

# The Role of Familial Influences in African American Women's Persistence in Computing

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**Abstract**—Because African American women represent a vastly underrepresented population in the field of computing (i.e., 1% of bachelor's degrees awarded to African American women in 2018), multiple approaches have been utilized to increase the representation of African American women in the computing pipeline. However, strategies to recruit and retain African American women in computing emphasize mentorship in educational settings, ignoring the significance of familial influences in African American women's decision to pursue a degree in computing or how this impacts their ability to successfully navigate the computing pipeline. Furthermore, familial influences represent one form of social capital that can be leveraged to gain access to opportunities in computing. In this exploratory study, we investigate the role of family members and the family values that influence African American women's decision to pursue computing as a preferred field of study and a viable career option. Leveraging Black Feminist Thought as a critical framework, we interview 34 African American women in various stages of the computing pipeline to explore their lived experiences. Qualitative analysis reveals that families play a pivotal role in African American women's persistence in computing in six crucial ways: 1) early exposure and access to computing; 2) support for African American women's self-efficacy; 3) education as a family value; 4) career guidance and advice; 5) emotional support; and 6) family members as role models. We provide recommendations to leverage African American women's strong ties with family members.

**Keywords**—African American Women, family, computing

## I. INTRODUCTION

With the increasing job growth in the technological sector, recent statistics show a shortage of employees with the necessary education or job training to fill positions in the field of computing (e.g., Computer Science, Information Technology, Computer Engineering, etc.) [1], [2]. Having a more diverse group of skilled personnel regardless of race and gender increase likelihood of success in the global market[3]. The 2019 Taulbee Survey [4] reveals that only 1% of the 28,884 bachelor's degrees in computing were awarded to African American women, a vastly underrepresented population in the field of computing. Recruiting more African American women to pursue computing as a career choice not only helps to address the shortage of competent employees, but also contributes towards a more inclusive culture in the field of computing.

Current efforts to recruit and retain African American women in computing emphasize mentoring in educational settings. Examples of mentorship models include faculty members of the same race and/or same gender who serve as role models in computing departments, students of color campus organizations that provide safe havens from the oftentimes toxic, White male-dominated computing culture perpetuated on so many predominantly White institutions (PWIs) or cohorts of African American students who serve as an immediate network of emotional, cultural, and academic

support at both PWIs and Historically Black Colleges & Universities (HBCUs) [2], [5]–[8]. However, none of these approaches explore the sociological factor of familial influences that impact African American women's pursuit of and persistence in computing education.

Persistence, one's determination to complete required course work/curriculum to attain a degree [9], becomes a crucial predictor in women's choice of majors and careers [10]. Prior research shows African American women in computing often struggle with persistence, resulting in decreased retention in computing [11]–[13]. Although multiple factors such as hostile computing departments and workplaces, gendered racism, lack of exposure, and access to computing education contribute to the underrepresentation of African-American women, persistence is crucial to their retention in the computing pipeline[5], [13]–[15]. Although the aforementioned mentorship models have served as strategies for increasing the recruitment and retention of African American women in computing, less is known about how relationships with family members and family values can provide another level of professional and emotional support that contributes to African American women's persistence in computing. Given this dilemma, additional research is needed to develop an in-depth understanding of the lived experiences or personal journeys of African American women in computing, especially how they leverage their social capital to persist in computing.

One's ability to leverage social capital largely influences the level of success one can achieve [16]. In this paper, we examine African American women's familial relationships—an example of bonding social capital—as a first step towards understanding how African American women in computing leverage their social capital to gain greater access to career opportunities in computing, including educational preparation and professional development. Bonding social capital indicates strong social ties with African American parents, siblings, spouse, and/or extended family members (aunts, uncles, grandparents, etc.), is based on trust, and negates the lack of visibility and the feelings of discouragement and isolation experienced by some African American women in the field of computing [13], [17], [18].

