

© *Journal of International Students*
Volume 12, Issue 1 (2022), pp. 156-174
ISSN: 2162-3104 (Print), 2166-3750 (Online)
doi: 10.32674/jis.v12i1.3367
ojed.org/jis

The STEM Glass Ceiling: The Influence of Immigration Status on STEM Trajectories of Afro-Caribbean Women (A Narrative Approach)

Sophia Rahming
Florida State University, USA

ABSTRACT

Afro-Caribbean women initially construct their science identity outside of the United States in unique sociocultural contexts where Black is the dominant racial group and British-styled instruction remains intact. Afro-Caribbean women often experience the “triple threat” minoritizing effects of being Black, female, and international/nonimmigrant when they pursue STEM education and careers in the United States. Using grounded theory methods, I gathered the narratives of eight Afro-Caribbean women in STEM education or careers in the United States to examine how citizenship and immigration status influenced their STEM trajectories. Participants described how their educational and career aspirations were either supported or constrained by citizenship. Immigration status, therefore, operated as a figurative glass ceiling for some of the Afro-Caribbean women in this study, limiting degree and career choice.

Keywords: Afro-Caribbean women, barriers, international students, science identity, STEM

INTRODUCTION

The literature on Afro-Caribbean women’s STEM identity development and their experiences at all strata of science, technology, engineering, and mathematics in the United States is limited (Rahming, 2019a). Such a dearth might suggest that

there are no Afro-Caribbean women engaged in branches of STEM, or that there are very few at the levels that would be of interest to investigators interested in science identity construction among Black women. This assumption would be false, and their apparent invisibility may be analogous to other findings about women's presence in STEM fields, especially previous research about African American women in STEM (Rahming, 2019a). We do not know because not many studies have focused on Afro-Caribbean women in STEM (Rahming, 2019a). What novel and unique findings might an investigation into foreign-born Afro-Caribbean women and their STEM identity development reveal and add to the literature on Black women's absence from STEM spaces?

Several research studies have investigated why there are so few women in upper-level management (Fagenson, 1993; Simpson & Holley, 2001). Such studies have been responsible for the introduction of terms like the "sticky floor" (Reskin & Padavic, 1994, 2002; Tesch et al., 1995) and, for Black women, in particular, the "concrete ceiling" (Ogilvie & Jones, 1996). Morrison and Von Glinow's (1990) iconic work, "Women and Minorities in Management," introduced the term "glass ceiling," though the empirical evaluation of the "glass ceiling effect" was and continues to be in contestation. What is generally agreed upon is the idea of barriers and obstacles that are systemic and invisible (Maume, 2004; Morgan, 1998).

Morrison and Von Glinow (1990) offered this definition of the glass ceiling: "a barrier so subtle that it is transparent, yet so strong that it prevents women and minorities from moving up the hierarchy" (p. 200). Since the publication of the researchers' work, the glass ceiling framework has been applied to varied contexts beyond business management, including the fields of social science and education (Di Palma & Topper, 2001; Glazer-Raymo, 1999; Hill, 2004). Research projects have focused on race, gender, and their intersections as subtle and invisible barriers to women, minorities, and minority women, in particular (Hill, 2004; Ogilvie & Jones, 1996; Powell & Butterfield, 1997, 2002).

Many identified factors inhibit Black women's entrance, persistence, retention, and advancement in STEM fields (Ong et al., 2011). These factors include inadequate college preparation in math (Cole & Espinoza, 2008; Ellis et al., 2016; Huang et al., 2000), a chilly academic climate (Hall & Sandler, 1982; Seymour & Hewitt, 1997; Shakeshaft, 1995), lack of funding (Ginther et al., 2011), few undergraduate research opportunities (Crisp et al., 2009), and a shortage of role models (Leggon, 2006)—that is, senior Black scholars and professionals who provide representation and mentorship to junior Black women in STEM education and careers. The myriad obstacles and barriers converge and diverge in an oft-cited "leaky pipeline" analogy (Atkin et al., 2002) sometimes used to explain the absence of a critical mass of Black women in STEM.

