

Intersectional perspectives: Interpersonal contributors to moments of doubt for graduate women of color in STEM

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1. Introduction

The status of women of color in science, technology, engineering, and mathematics (STEM) fields was first addressed by Malcom and colleagues in the 1978 publication - *The Double Bind: The Problem of Being a Minority Women in Science*. Here, these researchers coined the term “double bind” to refer to the unique challenges faced by women of color as they simultaneously navigate sexism and racism in STEM fields (Ong et al., 2011). Nearly 40 years later, women of color remain relatively invisible across all levels of education. In fact, Black, Latina/x, and Indigenous women represented only 5.34%, 5.24%, and 0.01% of the total doctorate recipients in the physical sciences, engineering, and mathematics, respectively (National Science Foundation: NSF, 2017). The continued underrepresentation of women of color in STEM demonstrates the exceedingly slow progress of efforts designed to broaden participation in STEM. In 2012 alone, more than \$911 million dollars were awarded to address the visible disparity in STEM fields (Committee on Equal Opportunities in Science and Engineering: CEOSE, 2014). However, many of these efforts failed to take an intersectional approach and instead focused solely on single-axis groups (e.g., women, underrepresented minorities, and individuals with disabilities). Consequently, individuals who reside at the margins of both race and gender – women of color – remained invisible in these multi-million-dollar endeavors.

Critical Race theorists have frequently noted that women of color are raced and gendered differently compared to their male and white female counterparts. In traditionally White and male dominated STEM spaces, women of color must contend with a myriad of race- and gender-

based interpersonal interactions that at best, increase students' self-doubt and at worst, contribute to students choosing to discontinue their STEM doctorates. Failure to incorporate an intersectional approach to broadening STEM participation will render the nuanced experiences of women of color invisible and in turn promote the detrimental thinking that one size fits all. Scholars such as Kimberlé Crenshaw (1991) and Patricia Hill Collins (2000) have urged researchers to examine new categories of analysis that are inclusive of interlocking structures of oppression. Consequently, the present study employed an intersectional approach to investigating the daily interpersonal encounters that influence women of color's (i.e., African American, Latinx, and Native American) decision to discontinue her pursuit of a STEM doctorate.

1.1 Intersectionality Framework

The current study is grounded in the theoretical framework of Intersectionality (Collins, 2000; Crenshaw, 1991). Central to this approach is the nuanced way in which people's lived experiences are shaped by a multiplicity of interdependent social categories and identity markers (Cole, 2009). For example, the structures of race, class, and gender "create disadvantages for women of color" but also "provide unacknowledged benefits for those who are at the top of these hierarchies" (Zinn & Dill, 1996, p. 327). More recently, Purdie-Vaughns and Eibach (2008) coined intersectional invisibility and defined it as "the general failure to fully recognize people with intersecting identities as members of their constituent groups" (p. 381). Consequently, individuals residing at the margins of subordinate groups (e.g., women of color) will likely endure misrepresentation, marginalization, and disempowerment. Several researchers have highlighted the salience of intersectionality in understanding the development and persistence of women of color in STEM (Carlone & Johnson, 2007; Settles et al., 2006; Wilkins-Yel, Hyman, & Zounlome, 2018).

1.2 Chilly STEM Climate

Consistent with Malcom's (1978) double bind, researchers have attributed the low enrollment and decreased persistence among women of color to toxic interpersonal interactions levied in many STEM milieus. For example, graduate women of color in STEM cited a plethora of gendered and racialized micro- and macro-aggressive encounters (Wilkins-Yel, Hyman, & Zounlome, 2018). These experiences can fuel feelings of isolation and lack of belonging, as well as self-doubt, and potentially lead to the discontinuation of one's doctoral program (Carlone & Johnson, 2007; Ko, Kachchaf, Hodari, & Ong, 2014). The decision to discontinue one's graduate program is likely caused by an amalgamation of smaller negative events occurring over time versus a single one-time event. However, no study to date has examined the interpersonal experiences that contribute to such decision-making. Consequently, an examination of the daily interpersonal experiences that erodes persistence intentions is warranted. Women of color in STEM continue to be identified as an untapped source of domestic talent for STEM fields (Ong, 2010). So, it is imperative to investigate the influential factors that can thwart persistence among doctoral women of color in STEM.

