial groups in computing. For instance, men were much more likely than women and non-binary/gender non-conforming people to report advantages for Black, Latinx, and Native/Indigenous groups. This gender gap aligns with research showing women face compounded biases in computing [33], [34]. When race and gender were considered, further information about perceived advantages for these groups was uncovered. For example, white women were only slightly less likely than white men to report advantages for Black, Latinx, and Native/Indigenous groups in computing, whereas most other within racial group comparisons showed stark differences. This finding supports prior research showing that white women's racial attitudes are often not more favorable than those of white men [35].

Second, the frequency of discussions about race in familial and classroom settings correlated to perceptions of advantage in computing. For example, Black and Latinx respondents who discussed race with their families perceived less advantage for marginalized racial groups in computing, while white respondents perceived more. These differences could stem from marginalized families talking more openly about discrimination while white families emphasize more meritocratic narratives [36], [37]. In contrast, when Black respondents discussed race with teachers and classmates, they instead perceived more advantages for marginalized groups in computing. Taken together, these findings highlight differences in race messaging across contexts. Ultimately, these findings underscore the complexity of race perceptions, highlighting how pre-college race socialization shapes views on privilege and equity in nuanced ways depending on one's racial background, discussion contexts, and intersecting identities.

Conclusions and Future Work

This study explored associations between pre-college race discussion frequency across social groups and perceived advantages for marginalized identities in computing. Key findings demonstrate that the frequency of race conversations – especially with family and classmates – links to perceived advantages for marginalized groups based on respondents' racial identification and gender. These findings highlight the need for intersectional approaches accounting for diverse standpoints in analyzing and addressing equity issues in computing. Specifically, findings could inform guidelines and professional development for faculty and administrators on facilitating constructive race dialogues among student populations. Outreach targeting families and communities may also be warranted to align messaging across spaces. Future work can delve deeper into student backgrounds including where students spend their formative years and the type of college they currently attend.

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