Received: 27 September 2024 | Revised: 7 July 2025 | Accepted: 8 July 2025

DOI: 10.1002/jee.70025

JEE Journal of Engineering Education

RESEARCH ARTICLE

What about your friends: A critical qualitative inquiry of the experiences of Black and Latiné women in computing

Monique S. Ross[1] | **Susan McGrade**[2] | **Tamecia Jones**[3] | **Atalie Garcia**[4] | **Antonella Avogadro**[5] | **Brenda Guerrero**[6]

[1]Engineering Education and Computer Science and Engineering, The Ohio State University, Columbus, Ohio, USA

[2]College of Arts and Sciences, Indiana Institute of Technology, Fort Wayne, Indiana, USA

[3]College of Education, North Carolina State University, Raleigh, North Carolina, USA

[4]Ira A. Fulton Schools of Engineering, Arizona State University, Tempe, Arizona, USA

[5]Knight Foundation School of Computing and Information Sciences, Florida International University, Miami, Florida, USA

[6]Association of Zoos and Aquariums, Silver Spring, Maryland, USA

Correspondence
Monique S. Ross, Engineering Education and Computer Science and Engineering, The Ohio State University, 174 W 18th Avenue, Columbus, OH 43210, USA.
Email: ross.1982@osu.edu

Funding information
National Science Foundation, Grant/Award Numbers: 1748384, 1845884, 2331066

Abstract

Background: Computing degree programs have struggled immensely over the years with broadening participation in the field. In the United States, scholars and educators alike have grappled with the many barriers that impede the participation of women and people of color and exacerbate the education debt so prevalent in computing.

Purpose/Hypothesis(es): An exploration of the pathways to and through computing of Black and Latiné women from both computer science (CS) and computer engineering (CE) has the potential to unlock an understanding of these barriers as well as gain insight into the mechanisms leveraged to navigate an often lonely and hostile learning environment.

Design/Method: This qualitative inquiry presents the findings from interviews with 30 women who self-identify as Black and/or Latiné and were enrolled in a CS or CE undergraduate or graduate program. This research was guided by social identity theory and intersectionality and interpreted leveraging feminist theories during the analytical phases.

Results: The findings suggest that one mechanism that these women used to find and navigate through computing was friendship. These friendships included other Black and Latiné women (homophily) and men (allyship). They were facilitated by closeness and frequency of contact (propinquity).

Conclusions: Creating space and opportunity for computing students to foster friendships is critical to their participation and persistence in computing. Furthermore, such space and opportunity can be established in the computing classroom, but this would require a stark departure from the highly competitive and isolating practices that currently dominate traditional teaching methods.

KEYWORDS

Black women, computing, friendship, Latiné women, qualitative

"It is time to bring friendship to the foreground. To see it for what it is. It actually is a matter of life and death. It is carried in our DNA, in how we're wired. Social bonds have the power to shape the trajectories of our lives. And that means friendship is not a choice or a luxury; it's a necessity that is critical to our ability to succeed and thrive"

(Denworth, 2020, p. 19)

1 | INTRODUCTION

Computing degree programs have struggled immensely over the years with broadening participation in the field. In the United States, the field has suffered drastic decreases in the participation of women over the years (Lunn et al., 2021) and has, from its inception, struggled with the participation of people who identify as Indigenous, Latiné, and Black. The disaggregated data describes a computing landscape that is far below US national representation, with Black women comprising only 4.6% of undergraduate degrees in computer science (CS) and 5.4% in computer engineering (CE). For Ph.D., Black women comprise only 2.0% for CS and 3.3% for CE. Latinas comprise only 7.5% of undergraduate degrees for CS, 8.4% for CE, and for PhDs, only 0.3% for CS, and 3.3% for CE (Zweben & Bizot, 2023).

This lack of diverse participation persists despite a strong scholarly movement to research and change it (DesPortes et al., 2022; Eisenhart & Allen, 2020; Erete et al., 2021; Ross et al., 2020). Unfortunately, these research efforts have thus far had little impact on the participation rates and persistence of Black and Latiné populations (Zweben & Bizot, 2023). Many of these studies were guided by frameworks that were largely established and tested with the nation's dominant population in computing (White men), and despite the insight that these frameworks have given us in understanding the majority in computing, they have fallen short of the goal of broadening participation in computing, likely because they lack a nuanced and rich understanding of Blackness, Latinity, and the added complexity in relation to femininity. This lack of understanding has inspired us to return to the voices of Black and Latiné women to listen to their accounts of their attraction to, and retention in, computing. What we found was the power of *friendship* as a motivating and retaining force in their computing experiences.

While computing and engineering education have long pointed to factors such as social integration and ecosystems as support mechanisms for engaging marginalized populations in these disciplines (Lee et al., 2018), that understanding has been critiqued for its reliance on assimilation as being necessary to integrate socially into the fabric of an academic setting (Lee et al., 2018). This assimilated and compromised version of "self" ultimately subjugates the possibility of harnessing the power of *friendship* and *friends*, a power that has been used as a means of survival for women and women of color for centuries.

We therefore argue for a more nuanced understanding of social integration that honors the cultural traditions of Black and Latiné women. This paper presents the results of a study of the experiences of Black and Latiné women in computing which leverages the frameworks of friendship and feminism to understand their participation in computing. This work not only challenges the current practices in computing classrooms but also provides a possible solution to the lack of diversity in computing: *the role of friendship and its ability to attract and retain students*. While we present the findings of work that centers Black and Latin women, we believe the proposed changes could make computing more attractive to any person who does not conform to the dominant identity in computing. This qualitative inquiry, consisting of semi-structured interviews and inductive coding, reveals that the concept of friendship could be used as a framework for understanding the choice of computing as an occupational pursuit and persistence for Black and Latiné women. This phenomenon is further situated within feminist theory, Black feminist theory, and Latin critical theory, and contextualized in computing, engineering, and STEM more broadly.

The *research questions* guiding this work were the following:

1. How do Black and Latiné women describe the role of friendship in their pursuit of computing?
2. How do Black and Latiné women describe the opportunities to actualize friendship in computing?

2 | RELATED LITERATURE

2.1 | Black and Latiné women in computing

Concerns related to participation of women (and more recently women of color) in computing have resulted in a wealth of literature focused on developing new engagement strategies (DesPortes et al., 2022; Eisenhart & Allen, 2020; Erete et al., 2021; Rankin et al., 2021; Rankin & Thomas, 2020; Ross et al., 2020), as well as approaches for improving retention (Rankin & Thomas, 2020; Rodriguez & Lehman, 2017; Ross et al., 2022). Engagement is defined as "how involved or interested a student appears to be in learning" (Axelson & Flick, 2010, p. 38). These new engagement strategies range from addressing individual factors such as identity (Rodriguez & Lehman, 2017) to systemic factors such as institutionalized racism that contribute to the absence of Black and Latiné women in the field (Rankin et al., 2021; Thomas et al., 2018). These recent efforts are the result of scholars in engineering education and computing education who have made the argument that in the quest to increase the participation and retention of women in computing, we have overlooked the plight of women of color, namely Black and Latiné women (Fletcher et al., 2021; Ross et al., 2020). In short, attention to understanding the participation and persistence of women "globally" does not attend to the nuance at the intersection of race, ethnicity, and gender. Ross et al. (2020) determined that while Black women are similar to women in some cases and similar to Black men in some cases (also referred to as their *near peers*), they are often different from both; therefore, any efforts that solely focus on *women* typically serve to advance White women, leaving Black and Latiné women stagnant. Lunn et al. (2021) demonstrated in their analysis of participation rates across race, ethnicity, and gender that White men and White women are well above all other demographics with regard to participation in computing. Such analyses demonstrate the need to critically examine who benefits from current efforts to engage more women in computing.

This need for a closer examination of marginalized women (in this case, Black and Latiné women) in computing led to an inquiry into disciplinary identity and its impact on participation and persistence of Black women in PhD programs in computing (Ross et al., 2022). This approach was inspired by a litany of scholarship which indicated that disciplinary identity (e.g., identifying as an engineer, or as a computer scientist) was key to participation and persistence in science education (Carlone & Johnson, 2007), engineering education (Godwin, 2016; Ross et al., 2017; Verdín et al., 2018) and computing education (Lunn et al., 2021; Mahadeo et al., 2020). However, the results of the work of Ross et al. (2022) suggested that computing identity was not the primary force grounding these women in computing; in fact, the study of six Black women in computing PhDs revealed that only two of them saw themselves as computer scientists, while the other four did not. They were attaining the highest degree in computing and yet were reluctant to ascribe the identity of computer scientist to themselves. Instead, they attributed their persistence to *community* and *support* and, more specifically, to a *sense of belonging*. The results of these studies point to the incongruities of scholarly adherence to disciplinary identity as both an indicator and predictor of engagement in computing.

This lack of dependence on identity salience has resulted in the need to return to the words of the participants for possible explanations of their continued participation in the field. We therefore revisited data collected in a larger study that included the participation of 30 women who identified as Black/African American, Latiné, or both, and were in pursuit of a computing degree (CE or CS), at either the undergraduate or graduate level. It was this reexamination that revealed the importance of *friendship*; in fact, friendship was identified as not only the force that brought these women to computing but also the force that supported them along their trajectory.

2.2 | Friendship studies

The concept of friendship has been an area of interest in many academic disciplines for centuries: in philosophy, ancient philosophers examined the relationship between friendships, the state, and ethics (Baltzly & Eliopoulos, 2014; Nehamas, 2016); in literature, friendship has played such a significant role that multiple anthologies have collected thousands of years of essays, short stories, poems, and plays that illuminate the power and complexities of friendship (Enright & Rawlinson, 1991; Sharp & Welty, 1991). And while the social sciences, including psychology, sociology, and anthropology, traditionally focused more attention on kinship bonds, they are now generating much more research on friendships (Denworth, 2020). Natural scientists are also focusing more attention on friendship than ever before; scholars in evolutionary biology, immunobiology, neurobiology, and ethology (more specifically primatology) are now

researching and writing about friendship (Denworth, 2020). The research has become such a phenomenon that "friendship studies" and "critical friendship studies" have emerged throughout the world (Smith et al., 2023).