Black Feminist Thought (BFT), a critical framework based upon the unique, intersectional experiences of women of African descent, positions African American women as experts of their lived experiences [19]. BFT encompasses all women of African descent (e.g., West Indian women, Afro Brazilian women, etc.) as being Black women intellectuals with a collective standpoint [19]. Consequently, in this paper, we leverage BFT as a methodology for invoking the personal experiences of 34 African American women in various stages of the computing pipeline (e.g., first-year graduate students, Ph.D. candidates, early career professionals, seasoned career professionals, assistant professor). Content analysis of the 34

interviews reveal that African American families do indeed play a crucial role in African American women's persistence in computing, especially when they encounter obstacles that would deter them from reaching their educational and/or career goals. Results from the data analysis reveal six effective strategies that African American family members employ to help their daughters, sisters and granddaughters prevail against the odds, thus leveraging the bonding social capital inherent in African American women's social networks.

The paper is structured as follows: First, we provide a cursory overview of BFT and the significance of social capital as a gateway to opportunities in the field of computing. Next, we provide a detailed outline of the methodology for conducting 34 semi-structured interviews, including the details for how we recruited African American women to participate in the interviews. Data analysis reveals patterns of emergent themes that surfaced in the content analysis, demonstrating a counter-narrative that shows that African American families do appreciate the wealth of opportunities available in the field of computing. Finally, we conclude with a short list of key takeaways for leveraging the bonding social capital inherent in the African American women's social networks, takeaways that can significantly contribute to their persistence in computing.

## II. REVIEW OF RELATED WORK

### A. Black Feminist Epistemologies (BFEs)

Within the field of education research, a range of epistemological frameworks, theories, methodologies, and methods have emerged to understand STEM+Computing learning, but much of that work has not centered Black girls [20]. Black Feminist Epistemologies (BFEs) are which concerned with writing Black women into existence, through their lived experiences with both oppression and resilience in all aspects of society, including education systems [19]. Because Black women live at the intersection of, at a minimum, race and gender, Black women face intersectional subordination, not only in their everyday lives, but also in STEM+C contexts [21], BFEs help interpret Black girls' and women's lived experiences in computing contexts because these contexts illuminate the White supremacy, White logics, and patriarchy upon which these spaces were built historically and remain contemporarily [13]. For this work, we'll explore two such epistemologies: Intersectionality and Black Feminist Thought.

#### 1) Intersectionality

Collins and Bilge [20] describe Intersectionality as "a way of understanding and analyzing the complexity in the world, in people, and in human experiences." Informed by Critical Race Theory [22], Intersectionality posits that social inequality in societies rarely emerges from one social division, but rather at the intersection of people's identities and the ways those identities simultaneously interact with systems of oppression [22]. Intersectionality can be leveraged as an analytic tool when the research aim is to problematize extant de-contextualized narratives related to discrimination that people experience. As a result, issues that are specific to Black women often remain unaddressed or "subordinated within racial- or gender-focused movements. Intersectionality examines how power relations are intertwined and mutually constructing"[2]. Although the term Intersectionality was coined by Kimberle Crenshaw [21],[22]

and her work focused on the discrimination of Black women in the legal system, intersectional work towards social justice for women of color dates back to the 19th century [25]. Collins and Bilge point out that the organization of power in our society can be examined through four distinctive lenses, including interpersonal, disciplinary, cultural, and structural [20]. Overall, intersectional analyses provide ways to illuminate the structure of social inequality as an interlocking system of oppression for Black and other women of color. (ibid), suggesting single-axes analyses (i.e., race or gender) as insufficient.

#### 2) Black Feminist Thought (BFT)

*Black Feminist Thought (BFT)* argues that women of African descent from all walks of life (the ordinary, the educated, the illiterate, the young, the old, etc.) must define their own self-worth, espouse their relationships to other Black women and speak their truth [13]. It also argues that the experience of being a Black woman cannot be understood independently in terms of being Black and of being female, since Black women experience race and gender simultaneously (ibid). *BFT* encompasses all women of African descent (African American women, West Indian women, Afro Brazilian women, Black Puerto Rican women, Haitian women, etc.) as being Black women intellectuals with a collective, distinctive, and unique standpoint that comes from living as Black women (ibid).