One possible variable contributing to the underrepresentation of Black women in STEM that remains to be investigated is the invisible yet limiting influence of immigration status on international Black women's advancement in

STEM. Here, I apply Morrison and Von Glinow's glass ceiling in a contemporaneous investigation of eight Afro-Caribbean women at several STEM education stages and in careers ranging from undergraduate studies to early career professionals in the United States. This project enriches our understanding of how immigration status and STEM's glass ceiling—a transparent barrier of immigration policies, and, in some instances, xenophobia—can both promote and simultaneously constrain STEM aspirations, postsecondary education, and careers for a unique group of Black women.

Afro-Caribbean women pursuing STEM-related education or careers in the United States present a unique subset of international Black women in the STEM community, probing the influence of immigration status and citizenship on STEM trajectories (Rahming, 2019a). Forty percent of all international college students in the United States enroll in STEM programs (National Science Board [NSB], 2018). In 2014, the Caribbean sent the highest proportion of female international students (44%) to study STEM in the United States (U.S. Immigrations and Custom Enforcement [U.S. ICE], n.d.-a), while in 2016, the Caribbean was second to Melanesia (41% and 45%, respectively; U.S. ICE, n.d.-b). Afro-Caribbean women have constructed personal and collective identities crucial to constructing science identity and STEM career development outside of the United States in unique sociocultural contexts where Black is the dominant racial group and British-styled instruction remains intact. Afro-Caribbean women studying STEM or pursuing STEM careers in the United States exist in a unique bifurcation of hypervisibility and invisibility resulting from multiple and intersecting identities, and they experience the “triple threat” minoritizing effects of being Black, female, and international/nonimmigrant (Asher, 2010).

The importance of considering women's intersecting identities in STEM has recently been noted (Grossman & Porche, 2014; Johnson, 2012; Rodriguez et al., 2016). Afro-Caribbean women, however, tend not to be featured in research on STEM diversity and participation. In fact, women are often examined in educational research as a monolithic group, without specific attention to how their experiences in STEM may be further shaped by their immigration status, racial or ethnic identities, socioeconomic class, or other identities. It is increasingly clear that any understanding of women's experiences in STEM must attend to the many dimensions of women's lived experiences and how their experiences are distinct from those of not only men but also other women.

A few studies focus on Caribbean women in U.S. higher education (Edwards-Joseph & Baker, 2014; Hunter-Johnson & Niu, 2019; Rahming, 2019b). However, few exclusively concentrate on these women's experiences in STEM (Rahming, 2019a). To address the lack of literature about Afro-Caribbean women's experiences in STEM, I used grounded theory methodology to gather narrative data about eight women's experiences in STEM educational programs and career fields for a substantially larger research study (Rahming, 2019a). The larger project focused on how Afro-Caribbean women developed a science identity in

U.S. STEM programs. I approached the research question about constructing science identity by examining Anglophone Afro-Caribbean women's STEM experiences before, during, and after their postsecondary STEM programs. I found that well-prepared Afro-Caribbean female students with "troubling languages" (Meyer & Land, 2003, 2005) navigated liminal spaces (Hahamovitch, 2011; Rollock, 2012) as they transformed and adjusted to their identity as both scientist and minority.

What organically surfaced in the larger study was that constructing science identity is an iterative process. Many of the same processes that affected the participants' academic success in early life and contributed to their decision to pursue STEM were also prominent in their postsecondary and career STEM experiences. Women claimed the title "scientist" at various points along the continuum of constructing their science identity. Several described sponsorship or advocacy by meaningful people in and out of STEM who opened doors to academic and professional success. The overall findings resulted in a model for constructing science identity for Afro-Caribbean women (See Figure 1). A major finding within the larger project was the importance of citizenship and immigration status as a glass ceiling for the women in the study. Immigration status was an unexplored factor that either promoted or constrained Afro-Caribbean women's trajectories in STEM. Immigration status operated invisibly, under the radar as it were, prescribing and restricting the international women into particularized STEM fields (Rahming, 2019a).