Although different disciplines have different foci—for example, the impact of friendship on the brain, or the impact of friendship on social systems, or physical health—the results of the research are clear: friendships are part of our evolutionary experience, they have helped us survive in a literal sense, they increase our overall physical and mental health, and they contribute to learning (Denworth, 2020).

2.2.1 | Friendship and women

More specifically, and of special importance to this research, friendships have been an especially critical part of women's evolutionary experience, their cognitive development, and their political and social gains (Denworth, 2020). In fact, research suggests that friendships have been *more* critical to the evolutionary experiences of women than men. For example, recent research in psychology concluded that while men commonly respond to stress and danger with the dominant "fight or flight" metaphor, women actually respond to such stress by "tending and befriending," a phrase that describes the phenomenon of women protecting offspring and turning to others when experiencing stress (Taylor, 2002, Preface). To further underscore the importance of friendship, complementary work in evolutionary science demonstrates that when we have supportive social relationships, our negative physiological responses to stress are lessened (Denworth, 2020). Given this effect, it is easy to see why tending and befriending might be critical to the success of those in vulnerable or marginalized positions, such as women in computing programs.

2.2.2 | Friendship in college education

The research on friendships among college students, much like other research on friendship, has begun to flourish only in the past decade or so, beginning in the 2000s in response to two events, the Gruter *vs*. Bolinger case on affirmative action (which gave rise to research on interracial friendships) and a 2008 sociology push for research on friendship and student success (McCabe, 2023). By 2007, Buote et al. found that friends contributed to adjustment among first-year college students, and by 2011, Arnet et al. posited that friendships are most significant in college (Buote, 2007, as cited by McCabe, 2023; Arnet, 2011, as cited by McCabe, 2023).

Much of the research in this area centers on peer relationships, social integration, or the model of co-curricular support (MCCS), all of which stop short of differentiating or defining friendships within these frameworks (Lee et al., 2018; McCabe, 2023). Tinto's (1993) model, which had social integration as a critical construct, has received critiques for its reliance on cultural assimilation which has been deemed unproductive when exploring the experiences of marginalized populations (Lee et al., 2018). The newer MCCS model has proven helpful in understanding the need for institutional support, but it is limited to a macro view of social integration. We argue that while these frameworks have utility, they lack the nuance or depth of understanding of what constitutes a productive or impactful peer relationship for marginalized populations. For those who are already outliers, it is not enough to have casual encounters with other humans to compel them to stay in a community or classroom or discipline; what they may actually need are friends.

2.2.3 | Friendship among college women

When narrowing the focus to friendships for college women, the research is sparse, but telling. In 2010, Aleman demonstrated that female friendships in college were actually mechanisms for cognitive development (Aleman, 2010), clearly showing that friendships are not simply about social relationships but about intellectual growth. She also found that women of color in particular used the power of their sororal friendships to combat feelings attributed to racial and ethnic resistance and discrimination (Aleman, 2010). In addition, research shows that female friendships help women to navigate transitions (including the move to undergraduate and graduate school) and that these friendships serve as an added curriculum that helps them to solve problems, maneuver, and survive the sometimes combative spaces they encounter at universities (Aleman, 2010). More recently, a 2023 publication highlighted the importance of friendship to Black women, who testified that their friendships were critical to their degree completion (Johnson et al., 2023).

2.2.4 | Friendship in STEM education

The groundwork for friendship in STEM has also been laid. In 2021, Park et al. presented findings from a structural equation model which explored the benefits of studying with a *close friend* of a different race and/or gender (Park et al., 2021). Their work underscored the benefits of friends—the direct and indirect benefits, especially with regards to GPA. However, disaggregated data have shown that Black students were less likely to have close cross-gender or cross-racial friends as study partners. They speculate that this is due to the racialized and gendered nature in STEM, as well as a problematic culture and climate that makes it hard for Black students to foster friendships (Park et al., 2021).

Gayles and Smith (2023) leveraged their work and prior literature to make recommendations to institutions based on the experiences of Black women in STEM majors (Gayles & Smith, 2023). Their list of recommendations includes creating a community of mentoring and support, explicitly citing the role of *friendship* in that community (Gayles & Smith, 2023). Their work demonstrated that friendship was important to the college experience, but more specifically it showed an "added bond" associated with "struggling together" in STEM fields with a friend (Gayles & Smith, 2023, p. 31). They discuss in detail the importance of friendship for providing advice, sharing experiences, and studying together. They also recognized the unfortunate reality that the classroom (based on its current delivery) has not been a good place to foster these friendships (Gayles & Smith, 2023, p. 31).

2.2.5 | Friendship in computer science education

The body of literature in CS education that explicitly explores the idea of *friendship* as a critical component of education is limited to two studies. Kargarmoakhar et al. (2019) point to friends and family as being instrumental in the engagement of women in computing. Meanwhile, Bhardwaj (2022) collected the perceptions of first-year CS students on the role of friendship in their engagement in CS. During this time, students did not have intentional in-person opportunities to establish relationships with their peers due to COVID, which ultimately created a deficit for students in the development of friendships. The study concluded that not only did students long to establish friendships in their classes but they also noted the importance of friendships in their academics. Students articulated that they wanted the opportunity to discuss work with their peers and collaborate, and noted that friendships helped them to develop resilience and combat mental health challenges (Bhardwaj, 2022). The author suggested that the CS education community further adopt the practice of active learning to provide space and opportunity for students to make friends.

Though this death of literature on *friendship* in computing persists, some scholars have begun to explore and understand the importance of related constructs like the *sense of belonging* (Ross et al., 2022), *community* (Hug & Jurow, 2013), and *social capital*. However, most research stops short of naming a critical element of these constructs—the presence and impact of *friends*.

3 | THEORETICAL FRAMING

The frameworks used in this study were emergent in nature. The larger original inquiry was designed with *social identity theory* and *intersectionality* as the guiding frameworks; however, the findings suggested that the complexity of participants' experiences could not be explained solely by these theories. It was due to this remaining ambiguity that we leveraged practices often seen in emergent research design (Hammersley, 2022), namely to listen to the themes that emerged from participants, despite our original framing. Our attention to the words of the participants pushed us to further explore the theoretical framework of *friendship* as it is used in feminist studies (including Black and Latin feminist theories). The complexity of race, ethnicity, and gender resulted in the need to tend to nuance: the nuance of being a woman, the nuance of being Black, and/or the nuance of being Latiné, all interwoven into being a Black or Latiné woman in the field of computing. This pushed the inquiry to lean on the critical theories that best explain or unpack the experiences of these women—*feminist theory*, *Black Feminist theory*, and *Latin critical theory*.

3.1 | Feminist theory, black feminist theory, and Latin critical theory

This research would not be possible without the foundation and context of feminist studies. These fields provide theories and terminologies within which to understand the phenomena that surfaced in interviews with our participants. Modern feminist philosophy has argued that women's friendships aid women in achieving their full power (Raymond, 1986) and that friendship among women is tantamount to freedom (Raymond, 1986). Other feminist research has demonstrated that friendship among women moves beyond companionships; it has in fact educative value (Aleman, 1997). We therefore argue that it is time for educators to begin to understand, acknowledge, and enable the power of female friendships, especially in classroom spaces that are traditionally dominated by men.

We chose the word "friendships" deliberately, although Black feminists provide us with the possibility of *sisterhood* (Collins, 2000; Hooks, 1995) and Latina scholar Maria Lugones offers the term *compañera* which denotes both friendship and political struggle (Lugones & Rosezelle, 1995). However, Lugones convincingly argues that the terms sisterhood and *compañera* are not appropriate terms for cross-racial friendships with White women (or men), wherein dominant discourses such as racism and sexism often still prevent egalitarian relationships.

Ultimately, Lugones argues that we strive for an ideal, a "pluralist" friendship that carries "with it a commitment to understanding the realities of the friend" (Lugones & Rosezelle, 1995, p. 142–143). In her view, such relationships are difficult, as they require a commitment to understanding positionality and its impact on our lives, but they are not impossible. In fact, such friendships can be seen in our research. While most of the relationships in this study were among women of color, some of the participants refer to White men as friends who were significant sources of sustenance in their lives. We therefore continue to use the word "friendship"—defined in this pluralistic sense—to describe the relationships that helped sustain these women in their field. The participants described the actions of their friends in the following ways, all of which correlate with the pluralist definition of friendship: (i) they provided support, (ii) they provided a sense of safety, and (iii) they shared a mutual fondness or appreciation. In the context of our interviews, support was used to describe those who provided insight into how to succeed academically, professionally, and personally. Safety was described as providing a feeling of security. In some instances, this was purely a matter of numbers—not being the only one. In other instances, it was a judgment-free space to be authentically themselves (Black, Latin, woman, etc.), demonstrating shared trust and respect. Mutual fondness or appreciation was defined as someone they enjoyed being around due to compassion, care, and understanding. These actions together—providing support and safety, while also sharing a mutual understanding and appreciation—demonstrate the pluralistic friendship which Lugones asks that we aspire to. These characteristics also provide a distinction from other kinds of relationships, such as mentor relationships, peer relationships, or support personnel, because they are egalitarian in nature and contain feelings of mutual fondness and appreciation.

4 | RESEARCH DESIGN

While this inquiry was originally designed with other theoretical foundations, we ultimately embraced the critical qualitative approach of emergent theory and chose to pivot to honor the voices of our participants. While social identity theory provided the original foundation for the interview questions, the emergence of a dominant theme motivated us to avoid the perpetuation of inquirer-oriented power and instead center the "new truth" provided to us by our participants (Denzin & Lincoln, 2018). Such a move ensured that we produced knowledge *for* our participants, rather than just *about* our participants (Denzin & Lincoln, 2018).