### B. Non-Technological Influences on Black Girls and Women In computing

The parent-child dyad is significant because it is one of the most influential, relevant, and meaningful relationships in an individual's life [26]. Vygotsky introduced the idea of social interaction with parents helping kids gain knowledge and cultural practices [27]. Previous research has illustrated how families play a significant role in keeping Black girls and women's interest in STEM+C pathways [13], [28]. Additionally, previous research has illustrated the importance of faith, family, and mentorship from mentors both inside as well as outside of the field of computing in helping Black women to persist personally, academically, and professionally [13], [29]. However, more research is needed to understand these influences and their impact on Black girls and women in computing. This is particularly true if colleges, universities, and other organizations who say they are committed to diversity and inclusion in computing really want to better support Black girls and women to not just persist, but to thrive and succeed within their organizations.

### C. Bonding Social Capital

Social capital becomes useful for gaining access to education/training and exploring job opportunities, thus contributing to economic growth and career development [30]–[32]. Lack of social connections can limit one's ability to attain resources to overcome obstacles or resolve problems [30], [33]. Within the field of computing, social capital represents just one of the factors that has serious implications for upward career mobility. Thus, one can expect social capital to play a pivotal role in Black women's ability to persist in computing.

Social interactions (e.g., talking on the phone, sending text messages, eating lunch with friends) occur on multiple levels and can be characterized based on frequency, quality and mode of communication. Social capital refers to how these social interactions support the sharing of information

with others, engender a sense of trust (or lack thereof), and afford opportunities to help others whenever possible (reciprocity) [16],[18],[32]. Additionally, social capital relies on the value of connections between an individual and others (people, institutions, professional organizations, etc.). As such, evaluation of one's social network reveals both strong ties (bonding social capital attributed to close connections with family and friends) and weak ties (bridging social capital that connects people across lines of race, age, class, and ethnicity).

Because strong ties are typically established with close family and friends, these social connections offer emotional support and are more likely to be within a homogenous group (i.e., same race, similar age range, same class) [16],[30], [32]. In contrast, weak ties are more likely to be established with distant friends, acquaintances, or strangers [30]. Weak ties provide exposure to new people, new information, new ideas and new opportunities [17],[18],[32],[34],[35]. Cultivating both bonding and bridging ties demonstrates high social capital whereas the lack of bonding or bridging ties can contribute to low social capital [18], [34]. Though both strong and weak ties are equally important, we focus on strong ties with family members or bonding social capital.

The culture of computing has proven to be a hostile environment for women, and even more so for women of color [2], [12],[13],[36]–[38]. As such, women of color seek *counterspaces* or safe social spaces from the White male-dominated culture associated with computing, one that devalues African American women and renders them invisible[6],[12]. For example, one African American woman enrolled in a computing course revealed that she experienced fear whenever the teacher instructed students to pick a partner because her male peers were reluctant to work with her and sometimes outright rejected her [12]. African American women often described themselves as “being the only one,” thus experiencing feelings of isolation [13]. These examples indicate low social capital or weak bridging ties. However, strong bonding social capital can alleviate symptoms of weak bridging ties, reaffirming African American women's sense of self-worth and determination to succeed in the field of computing. As evidence of bonding social capital, Black women credited strong relationships with their fathers as influential in increasing their self-efficacy and self-esteem, inoculating them from microaggressions they experienced from computing faculty and peers [13]. These testimonies have only begun to scratch the surface as it pertains to understanding the characteristics of the social networks of Black women in computing and the social factors that inhibit their ability navigate the computing pipeline. As such, we seek African American women in various stages of the computing pipeline, imploring them to share personal information about social networks, specifically their familial experiences in the context of navigating the “leaky” computing pipeline [6].

### III. METHOD

#### A. Participants & Setting

We employed the snowball sampling method [25] to gain access to African American women in computing who were willing to share their lived experiences. Initially, four African American women agreed to participate in an interview. After completing the interview, each participant recommended we contact one or two African American women they knew to

participate in the interviews. This helped us to recruit a total of 34 African American women in various stages of the computing pipeline. Participants' status is as follows: a) 6% (2 out of 34) assistant professors; b) 23% (8 out of 34) graduate students; and c) 71% (24 out of 34) career professionals. One co-author conducted each interview. All 34 interviews were conducted over a period of 10 weeks.