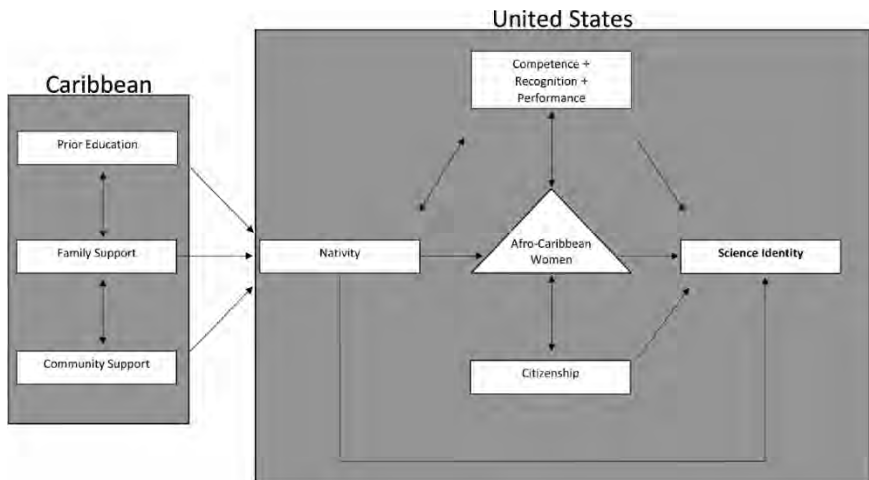


Figure 1: Rahming's (2019a) Grounded Model of Science Identity Construction in Anglophone Afro-Caribbean Women.

Based on results from my larger study, I concluded that citizenship, and therefore immigration status (Rahming, 2019a), was missing from extant science identity construction models (see Carlone & Johnson, 2007) for minoritized women. I proposed that nativity and citizenship were most likely missing from such models because the women of color interviewed in these studies had all lived in the United States for all or most of their lives and possessed U.S. citizenship or permanent residency status. The influence of the push and pull of nativity and immigration status on minority women's personal and science identity construction, and by extension, possible STEM trajectories, would not have been considerations given the contexts, participants, and settings of previous studies. Therefore, I tended to the gaps in STEM research foregrounding immigration status by answering the following research question: How has citizenship or immigration status impacted the STEM trajectories of Afro-Caribbean women in U.S. postsecondary STEM education or careers?

METHOD

Data for this study came from digital recordings of two rounds of interviews of eight Afro-Caribbean women that were conducted as part of the larger study on science identity construction (Table 1; Rahming, 2019a). I conducted 16 individual interviews with eight participants for a total of 64 hrs of interview data. Four interviews were conducted in person, and 12 were conducted via Zoom, an online digital conferencing platform. In Round 1, I listened to stories and illustrative examples and asked clarifying questions in interviews with the research participants (Atkinson, 2007; Crossley, 2000). During this round of interviews, I asked about participants' early introduction to science and math, their social and educational influencers, and the role of race, gender, and ethnicity in their high school science experiences.

Table 1: Participant Demographics

Name	Immigration status	College type	Class standing	Degree/ program	SES	Family structure
Denise	Dual citizenship	Private	Senior	BS, Mechanical Engineering, Minor: Math	Lower middle class	2-parent household; 1 sibling
Gina	Nonimmigrant F-1	Private	Senior/ 1st year masters	Combined BS & MA in Applied Math and Statistics; MA, Financial Math	Middle class	Single-parent household; 2 siblings
Jasmine	Nonimmigrant F-1	Private	Freshman	BA, Computer Engineering	Working class	Single-parent household; 0 siblings

Name	Immigration status	College type	Class standing	Degree/ program	SES	Family structure
Jenny	Nonimmigrant H-1B (change of status in progress)	Private	1-year postgrad	Combined BS, Biomedical Engineering & MS, Chemical Engineering	Working class	2-parent household; 4 siblings
Tanya	Permanent resident	Private	Freshman	BS, Biomedical Engineering, Minor: Biochemistry	Upper middle class/working class	Single-parent household (divorced); 1 half-sibling
Kendra	Nonimmigrant H-1B	Private	1st year postgrad	Combined BS, Biomedical Engineering & MS, Chemical Engineering	Working class	Single-parent household; 0 siblings
Rhonda	Nonimmigrant H-1B	Private	2 years postgrad	BS, Mechanical Engineering	Middle class	Single-parent household; 0 siblings
Sharon	Nonimmigrant F-1	Public	Junior	BS, Mechanical Engineering	Working class	Single-parent household; 1 sibling

Note: SES = socioeconomic status.

