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Exploring the Impact of “Onlyness” Among Black Women Doctoral Students in Computer Science and Engineering

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Given the continuous underrepresentation of Black women in science, technology, engineering and mathematics (STEM) fields (Artis et al., 2018; Spencer et al., 2022), this study delves into the nuanced experiences of Black women doctoral candidates in computer science and engineering. Central to this exploration is the multifaceted mental health impact of “onlyness”—a term developed through this research to encapsulate the unique challenges these women face due to their significant underrepresentation. Employing grounded theory (Corbin & Strauss, 2015), interviews with 32 Black women doctoral students revealed not just the challenges of being the only ones in their respective programs but also how these experiences initiate a complex cycle of isolation, self-doubt, impostor syndrome, and substantial emotional and mental distress. This article aims to highlight the critical need for higher education administrators and faculty advisors to adopt intersectional and systemic approaches to support Black women in STEM (Collins & Bilge, 2020; Joshi et al., 2021). Furthermore, it offers insights into the resilience strategies and coping mechanisms these women employ to navigate their doctoral journeys, thereby contributing to discussions on enhancing their retention in STEM graduate programs.

Keywords: Black women, doctoral, STEM, mental health, onlyness

While past literature has highlighted the underrepresentation and challenges Black women face in STEM (e.g., Artis et al., 2018; Spencer et al., 2022), a gap persists in addressing systemic barriers contributing to their minoritization and underrepresentation in STEM education and career pathways. Studies on Black women in STEM education discuss the nuanced experiences of Black women who were able to mitigate the barriers at secondary and postsecondary levels (McGee, 2020; Ong et al., 2018; Spencer et al., 2022; Wilkins-Yel et al., 2019). For instance, Black women in STEM doctoral programs report constant code-switching to assimilate in predominantly White, male-dominated spaces, where they are often the only woman and/or the only Black woman (Spencer et al., 2022). Additionally, they continue to face systemic racism, microaggression/macroadgression, sexism, and harassment (McGee, 2020; Ong et al., 2018; Spencer et al., 2022; Wilkins-Yel et al., 2019) at these institutions.

An implication of continued exposure to discrimination and harassment is the mental and emotional distress that Black women experience. While some Black women achieve success in STEM, often their success comes at great personal cost due to persistent barriers rooted in racism and sexism (Ireland et al., 2018). The problematization of Black women’s success in STEM obscures larger systemic issues of inequity and exclusion that continue to minoritize Black women in these fields (McGee, 2020). Black women suffer higher rates of depression, isolation, posttraumatic stress, and anxiety than other racial subgroups in the United States (Joshi & Manette, 2018; Williams & Lewis, 2019). However, little has been done to acknowledge and/or address these women’s mental health issues as they attempt to overcome barriers at both interpersonal and institutional levels. Hence, through this article, the authors aim to discuss (a) how Black women continue to face the challenges of “being the only one” in STEM fields of computer science and engineering (CSE) and (b) the emotional and mental health impact of “being the only one” and (c) offer strategies to promote mental health awareness and self-care among these women. This article argues that although the systemic barriers and underrepresentation of Black women in CSE doctoral programs contribute to a challenging academic environment, the unique experiences of isolation, impostor syndrome, and emotional distress they face in the form of “onlyness” highlight the need for institutional reforms and targeted support mechanisms.

Black Women in PhD Programs

Despite earning master’s degrees at rates similar to or exceeding other racial/ethnic groups, Black women remain substantially

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underrepresented in doctoral degree attainment, with just 3.4% of all doctoral recipients (Grieco & Deitz, 2023). Black women in PhD programs face challenges, including isolation, racial and gender biases, and a lack of mentorship (M. Shavers & Moore, 2019). They frequently feel pressured to conform to departmental cultures and conceal their authentic identities (Haynes et al., 2020). Support systems to nurture mental health and well-being are often insufficient (Barker, 2016), as Black women navigate their doctoral journeys through systemic racism and sexism. These experiences often impact the retention and success of Black women in PhD programs. Moreover, such experiences further contribute to higher turnover rates of Black women from their respective workforces (see Sendze, 2023).

Black Women's Experience in STEM PhD

The presence of Black women in STEM is even more scarce. For example, according to the Grieco and Deitz (2023), only about 3% of Black women are in the CSE workforce. The underrepresentation of Black women in doctoral programs often leads to overlooking their experiences and how these women are navigating their educational journeys. For instance, Black women in STEM not only face overt racism but are more likely to experience "color-blind racism" (Bonilla-Silva, 2017). They experience microaggression/macroaggression, feeling invisible and hypervisible (Golden, 2020). Black women have their competency challenged as both doctoral candidates and graduate assistants in STEM by their students and faculty alike and often use code-switching to cope with these experiences (Artis et al., 2018). However, code-switching is exhausting and takes a mental and emotional toll on Black women (M. C. Shavers & Moore, 2014a, 2014b; Spencer et al., 2022).

Adding to these challenges is the meritocracy myth that Black women face, where they are expected to demonstrate high competence as their fellow White male peers and get blamed for the injustices infringed upon them (McGee & Bentley, 2017). Black women in STEM must also balance the development of their STEM identity and interpersonal cultural identities within predominantly White spaces (Jackson, 2013). By the time these women transition to the STEM workforce, the impact of these experiences results in many Black women leaving the STEM field (Haygood, 2021). Those who stay in the field are often left with emotional stress due to the discrimination they experience at the intersection of their race and gender (Spencer et al., 2022).