#### B. Procedure

Once a participant agreed to do the interview and signed the IRB consent form, the interview was scheduled at a time convenient for the participant. Each semi-structured interview was conducted via Google Hangout for a duration of approximately 45 minutes to 1 hour. The interviewer asked a series of questions about self-identity, educational background, social support, experiences at work or during the study as African American women, the process took them reaching the current status, their motivations, and future career aspirations. Participation in this study was strictly voluntary and participants could cease participating in the interview at any time. Upon completion of the interview, each participant was asked to recommend 1-2 African American women in computing that she knew and only provide their contact information after she received their permission to be contacted by the researcher to schedule an interview. Participants received compensation for completing the interview.

#### C. Data collection and analysis

Each semi-structured interview was audio-recorded and transcribed for data analysis purposes. Two researchers identify themselves as African American women in computing and leverage their positions within society to conduct the qualitative analysis [39]. In the first phase of data analysis, all 34 transcripts were imported into NVivo-12. Two researchers coded a small subset of the interviews to identify an initial set of 50 unique emergent themes (i.e., *a family member suggests student change major to computer science, dad encourages participant to major in computing, etc.*) related to familial influences. Similar emergent themes were collapsed into categories and all duplicates removed to reflect 10 categories of emergent themes. These initial 10 categories served as the basis of the codebook. Then, the researchers met repeatedly to compare and discuss the identification of categories of emergent themes before resolving differences to achieve an interrater-reliability of 85%. In the third phase, the two researchers individually coded the remaining interviews. Finally, two researchers met to discuss differences and collapse similar emergent themes into six distinctive categories: 1) *exposure and access to computing*; 2) *support for self-efficacy*; 3) *education as a family value*; 4) *resource for career guidance & advice*; 5) *emotional support*; and 6) *family members as role models*.

### IV. FINDINGS

It is critical that individuals have access to a system of support when seeking help [40]. Support for the case of women in computing comes in many different forms, including encouragement to pursue educational opportunities, assistance with employment opportunities, financial support and parental support [41]. In this study, 59% of participants (20 women) talk about their familial influences that positively influenced their ability to persist in computing. These influences include: 1) *exposure and access to computing*, 2) *support for self-efficacy*, 3) *education as a*

family value, 4) resource for Career Guidance & Advice, 5) emotional support, 6) family members as role models.

#### A. Exposure and access to computing

Lack of exposure to a major—through course taking and preparation before college—is one of the reasons women are underrepresented in STEM courses [42]. Therefore, it is important to facilitate ways that female students learn about computing before college. P31 says:

*“I got interested in computing in – really like in high school. When I was younger, my parents were always putting me in engineering camps and stuff, and my dad worked in IT stuff.”*

P31 highlights the important role of African American parents in exposing their children to computing education and providing access to pre-college opportunities such as after-school classes, extracurricular activities, and summer camps.

Further exposure can be facilitated by encouraging African American girls to “look under the hood” to learn how technological devices work or to repair them [41]. Brickhouse and Potter discuss how they found a relation between being successful in computing and being exposed to masculine culture of computing by a father of African American girl that they studied [43]. P 30 says:

*“I – it started when I was like six, seven. My dad gave me my first laptop. (laughs) It had no internet, so I had to find other things to make it interesting... I started learning how to replace the screens, and then it was said and done from then on.”*

Her father’s decision for giving her a laptop led her to explore the hardware and learn how to repair the laptop screen. These hands-on experiences made her pursuing a degree and ultimately a career in computing. Although early exposure can make students to learn more about the computing and join the formal education, we learned “never is too late” to join computing. P27 was an architect which joined computing after she was exposed to computing with her brother’s work. She says:

*“My brother is actually in computer science...I was uninformed about what computer science was. So he was doing a lot of side projects on nights and weekends, and he was like, hey, I don't know how to build web applications, could you help me out, you know, you could use some of the design skills that you've picked up from just your years in architecture and doing a lot of graphic presentation, and I was like, sure, you know, I'll sit down and figure it out.”*