Method

1.3 Participants

Data were collected from three focus groups comprised of a total of 11 graduate women of color pursuing their doctorates in the Physical Sciences, Mathematics, and Engineering (e.g., chemistry, biomedical engineering, environmental engineering, industrial engineering, etc). Their ages ranged from 24 to 40 ($M = 28.06$). The ethnic breakdown of the sample included American Black/African American ($N = 3$) and Hispanic ($N = 8$). Study participants attended institutions that were primarily located in the Midwest and on the West-coast. A total of nine

participants identified as U.S. citizens, and two identified as international students. See Table 1 for a breakdown of participants' characteristics.

<INSERT TABLE 1 HERE>

1.4 Procedures & Data Analysis

Participants were recruited from STEM doctoral programs nationwide. Specifically, recruitment letters containing the link to the demographic survey were sent to department administrators who were then asked to forward it to their students. Interested participants provided consent for their participation in the study, completed the brief demographic survey, and indicated their availability for a 90-minute focus group. Participants who shared similar availabilities and social identities were scheduled in a focus group together. Semi-structured focus group interviews were conducted by a member of the research team using Zoom video-conferencing platform. Interviews were transcribed verbatim and transcriptions were checked to ensure accuracy. Pseudonyms were used to protect participants' confidentiality.

Constant-comparative (Corbin & Strauss, 2008; Glaser, 1965), open coding process on meaning units or "chunks" of data was used to code the interview data. This well-researched method of analysis facilitated continued examination of the data until it was clear that no new themes existed (Fram, 2013). Researchers independently coded the focus group interviews then came together to collaboratively decide on the final codes and themes.

2. Results

The daily interpersonal encounters that stymie STEM persistence intentions among doctoral women of color were organized into five broad themes. These included: delegitimization of credibility, isolation and lack of STEM belonging, pressures to adhere to cultural norms, tokenized as the face of diversity, and differential treatment based on gender and racial identities.

In the following paragraphs we define these themes and provide illustrative quotes to describe the phenomenon.

Delegitimization of credibility. Participants in all three focus groups described frequent experiences where their skills and expertise were discounted or dismissed. Liz shared that in her first year in Environmental Science, a White male colleague constantly assumed that she had little to no knowledge of a subject matter:

His background is very rich in chemistry and he would automatically assume that I did not have that...So it was a lot of him giving me, little remarks, telling me, "Oh, if you knew about chemistry, you would understand this such and such thing." But the problem itself was about physics, it wasn't actually a chemical reaction.

Similarly, Dionne shared that her perspective was often dismissed in group interactions: "I've noticed back in my day to day interactions if I'm in a group and they ask a question and I start to respond, my response isn't necessarily taken as seriously as the others even though I have proven myself in other areas." Erica also described being blatantly ignored when she spoke to a White male colleague. She internalized this experience and described questioning her own competence:

It still did make me feel as though he's ignoring me either because he feels like I'm incompetent, or he feels like I'm not worthy of his time. But it really gave me some insecurities... is it because I'm dumb? Am I dumb? Am I incompetent? It did make me question myself and wonder, "Is it my race, or is it because I'm just dumb?"

Participants' skills and expertise were also questioned because of their gender and gender expression. Beth described an encounter where a colleague expressed surprise after witnessing her knowledge and skill set:

I like girly stuff. I like make-up. I like wearing flowery shirts...recently we had a visiting scholar who was a professor from a different country and a different University and I was wearing a skirt that day and I had my hair all done. I was in charge of orienting him and showing everything. I just remember the reaction that I got [at the beginning] was, "Oh, you're Brenda?" and then after the tour that I gave him, he's like, "You're *actually* really knowledgeable, you know. You're going to do really good." It's very condescending and many people again don't realize that they are doing that.

Contrary to discounting their credibility, participants noted that there were instances where their colleagues acknowledged their successes. However, these accomplishments were attributed to participants' race and/or gender instead of their capabilities. Liz described two separate experiences where her successes were attributed to her social identities:

I've had interactions with my past advisor [since] undergrad. he said remarks [like], "Oh, no wonder you got into the graduate program because you're a woman of color in the science, and of course you got in." But I was like, "I worked under you. You saw my work. I'm actually competent enough to be here."