Need for Black Women in STEM Workforce

While racial and gender bias continues to plague the experiences of Black women in STEM, they persist (Spencer et al., 2022). For most Black women, the motivator to continue and be represented in the STEM workforce is partly due to the burden of representation and serving as role models for other Black girls and women. (Sanchez et al., 2020; Sendze, 2023). As asserted decades ago, seeing Black women scientists is affirming for other Black girls and women in their racial and professional identities (Carlone & Johnson, 2007).

The underrepresentation of Black women in STEM starts early during P-12 education, when deterred from taking advanced-level science and mathematical courses (Sanchez et al., 2020). These girls are often taught by White teachers in STEM classes at each educational stage, including postsecondary education, and the

lack of representation influences how they perceive themselves and the careers that they can choose from (Sanchez et al., 2020; Sendze, 2023).

Additionally, being the "only one" or "among the few" leads to the "problematization of resilience" (McGee & Bentley, 2017) for Black women who succeed despite institutional and structural oppression. This further contributes to the meritocracy myths and becomes an excuse for institutions, specifically in STEM fields, to continue to perpetuate these oppressive practices. An increase in the recruitment and retention of Black women in the STEM workforce can normalize Black women in STEM instead of being tokenized for being Black and women in STEM.

Research Inquiry

The information provided in this article is part of a larger research study (Artis et al., 2018; Spencer et al., 2021, 2022) whose primary purpose is to answer the following research questions: What are the experiences of Black women doctoral students in CSE, and how do those experiences impact their overall well-being?

The focus of this article looks specifically at the following research subquestions:

1. How does the impact of "onlyness" or being one of a few, impact the mental and emotional well-being of Black women doctoral students in CSE?
2. What strategies are Black women in CSE using to overcome any challenges/barriers to their mental and emotional well-being while in their doctoral program?

Theoretical Framework

Black Feminist Thought

The decreasing percentage of doctoral degrees awarded to Black women in CSE suggests that Black women have unique experiences that must be investigated separately (Spencer et al., 2022). The dualistic perspective of most research solely focuses on either race or gender, but African American women are not solely women or solely African American; rather, they stand at the intersection of both identities and thus are often invisible in these studies (Smith, 2015). This sheds light on the experiences of women of color and brings awareness to the multiplicity of their identities, realizing that women do not all share the same experiences, nor do all African Americans or all African American women (Smith, 2015).

Black women have unique experiences shaped by the intersection of race, gender, class, and other identities. Therefore, Black feminist thought (BFT) was selected as a theoretical framework for this qualitative investigation because it integrates, validates, and centers on the unique experiences of Black women (Collins, 2000). BFT combines many tenets from critical theories that challenge dominant-group thinking (Solorzano, 1998) and feminist theories, which emphasize women's experiences and challenge ideology (Corbin & Strauss, 2008). BFT has several tenets that were used to shape and contextualize this study (Collins, 2000), including:

- The lived experiences of Black women shape the framework and assume that their lived experiences are credible (Collins, 2000).

- Although each person's experience is unique, Black women share some similarities in experiences due to the intersection of race and gender (Collins, 2000).
- Despite commonalities, the diversity of class, religion, age, and sexual orientation provide contexts for understanding Black women (Collins, 2000).

Consequently, BFT serves as a lens used to conceptualize, design, and develop the methodology of this study. Interview questions were developed using BFT to look specifically at the lived experiences of Black women while providing context for their intersecting identities (Collins, 2000). Based on the interpretative nature of qualitative research and the desire to use a theoretical lens to capture the participants' experiences best, BFT is also used as this study's methodological and interpretive framework.

Researcher Positionality

Following the guidelines outlined by Porter (2023), we aim to exemplify congruence by explicitly naming our positionality and epistemology in relation to—and in congruence with—our methodological decisions, particularly concerning our examinations of Black women in higher education. Four of us identify as Black women and one as an international woman, bringing various intersectional experiences to the study. Two of us serve as faculty members, two as administrators in higher education, and one works in the private sector. As researchers, we approach this work through the lens of BFT, which centers and validates Black women's lived experiences as sources of knowledge (Collins, 2000).

Our shared positioning as Black women and members of other minoritized groups connects us to participants and the methodological approach. We draw on Black feminist epistemology, recognizing our own experiences as Black women inform our understanding and analysis of the data. At the same time, we acknowledge diversity across individual narratives. Guided by BFT, we aim to represent participants' experiences holistically while contextualizing them within relevant literature. As researchers, we critically reflect on our subjectivities and social locations throughout the process. We are committed to rigorous, ethical inquiry that centers the knowledge and perspectives of Black women.

Methodology

Recruitment and Participants

Targeted participants were recruited through various email listservs (e.g. the National GEM Consortium [GEM] and the National Society of Black Engineering) and conferences for underrepresented CSE students. The team also contacted Ronald McNair Scholars and Research Experiences directors to recruit alumni from their programs.