In Round 2, I used a protocol of more semistructured questions to elicit participant responses that addressed the research questions and filled in gaps or discontinuities that arose in participant narratives during Round 1 interviews. The interview protocol was composed of 15 semistructured interview questions with latitude built in for additional probing to clarify when ambiguity arose and to extract more detail from interviewees when necessary.

Introductory questions in the protocol encouraged interaction and built rapport (Halcomb et al., 2007). Interview questions invited reflections on race, gender, nationality, minoritization, and relationships with peers, faculty, and their institutions to explore the processes by which participants came to see or failed to see themselves as scientists. Each interview lasted for approximately 1–2 hrs. I recorded responses to interview questions, completed initial transcribing for hand coding, and then ordered professional transcripts for NVivo coding.

During the first round of interviews, I used life story interview techniques (Atkinson, 2007), also called narrative interviews (Crossley, 2000). This investigatory technique allowed me to pose questions that sought depth and detail about the participants' science identity formation rather than collect normative data. I encouraged participants to describe events from their lives in "chapters" that they perceived to be particularly salient to the construction of their scientific identities. Excerpts from the narrative interviews are presented next to support the

proposition that STEM trajectories are delineated by immigration status. Participants are identified by pseudonyms and their reflections are verbatim to preserve the respondents' subaltern voices and the context of their viewpoints. Thus, I have retained what to some might be considered "incorrect" grammar in an effort to protect and respect participants' use of English (Nero, 2014).

RESULTS

Interviews with the eight Afro-Caribbean women in STEM revealed that participants experienced minoritizations related to their race and citizenship. Moreover, interview data significantly demonstrated that citizenship or immigration status operated either as a benefit or constraint on the participants' STEM trajectories, depending on the context. Below, I present excerpts of interviews with study participants that detail how they formulated beliefs about how citizenship influenced their science trajectories. For instance, Rhonda, in the following reflection, revealed how Caribbean nativity and citizenship influenced her early career aspirations at home in the Caribbean:

I knew I didn't want to be a lawyer, and particularly, growing up in the Caribbean, the options that are presented to you are mostly law, teaching, things along that track, right? Granted, I was a teacher at some point, but I knew that long term, I probably wanted to get out of that field for a bit. I knew I didn't want to become a lawyer, and being a doctor wasn't my top interest, so what was left was engineering; that's because that's what we're exposed to back home.

The Afro-Caribbean women in the study either experienced immigration status as a beneficial contributor to their STEM success and foundation of discipline choice, or as the cause for lost STEM opportunities, including constraints on career choice and trajectories.

Members Only: Immigration Status as an Advantage in STEM Trajectories

Immigrants to the United States often compartmentalize positive and negative social experiences in order to achieve success (Ogbu, 1992). The participants in the current study demonstrated similar modes of compartmentalization when they immigrated to the United States and as they matriculated in U.S. STEM programs or advanced in STEM careers. The women in this study felt enormous pride that they were from small countries yet were achieving so much at their academic institutions and in their STEM professions. Participants noted more than once that Caribbeans use fictive kinships (Ebaugh & Curry, 2000; Ho, 1993; Rogers, 2001) when possible to connect, support, and shield themselves from the assaults of race, gender, and nationalism in the United States. Jenny described the way in which citizenship was the bulwark that allowed Caribbean students to succeed:

We were all awarded the top scholarship. Yeah, we came to our institution, and you know Caribbean people tend to stick to each other

because my school's club teams are like 90% Asian. So, we tend to stick to, and we had our own little clique. It was very important. I mean, that's the type that like, we share the same culture for Christ's sake, you know. We speak the same. We understood each other. We know the struggle. Most of us, we came from nothing. We got the opportunity to come to the US to study, and we always used to push each other.

Two of the study's participants had dual citizenship. They were legally both Caribbean and American, and immigration status opened new federal funding and work opportunities. Denise explained:

Well, the case for me, and fortunately, I was born here [United States]. But I just grew up in the Caribbean with my parents. So, I didn't have that issue of getting a visa. And that was one of the reasons why I decided to come up here, too, because of that, you know, ease of access, I would say. I had the opportunity. I often say, if I was like...if I was not a citizen, I'm not sure how I would have been able to afford coming out here.