Liz also encountered a similar interaction with a White male colleague:

He would make little remarks since he sat next to me. If I was applying for a grant, he would say, "oh with your background of course you're going to get it." And it bothered me because in one setting, he would say, "you don't know that much." And in another setting, he would say, "oh yeah, you're going to get it."

As women holding multiple marginalized identities, participants noted using cognitive energy to determine whether these encounters were due to their race and/or gender. Liz acknowledged the difficulty in separating the two because she held both identities:

Is it because I'm a woman? is it because I'm a woman of color? Is it because he thinks I'm incompetent? It's kind of hard to delineate those things because you're all of those things. Hopefully not, you know, incompetent, but you're all of these things in one package, and it's kind of hard to say, "it's because of this." Because you can't really take one thing away, you know.

Excluded and Isolated. Participants described multiple interactions with peers and professors that left them feeling outcasted and disconnected from their program and lab environments. For example, Claire worked in her advisor's lab as an advanced undergraduate student and subsequently decided to continue in the lab after being accepted into the doctoral program. However, she described feeling excluded by a group of female colleagues upon starting the doctoral program:

My decision to come here happened right around the time [that] my relationships with my lab mates went a little sour. So, I second-guessed myself, should I go if I'm not going to be in that circle anymore? ...throughout my time in my first year, I had to deal with that. The group tends to be very clique-y, which makes it good for the people in the clique, but the people outside of the clique can suffer from it... [It was] hard because I share an office, I share a lab, I share everything with them.

Similarly, Jessica described feeling a part of the out-group as it pertained to her relationship with her advisor:

It's a very small lab, and so it's kind of a unique situation because my advisor is really young. He's in his early 30s. and when he started the lab, it was about 8 years ago. And he started a lab with one graduate student. It was a man. I think because of the age, they became very friendly during that startup process. So, when I came into the lab a year

later, the environment changed a little bit. What I've noticed over the years, though, is that they have very much kept a very close relationship. They might go to football games together. Oftentimes those sports conversations are brought into the lab space, where I don't participate because I don't enjoy the sports conversation. But I think it is a little weird for me [particularly] in a professional environment.

Given the toll of these exclusionary experiences, it can feel incredible to have a strong connection with someone in the lab or department. Erica described her refreshing surprise when she finally found such a connection, "I didn't realize how much I yearned for that until an opportunity presented itself. And now I'm just a lot saner this year, because I always have someone I can talk to." It follows then that losing such a friendship could have significant ramifications. Liz shared that a female friend had recently decided to leave the doctoral program with her masters. She stated that her friend's impending departure has been difficult and has "given [her] anxiety." She noted that their strong bond resulted from being "the only people in our families who not only have gone to college, but also graduate school." Liz shared her hopes for more diversity because she wants to connect with someone from a similar background to hers.

Pressures to adhere to cultural norms. Given the strong familial values prominent in Latin cultures, Latinx participants in the three focus groups described frequent interactions where they were being pressured to adhere to complex cultural norms and traditions. These encounters left participants questioning their decisions to pursue their doctorate in STEM. Jessica described feeling pressured by her mom to have children:

I am also married, but I get a lot of pressure from my mom. She's always like, "When are you going to start having kids?" I'm twenty-four and I'm like, "Umm, like five years." But

ever since I got married in undergrad, she's like, "When are you going to start having kids?"

Isabel shared similar pressures from her peers:

They don't ask how you're doing, like 'How is your PhD going? When are you going to be done?' No. It's like, "Oh, okay. You're here. Are you planning to have kids? They're the ones asking where my relationship situation is, [what] I'm planning moving forward. If I'm planning to have kids, because that's what they care more than if I'm happy.

Several participants also described the "Why do you need to do this?" phenomenon where they are bombarded with comments that question their decision to pursue their doctorate. Jessica shared:

Yeah, the whole idea of, "Why do you need to do this?"... my family, my mom's like, "People who graduate from Cal Tech make a lot of money, so why don't you just do that and live with [your husband]?" and I'm like, "That's not what I want to do,". It's like you graduated from college, why do you need to do more?