Researchers used purposeful criterion-based sampling and snowball sampling to recruit women in CSE doctoral programs who identify as Black or African American. This article includes data from 32 participants. Participants were at various stages in their program, with 12 taking coursework, four in comprehensive exams, eight in their dissertation prospectus (DP) stage, and seven having completed all but their dissertation. Thirteen students (40.6%) identified as low-income or were Pell grant-eligible during their undergraduate

education, and nine (28.1%) reported being first-generation college students. Only one (3%) participant was part-timer. Additional data and the pseudonyms for each participant, used throughout the results section, are available in Table 1.

Data Collection and Analysis

Four forms of data were collected: (a) screening questionnaire, (b) semistructured interviews, (c) demographic questionnaires, and (d) graduate experience survey. Semistructured interviews ranged from 45 to 75 min. Each interview was audiotaped and transcribed verbatim. Interviews were conducted to use dialogue as a process for knowledge validation (Collins, 2000). After the interview, participants took a graduate experience survey and received a \$25.00 gift card for their participation.

Themes were analyzed using a grounded theory approach to data analysis, which consisted of a two-stage, open, and axial coding process to analyze the data, followed by memo writing, theoretical sampling, and theoretical saturation (Schwandt, 2007). While grounded theory was used as a method, BFT (Collins, 2000) was used as an interpretive lens to make sense of and apply the themes identified using grounded theory.

A team of researchers independently coded themes. At least two researchers coded each interview independently. In the initial coding phase, the research team identified a wide range of codes reflecting the participants' experiences and perceptions. These initial codes included terms like "only one," "first one," "isolation," "questioning," "doubt," "impostor," "support networks," and "resilience." Each code represented a specific aspect of the participants' narratives, highlighting their personal and academic journeys within the CSE doctoral programs.

After individual coding, the team discussed emerging themes and agreed on specific themes and relationships. Through an iterative process of comparing and contrasting codes, the team identified several emerging themes. For instance, codes related to "only one," "first one," and "isolation" were integrated into a broader theme of "onlyness," capturing the unique experience of being the sole or one of the few Black women in their programs. Similarly, codes like "impostor syndrome" and "resilience" coalesced into themes that articulated the participants' internal struggles and coping mechanisms. The process of agreeing on specific themes involved in-depth discussions among the research team members. Each researcher shared their interpretation of the data, supported by excerpts from the interviews. Disagreements were addressed through a democratic process of voting or by revisiting the data for further clarification. This collaborative effort ensured that the final themes truly reflected the participants' experiences. Additionally, the relationships between themes, such as how "onlyness" contributes to "impostor syndrome," were mapped out through a collective understanding of the data's narrative structure.

Follow-ups were conducted using member checking, which was a two-step process. After the interview, participants were emailed a survey to share their thoughts, perceptions, and additional comments or questions. For additional member checking, the final themes were shared with participants via email, including a summary of the themes. Participants were encouraged to share their reactions and provide clarity where they felt it was appropriate.

Table 1
Participant Demographic Data for Black Women in Computing or Engineering Doctoral Programs

| Pseudonym | Low income (Pell grant-eligible) | Doctoral GPA | First generation | Stage of doctoral study | Enrollment status | Previous experience |
|-----------|-------------------------------------|--------------|------------------|----------------------------|-------------------|-------------------------------------------------------|
| Cori | No | 3.8 | No | Coursework | Full-time | Degree-related industry or government position |
| Jenna | No | 3.21 | No | Coursework | Full-time | Internship/co-op experience during undergrad position |
| Carmen | Yes | 3 | Yes | Coursework | Full-time | Degree-related industry or government position |
| Tanisha | Yes | 3.95 | Yes | ABD | Full-time | Internship/co-op experience during undergrad position |
| Molly | No | 3.868 | No | DP | Full-time | Internship/co-op experience during undergrad position |
| Nicole | Yes | N/A | Yes | DP | Full-time | Internship/co-op experience during undergrad position |
| Gabrielle | Yes | 3.52 | Yes | Coursework | Full-time | Internship/co-op experience during undergrad position |
| Taylor | Yes | 3.62 | Yes | Comprehensive exam (comps) | Full-time | Degree-related industry or government position |
| Kiara | Yes | N/A | No | Coursework | Full-time | Internship/co-op experience during undergrad position |
| Erica | No | 3.8 | No | DP | Full-time | No |
| Raven | No | 3.85 | No | ABD | Full-time | Internship/co-op experience during undergrad position |
| Brittany | Yes | 3.7 | No | DP | Full-time | Internship/co-op experience during undergrad position |
| Tiffany | No | 3.821 | No | Coursework | Full-time | Internship/co-op experience during undergrad position |
| Lauren | No | 3.5 | No | ABD | Full-time | No |
| Lori | No | 3.9 | No | Coursework | Full-time | No |
| Nia | No | 3.8 | No | ABD | Full-time | No |
| Latasha | No | 3.63 | No | Comps | Full-time | Internship/co-op experience during undergrad position |
| Melanie | No | 3.95 | No | Coursework | Full-time | Degree-related industry or government position |
| Bianca | No | 3.3 | No | Coursework | Full-time | Internship/co-op experience during undergrad position |
| Karen | No | 3.7 | No | Comps | Full-time | No |
| Sara | No | 3.7 | No | ABD | Full-time | Internship/co-op experience during undergrad position |
| Ella | No | 3.6 | No | DP | Full-time | No |
| Angela | Yes | 3.3 | Yes | DP | Full-time | Degree-related industry or government position |
| Madison | Yes | 3.75 | Yes | ABD | Full-time | Internship/co-op experience during undergrad position |
| Elizabeth | Yes | 3.52 | No | DP | Full-time | No |
| Kimberly | No | 4 | No | Coursework | Full-time | Internship/co-op experience during undergrad position |
| Chloe | No | 3.12 | Yes | Coursework | Full-time | Internship/co-op experience during undergrad position |
| Kelly | Yes | 4 | No | Comps | Full-time | Internship/co-op experience during undergrad position |
| Kristen | Yes | 3.2 | No | Coursework | Full-time | Internship/co-op experience during undergrad position |
| Michelle | No | 3.79 | No | DP | Full-time | Degree-related industry or government position |
| Megan | No | 3.5 | Yes | ABD | Full-time | No |
| Kennedy | Yes | 3.9 | No | N/A | Full-time | Internship/co-op experience during undergrad position |