Tanya was similarly fortunate to immigrate to the United States after she graduated from high school because relatives sponsored her family. She revealed the following:

I think it was Grade 10. I went to take my green card interview, and then my mom just asked me, "Do you want to go to school in the States?" I was like, "Okay, why not?" And then, from then on, I knew that I was going to end up going there. I didn't take time to think about it; I just said okay. I had a grandmother; my mother's mother was living here before us, and she filed for my mom. And, I'm not sure, but somebody on my father's side had filed for me. So, yeah, so I think me and my mother coming up were separate events because I went to my father, and she went to New York.

Citizenship as a benefit or a positive experience extended beyond tertiary education into STEM careers in the United States. Rhonda recalled that she was the first international employee at a Fortune 500 company:

I was the first, I guess, to be entered into the system. The immigration and HR teams were somewhat intrigued by that. It felt good to be the first. Being different and coming in and breaking boundaries of what people thought a third-world country was capable of felt good.

Guest Workers: Immigration Status as an Invisible Barrier to STEM Trajectories

According to the participants, the constraints of citizenship and immigration status often began long before arriving in the United States but became magnified when they realized the limitations placed on their aspirations. The women described ways that their international status constrained their STEM trajectories, access to financial aid, networks, and other human capital resources. Support was

funneled to those who could study in the United States and impacted who among them could envision and build long-term STEM careers.

Participants reported not knowing about the many available fields of study in STEM before they arrived in the United States. Others talked about their limited career options in their home countries if they chose the STEM field in which they were most interested. Therefore, citizenship became the factor that the women talked about as unexpectedly influencing their science identities. Even though participants had proven themselves academically and possessed the relevant educational experiences, competence, evidence of strong scientific performance, and the recognition of faculty or sponsorship of important and strategically placed mentors, citizenship was the gatekeeper students could not evade. Only participants who possessed the means to qualify for student visas (F-1 immigration status) or held dual citizenship or permanent residency status had the opportunity to explore a wider range of STEM fields in the United States. Rhonda explained:

So, I did the whole math, physics, geography thing, graduated [high school in the Caribbean]. Jobs are at a scarcity. So, you kind of take what you get until you get what you want. So, as I said, I was able to do the short stints at the meteorological office. They were just rotating students because I did the geography, and I wasn't old enough to join the army, and my mom wouldn't sign. I'm like, "I'm ready for more. I'm ready for...I need to get out." I felt a little trapped in my country because it didn't have what I wanted, and I wasn't even sure what the heck I wanted, but I knew that whatever it was, it wasn't there at the time, at least. I had interest in planes and space shuttles. The aerospace thing—I knew it would be difficult as a non-U.S. citizen to find a job in that field, first of all. That's why I chose mechanical engineering. I'm enjoying the journey.

Rhonda discussed another poignant example of the constraint citizenship placed on her educational trajectory. She explained that if students were interested in studying to be an air traffic controller, they would do so with the knowledge that they would probably not be eligible for internships nor have the opportunity to develop a career in the United States because of immigration status. Rhonda wanted to be an astronaut and came close to joining the NASA program, but when recruiters discovered she was not a U.S. citizen, the offer was rescinded.

In effect, she ran into a glass ceiling when her citizenship proved to be a barrier she could not overcome. Rhonda admitted, "I would still say that it would be awesome to be an astronaut." Denise, who had dual citizenship, also noted the importance of citizenship, saying:

A lot of these students in STEM in the smaller islands, like, a lot of them, tell me that you know they're trying to stay here, of course, for the opportunity because back home there's not much, you know, maybe teaching as far as STEM degrees. So, for them choosing something like that STEM, where in the back of their mind, knowing that, OK, there's not much opportunities in the country to work for the small islands. Of

course, because Trinidad, you know, I feel like a lot of the Trinis that I knew studied here, a lot of them went back. With the small islands, you know you're trying to get internships and get sponsored, so I think that's a very big step, you know, coming and studying and you don't really know what's going to happen after that.