Erica further described the impact of these and other belittling comments:

I guess, those relationships make me think that I didn't make the best decision...make me think, "Am I a bad person for getting an education?" As it relates to my family, I do have family that's 100% supportive but then I have family where it's like, "oh you college-educated people think that y'all know everything."

Despite these encounters that question participants' decision to further their educational pursuits, participants also highlighted the opposite experience. Specifically, several participants described being exalted for being the first in their family to pursue such advanced education. In this way

they felt pressure to *stay* in their doctoral programs even when they questioned if it was right for them. Erica's familial experience highlighted this conflicting message:

Since I'm the only one in my family who has gone to college and to graduate school, every time I come around, my family is like, "oh, you're gonna be a doctor!"... [So] every single time that I'm at work and I'm considering "is this really what I want to do," I have that in the back of my mind, wait, I'm going to let all these people down? And it feel[s] like that's so much pressure. Every single time someone has to mention, "oh, she's doing this, and she's the best example for my children." You know, for my nieces and nephews. But at the same time, I don't really want that much pressure because if I fail, then I'm failing everyone.

Tokenized as the face of diversity. Several participants described being taxed with additional service requests (e.g., pictures for the program website, video cameos, etc.) because departments and programs want to illustrate the diversity of their student body. Dionne illustrated this phenomenon by saying, "I get to take two boxes- well, three. I'm international, I'm black, and I'm female, and so there is the pressure to be a part of those activities." Jessica shared that "when students come to visit, they want me to go." Dionne went on to describe the toll that these additional experiences have on her productivity:

It sometimes does weigh on [me], "Okay, I have to do this. How am I going to do this? I do have my own work to do, and it is taking time out, but how do I manage that and still be a responsible citizen while also promoting and allowing the wider society to realize that we do belong at the table?" You know, how do you balance that with your main 'I am a student.

Jessica highlighted the great lengths that she takes to overcome tokenism in her professional settings:

If there's one thing that people know about me, it's that I like math a lot, and instead people are looking right past that and not coming to me to talk about math but politics and stuff, and they want to hear their one friend's opinion so that they can tell all their other friends, "I have a friend and they said this," and so I've had to sort of downplay [interest in politics] because people can't see past that. They can't see past me in that role in their lives and seeing me as who I am which is a mathematician to be, a mathematician in training

Differential treatment based on gender & racial identities. As individuals holding both marginalized gender and racial identities, participants cited explicit encounters where they received differential treatment because of their gender or race. Claire described experiencing significant discomfort at her discipline-specific conferences:

Conferences are, I think, the places where I feel the most...where my gender and my ethnicity are factors in the way I interact with people. Mainly because most of the conferences I go to are [discipline-specific] conferences, and they're mostly white, older, male-dominated. So, when they see a female studying [this specific area], they wouldn't think of a girl studying this gross topic. So that's where I get a lot of the: "Oh my gosh, you study [specific topic]?" or "Oh my gosh, why are you at this [discipline-specific] conference!?"

Claire further described encounters of sexual harassment at these professional conferences, especially once alcohol is involved.

Stuff will happen at [these] conferences where alcohol is involved. I don't think these male leaders in the industry would go up to another male student and do the same...they wouldn't interact with a male student the way they would interact with us. They feel like because we study [specific topic], that professional and not professional world is already broken... so they feel like they can be more comfortable in saying things that are not very appropriate.

Beth, also cited discomfort while observing sexist encounters in her lab:

In lab settings he'll probably give cool projects and big responsibility to the men in his lab, and then he'll have all of his technicians be women, and there's another situation here that makes me feel really uncomfortable where there's a professor that only accepts generally attractive, young women in his lab, and he treats them sexist.