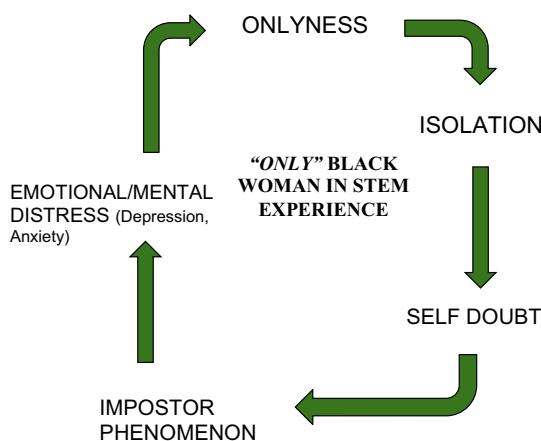
Note. Cells with N/A signify that this information was not available and/or obtained from the participant. GPA = grade-point average; ABD = all but dissertation; DP = dissertation prospectus; co-op = co-operative.

Findings

A key theme identified during the analysis process was the phenomenon of “onlyness,” which is the premise of this article. The term “onlyness,” coined by the authors through an in-depth analysis of the data, emerges from the complex experiences shared by participants, reflecting more than the simple reality of being one of a few Black women in their programs and capturing the multifaceted nature of their experiences of isolation, imposter syndrome, and emotional distress. Nineteen (59.3%) participants reported being the only Black woman or one of the first Black women in their doctoral program or department. The reality that many Black women find themselves as the singular representation of their race and gender in their doctoral programs brings to light a critical oversight: The likelihood that faculty and staff within these academic units have not fully considered, let alone addressed, the specific challenges these students face. This absence of representation not only underscores a gap in the academic culture but also indicates that the unique obstacles encountered by Black women in STEM are likely uncharted territory for many program administrators and educators. Consequently, the pervasive “onlyness” experienced by these women serves as a stark reminder of the need for intentional reflection and action within academic institutions to understand and support the nuanced experiences of underrepresented groups.

Of those who were not the only Black women in their program, every other participant except one reported being hyperaware of how they “stood out” (Golden, 2020) by being one of a few. Being the only one or one of a few often leads to tokenism, or “perverse visibility and a convenient invisibility” (Tierney & Rhoads, 1993, p. 69). The process of being the only one is complex and layered. Findings from the study demonstrated how continued instances of being the only one start a cycle of isolation leading to feelings of impostorism, which is a key factor in experiences of emotional distress such as depression and anxiety among Black women. The following section discusses in depth the experience of onlyness that these women shared, as shown in Figure 1.

Figure 1
The Cycle of Onlyness



Note. See the online article for the color version of this figure.

Onlyness

Black women being the “only ones” in STEM has been evidenced in previous literature. Similarly, most participants reported being the only ones in their respective programs, and for some, even in their respective colleges. For instance, one participant, Karen, shared the “normalcy” of being the only one. Karen explained

I guess that was kind of normal for me not being around people who look like me. I don’t think I really noticed it as a huge factor until I got into the Ph.D. program. ... I guess it became really prevalent when I walked into my first day of orientation and [an]other graduate student comes up to me like, “There’s another one!” And I immediately knew that she was talking about, like, another black female engineer and I was like, “Oh, interesting. I wonder what I’ve walked into.”

Corroborating with the previous participant, Lauren said, “I was not only one of the few in my department, which most would expect for computer science, but also one of the few in my university.” Being the only one was something she expected in her department, but being one of a few at the university increased her sense of onlyness. Lauren also shared that she became more aware of her onlyness as she grew up. The experience of “onlyness” among Black women in STEM disciplines is not just a statistical observation but a lived reality that shapes the participants’ academic and professional journeys. This concept echoes previous literature examining Black women’s underrepresentation and unique challenges in these fields. This heightened awareness contributes to feeling hypervisible, where they become acutely aware of their uniqueness in a setting, creating added layers of scrutiny, pressure, and sometimes isolation. The profound isolation and hypervisibility can exacerbate mental health issues like anxiety, depression, and trauma for Black women pursuing these doctoral degrees.

Isolation

The feeling of isolation while navigating through predominantly White environments was a consistent sentiment expressed by participants. Angela touched on the dual challenge of being both Black and a woman in such spaces. For instance, Angela shared,

It means you’re going to be almost one of the only ones. Get used to being around men, especially White men. What does it mean to be a Black woman in material science? It means you must be tough because people are misogynistic and aren’t understanding.