4.1 | Data collection method

The data collected for this work was via *semi-structured in-depth interviews*. The research team regarded interviewing as a method to develop a rapport with our participants, providing space for autonomy of their words while keeping the focus and attention on their experience (Seidman, 2006). The interview protocol was partitioned into five sections—*Background*, *Social Integration*, *Meaning-making*, *Career Aspirations*, and *Closing*. The *Background* section established the foundation of the study by providing the participant with the intent and purpose of the study, and then moved into questions related to their self-identity (e.g., race, ethnicity, and gender), their background (e.g., where they were from, where they went to school), and their trajectory to computing (e.g., how they came to know about computing as an

occupation). We also asked questions about their transition from high school or community college to their 4-year computing program. In addition, we asked questions that explored the impact of people (e.g., professors, peers, family, staff) within their computing experience. *Social Integration* included involvement in the university, campus, department, and discipline; those questions ranged from formal structures (such as recognized student organizations) all the way to informal or virtual structures (such as social media). The *Meaning-making* section included questions related to their ontological beliefs about computing (e.g., What is computing? What is a computer scientist? What is success?). We also asked about their understanding of the role their (self-ascribed) identities played in their interpretation of their experiences. The *Career Aspirations* section included questions about their vision of a dream job, and *Closing* provided an opportunity for the participant to ask us questions and/or tell us things we had not asked about in the interview protocol. The original interview protocol design did not contain any questions that explicitly asked about friends. Nevertheless, the terms "friend," "friends," and "friendship" emerged in the data. Interviews were, on average, 60 minutes long and were the same for both undergraduate and graduate participants. While graduate students had the added contribution of talking about their experiences in graduate school, they also talked about their experiences as undergraduates.

Our *sample* of participants consisted of 30 students ($n = 30$) and was collected over 6 years (starting in 2017); this was in large part due to the scarcity of Black and Latiné women in computing (Slaton & Pawley, 2018) (see Table 1). We started with *purposeful* sampling, focusing on a *typical case* that consisted of people that self-identified as women, Black, and/or Latiné who were pursuing a degree in computing (CS or CE). It should be noted that the gender, race, and ethnicity noted in the Table 1 were self-reported. We initially sought women pursuing a bachelor's degree and then expanded it to include graduate students, given the shared experience of choosing the occupational pursuit; after all, women pursuing a graduate degree in computing would have come through an undergraduate computing program (which was true in most cases). The participants were solicited from seven institutions with national designations of either Hispanic Serving Institution (HSI), Historically Black College or University (HBCU), and Bonilla-Silva and Peoples (2022) designation of Historically White Institution (HWI). There was at least one institution from the West Coast and the Great Plains, but the highest concentration was along the Atlantic Coast.

4.2 | Analytical method

The research team followed the principles of thematic analysis to guide the process— familiarization, coding, generating themes, reviewing themes, defining and naming themes, and writing up (Maguire & Delahunt, 2017). We began by re-acquainting ourselves with the transcripts from the interviews. Rather than using theory to search for specific constructs, the team instead began with an initial cycle of coding which used the exploratory method of assigning preliminary codes that emerged in the corpus of interview transcripts (Saldaña, 2021). This was accomplished through collaborative coding—assigning two interview transcripts to a team of three (two undergraduate researchers, one graduate researcher) with overlap: meaning Researcher 1 had transcripts A and B; Researcher 2 had transcripts B and C; and Researcher 3 had transcripts A and C (Saldaña, 2021). Each researcher was asked to read the transcripts and report what they identified as the factors that influenced the participants' engagement in computing and the factors they attributed to persistence (retention in computing). The team (including the principal investigator/first author) then met and discussed the first cycle codes and our collective intersubjectivity (Granek, 2013) until we converged on a finding: *friendship* (Saldaña, 2021). We used this emergence of *friends* and *friendship* to guide the second cycle of coding—focused coding. Focused coding is defined as a "streamlined adaptation of grounded theory's selective and axial coding" (Saldaña, 2021, p. 240). The goal was to develop categories by looking for "the most frequent or significant codes to develop the most salient categories in the corpus" (Saldaña, 2021, p. 240).

5 | POSITIONALITY

The research team consisted of all women, of which two self-identify as Black/African American, three self-identify as Hispanic/Latin, and one self-identifies as White. Half of the team consisted of women who were either in a computing major or completed their studies in computing, and were complemented by one engineering education scholar, one English scholar, and one STEM education graduate student.

The inquiry was designed by the first author, who self-identifies as both Black and Latina and has a background in computing. The first author also situates herself ontologically among critical scholars and constructivist scholars—all of

TABLE 1 Participant composition.

Pseudonym	Institution type	Year	Race	Ethnicity	Major
April	HSI	Senior	NR	Hispanic	Computer science
Carla	HSI	Senior	NR	Hispanic	Computer science
Hannah	HSI	Senior	NR	Hispanic	Computer science
Lauren	HSI	Sophomore	NR	Hispanic	Computer science
Ann	HSI	Junior	NR	Hispanic	Computer science
Tasa	HSI	Junior	Black	NR	Computer science
Charlie	HWI	Senior	Black	NR	Computer science
Jya	HBCU	Sophomore	Black	NR	Computer science
Sunshine	HWI	Junior	Black	NR	Computer science
Carrie	HWI	Sophomore	Black	NR	Computer science
SZ	HWI	Senior	Black	NR	Computer science
Jessica	HSI	Senior	Non-White	Mexican	Computer engineering
Fubar	HWI	Senior	NR	Latina/Mexican	Computer engineering
Lourdes	HSI	Junior	NR	Hispanic	Computer science
Vanessa	HSI	Junior	NR	Hispanic	Computer science
Monica	HSI	Senior	Black	NR	Computer engineering
Jaz	HSI	Junior	Black	NR	Computer engineering
Sarah	HSI	Junior	Black	Hispanic	Computer science
Alice	HSI	Junior	White	Hispanic	Computer science
Veronica	HSI	Senior	Black	NR	Computer science
Mary	HSI	Senior	NR	Hispanic	Computer science
Elle	HSI	Sophomore	NR	Hispanic	Computer engineering
Elizabeth	HSI	Junior	White	Hispanic	Computer science
Corrin	HSI	Sophomore	Black	Hispanic	Computer science
LaTanya	HWI	2nd year Ph.D.	Black	NR	Computer science
Cicely	HWI	2nd year Ph.D.	Black	NR	Computer science
Alexis	HWI	5th year Ph.D.	Black	NR	Computer science
Janine	HWI	7th year Ph.D.	Black	NR	Computer science
Avatar	HWI	3rd year Ph.D.	Black	NR	Computer science
Emma	HWI	2nd year Ph.D.	NR	Hispanic	Computer science

Note: Ethnicity is presented as it was self-reported by the participant.
Abbreviations: HBCU, historically Black College or University; HSI, hispanic serving institution; HWI, historically white institution; NR, not reported.

which influence the methodological and theoretical choices. Owing to the deeply personal nature of the inquiry, the research was handled with extreme care, deferring to the participants and their ways of knowing. To continue this care and deference, the first author recruited three undergraduate researchers who self-identify as Latinas and were enrolled in computing fields and pursuing their undergraduate degrees. These emerging scholars helped us with data collection and analysis.

When the research team encountered incongruities between the guiding frameworks and the findings, the lead author enlisted trusted scholar friends to help with the interpretation and presentation of the findings. Author 1 and Author 2 are friends who immersed themselves in the friendship literature, sharing research and perspectives to gain a better sense of its importance and impact on others, as well as in their own lives. And it was the reliance on this friendship as a support system that reinforced the findings of this work.

6 | FINDINGS

The focused coding of the 30 transcripts revealed that "friend," "friends," "friendship," and "friendships" occurred 818 times in the transcripts, despite the term never being used within the interview protocol (with the exception of the interviewer asking as a follow-up). As a team, we examined those excerpts to contextualize and interrogate the use of the word. For example, was it a casual term? Was it described as impactful? Was it discussed with love and affection? This approach was guided by the feminist theories and prior literature related to friendship. The research team then used this context to generate, name, and define the themes below.

In conversation with the participants, we determined that friends played a critical role in two ways (and we borrow terms from physics to explain the phenomena): (i) they helped to pull their trajectory towards computing, *friendship force*, and (ii) they helped with persistence in computing, *friendship gravity*. Relationships they established as early as orientation day influenced their occupational pursuits, sometimes changing their occupational trajectory. Likewise, relationships they developed while enrolled in a computing program helped them to persist in computing degree programs, effectively keeping them grounded in their pursuit of computing (see Figure 1). This theme of *friendship gravity* contains three sub-themes—*homophily*, *propinquity*, and *allyship*—which provide details about the friendships and their formation. In addition to friendship force and gravity, participants told us about how they made these friends, revealing a *friendship field*. Friendship field has two sub-themes—*collaborative connection* and *plus one*—which provide some insight into how or where friends were found.

6.1 | Friendship force: Changing the trajectory toward computing

The friendship force is defined as the force that changed the course of a participant's occupational trajectory. They came to campus intending on majoring in one degree (e.g., math), but changed their mind when they encountered the force of a friendship. When we spoke to our participants about why they chose computing as an occupational pursuit, they often spoke about the role a friend had in their decision to "try" CS or CE as a major.