#### B. Support for self-efficacy

Self-efficacy is defined as an individual’s belief that s/he can successfully execute a task or behavior for producing a specific outcome [44]. Although self-efficacy is addressed as an intrinsic motivation for success and persistence in study and work [9], [44] close ties with family members and friends can increase one’s self-efficacy. In the study of career development of African American women, Pearson and Bieschke found verbal persuasion, receiving encouragement and support from family increased African American women’s self-efficacy [45]. Participant 29 confirms this behavior:

*“I have my family, whose response is just like, you can do it, you can do it. I'm just like, yeah, you all say that but you all are...I can't really do; it's not as simple as it sounds. Like, I hear you all, but no, it's not that simple. (laughs) But I have a good – I do have a good support system.”*

Though the participant was doubtful about her ability to persevere, her family expressed confidence in her ability to do the work and bolstering her self-efficacy. Consequently, she graduated with a graduate degree in CS and was hired as a computing professional in one of the government agencies.

In another example, P14 talked about how her family encouraged her to overcome the challenges she faced as a graduate student at a PWI.

*“I also think, you know, having family support, so your family, just being able to encourage you even when, you know, you feel like you're not doing good, and their support was really helpful...Having a good – a family that is there for you and very supportive.”*

Graduate school is not an easy endeavor for most students, regardless of race or gender. Going through this process is what caused these African American women to question their ability to succeed. However, both women apply family affirmations as a strategy for enhancement of their self-efficacy and to overcome the challenges associated with graduate school.

#### C. Education as a family value

Family expectations can influence on African American women education. Parents’ focus on the importance of education from the early ages, drives students to perform better and persist in the college [46]. African American families who are interested to send their children to college and need their children to be persistent need to establish some expectations of obtaining postsecondary education from the early ages [46]. We also see the same pattern in case of our participants. Like P2 says:

*“When I was younger, my dad always encouraged us to concentrate on our education, everything else is a distraction, that kind of thing, and me and all my siblings have kind of attributed our life to that, essentially...my dad kind of imprinted that on us when – from the time we were kids until we were adults.”*

In a study of career development of African American women, the authors found: the most salient value that family emphasized was *education* within the familial unit [45] which in our investigation also stand out. P33 states:

*“My sister has her master’s, and like my mom just pushes education a lot...education is really important to our family.”*

Additionally, P26 says:

*“Well, education is, like, really important in my family, so it was kind of an unsaid thing that everyone kind of goes to grad school.”*

These testimonies exemplify how parents and siblings espouse a higher education, thus encouraging African American women to progress further down the computing pipeline. For some African American families, there is the

expectation that their daughters or sisters will attain an advanced degree in their respected fields.

#### D. Resource for Career Guidance & Advice

Family members play a significant role in helping students to choose the right major for their undergraduate degree [47]. African American adolescents choose careers that are more inclined with their parents' desires and are more engaged with collective career decision making [48]. In this study, some participants involve their parents in the process of choosing a major. For example, P30 says:

*"I was talking to my dad and he was like, well, you always liked taking apart computers. Why don't you try that, and I was like, okay, you know, and as soon as I started I realized how much I loved it, and how I could pursue my kind of creative problem-solving skills to change and alter technology and create programs and stuff"*

In the case of P17, she says:

*"My dad... comes to me and he tells me – it's like my senior year in high school and he's like, yeah, you know, this is the number one paying job in the US right now. So he gives me this newspaper article and it's this – it's a white woman who is a system programmer, and she – they did this article on her and how she was in like the top job in the country at the time. And they said that she majored in computer science (laughs)"*

This particular woman seeks guidance from her father, whom she trusts to provide good advice. Her father suggests computer science as a major because he is intimately acquainted with his daughter's interests. Consequently, she selects computer science as her major, and the rest is her story.