Angela addressed the challenge of being the only Black woman and discussed dealing with misogyny and feeling ununderstood. Ellis (2001) found that Black women were the most isolated and dissatisfied, and that concern seems to persist.

Erica also articulated isolation by saying, “So I already felt isolated my first year, but putting that with doing research, I felt even more isolated.” So, I searched for different groups where I could participate because I was like, “I can’t live like this for the rest of the duration here.” Similarly, Sara stated, “Just the whole process of being in a Ph.D. program, you know, you experienced it to be something that you thought would be lonely.” Finally, Brittany shared, “it is isolating when you’re the only one in your class.” These participants are battling not just the challenges of being Black and one of the “only” Black women in predominantly White spaces but also the inherent isolation that comes with the demanding nature

of their academic paths. This dual challenge undeniably has repercussions on their emotional well-being.

Black women in CSE face additional challenges, including the stress of representation, where they might feel pressured to represent their entire community, and the dual challenge of facing racial and gender biases. When feelings of isolation compound these academic and personal challenges, it creates an environment where their emotional and physical well-being can be severely compromised.

Self-Doubt

For many participants, the layered and multifaceted experience of being the only one—often the sole Black woman—in their academic environments significantly influenced their feelings of self-doubt. These feelings often manifested in debilitating questions such as “was my acceptance in this Ph.D. a mistake?” or “Do I belong here?” The keen awareness of their “otherness” made participants feel tokenized, amplifying their self-doubt. Kimberly shared: And I was like the only one from my school at those internships. ... So I think like even once I got it, I kinda get that feeling of why did I get in? Or those questions. Doubt always filled in. And I struggle with that kind of doubt whenever I start something new. So I remember when, I got there and looked around and I was like, “Okay, there’s not many of us.” Kimberly began questioning herself and shared that doubt began to filter in, particularly when starting something new. Similarly, Erica’s experience speaks to self-doubt and othering:

It’s definitely been a rocky year, a rocky four years of my life. I’ve had the best times and the absolute worst times, I guess I’ll go back. ... When you go to recruitment weekend, you’re supposed to meet different people, meet the faculty, and see if you’re a good fit for the school. And I’ve probably gone ... most of the recruitment weekends that I went on, of course, I was the only Black woman there or even Black person in general, and so I was isolated a lot. Sometimes I felt like the token Black girl or token Black person, so it was really hard to try to connect with people and really try to see if I fit in.

The concept of “onlyness,” as articulated by the participants, delves deep into the realm of identity, belonging, and self-perception. When individuals are constantly the “only one” of their kind in a space, it subtly yet persistently communicates a narrative of exclusion and deviation from the norm. Such consistent othering does not just impact an individual’s sense of belonging but also influences their self-efficacy. As individuals grapple with the complexities of identity in homogeneous spaces, their internal dialogue includes self-doubt. Constantly questioning one’s place and value in these academic settings reflects larger societal constructs that marginalize identities. Analyzing “onlyness” from this lens, it becomes evident that Black women’s emotional and psychological challenges in CSE are not just personal hurdles but are symptomatic of deeply ingrained systemic issues that necessitate comprehensive scrutiny and reform.

Impostor Phenomenon

Impostor phenomenon, or impostor syndrome, is a feeling of fraudulence experienced by high-achieving individuals who cannot own their success (Clance & Imes, 1978) and is interconnected to self-doubt described above. A general sense of self-doubt can fuel impostor phenomenon, making individuals more likely to attribute

their achievements to external factors rather than their own capabilities. Symptoms of anxiety and depression often overshadow this feeling of impostorism. For Black people and especially Black women, the experience of the impostor phenomenon can be connected to being the “only one” and experiencing isolation and loneliness as a result (Cokley et al., 2013; Joshi & Mangette, 2018). In the study at hand, most of the participants reported feeling like an impostor. This study indicates that Black women link their impostor feelings to their “onlyness” and the ensuing isolation and loneliness. Crystal underscored this phenomenon and said:

I don’t believe in my potential enough. So, I think it’s a confidence thing, which is sad. ... I should feel way more confident in my abilities than what I do. But I think that definitely [the self-doubt]. I don’t think it helped my success at all. I think that’s the biggest thing, it’s just doubt. Just doubtful. I think that’s what I struggled with on a weekly ... daily basis.

Crystal narrative exemplifies the classic manifestations of impostor syndrome, where despite her evident achievements that she shared earlier in the interview, a profound doubt lingers about her competence. This is more than a lack of confidence, but it also illustrates that her success does not seem to enhance her internal validation.

Next, Taylor’s narrative resonates with the pressures of perfectionism often accompanying impostor syndrome:

I feel like there’s definitely no room to slip up. Being in this environment can be intense at times and I think that I’ve definitely dealt with imposter syndrome. Like it’s still something that I deal with from time to time. Definitely just always feeling like I need to have everything together. I need to be prepared. Definitely, is a touch of perfectionism in there, even though it’s not realistic. I think probably more than anything, I probably just always feel like I have to be prepared.