> My first introduction was because one of my friends actually suggested the class, this was an intro programming class. Yeah, definitely. That was my first computer science class ever. And it's funny because I just took that class to take it with my friends.
>
> (Charlie)

Charlie was not certain what she wanted to pursue in her academic studies, but upon the recommendation of a trusted friend, she took her first computer programming course. That influence, coupled with a favorable experience in that first class, resulted in a student discovering the versatility of the field and being able to find a match between her "varied interests" and an intriguing field. A similar phenomenon was discussed by Avatar:

> [...] I started as a math major [with a computer science minor]. Then, after my freshman year, my best friend, my roommate, she was computer science. She just so happened to be computer science because she said, the only reason why she was computer science was because she followed me to registration and she was like, 'Oh, you're math [with a minor in computer science]. Oh, this looks cool.'
>
> (Avatar)

Avatar declared a major of math with a minor in CS during her university's registration. This action influenced her roommate (and only friend at the time) to declare her major as math with a minor in CS as well. This choice would be reinforced by the presence of a Black woman instructor in their introductory computing course, which led to a cooperative education (co-op) experience (a program that formally integrates a student's academic studies with work experience with participating employers) (Wallace, 2020) at NASA. Both women found out during their summer experience that if they wanted to continue their experience at NASA, they had to major in CS, so they both declared CS as a major, resulting in double majors in math and CS. These two women met as roommates and effectively participated in all things computing as one unit—classes, undergraduate research experiences, co-op, and so on. If one discovered an opportunity, she pulled the other into the experience/opportunity with her.

Meanwhile, Alexis had her heart set on an Ivy League institution but was persuaded by her best friends to consider an HBCU. Her new set of friends at the HBCU subsequently influenced her choice to pursue a research experience for undergraduates (REU), "[...] but if it wasn't for my friends [...] someone pushed me to go to [an REU] with them [...]" (Alexis). Likewise, friends that Alexis made at her REU convinced her to consider graduate school and told her about the research and research group of Professor X (at an institution she had not considered) when she was applying to graduate school. After talking to Professor X she decided Professor X's institution is where she needed to be for graduate school, "[...] someone said, 'You should check out Dr. X.' I forgot who that was. It might be my friend that said [Dr. X's institution]. I should thank him" (Alexis). While factors like financial aid/scholarships, institutional rigor, and reputation were top considerations, the element that tipped the scale for this student was the pushing and prodding of friends. People she identified as trusted friends had convinced her to expand her options and consider programs and institutions that were not on her radar when considering her occupational pursuits. Even though Alexis was firm in her decision to pursue computing, where she applied and the extent of that pursuit (Ph.D. program) were heavily influenced by the friendship force.

Emma was an engineering major who felt isolated in her graduate research lab. In her pursuit of community, she attended a Society of Hispanic Professional Engineers (SHPE) meeting, where she met a Latin man who was studying CS for his graduate studies. Through her participation in SHPE, they developed a friendship, and as she confided in him about her struggles in her current graduate program, he invited her to attend his research group meeting. Even though she was preparing for qualifiers in her current program, she accepted his invitation to attend his research group meeting.

> So, Society of Hispanic Professional Engineers has a grad student component and so [friend name] was the other Latino student in the lab, so he was at that meeting, and so I met him first and talked about what I wanted to do... So, I came in, I met the students....
>
> (Emma)

In addition, Emma ultimately completed her qualifier for her engineering graduate program, but switched graduate majors to be a CS Ph.D. student. Her friendship inspired her to try something different (computing). After attending research group meetings, working projects in the group, and establishing relationships in her new discipline, she decided it was a better fit for her—arguably a path she would have never considered without the encouragement from her friend.

> When I took the computer science course over at [other institution], I remember meeting my... He's still my friend now. His name's [X]. And he does Computer Science. I remember just really getting along well with him and I was like, 'Okay.' [...] At that point, it just made me think, 'Hm.' At that point I really got educated about the major. Prior to that, I hadn't known anybody who was doing it.
>
> (Elle)

6.2 | Friendship gravity: The grounding force towards retention in computing

While the friendship force (pushing/pulling them to computing) was not something that all participants discussed, the role of friends in being retained in the field was talked about by almost all participants. The following three participants were most explicit about the importance of their friends in their retention in the field:

> Yeah, they [friends in computer science] are the only reason I haven't chopped it off. Definitely peers have been the glue for me because they help me study, help me understand concepts, we do our homework together, they'll look over my code, I'll look over theirs, and also looking over other people's code is so helpful because seeing the other way that people thought it through and then being like oh, there's a whole other way to do it.
>
> (Sunshine)

> Well, you know, most of my classmates are my friends, so that helps me keep going, because there's somebody else you know going through it with me.
>
> (Mary)

> Yeah, definitely. I'm actually, like, still ... One graduated already, but the other one's like, my best friend pretty much, and like, we help each other with all opportunities, so, we were at Grace Hopper Conference this past week, and like, that was really exciting, but like, the entire time, it was like, we treated each other like a package deal. Like, we'd talk to a company and would come together and like, we'd kind of talk each other up and like, companies that really loved to see us and stuff. So, it was fun, like, I mean, she's always like, 'Oh, hey, this company's hiring, go apply' and I'll tell her, 'Hey this is what's going on now.' So, we help each other completely with both. So, it's been nice. I mean, we've been in college for like, three years and we've been helping each other nonstop since.
>
> (Alice)

These three participants clearly specify that their friends were critical to their success and retention in computing.

However, the transcripts also revealed variation in how the participants talked about their friends. Some were discussed in terms of *homophily* (the tendency to be drawn towards sameness); in other cases, it was the proximity or intimacy of the friendship, *propinquity*; and finally, there were friends who were considered to be more in the *ally-ship* category.

6.2.1 | Homophily

For some of the women, finding and establishing friendships with people in computing with a shared identity was important to their prolonged participation. They found that shared social identity, such as race, ethnicity, gender, and/or nationality, resulted in a perception of shared experience, providing a safe person to navigate computing with, rather than feeling alone or isolated due to their social identity.

> [...] I met this other Nigerian girl. She's doing computer engineering. And this other Haitian girl, which is doing computer engineering. I think those are the ones I got the closest to because we used to study together, and we used to help each other program. [...] those are the people that I remember because I still have classes with them and I still talk with them. So those are the two that I remember. Of course, I made some more, but those two.
>
> [Interviewer: Do you feel that those two friends were important?]

> Yeah, because [they] we're both Black women. Well, we were all Black women so yeah, you can make friends with everyone else but it's nice to see someone else who is in this with you because we're such a minority and it's nice to have someone who you can relate to and who is doing the same thing that you're doing.
>
> (Monica)

Monica explained that she had made many friends in computing and that they were helpful in her pursuit of her degree, but found that the relationships with women who had the additional shared identity of being Black were more impactful. She described these friends as being the ones who she continued to engage with and who she recalled as being most important. Their shared intersectional identity—being Black and being a woman—provided a reflection of herself in the computing community (her classes), combating the often-experienced isolation in the field.

Emma described the necessity of friends as being part of both her undergraduate and graduate journey. Her undergraduate institution offered a bridge program for students with marginalized identities prior to the start of their first term:

> So, [institution] has a, it was like a pre-freshman orientation ... It's primarily for minority students to get acclimated to the campus and things like that. [...] And I found that was very valuable, that's how I was able to develop my group, my group of friends, before we even started taking classes. So right away, I already knew who I could talk to, who I could do homework with, and things like that.
>
> (Emma)

This orientation provided a space for her to identify and build relationships with people who she would work with the rest of her undergraduate program. And because the institution recruited diverse students to this program, it provided an opportunity to seek out people with similarities—in some cases, a shared identity (e.g., race, ethnicity, gender), and in some cases, the shared experience of being marginalized at the institution.

Charlie struggled in computing at first because she did not know anybody in her classes. A friend (the same friend that pulled her into computing) introduced her to student organizations like Women in Computing, Women in Computer Science, and National Society of Black Engineers.

> Yeah. I just recently got to be a part of those clubs in schools, and that was mostly because I didn't really know anybody in my classes. I felt like the best way to get to know people would be to engage myself, I guess. I started going to these clubs, like Women in Computing was one of the clubs I went to. One of them was on women in computer science. A friend introduced me to the club, so I just stayed there because I really liked it. And then NSBE was another one, National Society for Black Engineers. I actually became really involved with NSBE so now I am a member on the e-board. Those were some of my biggest motivations because I got to see other people in the field that I guess resembled me.
>
> (Charlie)

The friend was the bridge between feeling isolated in her classes and finding multiple communities with shared identities—women and Black students in engineering and computing. This community provided her a space for not just social integration but also learning: "Oh yeah. I guess my best way is learning through friends. You need a team to put things together" (Charlie).

These women talked about how a friend helped them to remain engaged in computing and how in some cases the shared identity was the link. This shared identity was rooted in gender, in race, in ethnicity or nationality, and also in intersectionality. They were drawn to their friend by this sameness or homophily due to comfort in seeing someone like themselves in their field.

> I'm doing a lot better than when I initially started with. I feel a lot more confident. I have a lot more friends, and I have a bigger community now, so we always study together. We always help each other. In my classes, I participate more, because I have my friend there, it's a little bit easier to talk.
>
> (Sarah)

6.2.2 | Propinquity

Propinquity, a term used in sociology to describe closeness and frequency of contact, was another characteristic of friends that emerged during conversations with participants. Propinquity was attributed to the amount of time spent with a friend(s) and/or the amount of trust developed with a friend. Shared identity often overlapped with propinquity, although it was not dependent upon it. While shared identity aided in the establishment of the relationship, it was the collaboration, shared experience, and support that determined if a friend was "close":

> But three of my closest friends are in computing or computer science and one is computer engineering, but us three are mostly the same. So it's really great to be able to work with them and do homework with them and everything.
>
> (Sunshine)

For Sunshine, the specific discipline (CS vs. CE) was not the most compelling part of their relationship; rather, the opportunities to work together were most important to her. Avatar, on the other hand, described a friend with whom she did everything. Therefore, her definition of propinquity went beyond the classroom.