Further, only some Afro-Caribbean women from their networks could work during their educational careers or seek employment after graduation. Without additional immigration paperwork, Afro-Caribbean women could not fully actualize their science identities in whatever field interested them. Students with dual citizenship had the option of choosing any field of study during their college matriculation, but students without similar immigration or citizenship status had to position themselves in multiple fields simultaneously to be able to take advantage of future internships or possible job opportunities that were allowed by the immigration process (Table 1). Kendra shared an incident that involved a negative interaction with an advisor at her school that hurt her deeply. She recalled:

I do remember going to one of my advisors and asking about the research opportunity, and being asked the question, "Well, do you have any money? Why do you think you have any money?" And I did not understand that at first. Okay, that if you want to do research, you need funding, and they only fund U.S. citizens to do research.

Like many African American women, Afro-Caribbean women also experience reduced access to research funding and undergraduate research opportunities, an identified obstruction to developing real-world STEM expertise.

In Kendra's case, immigration status represented an additional impediment that she could not breakthrough. Choosing to stay in the United States to gain experience or to stay permanently due to lack of jobs in the Caribbean was just the first step to remaining and succeeding in the United States. Participants noted that they had to negotiate the Optional Professional Training (OPT) or the H-1B (work-related green card) process. Some companies were willing to hire study participants, and often the immigration paperwork and process could be confusing and onerous without guarantees of success. Gina noted:

I had an experience this summer where it's just one of the difficulties of being international, where my company, they were like, "We like the work you're doing. We want to offer you a position. We just don't know how this is gonna work in terms of the visa." It was because of the STEM thing that they were like, "Okay, we'll give you a chance." He said something; I was very moved. Like something like, "We view you as an exceptional candidate." And worst case, the company I'm working for starting in February is an international one. So, they were like, "Worst case, we'll find another country." And then, also being mathematicians, they calculated the probability. And he said it was like a 19 point something percent chance I wouldn't get it.

Jenny saw the difficulty in securing a job because of citizen status as U.S. protectionism, and she believed that this policy constrained Afro-Caribbean women from choosing fields in STEM that they truly wanted to pursue. She said:

These people cater to their people, Americans to Americans. I know so many of my friends had to return to the Caribbean because they weren't lucky. Not even for an international student, you want to get a company that will give you the H-1B visa and stuff like that. When you apply to most companies, they say, "oh yeah, she's not a U.S. citizen." Boom, they just cancel that.

Rhonda, who got a job and a green card, was perhaps the most successful of all the women. She made the most money, had the most professional responsibility, and traveled for her job. She was also among the highest credentialed at her company. She reported that citizenship still constrained her STEM trajectory. She stated:

There are certain things you can do and [can]not do, but because these are unionized workers. If anybody's going to get fired, I will be. I had to think about, hey, I have a student loan to pay back. I need to watch my words. It was frustrating at times, super frustrating. I feel like maybe once or twice, I probably cried about it at home. I just had to release it. I'm sure I did. I remember, I'm sure I did, but it was uncomfortable. One, frustrating because you can't answer back as you would in another society because if somebody writes you up, you get sent home. For me, it wasn't just [about] being unemployed. There are other immigration issues to go with it.

Hegemony of Immigration Status on STEM Trajectories

The Afro-Caribbean women in the study opted into STEM fields or careers regulated by their immigration statuses and the possibility of working in the United States or in their home countries. All participants spoke of a return home or plans to retire at home in the Caribbean. Their reasons were varied: They could be authentically themselves in the Caribbean; they could go where they wanted without fear, do what they wanted, and say what they wanted; or they had the confidence of dominance. They wore their nativity as metaphorical shields while they immersed themselves in the United States as an intellectual site—a place to acquire degrees and professional experience, and when possible, a way to provide financial uplift for their families. Not all STEM fields are economically viable in all countries. Not all institutions are as committed to providing globalized internships, whether directly or indirectly through their broad networks, as they are to providing globalized and diversified education through international student recruiting.

Some participants noted that the globalization and internationalization discourse found in institutions' mission and vision statements stopped at graduation. Some recognized that their institutions did not perhaps consider

student career outcomes as part of the educational process and limited the support to a narrow conception of education as defined by the coursework. More than one woman in the study believed that the lack of equitable access placed Afro-Caribbean women at a disadvantage both academically because they missed out on some of the real-world applications of their course of study and professionally because postgraduation, their resumes were not as competitive in terms of experience as domestic U.S. students graduating with STEM majors.