In some cases, individuals may initially choose one major before realizing that they do not like that major. In this instance, familial relationships serve as a reliable resource to guide African American women through the process of finding the best fit between self-interests and choice of major. P1 shares her mother's influence in changing her major:

*"When I was younger. I always wanted to be a doctor. And then I took a biology class and I was like, yeah, this is not really for me. And so my mom suggested I try out computer science because she could tell just based off of like my analytical skills and just like how I liked being on the computer and stuff that I would like doing that more. And so when I went to Spelman, I tried it out and I really liked the classes then so I just stuck with it. So (laughs) I ended up doing it."*

Family can be a source for important information about work [45], especially when African American women are working as professionals in the tech industry. For example, P7 admits that she seeks her mother's advice about work issues:

*"...my mom didn't have a person in a similar situation to get advice from or to get feedback from and she moved on in her professional career, so it's a major benefit to me to have somebody that has been in my shoes before and navigated around in a male-dominated society and been able to excel. So it's nice to have somebody that's in a similar place that I can bounce ideas off of and just communicate with on a regular basis."*

For this participant, her mother represents as a successful African American woman in the tech industry who has firsthand experience dealing with and overcoming the challenges that African-American women face in male-dominated occupations. She is comfortable going to her mother for career advice which helps her to excel as a computing professional.

In terms of recruitment efforts, African American women may not enter the computing pipeline using traditional pathways (e.g., bachelor's degree in Information Technology), but are contemplating a much-desired career change. Sibling relationships can motivate African American women to consider computing as a viable career option. P27 talks about how her brother encouraged her to make a career switch:

*"My brother is also in computer science... and he was like, hey, I don't know how to build web applications, could you help me out, , you could use some of the design skills that you've picked up from just your years in architecture and doing a lot of graphic presentation, and I was like, sure..., I'll figure it out. So, what I realized very quickly was that I – you know, my skills are mostly for print and the web is a totally different game. So, I had to start looking around to figure out how do I learn how to translate those skills from print to web."*

Though P27 did not possess a bachelor's degree in computing, she transferred her architectural skills to the context of web design before eventually completing a computing boot camp and securing a position in industry.

#### E. Emotional support

Emotional support is an important factor which positively impact on students' success in college[46]. Family members serve as the primary source of emotional support in the lives of African American college students, specifically mothers who provide encouragement and reassurance [46], [49]. P3 shares that her parents offered her emotional support when she started college:

*"They were huge in terms of emotional support because I mean I felt like I was ready but it was still some emotional things that were going on. (laughs) It was a big culture shock and everything else."*

P12 talked about her spouse's emotional support.

*"My husband ... you know, the people that were in my outside academic space were also very important emotionally. And so you need to have that ... space where you can go and kind of, you know...let you push real hard and help you get over the bumps and the bruises and stuff and so I think without that, a lot of people will struggle."*

For this particular interviewee, her husband was instrument in her ability to attain her doctoral degree. This suggests that, for married African American women in computing, spouses can play an important role in their ability to persist in the computing pipeline. This is in agreement with Mc Gee et al.'s finding about the important role of significant others for motivating African American PhD students to complete their engineering doctoral degrees [50].

#### F. Family members as role models

##### 1) Role models external to the field of computing

Families can be count as a source of inspiration and instill values that are critical for success in people's life. Therefore, mothers and other family members can be seen as role models and the source of inspiration in Black women's life. Basow and Howe [36] define role model as someone who influence student's life in their career choice. Role models may play more important role in women's life who are from the minority groups comparing to their male counterparts because this influence their self-efficacy indirectly[51].

P4 talks about how her mother was an inspiration for her in terms of being a hard worker. she states:

*"From my mother, I've always learned to be a hard worker. My mother is also Afro-Latina. She grew up there in a tiny village like seven hours away from like the nearest town or city. And her story of how she got to America, how she got her bachelor's degree, how she became one of the most successful employee of... for the state of Texas, like her story makes me cry every time I tell it. And she's just my biggest inspiration in the world."*

The narrative P4's mother of being strong and successful through difficulties in life pictured her as a source of inspiration and helped her to be persistent in her life.

*"But from her, I've learned how to work hard and what preparation means, and taking the opportunities that come to me. I'm so grateful to both of my parents for the lessons that they taught me. I've had so many opportunities because of them. But you can have all the opportunities in the world and still miss, still not be successful if you don't work hard. And so the lessons that my mother instilled in me and the inspiration and the example that she set has always encouraged me to work hard and build upon everything that she's created. So when I think about any success, I have to thank my mom."*

## 2) Family members who are computing professionals

One of the participants sees herself as an inspiration for her younger sister, as she joined CS recently.