> Oh, we co-op together too. So, we intern together. Literally, we were everywhere together. But, we kind of balance each other out. So, she got me out more but she claims I influenced her to work harder. I'm like, no, I don't think. She was like, 'No, you did.' So we were like that. People got us confused. Seriously, having her just really helped me get through because there were rough times and, even with our professor. She got on our nerves and it's like nobody else will understand because there wasn't a lot of females in computer science. So, having her.... We co-op together. So, that was really important to have her. I love her.
>
> (Avatar)

Avatar described how her close relationship was predicated on this shared experience. There were so few women in computing, but they had each other. They frequently commiserated together, celebrated together, as well as supported each other from classroom to co-op.

Alexis described a similar experience when discussing the women she met and called friends during her pursuit of a computing degree. She started her journey without any friends in engineering, but then met two other women in her discipline who not only got her through computing but are still close friends now, post-baccalaureate. She spoke fondly of daily contact:

> Well, I didn't know anybody except for my best friend I went on the college tour with, but she went to psychology, so I didn't know anybody in engineering coming in. It was actually a group of ... Of course, it was less women than men. It's a group of three of us [women]; we're still close to this day, like talk everyday type of thing.
>
> (Alexis)

This frequency of contact ultimately led some participants to use familial metaphors to describe their degree of closeness. They pursued internships with their family, co-oped with their family, and credited the completion of their degrees to this family. "Friends, I lump them in with family, are very important to me" (Janine).

6.2.3 | Allyship

Given the dominance of White males in computing, Black and Latiné women are more likely to encounter White males than women of color or men of color (also underrepresented) in their disciplines. Thus, having allies in the field is critical to combating isolation in computing. What can start as an allyship can be cultivated into a friendship.

> Oh, so there's another person. I've realized that having a ... Not saying we have to have White friends or a White ally but, that really helps because it's this guy. [...] My first year I thought he was racist. Thought he didn't like black people, but I realize he just don't like people, and it's fine. I was like, 'Oh, it's not me?' So, we got to know each other, and we are like, we got each other's back. I didn't realize he was actually speaking on my behalf when I didn't know. When I had issues, he was actually going to [my advisor] and not telling me. Then, I would go in there and stuff would already be in motion. I had no idea how but, he revealed it to me later. Anyway, he's definitely an ally. He's taught me how to be an ally to my friend. [...] And it's not about him being white. It's just about him being ... I think it's more so him being a male than anything. I feel like male allies are important because if it's an all girl thing, they're just going to section you off as, 'Oh, that's girls.' But then, when you have somebody who's like a male ... and it's not just about ... I don't know. It's not about white male. It's not about male. I don't know what it is but just having him as that person. He's a senior. He's more senior than me. He's connected with our advisor. He knows things and he can help me. We take walks, go get coffee all the time. He advises me. Then, I feel like I'm able to pour that into my friend. So, having that mentor ... I think it's just mentorship. Not really, we're friends though.
>
> (Avatar)

Avatar described a peer—White male—who was an active advocate for her. His ability to listen to Avatar and take action with the advisor was a demonstration of compassion and translated to trust between Avatar and her White male

peer, moving him from peer to friend. In fact, such a friend demonstrates the pluralist friendship that Lugones describes: he seemed to understand the realities of her experience and acted accordingly. In addition, Avatar learned how to become an "ally" or champion for others through this pluralist friend. Another participant, Fubar, did not provide as much detail about her White male engineering colleagues, but she did mention that their presence and support were helpful during her journey in computing.

> As a woman of color, I always go up to the women of color. So the women of color I try to make friends with are of course friendly but, I mean I do have White male engineering friends who are very helpful too.
>
> (Fubar)

While the participants talked about the importance of friends that had a shared identity (Black, Latiné, women, women of color), they also noted the importance of White men on their journey. Their active participation, help, and advocacy helped to establish friendships with those who lacked a shared identity. These friendships were viewed as valuable to their retention in computing as well.

6.3 | Friendship fields: Where do you make/find friends?

6.3.1 | Finding your friends: Collaborative connection

"Friendship field" was named after an electromagnetic field, as an area that contains potential energy. While some of our participants followed their friends to computing and others found their friends at orientation, some found them in classes that were centered on collaboration. Academic cultures (university-wide, departmental, or classroom) that presented opportunities and encouraged collaboration among their students created an opportunity to make friends. Emma talked about how her school encouraged students to work together on homework assignments and how this created the space to make friends, friends who she credited for her retention in the program and at the university:

> Well, the professors were really great. Those friends, we would work together and that was helpful, that was just part of the collaborative environment of the school is that they really encourage you to do your homework together, so that was helpful. If I had to do that all by myself, I probably would've quit and just transferred schools or something.
>
> (Emma)

Likewise, departments that are smaller in size have the advantage of smaller enrollments and cohorts, enhancing the opportunity to make friends, as described by Mary:

> Okay, well ... since computer science is a small field, there's not that many people going into it. I think that we're very close, 'cause you're always seeing the same 30 ... 60 people, right, unlike some other majors where they have like 200 students. I think I have kept up with the same people throughout my degree. I'm still friends with them, and we still like study before exams. I see them on a weekly basis, and we interact with each other in group chats like Slack, WhatsApp.
>
> (Mary)

The culture of community and collaboration helped to dismantle the often prevalent feeling of competitiveness in the classroom and made room for empathy and support for others in computing. This support provided opportunity for the nurturing of relationships.

> I would say yes. I feel like we all have a communal-ism type of spirit when it comes to certain subjects. If you see someone struggling and you happen to be within their vicinity you don't say 'oh wow, you're struggling' and you just turn away. It's like, 'Alright, what don't you get?' Because if I can explain then I obviously understand it and I can help you along the way, so why not. I mean, that's just the type of environment my university held, or at least the people I kept within my environment.
>
> (LaTanya)

For those students who do not already have friends in computing, finding a friend in a field with few women and people of color can be hard. However, university, departmental, and classroom cultures that facilitate healthy collaboration can provide the space and opportunity to develop and nurture friendship in computing. This can help Black and Latiné women to find friends who are the same, as well as allies in those who are different.

6.3.2 | Plus one

Avatar talked about isolation being a major factor that jeopardized her persistence in computing. She had a close friend in undergraduate school who walked alongside her on the journey, but when she started graduate school, she found herself isolated, lonely, and struggling on account of it. During her first semester, her grades suffered. There were two things that helped her battle this barrier: (i) finding *strength in numbers* and (ii) finding *allyship*. Below is an excerpt from our discussion with Avatar about strength in numbers.

> One of my friends is in the lab now. She's a Black female. That kind of happened because I asked him [my advisor] if I could have her help me on a paper and [it] got accepted. So, [my advisor] was like, 'Oh, does she want to be in the lab?' So, she joined the lab and she's working on a project [...] I spoke on her behalf. She doesn't know. She still doesn't know [...]. That's the thing, that's my friend. I told her and I was like, 'We have a unique opportunity where we are not outnumbered. So, we can speak on each other's behalf, and we can support each other, [...].' My existence in the lab was not fulfilling til I was able to bring my friend in, and get her going, and help her. I mean, she's helped me as much as I feel like I could have even helped her.
>
> (Avatar)

Avatar met another Black woman computing graduate student at a conference, befriended her, and when she recognized that they had overlapping interests, she invited her to work on a paper with her. The success of that paper, as well as her friend's demonstrated efforts, resulted in her joining the same research group. This addition of another Black woman in her group provided an amplified voice and added support.

7 | DISCUSSION

The participants of this study described their friendships as conduits to finding the field of computing (*friendship force*), and the force for grounding them in the field or contributing to their persistence (*friendship gravity*). They shared with us insights into the potential means of making friends (*friendship fields*), and revealed friends who were either homophilic or heterogeneous in nature (inter-racial/inter-ethnic/inter-gendered). Most importantly, they revealed that computing friends are critical to the engagement and persistence of Black and Latiné women in computing. Together, they defined friends as people who (i) provided support, (ii) provided a sense of safety, and (iii) shared a mutual fondness or appreciation. The mutual fondness and appreciation, in particular, demonstrates an egalitarian and voluntary relationship that creates a distinction between other relationships such as mentors or peer support personnel.

7.1 | Friendship force

Scholars in CS and CE have hinted at the value of friendship (Bhardwaj, 2022; Kargarmoakhar et al., 2019; Ross et al., 2020) to student engagement in computing, but the findings of this study move it from a peripheral component of the educational experience to the *central cause* or reasoning for selecting and sustaining Black and Latiné women in the field of computing. The participants in the study talked extensively about the role of friends or friendship on their choice of pursuing computing as an occupational pursuit. The explicit connection between friends and occupational selection has a long history in occupational theory (Dufty, 1971), and the work by Gallagher et al. (2015) further explored this phenomenon among students identified as marginalized (Gallagher et al., 2015). Their work suggested that marginalized students often make occupational choices based on their connections to others over individual pursuits (Gallagher et al., 2015). Likewise, Brennan and Gallagher (2017) determined that women were influenced not

only by their individual interests but also by their social grouping or friends when choosing a career pathway (Brennan & Gallagher, 2017). Through this work, they determined that occupational choices extend beyond personal choice and are influenced by environmental factors, including friendships. In addition, Sinclair et al. (2014) theorize that a fear of losing friends can motivate a young person to compromise their career choices. Effectively, a young person's need and desire for stability in friendship influences their occupational pursuits; however, our findings are more emphatic in that friends were *critical* to the choice of the computing pursuits of our participants.

7.2 | Friendship gravity

Once the women in the study determined that they would pursue CS or CE, their experiences varied. Some spoke of an introductory instructor that made them question their aptitude and belonging in the field, while others described having a woman introductory programming instructor who made them feel welcomed and supported. In either case, they attribute their commitment to persisting in large part to friends who acted as a counterforce to the negative experiences that might have otherwise repelled them from the field. This aligns with strategies for success for women in STEM that emphasize the importance of networks (Pritchard & Grant, 2015). A network or community provides space to "vent" and reminds us that our struggles are not ours alone (Pritchard & Grant, 2015, p. 31). Friends, however, also provide this experience, with the added benefit of mutual fondness. Sometimes these friends were other women of shared racial or ethnic identity (homophily), and sometimes these friends were men (allyship). Oftentimes, the participants had both within computing.