Samantha, described several racially-charged encounters with a technician in her lab that was really infuriating:

He would say little things, you know? Like little things...one day he came in and he said, "Samantha, I uh.." we were talking about an instrument, and he said, "I saw this thing on 'Black-ish' last night. It kind of startled me for a little bit. I think I responded with, "You know, all black people aren't the same. He would make other comments, you know, he would do little things to get under my skin or provoke a reaction. Like, accusing me of having an attitude, accusing me of...he swore one day that I cursed at him. I don't even curse in front of my own parents, let alone curse in front of someone else. If I disagreed with something that he said, it was a big deal. He was like, oh you're being rude, you're being mean, you're being snappy. He even made the comment to a lab mate that I have a

short temper and the lab mate responded, "I've never seen Samantha get upset over anything."

The accumulation of these racial encounters left Samantha questioning the degree to which she wanted to continue in that specific doctoral program:

I just remember being like...I don't have to deal with this. I'm smart, I could take a Master's, I could go. I don't have to deal with this issue... That was in my second year. And that was a year where you start to see a lot of your friends leave with Master's, and it's...I think it's one of the hardest years.....I remember telling my mom, you know, I'm done. I actually got interviewed for jobs and got offers.

Although Samantha eventually sought assistance from higher administration and stayed in her program, she acknowledged that this experience made her 'second-guess' the program and the university.

Erica, another black woman, shared her fear of being regarded as "an angry black woman" if she asserted her views and noted that this fear hinders her expression at times: I feel like, for me, with standing up, I don't ever want to be that 'angry black woman.'...that's my biggest thing. I need to first learn how to communicate in a way where I don't sound like I'm angry, but I am angry.

3. Discussion & Implications

The present study used an intersectional approach to examine the daily interpersonal encounters that stymie women of color's decision to continue her pursuit of a STEM doctorate. Consistent with intersectional invisibility (Purdie-Vaughns & Eibach, 2008), women of color in the current study encountered a myriad of experiences that were tied to their marginalized identities as both women and people of color. Specifically, five broad interpersonal experiences

were found to influence participants' persistence intentions: delegitimization of credibility, feeling isolated and excluded, pressures to adhere to cultural norms, tokenized as the face of diversity, and differential treatment based on gender and racial identities.

It was evident from these results that the challenging interpersonal encounters cut across peers, both within and outside of the labs/department, professors, advisors, immediate and extended family members, as well as the broader department. Further, these results support our earlier hypothesis that frequent and sustained experience with challenging interpersonal encounters (versus singular events) contribute to students decision to discontinue one's graduate program. The study results also demonstrate the ways in which these interpersonal encounters erode persistence intentions among doctoral women of color in STEM. These results demonstrated that navigating these challenging experiences day after day, caused many to doubt their decision and some to even act on these doubts by participating in job interviews.

Despite the significance, this study is not without its limitations. First, this study only comprised of 11 participants. Therefore, caution should be taken in generalizing these results to a larger audience. This is typically the case with qualitative results. Similarly, the sample consisted of only three African American/Black students. Although Black and Brown folks encounter similar 'isms'. Researchers are discouraged from adopting a once-size-fits-all approach to promoting persistence intentions among women of color in STEM.

These findings support the adoption of an intersectional approach to all efforts designed to broaden STEM participation. As the United States continues to position itself as a world leader in science and engineering, it will be in its best interest – economically, socially, and technologically – to retain and advance the success of all our human resources, an important portion of whom are women of color. It is equally important to promote access to all who chose

to pursue STEM by addressing and eradicating the myriad of interpersonal and environmental barriers that plague these spaces.

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Table 1.

Study participant characteristics

Participant	Academic Program	Year in Program	Ethnicity	Focus Group
Erica	Chemistry	2 nd	Black/African American	1
Liz	Environmental Sciences	2 nd	Hispanic	1
Samantha	Material Sciences and Engineering	4 th	Black/African American	1
Dionne	Statistics	7 th	Black (International)	2
Jessica	Mathematics	1 st	Hispanic	2
Isabel	Industrial Operations Engineering	4 th	Hispanic	2
Beth	Structural and Computational Biology	1 st	Hispanic	2
Fleur	Chemistry	3 rd	Hispanic	3
Claire	Environmental Engineering	1 st	Hispanic	3
Annika	Geological and Earth Sciences	1 st	Hispanic	3
Sil	Biomedical Engineering	5 th	Hispanic (International)	3