Taylor dealt with imposter syndrome by using perfectionism or trying not to make mistakes. Her strategy of leaning into perfectionism to combat impostor syndrome inadvertently reinforces her feelings of inadequacy because perfection is unattainable. This approach, while intended to mitigate the fear of being exposed as an “impostor,” strengthens it by establishing a standard that is inherently unreachable. The impossibility of achieving perfection thus becomes a self-fulfilling prophecy, where each perceived shortcoming not only validates her impostor syndrome but also deepens her sense of not belonging in the academic sphere.

Impostor syndrome is a profound psychological experience (Clance & Imes, 1978), and in this study, participants articulated a profound resonance with this phenomenon. This sensation of feeling like an impostor was deeply tied to their sense of “onlyness.” Kimberly’s remarks shed light on the initial shock of self-doubt in the previous section, revealing its roots in the visible lack of diversity. Crystal and Taylor show us the link between self-doubt and impostor syndrome. Taylor’s account underscored the immense pressure to perform perfectly, intensified by underlying self-doubt and the unattainable goal of being perfect. The consistent presence of impostor syndrome among the participants illustrates the personal battles these women face and draws attention to the larger, systemic issues at play in academic and professional environments that amplify these feelings.

Emotional/Mental Distress

Participants reported high stress and anxiety as they worked through their graduate programs and addressed the barriers of being

the only ones. The journey through graduate programs is strenuous. When compounded by the challenges of being “the only one,” many participants reported profound emotional distress, describing feelings of being overwhelmed and exhausted and grappling with anxiety, depression, and feelings of hopelessness. Kimberly stated:

I think my biggest challenge was really dealing with myself. Halfway through my first semester or halfway through the fall semester. I had like a complete breakdown. I just felt like. . . I don’t know, I think I had kept everything kind of built up to that point. And I remember I was in my apartment I was just crying; I was crying forever and it was just like I felt helpless and I felt like I was not supposed to be here.

Kimberly, who often spoke of her self-doubt and feelings of onlyness, recognized how this impacted her emotional well-being and identified a feeling of hopelessness.

While Kimberly discussed her own emotional stress, Gabrielle noticed that a lot of her friends and classmates seemed to be dealing with depression.

Depression at the graduate level is a real thing. I don’t have it and I have never really gone through it, but just watching other people go through it. Most of the African American graduate students at [participant’s university] have gone through a depression of some form or another during their experience here at [participant’s university].

Gabrielle knew that depression was an issue in her program. Megan, echoing the sentiment of exhaustion and frustration, contemplated the value of continuing in such taxing environments. She said,

I feel that a lot of the stressors were coming from my doctoral program. I’m working hard to work through it, but I just got to a point where I was thinking, “It’s just not worth it.” It’s not worth [the effort] always completing something.

Navigating CSE doctoral programs as a Black woman comes with a heightened emotional and psychological burden. The study reveals a manifestation of this strain as participants recounted their struggles. The experiences, characterized by overwhelming stress, exhaustion, anxiety, and bouts of depression, are intricately linked to their isolation and self-doubt. Being the only one in CSE programs and the challenges that Black women face due to their onlyness impact their emotional and mental well-being since isolation is linked to depression and poor cognitive functioning (Cacioppo & Hawkley, 2009). Black women in CSE doctoral programs are significantly underrepresented, and harmful implications can be at the cost of their mental health. Despite these challenges, these women persist and appear in spaces not “made for them.” The following section discusses the motivators and coping strategies for these women to continue their doctoral journeys and join the STEM workforce.

Discussion

The above findings highlight the shared experiences of Black women in CSE doctoral programs. It is important to note that the hierarchical positionality of these women in predominantly White and male programs greatly shapes their experiences of onlyness. For instance, Lori shared an experience where one of her professors did not call her name during roll call and made blatant statements such as “I know you are here . . . [because she is Black],” and at the same time, another professor demanded proof that she is a student in engineering because he does not believe her. These experiences

highlight how a Black woman’s positionality, specifically in the STEM fields of CSE, is determined by stereotypes and stereotype threats. Lori’s experience also exemplifies the constant invisibility/hypervisibility (discussed previously) that is fueled by being the “only ones” and contributes significantly to the emotional and mental distress Black women face in the STEM fields of CSE. It also affirms what Hooks and Crenshaw pointed out about White people’s inherent attitudes of othering and viewing only themselves as people.

The Phenomenon of “Onlyness”

The notion of “onlyness” is an omnipresent experience for Black women in CSE doctoral programs, a trend supported by literature and our findings. This phenomenon is a complex lived reality that creates various barriers for Black women persisting through CSE doctoral programs (Artis et al., 2018; Spencer et al., 2022). It is a nexus of multiple emotional and psychological burdens, including isolation, self-doubt, impostor syndrome, and emotional/mental distress. Additionally, due to its cyclical nature (see Figure 1), the phenomenon of “onlyness” often gets negated and is not accounted for when exploring strategies to support Black women in STEM fields of CSE. For example, literary evidence points toward intentional recruitment of Black women in STEM doctoral programs and workforces as a strategy. However, little consideration is given to the resources and support systems that would result in successful retention of these women, setting them up for facing “onlyness” once again. Hence, the concept of “onlyness” warrants critical reflection, as it mirrors systemic issues of ignorance, exclusion, and underrepresentation, which have long-lasting impacts on Black women’s academic and professional experiences.