The participants in the study often talked about the Black or Latiné women friends they had in their network. They talked about the importance of the shared identity for seeing themselves in the space of computing, for easing into new friendships in a field already viewed as isolating, and for boosting confidence. Prior literature tells us that homophily provides solidarity support—women are more likely to nurture talent in one another (than men) (Dinolfo et al., 2012). They will often find that "[...]their relationships with each other have often served [...] to provide them with the material, emotional, and intellectual resources to challenge their conditions. It is also testimony to the relevance of networks of love and support [...to] our ability as women to work in a hostile world" (Weiss, 1995, p. 9). Prior work also suggests that the environment created by women for women is one grounded in nurturing and is "[...] communal, intimate, and noncompetitive" (Weiss, 1995, p. 10), providing a reactionary force to the hyper-competitive culture in computing. Female support networks make it possible to maintain commitment in a hostile environment (Weiss, 1995). Computing has long been described as hostile to women and people of color in prior literature (Gürer & Camp, 2001; Jaumot-Pascual et al., 2021). This study demonstrates that friendship with other women in computing spaces provided a mechanism for combating that hostility.

Scholars in Black studies and Latin studies report that when contending with predominately White spaces that are hostile to Black women and Latinas, they will often retreat and find comfort in their own communities (Flores & Garcia, 2009; Terhune, 2008). The care, compassion, visibility, and amplification of their voices in these spaces provide healing and strength to carry on in these hostile settings. The gift of having other Black and Latiné women in computing helped our participants to develop their sense of belonging in computing. As scholars have told us, that sense of belonging increases with social interaction with other computing students for both male and female students and for those who identify as minorities (Biggers et al., 2008).

While networks and community prove to be helpful, it is the power of friendship that can bridge a gap between what feels like an unfeeling and cold discipline and the educative benefits of emotional connection. In particular, one participant used *love* to describe her connection with a friend. They spent a lot of time together, supported one another, cared for one another, and taught one another. Bell Hooks (1999, 2003) has in numerous texts explained the connection between love and education. In fact, Hooks (2000) introduced scholars in education to the idea of *love as resistance* through a "combination of care, commitment, knowledge, responsibility, respect, and trust" (Hooks, 1999, p. 3). Love is considered a means of dismantling oppression and a means of educating or being educated. One participant in our study struggled in computing, as most students new to computing do, but attributes her ascension to the highest degree in computing—a Ph.D.—and her subsequent graduation to this loving, supportive relationship. She then extended this love further to other Black women she encountered in computing as she invited them into her lab and shared her knowledge of how to navigate these spaces as Black women. Collins (2000) has spoken extensively about the power and empowerment associated with Black women and their friendships: "African-American women as sisters and friends affirm one another's humanity, specialness, and right to exist" (Collins, 2000, p. 102). And while she does not speak

explicitly about the context of computing, it is implied that this "right to exist" extends to spaces where Black women are marginalized, which includes computing spaces.

As for those heterogeneous friendships, our participants spoke about the value of White men, too, referring to them as both friends and allies. Allies are described as "[...] advantaged group members who take action in support of disadvantaged groups [...]" (Radke et al., 2020, p. 292). For the participants of this study, White men in computing were described as having impact and influence in their experiences by engaging with them and sharing resources. These shared resources were things like insight into instructors, study resources, student organizations, and prior experience. They also acted as conduits for connecting to others in the classroom. An invitation to a study group from a White male student often resulted in an additional opportunity to meet other students in the classroom. This aligns with prior work that has investigated inequality in social capital (Lin, 2000). In this case, inviting these women into their spaces was an example of sharing capital. This helped in managing anxiety associated with the ambiguity of belonging, but also helped to combat isolation. Prior work in social psychology has demonstrated that "[...] equality-supportive male ally reduces anticipated isolation and workplace hostility and increases anticipated support, respect, and gender-equality norms for women in general populations and women in science, technology, and math" (Moser & Branscombe, 2022, p. 372). White men who work to embrace, engage, or even become friends with the women in their classes—rather than ignore their marginalization in the space—have power: the power to attract and retain women, Black women, and Latiné women in computing. They also have the power to amplify their voices and acknowledge their assets.

7.3 | Friendship locator

We know from prior work that having friends in computing is critical to the engagement of Black women in the field, but we also learned from that same work that it is very rare for Black women to have friends in computing (Ross et al., 2020). Recent research suggests that this is a result of the racism, sexism, and hypercompetitive culture so dominant in computing (Ensmenger, 2015; McCurdy, 2020; Yadav & Heath, 2022). One approach to combating the dominant culture is to adopt a more collaborative and active classroom environment that can mediate the exclusion and isolation often experienced by women and people of color in computing (Pon-Barry et al., 2017; Pon-Barry et al., 2019). Leaning on practices like peer-led instruction and paired programming can transform the learning environment and make it more collaborative (Batten & Ross, 2021). Such an increase in peer interaction has been termed "STEM peer connections" and described as an important component of institutional support (Lee et al., 2022). We also know that collaborative environments provide opportunity for friendship development. Hall (2019) demonstrated that it takes approximately 40–60 h to move from acquaintance to casual friendship. Undergraduate courses often meet 3 days a week for an hour (6 h/week) for 15 weeks. That means, on average, undergraduate computer science students spend 45 h together in a semester—well on their way to casual friendship if given the opportunity to foster it in class (Denworth, 2020; Hall, 2019). This does not even include potential lab or project time. The computing classroom, with the right structures in place (e.g., pair programming, active learning engagement strategies), has the potential to be the ideal place to establish, foster, and nurture friendship in computing. In the absence of these intentional structures, the classroom can exacerbate isolation and stress for women and people of color.

Another approach to locating a friend is simply by providing space for students to bring a friend with them—a CS a friend or a non-CS friend. Prior literature discussed the fear of losing friends; we also know that the current environment in computing impedes the ability to make friends, in which case, let them bring friends with them. Prior work has pointed to the success related to a "plus one" model, in which a student is allowed to bring a computing friend along (Ross et al., 2021). In addition, there is also a "recruiting in pairs" model, in which students are intentionally recruited into programs or classrooms in pairs (Waisome et al., 2020). Being with a friend—whether students bring them, or whether we provide the opportunities to make them—reduces stress, including the stress of new environments. Taylor and Denworth tell us that social groups that "tend and befriend" literally promote growth and regulate our stress systems (Denworth, 2020; Taylor, 2002). Programs could encourage computing students to align course schedules with a friend or remove barriers that impede students from introducing their non-computing friends to computing.

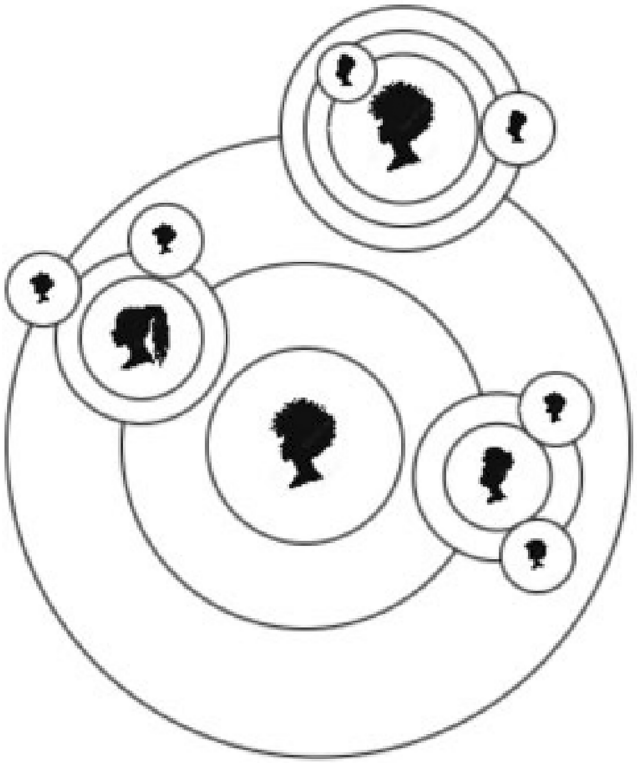

FIGURE 1 Friendship visualized like planets with their own gravity.

8 | LIMITATIONS OF THE STUDY

This study has several limitations that should be considered when interpreting the findings. Methodologically, data collection spanned over 6 years and only in the United States, during which time, some social and environmental changes have occurred. External events, such as global pandemics or societal shifts, could have influenced participants' experiences and recollections. Furthermore, the scope of the work was intentionally kept narrow to better understand the experiences of those designated as least represented in the fields of computing with the knowledge that learning from their experiences can help transform computing to be more welcoming to anybody who does not conform to the stereotypes in the field.

9 | CONCLUSION

This study clearly demonstrates the power of friendships in attracting and retaining Black and Latiné women in computing. Now that we have this insight, the challenge becomes how do we foster these friendships? This could be especially difficult in a discipline that has become distracted by the notion of cheating in programming courses (Roberts, 2002) and has adopted enrollment management strategies that reward competition (Alonso, 2023) and individualism (Simon et al., 2016), ultimately dehumanizing students by limiting their capacities to connect and collaborate with their peers. Such emphasis on individualism and competition perpetuates "popular ideas of what constitutes academic brilliance," which is "the notion that the critical thinker is unfeeling, is hardhearted" (Hooks, 2003, p. 180–181). Such popular notions effectively eliminate a survival and success strategy—to tend and befriend—that has clearly proven effective for women for, arguably, thousands of years. Instead, we might seek to create classrooms that capitalize on such relationships, recognizing that academic success does not have to be "unfeeling" (in fact, it rarely is: think about the joy of solving a problem or the frustration of failure) and instead can be cultivated precisely through the feelings of friendship.