*"I have a little sister who really, really looks up to me. She's starting computer science at XXX this year, so this is her first year of undergrad. She's starting computer science there, and I know like she really mitigates me. I know that there are so many people who depend on me and I just don't want to let anybody down, and I know that like I'm not just doing this for me. Like I'm doing this for me. I'm doing this for my family."*

## V. DISCUSSION – RECOMMENDATIONS FOR THE FIELD

These African American women's lived experiences provide a counter-narrative to the misperceptions that African American families are totally oblivious to the career opportunities available in the field of computing. It is in contrast with the idea that African American families do not value computing as a viable career option, nor do they encourage their children to acquire 21<sup>st</sup>-century computing skills. This exploratory study demonstrates that the African American community has become more astute about the economic benefits attributed to computing professionals and seek educational opportunities that give their children early exposure and access to computing resources (i.e., attending summer camps where children learn how to code) [52], [53],[54]. Similar to Ellison et al.'s criticism of scholarly research that depicts African Americans as being apathetic

about technology in this growing global economy, we caution those whose goal is to broaden participation in computing to seek authenticity in their research methodology [55]. Rather than relying solely on numerical data, researchers need to empower the voices of marginalized populations to capture the nuances of socio-cultural norms that are often misinterpreted by the dominant culture [20],[22]. These interviews reveal a different perspective of African American families, one that shows that their hopes and dreams for their children are the same as most parents – for their daughters or sisters to be successful and happy human beings. This is counter-narrative to prior work which portrays African American culture as being non-supportive of computing[56]. As such, the African American women in this study have strong bonding capital with parents and siblings who value computing. Consequently, they successfully navigate the computing ecosystem, turning to family members during challenging times or to get a second opinion about a professional dilemma.

While prior efforts [57] have been utilized to recruit and retain African American women in computing, such efforts, more or less, have emphasized the development of students' computational skills. We are not critical of these efforts as they have proven to be beneficial. However, a more holistic approach is required if the field of computing is to be more inclusive. Our recommendation is to apply a community-based approach to recruiting efforts for grades K-12 since this approach would engage African American parents and children. For example, a tech-based company (or research lab) could partner with teachers and parents of a local high school, collecting survey responses about the kinds of games the parents played when they were younger and the kinds of games their children currently play. Then, the tech-based company could sponsor a game night at a local high school, invite parents and students, and hold a competition for the best parent-child gaming team after playing a series of "old school" and current games. Later during the school year, the organization could moderate a panel about opportunities in gaming and so forth. The point is that such an approach demonstrates an appreciation for the active role that African American parents play in their children's education, including helping them to figure out which college to attend, which major to choose, and what career opportunities are available to them. In addition, it also creates an opportunity for African Americans to build and strengthen their bridging ties, those social connections that cut across race, gender, class, and age. It is the combination of strong and bridging bonding capital that will make a noticeable difference in increasing the recruitment and retention of African American women in the field of computing.

Of course, given the small sample size of African American women who participated in these interviews, we dare not infer that what is true for this specific population of African American women holds true for all African American women. Just a BFT espouses a collective standpoint, it also supports divergent experiences [19]. This brings us to the second recommendation for the field—to conduct more authentic research of African American women (and other women of color) in computing, research that chronicles their successes and failures, the sociological factors that impact their ability to remain in the field, or in some cases, contribute to them deciding to leave the field. Without studying why some African American have left the field, we miss the opportunity to fix what is broken. This is why this particular

paper only represents a first step towards understanding the significance of familial influences in the lives of African American women in computing. As an evolving discipline, the field of computing still has a long way to go to achieve diversity, inclusion and equity.

## VI. CONCLUSION

Results from this study reveal that family members play a pivotal role in the persistence of African American women in computing. Parents become mentors who offer career advice to help their daughters succeed in male-dominated workplaces. They function as role-models and a source of inspiration for getting through tough times. Siblings who are computing professionals encourage their sisters to contemplate a career change, pushing them to take the risk of starting over the field of computing. African American family members stress the value of education from early ages and expect their children to go to college and even graduate school, providing both emotional and social support. The combination of these familial influences serves as positive mechanisms for countering factors that negatively impact African American women's ability to persist in computing.

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