The Complexity of Isolation

Our study also found that feelings of isolation were exacerbated by the additional burden of being Black and women in predominantly White and male-dominated fields. The findings echo Ellis’s (2001) research on Black women feeling isolated and dissatisfied, highlighting the need to confront such hostile academic environments. Participants often sought out communities and support groups to alleviate this isolation, underlining the importance of such support systems in these spaces.

Additionally, it is important to note that, apart from navigating societal challenges and systemic oppression of racism and micro-aggressions/macroaggressions, participants also struggled with their perceptions of themselves. Another major challenge, regarding their experience of “onlyness,” is the need to prove themselves and foster a sense of belonging, often due to the impact of isolation. Certain provisions must be made and taken into account to ensure the emotional and mental well-being of Black women in STEM doctoral programs of CSE. Moreover, it is also important to take into account that, as a result of “onlyness,” Black women in STEM fields of CSE are unable to fully attain a sense of accomplishment due to the double-edged sword effect of trailblazing and tokenism. Therefore, it is critical to ensure support systems are put in place that reduce the burden of representation in such programs prior to recruiting these women.

Emotional Impact: More Than Just “Stress”

While stress is a given in any doctoral program, our findings indicate a far more layered emotional experience for Black women in CSE programs. This emotional turmoil is deeply tied to “onlyness” and the subsequent impostor syndrome and self-doubt, contributing to significant mental health risks. While stress, in its most general sense, is expected in any rigorous educational journey, our findings point to a multilayered, complex emotional terrain navigated by Black women. This complex emotional experience is intimately tied to the phenomenon of “onlyness,” the accompanying sense of isolation, the resulting impostor syndrome, and perpetual self-doubt. Together, these elements coalesce to pose significant risks to mental health, including but not limited to anxiety and depression.

For Black women in these programs, stress is not an isolated experience but is deeply interconnected with other emotional burdens. For instance, the “onlyness” that many of the participants described manifests not just as academic or social isolation but evolves into emotional isolation. This emotional isolation can breed feelings of loneliness, further exacerbating mental health conditions. Additionally, the participants spoke of a “perverse visibility,” which often led to a heightened sense of awareness and anxiety about their actions, academic performance, and interpersonal relationships. This heightened anxiety is not a simple derivative of academic workload or expectations but a byproduct of being conspicuously different. In such an environment, even mundane tasks or routine academic activities become significant emotional undertakings, charged with the tension of representing not just oneself but an entire community.

Similarly, impostor syndrome, as revealed by the study, is not an isolated phenomenon but a result of the pervasive “onlyness” and the subsequent feelings of isolation. This syndrome contributes to a vicious cycle where self-doubt feeds impostor feelings, and those feelings, in turn, further fuel self-doubt. The participants shared how impostor syndrome often led them to question their abilities, worthiness, and even their presence in these programs, which can cause considerable emotional distress over time. While it is crucial to identify anxiety and depression as significant risks, the emotional impact manifests in nuanced ways that often do not fit neatly into clinical categories. Feelings of hopelessness, persistent sadness, and emotional exhaustion also emerged as commonly experienced emotional states among participants. In sum, the emotional toll of being a Black woman in a CSE doctoral program cannot be reduced merely to stress. It is a multifaceted, deeply ingrained emotional burden tied to these women’s unique challenges. This emotional toll is not just an individual experience but a systemic issue that requires more than individual resilience; it calls for systemic change.

Persistence Despite Challenges and Resilience

Amid the immense challenges of “onlyness,” isolation, self-doubt, and emotional distress, the stories of the women in this study underscore the remarkable resilience of Black women in pursuing their doctoral degrees. As McGee and Bentley (2017) found, high-achieving Black women demonstrate success in STEM education despite systemic barriers designed to exclude them. Their persistence is grounded in their motivation to give back to their communities and act as role models for other Black girls and women (Ireland et al., 2018). Though emotional burdens take a toll, Black women draw on sources of social support, spiritual coping, and prior experiences

navigating oppression to sustain them (Haynes et al., 2020). The participants’ abilities to thrive while facing marginalization speak to Black women’s collective strength and endurance in pushing back against exclusionary STEM cultures. Their experiences compel institutions to enact systemic reforms rather than placing the impetus to overcome barriers solely on these women.

Recommendations

While recommendations can be made to address the impact of onlyness, the most glaring recommendation is to increase the recruitment of Black women in CSE doctoral programs. These women’s stories about being the only one and having to “tough it out” shed light on the need to actively increase enrollment of Black women in CSE graduate programs because having a “critical mass” reduces feelings of isolation (Estrada et al., 2018). To do this, institutions should intensify efforts to recruit a more diverse student body and faculty. Drawing on the insights from this study and existing literature, CSE programs must address the systemic barriers inhibiting the recruitment of Black women into CSE doctoral programs. Additionally, Harper and Simmons (2019) suggested hiring more recruiters of color and expanding the geographical scope of recruitment drives to include communities traditionally overlooked.