9.1 | Practical implications

This work provides insight into one of the key elements to the engagement of Black and Latiné women in computing, that is, friends and friendships. It also gives us some direction as to how to help create opportunities for establishing these relationships:

(i) Re-imagine the computing classroom by embracing practices already proven to create a more collaborative and inclusive environment (Braxton et al., 2013; Freeman et al., 2014; Porter & Simon, 2013; Salguero et al., 2020). This includes redirecting our energies from an emphasis on hyper-individualism to a focus on the development of collaboration and community in the classroom. (ii) Educate students on the importance of friendships in their learning and their ability to thrive in and beyond the classroom. The scholarship has been clear on the benefits of friendship on living a happy and healthy life for everyone and even clearer on the importance of these relationships to Black and Latiné women and their ability to thrive in a hostile environment (such as computing). (iii) Provide the space and opportunity for students to bring their friends with them to computing by evaluating the computing curriculum for barriers to entering computing beyond the traditional individual path. We can ask, are there curricular complexities that impede someone from engaging with computing if invited in by a friend? (iv) Invite the White men in your computing classes to lean into their power—not the power to reproduce oppression, but the power to invite others into the space of computing, to engage in study opportunities or student organizations, and to amplify the voices of their women colleagues in the classroom.

The participants of this study made it clear—through the 818 mentions of friends or friendship—that these relationships are crucial to their engagement and retention; the question is, will computing, a field almost notoriously known for independent work, embrace, or even allow this scholarship to impact their field? This is a call for radical change, a call to encourage friendship as momentum, as an educative tool.

ACKNOWLEDGMENTS

This material is based upon work supported by the National Science Foundation under Grant No. 1748384, 1845884/2331066. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. We would also like to acknowledge the students, staff, faculty, and administrators who supported this work, as well as the contributions of Nia Johnson and Cassandra Garza (Figure 1). And, of course, we would like to thank the many friends we have made and maintained throughout our own fraught educational experiences.

REFERENCES

Aleman, A. M. M. (1997). Understanding and investigating female Friendship's educative value. *The Journal of Higher Education*, *68*(2), 119–159. https://doi.org/10.1080/00221546.1997.11780879

Aleman, A. M. M. (2010). College Women's female friendships: A longitudinal view. *Journal of Higher Education*, *81*, 553–582. https://dlib.bc.edu/islandora/object/bc-ir:100525/datastream/PDF/view

Alonso, J. (2023). Universities can't accommodate all the computer science majors. Inside Higher Ed. https://www.insidehighered.com/news/students/academics/2023/11/02/high-demand-comp-sci-degrees

Axelson, R. D., & Flick, A. (2010). Defining student engagement. *Change: The Magazine of Higher Learning*, *43*(1), 38–43.

Baltzly, D., & Eliopoulos, N. (2014). The classical ideals of friendship. In *Friendship* (pp. 17–80). Routledge.

Batten, J., & Ross, M. (2021). A systematic review of social constructivist pedagogies in computing and their effects on broadening participation for women in undergraduate computing. In ASEE virtual annual conference.

Bhardwaj, J. (2022). Exploring cs entrants' expectations of friendship in their first year studies. In *Proceedings – Frontiers in education conference, FIE* (vol. 2022-October). Institute of Electrical and Electronics Engineers Inc https://doi.org/10.1109/FIE56618.2022.9962470

Biggers, M., Brauer, A., & Yilmaz, T. (2008). Student perceptions of computer science: A retention study comparing graduating seniors with CS leavers. *ACM SIGCSE Bulletin*, *40*(1), 402–406.

Bonilla-Silva, E., & Peoples, C. E. (2022). Historically white colleges and universities: The unbearable whiteness of (most) colleges and universities in America. *American Behavioral Scientist*, *66*(11), 1490–1504.

Braxton, J., Doyle, W., Hartley, H., III, Hirschy, A., Jones, W., & McLendon, M. (2013). *Rethinking college student retention (No. 6)*. John Wiley & Sons. https://doi.org/10.1353/csd.2014.0061

Brennan, G. J., & Gallagher, M. B. (2017). Expectations of choice: An exploration of how social context informs gendered occupation. *Irish Journal of Occupational Therapy*, *45*(4), 15–27. https://doi.org/10.1108/IJOT-01-2017-0003

Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching*, *44*(8), 1187–1218. https://doi.org/10.1002/tea.20237

Collins, P. H. (2000). *Black feminist thought: Knowledge, consciousness, and the politics of empowerment* (Second ed.). Routledge.

Denworth, L. (2020). *Friendship: The evolution, biology, and extraordinary power of life's fundamental bond* (First ed.). Norton & Company.
Denzin, N. K., & Lincoln, Y. (2018). *The sage handbook of qualitative research* (Fifth ed.). SAGE Publications, Inc.
DesPortes, K., McDermott, K., Bergner, Y., & Payne, W. (2022). "Go [ing] hard... as a woman of color": A case study examining identity work within a performative dance and computing learning environment. *ACM Transactions on Computing Education (TOCE)*, *22*(4), 1–29.
Dinolfo, S., Silva, C., & Carter, N. (2012). *High potentials in the pipeline: Leaders pay it forward (report) (tech. Rep.)*. Catalyst.
Dufty, N. F. (1971). The effect of occupational experience on the use of relatives and friends as sources of information on occupational choice. *Journal of Industrial Relations*, *13*(3), 304–309.
Eisenhart, M., & Allen, C. D. (2020). Addressing underrepresentation of young women of color in engineering and computing through the lens of sociocultural theory. *Cultural Studies of Science Education*, *15*, 793–824.
Enright, D., & Rawlinson, D. (1991). *The Oxford book of friendship*. Oxford University Press.
Ensmenger, N. (2015). "Beards, sandals, and other signs of rugged individualism": Masculine culture within the computing professions. *Osiris*, *30*(1), 38–65.
Erete, S., Thomas, K., Nacu, D., Dickinson, J., Thompson, N., & Pinkard, N. (2021 10). Applying a transformative justice approach to encourage the participation of black and Latina girls in computing. *ACM Transactions on Computing Education*, *21*(4), 1–24. https://doi.org/10.1145/3451345
Fletcher, T. L., Jefferson, J. P., Boyd, B. N., & Cross, K. J. (2021). Missed opportunity for diversity in engineering: Black women and undergraduate engineering degree attainment. *Journal of College Student Retention: Research, Theory & Practice*, *25*, 350–377. https://doi.org/10.1177/1521025120986918
Flores, J., & Garcia, S. (2009). Latina testimonios: A reflexive, critical analysis of a 'Latina space' at a predominantly white campus. *Race Ethnicity and Education*, *12*(7), 155–172. https://doi.org/10.1080/13613320902995434
Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences of the United States of America*, *111*(6), 8410–8415. https://doi.org/10.1073/pnas.1319030111
Gallagher, M. B., Pettigrew, J., & Muldoon, O. (2015). Occupational choice of youth in a disadvantaged community. *British Journal of Occupational Therapy*, *78*(10), 622–629. https://doi.org/10.1177/0308022615583065
Gayles, J. G., & Smith, C. (2023). Retaining each other: The power of community for African American women undergraduates in stem. In *Black women navigating the doctoral journey: Student peer support, mentorship, and success in the academy* (pp. 20–36). Taylor and Francis. https://doi.org/10.4324/9781003394648-3
Godwin, A. (2016). The development of a measure of engineering identity. In *ASEE 123rd Annual Conference & Exposition*. ASEE.
Granek, L. (2013). Putting ourselves on the line: The epistemology of the hyphen, intersubjectivity and social responsibility in qualitative research. *International Journal of Qualitative Studies in Education*, *26*(2), 178–197. https://doi.org/10.1080/09518398.2011.614645
Gürer, D., & Camp, T. (2001). Investigating the incredible shrinking pipeline for women in computer science (Tech. Rep.). National Science Foundation, Final project report, 9812016. http://www.acm.org/women
Hall, J. A. (2019). How many hours does it take to make a friend? *Journal of Social and Personal Relationships*, *36*(4), 1278–1296. https://doi.org/10.1177/026540751876122
Hammersley, M. (2022). Emergent design. In *The sage handbook of qualitative research design* (Vol. 1). Wiley Online Library.
Hooks, B. (1999). *All about love: New visions*. William Morrow.
Hooks, B. (2000). *Feminism is for everybody: Passionate politics*. Pluto Press.
Hooks, B. (2003). *Teaching community: A pedagogy of hope*. Psychology Press.
Hooks, B. (1995). Sisterhood: Political solidarity between women. In P. A. Weiss & M. Friedman (Eds.), *Feminism and community* (pp. 293–316). Temple University Press. http://www.jstor.org/stable/j.ctt14bs9ds.22
Hug, S., & Jurow, A. S. (2013). Learning together or going it alone: How community contexts shape the identity development of minority women in computing. *Journal of Women and Minorities in Science and Engineering*, *19*(4), 273–292.
Jaumot-Pascual, N., Silva, C. B., Martínez-Gudaoakkam, A., & Ong, M. (2021). Women of color in computing graduate education: Structural supports and navigation strategies for a hostile culture. In *In 2021 conference on research in equitable and sustained participation in engineering, computing, and technology (RESPECT)* (pp. 1–9). IEEE.
Johnson, A. C., Campbell, E. T., & Summerville, K. S. (2023). "If it mattered to them, it mattered to me" How Friendship Shaped Three Black Women's Doctoral Experience during a Pandemic and Racial Injustice from Black Women Navigating the Doctoral Journey.
Kargarmoakhar, M., Ross, M., Hazari, Z., Weiss, M., Georgiopoulos, M., & Christensen, K. (2019). Influences of friends and family on women's pursuit of computing: a sequential explanatory design. In Hawaii University International Conferences.
Lee, W. C., Godwin, A., & Nave, A. L. H. (2018). Development of the engineering student integration instrument: Rethinking measures of integration. *Journal of Engineering Education*, *107*(1), 30–55.
Lee, W. C., Hall, J. L., Godwin, A., Knight, D. B., & Verdín, D. (2022). Operationalizing and monitoring student support in undergraduate engineering education. *Journal of Engineering Education*, *111*(1), 82–110. https://doi.org/10.1002/jee.20431
Lin, N. (2000). Inequality in social capital. *Contemporary Sociology*, *29*(6), 785–795.
Lugones, M. C., & Rosezelle, P. A. (1995). Sisterhood and friendship as feminist models. In P. A. Weiss & M. Friedman (Eds.), *Feminism and community* (pp. 135–146). Temple University Press. http://www.jstor.org/stable/j.ctt14bs9ds.13
Lunn, S., Zahedi, L., Ross, M., & Ohland, M. (2021). Exploration of intersectionality and computer science demographics: Understanding the historical context of shifts in participation. *ACM Transactions on Computing Education (TOCE)*, *21*(2), 1–30.