Improving the Climate and Systemic Barriers

The authors recognize that increasing recruitment is not enough to support these women and mitigate all the impacts of onlyness, such as mental health challenges, self-doubt, and the imposter phenomenon. Thus, institutions can make specific changes to address Black women doctoral students’ unique needs in CSE programs, which will have a cyclical impact on recruitment:

- Provide networking and mentoring programs specifically for Black women. These programs help provide community and support (Shavers et al., 2022). Building connections with those who share similar experiences provides a sense of belonging and validation, helping to combat the isolation of onlyness.
- Offer identity-consciousness training for faculty and students to raise awareness of racial and gender biases and create inclusive cultures (Ireland et al., 2018). Increasing cultural awareness can help faculty and peers understand the additional stresses and self-doubt Black women face due to marginalization.
- Have transparent guidelines for addressing racism, discrimination, and microaggressions. Black women must feel institutions take their concerns seriously (McGee, 2020). Clear reporting guidelines help ensure Black women’s negative experiences are acknowledged, minimizing emotional distress.
- Provide mental health services, like counseling groups tailored for Black women, to acknowledge and support their specific needs (M. Shavers & Moore, 2019). Targeted services address the disproportionate anxiety, depression, and trauma worsened by onlyness and isolation.

- Encourage self-care practices and balance (Joshi & Mangette, 2018). The rigor of CSE doctoral programs compounds existing pressures Black women face, and promoting wellness helps ease emotional burdens like imposter phenomenon and persistent self-doubt.

Supporting Black women in CSE doctoral programs requires varied institutional changes to address systemic barriers, provide resources, and transform program cultures. Tailored initiatives that validate Black women's experiences and needs can mitigate negative impacts of onlyness like isolation, self-doubt, and emotional distress.

To empower Black graduate women who may be the only one in their programs, a range of strategies and resources are essential:

- Build healthy connections with family and friends to provide a robust foundation for overall well-being and counteract isolation (Ellis, 2001). Surrounding oneself with a strong support system can help mitigate the profound sense of isolation caused by onlyness.
- Create bonds with fellow students within their degree programs and other programs to expand social circles, promote collaborative learning, and find community (M. Shavers & Moore, 2019). Building relationships with peers provides a crucial sense of belonging and shared experience that counters the exclusion of onlyness.
- Identify and establish relationships with supportive campus administrators, faculty, and staff to foster a network of advocates and mentors to provide guidance and belonging (Dortch & Patel, 2017). Mentors and campus allies help ensure Black women's needs are heard and met, disrupting institutional dynamics that perpetuate onlyness.
- Pursue meaningful and intentional mentorship and advising relationships to meet your academic, professional, or personal needs. These mentors and advisors may be outside of the student's program and institution (Barker, 2016; M. Shavers & Moore, 2019). Advisory relationships beyond one's immediate context can provide the unique support needed to overcome challenges related to onlyness.
- Maintain ongoing communication with advisors to share successes, progress, challenges, or concerns related to feelings of self-doubt or imposter phenomenon (Parkman, 2016). Voicing doubts and getting validation from advisors helps mitigate the imposter phenomenon worsened by onlyness.
- Practice self-care routines, nurture spirituality, and develop effective stress-management techniques that contribute to holistic well-being and resilience (Collins, 2000). Intentional self-care combats the disproportionate emotional labor and distress experienced by Black women facing systemic exclusion.

The strategies outlined aim to provide Black women facing "onlyness" with critical connections and coping mechanisms to find community, get validation, and practice self-care. Building a multifaceted support system is key to empowering Black doctoral students in CSE to mitigate isolation, imposter phenomenon, and emotional distress caused by marginalization.

Limitations and Future Research

This study offers a comprehensive look at the unique experiences of Black women in CSE doctoral programs, particularly exploring the concept of "onlyness." While the data collected provides rich, detailed accounts, the reader should exercise caution in generalizing these findings. The authors acknowledge the importance of knowing which experiences we center and which we may unintentionally omit (McCloud & West, 2023). Although our study centers on the experiences of Black women, it does not fully explore the influence of other intersecting identities, such as sexual orientation, disability, or nationality, that could add further layers of complexity to these experiences. This limitation arises partly because the study was not initially designed to examine the concept of "onlyness" but evolved to focus on it. Expanding the scope to include these intersecting identities would be beneficial for future research. This would fill the identified gaps and provide a more complex and nuanced understanding of Black women's systemic barriers and emotional challenges in academia.

Additionally, longitudinal research would offer valuable insights into how these experiences and feelings of isolation evolve over time, identifying critical intervention points. Additionally, due to the emotional and mental distress identified in this study, it is important to explore the mental and emotional impact of "onlyness." Also, delving into the resilience strategies and coping mechanisms these women employ could also provide guidance for creating more effective support networks, ultimately contributing to a more inclusive and supportive academic environment for Black women in CSE.

Conclusion

In closing, this study provides an invaluable contribution to existing literature by examining Black women's emotional and systemic challenges in CSE doctoral programs. Going beyond the broad notion of "stress," our findings illuminate the specific burdens of "onlyness," imposter syndrome, and emotional turmoil, thereby revealing the multifaceted nature of these women's barriers. While most studies focus on external systemic hurdles, this research turns the lens inward to explore the emotional toll and its interplay with systemic issues. Our recommendations provide concrete, actionable steps for institutions to increase Black women's recruitment and holistically support their unique needs. While increasing numbers is important, transforming institutional climates and systemic practices is critical. This study is a clarion call for a more inclusive, supportive, and conscious academic landscape for Black women, emphasizing a commitment to diversity, equity, and inclusion.

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