Maguire, M., & Delahunt, B. (2017). Doing a thematic analysis: A practical, step-by-step guide for learning and teaching scholars. *All Ireland Journal of Higher Education*, *9*(3), 3351.

Mahadeo, J., Hazari, Z., & Potvin, G. (2020). Developing a computing identity framework: Understanding computer science and information technology career choice. *ACM Transactions on Computing Education (TOCE)*, *20*(1), 1–14.

McCabe, J. M. (2023). Friendships and student success in college. *From Journal of Postsecondary Student Success*, *2*, 5–22.

McCurdy, E. R. (2020). Discrimination as a barrier to diversity: Sexism and microaggressions against African American women in computer science and engineering (Doctoral dissertation, The University of Akron).

Moser, C. E., & Branscombe, N. R. (2022). Male allies at work: Gender-equality supportive men reduce negative underrepresentation effects among women. *Social Psychological and Personality Science*, *13*(2), 372–381.

Nehamas, A. (2016). *On friendship*. Basic Books.

Park, J. J., Kim, Y. K., Lue, K., Zheng, J., Parikh, R., Salazar, C., & Liwanag, A. (2021). Who are you studying with? The role of diverse friendships in STEM and corresponding inequality. *Research in Higher Education*, *62*(8), 1146–1167.

Pon-Barry, H., Packard, B. W. L., & St. John, A. (2017). Expanding capacity and promoting inclusion in introductory computer science: A focus on near-peer mentor preparation and code review. *Computer Science Education*, *27*(1), 54–77.

Pon-Barry, H., St. John, A., Packard, B. W. L., & Rotundo, B. (2019). A flexible curriculum for promoting inclusion through peer mentorship. In *Proceedings of the 50th ACM technical symposium on computer science education* (pp. 1116–1122). ACM Digital Library.

Porter, L., & Simon, B. (2013). Retaining nearly one-third more majors with a trio of instructional best practices in CS1. In *Proceeding of the 44th ACM technical symposium on computer science education* (pp. 165–170). ACM Digital Library.

Pritchard, P. A., & Grant, C. (Eds.). (2015). *Success strategies from women in STEM: A portable mentor*. Elsevier.

Radke, H. R., Kutlaca, M., Siem, B., Wright, S. C., & Becker, J. C. (2020). Beyond allyship: Motivations for advantaged group members to engage in action for disadvantaged groups. *Personality and Social Psychology Review*, *24*(4), 291–315.

Rankin, Y. A., & Thomas, J. O. (2020). The intersectional experiences of black women in computing. In *Proceedings of the 51st ACM technical symposium on computer science education* (pp. 199–205). ACM Digital Library.

Rankin, Y. A., Thomas, J. O., & Erete, S. (2021). Black women speak: Examining power, privilege, and identity in CS education. *ACM Transactions on Computing Education (TOCE)*, *21*(4), 1–31.

Raymond, J. G. (1986). *A passion for friends: Toward a philosophy of female affection*. Spinifex Press.

Roberts, E. (2002). Strategies for promoting academic integrity in CS courses. In 32nd Annual Frontiers in Education (Vol. 2, pp. F3G-F3G). IEEE.

Rodriguez, S. L., & Lehman, K. (2017). Developing the next generation of diverse computer scientists: The need for enhanced, intersectional computing identity theory. *Computer Science Education*, *27*(3–4), 229–247.

Ross, M., Capobianco, B. M., & Godwin, A. (2017). Repositioning race, gender, and role identity formation for black women in engineering. *Journal of Women and Minorities in Science and Engineering*, *23*(1), 37–52.

Ross, M., Farhangi, S., Patel, D., Waisome, J. M., & Garcia, A. (2022). Traversing the landscape of computer science: A case study of black Women's identity and sense of belonging in a computer science doctoral program. *Journal of Women and Minorities in Science and Engineering*, *28*(5), 69–107.

Ross, M., Hazari, Z., Sonnert, G., & Sadler, P. (2020). The intersection of being black and being a woman: Examining the effect of social computing relationships on computer science career choice. *ACM Transactions on Computing Education*, *20*(2), 1–15.

Ross, M., Litzler, E., & Lopez, J. (2021). Meeting students where they are: A virtual computer science education research (CSER) experience for undergraduates (REU). In *Proceedings of the 52nd ACM technical symposium on computer science education* (pp. 309–314). ACM Digital Library.

Saldaña, J. (2021). *The coding manual for qualitative researchers*. Sage Publications.

Salguero, A., McAuley, J., Simon, B., & Porter, L. (2020). A longitudinal evaluation of a best practices cs1. In *Proceedings of the 2020 ACM conference on international computing education research* (pp. 182–193). ACM Digital Library.

Seidman, I. (2006). *Interviewing as qualitative research: A guide for researchers in education and the social sciences*. Teachers College.

Sharp, R., & Welty, E. (1991). *The Norton book of friendship*. Norton.

Simon, Sheard, J., Morgan, M., Petersen, A., Settle, A., Sinclair, J., Cross, G., & Riedesel, C. (2016). Negotiating the maze of academic integrity in computing education. In *Proceedings of the 2016 ITiCSE working group reports* (pp. 57–80). ACM Digital Library.

Sinclair, S., Carlsson, R., & Björklund, F. (2014). The role of friends in career compromise: Same-gender friendship intensifies gender differences in educational choice. *Journal of Vocational Behavior*, *84*(2), 109–118.

Slaton, A. E., & Pawley, A. L. (2018). The power and politics of engineering education research design: Saving the 'small N'. *Engineering Studies*, *10*(2–3), 133–157.

Smith, G., Devere, H., & Von Heyking, J. (2023). *Friendship studies: Politics and practices*. Ibidem Press.

Taylor, S. E. (2002). *The tending instinct: How nurturing is essential for who we are and how we live*. Times Books, Henry Hold & Company.

Terhune, C. P. (2008). Coping in isolation: The experiences of black women in white communities. *Journal of Black Studies*, *38*(4), 547–564.

Thomas, J. O., Joseph, N., Williams, A., & Burge, J. (2018). Speaking truth to power: Exploring the intersectional experiences of black women in computing. In *2018 research on equity and sustained participation in engineering, computing, and technology (RESPECT)* (pp. 1–8). IEEE.

Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed.). The University of Chicago Press.

Verdín, D., Godwin, A., Kirn, A., Benson, L., & Potvin, G. (2018). Understanding how engineering identity and belongingness predict grit for first-generation college students.

Waisome, J. A., Jackson, J. F., & Gilbert, J. E. (2020). The iAAMCS ecosystem: Retaining blacks/African-Americans in CS PhD programs. In *2020 research on equity and sustained participation in engineering, computing, and technology (RESPECT)* (Vol. 1, pp. 1–4). IEEE.

Wallace, M. (2020).Understanding cooperative education. NACE Journal.https://www.naceweb.org/career-development/internships/understanding-cooperative-education

Weiss, P. A. (1995). Feminist reflections on community. In *Feminism and community* (pp. 3–18). Temple University Press.

Yadav, A., & Heath, M. K. (2022). Breaking the code: Confronting racism in computer science through community, criticality, and citizenship. *TechTrends*, *66*(3), 450–458.

Zweben, S., & Bizot, B. (2023). *2022 Taulbee survey record doctoral degree production; more increases in undergrad enrollment despite increased degree production*. Computing Research Association. https://cra.org/crn/wpcontent/uploads/sites/7/2023/05/2022-Taulbee-Survey-Final.pdf

AUTHOR BIOGRAPHIES

Monique S. Ross is an Associate Professor of Engineering Education and Computer Science and Engineering at The Ohio State University, Hitchcock Hall, Columbus, OH, 43210, USA. ross.1982@osu.edu.

Susan McGrade is a Professor of English and Humanities at Indiana Institute of Technology, Snyder Academic Center, Fort Wayne, IN, 46803, USA. semcgrade@indianatech.edu.

Tamecia Jones is an Assistant Professor of STEM Education at North Carolina State University, 1010 Main Campus Drive, Suite 300, Campus Box 7801, Raleigh, NC, 27695, USA. trjones8@ncsu.edu.

Atalie Garcia is a graduate student at Arizona State University, 1151 S Forest Avenue, Tempe, AZ 85282, USA. agarc687@asu.edu.

Antonella Avogadro is a Software Engineer at Fanatics, Miami, FL, 33199, USA. antonella.amadei@betfanatics.com.

Brenda Guerrero is the Director of Evaluation and Impact at the Association of Zoos and Aquariums, 8403 Colesville Road, Silver Spring, MD 20910, USA. bguerrero@aza.org.

How to cite this article: Ross, M. S., McGrade, S., Jones, T., Garcia, A., Avogadro, A., & Guerrero, B. (2025). What about your friends: A critical qualitative inquiry of the experiences of Black and Latiné women in computing. *Journal of Engineering Education*, *114*(3), e70025. https://doi.org/10.1002/jee.70025