DISCUSSION

Science, once the property of African scholars (Abdalla, 1997; Zaslavsky, 1999) and traditional healers engaged in “bringing rain [meteorology], detecting witches and criminals” [criminology], “‘doctoring’ armies” [trauma care] “... and using herbs and surgical procedures to cure and mend the body” [medical science] (Flint, 2008, p. 20), was denied to the enslaved in the West, while the mendacities about the paucity of Black intellect, creativity, and innovation were simultaneously proliferated (Willinsky, 1998). Since then, the Black mind has had to disrupt the discourse to remember and assert itself as equal, belonging, and imaginative (Do Nascimento, 1980; Gilroy, 1987; Young, 2004). Contemporaneously, gatekeeper restrictions persist, invisibly sorting who can and cannot engage in particular kinds of knowledge acquisition, and capitalist structures determine who is involved in innovation and the propagation of invention (Rahming, 2019a; Ong et al., 2011). For example, agreements by industrialized nations limit the free sharing of COVID-19 vaccines and COVID-19 knowledge through enforceable patents, instead offering the rhetoric of help and leadership while withholding the ability to save the world at no cost (Medecins Sans Frontiers, 2021). The result is the stockpiling of vaccines in some countries while other countries stockpiled bodies. This is the consequence of STEM as empire (Rahming, 2021–present)—a capitalist and imperialist in industry approach to STEM knowledge.

Similarly, but from the higher education quarter, during the Trump presidency, systemic and intentional policies attempted to limit the number of international students studying in the United States. The Trump administration proposed even more draconian measures to restrict the OPT and temporary worker H-1B visas that would have severely impacted career pathways (Mizelle, 2020). STEM education and STEM-related jobs might have been significantly obstructed for international students and workers. In the present study, citizenship (Celeste, 2016) was a gatekeeper, and I propose a figurative glass ceiling for the second group of women without dual citizenship or permanent residency status in the study. Therefore, citizenship and immigration status became crucial focal points through which I examined Afro-Caribbean women’s STEM trajectories through U.S. higher education to careers.

Applying the glass ceiling framework to the data, immigration status was “a barrier so subtle that it is transparent, yet so strong that it prevents [some Afro-Caribbean women and by extrapolation some international women] from moving up” (Morrison & Von Glinow, 1990, p. 200) and through STEM fields. The

consequences of immigration status were both professional and economic (Rahming, 2019a). Afro-Caribbean women attempted to push back at efforts to keep them in lower-tier jobs with fewer responsibilities, infrequently leading research and development projects, or the opportunity to engage in high-level work with transnational corollaries. Lower tier jobs also translate into lower incomes and diminished ability to be socially and upwardly mobile. It further impacts Afro-Caribbean women's capacity to send remittances to the family at home in their countries. The remittances may improve the lives and opportunities of family they left behind (Lim & Simmons, 2015).

The Afro-Caribbean women in the present study arrived in the United States either well-prepared, well-resourced financially, or well-connected, with a network that allowed access to education and the capacity to excel (Edwards-Joseph & Baker, 2014; Hunter-Johnson & Niu, 2019; Rahming, 2019a) in contrast to some of the research on Black women's preparation for college STEM degrees (Cole & Espinosa, 2008; Ellis et al., 2016; Huang et al., 2000). Participants looked inward or outward to other Caribbean students to persist and achieve, especially in math or physics (Edwards-Joseph & Baker, 2014; Hunter-Johnson & Niu, 2019; Rahming, 2019a). Despite societal racial and xenophobic tensions within and outside STEM (Hall & Sandler, 1982; Seymour & Hewitt, 1997; Shakeshaft, 1995), the women continued to be successful in their programs, winning awards and scholarships and garnering faculty members' recognition.

Although the second group of women was well-prepared academically to secure jobs and succeed in STEM careers, they were limited in STEM field options by their immigration status (Rahming, 2019a). In response, the women positioned themselves in multiple STEM education fields simultaneously, not based on STEM interest necessarily, but rather to take advantage of future internships or possible job opportunities allowed by immigration processes. After graduation, those who secured employment needed to complete additional immigration paperwork that was sometimes protracted with long waiting times for approvals or denials from U.S. Citizenship and Immigration Services, a component of the United States Department of Homeland Security. Therefore, the study results show that STEM degree choice and trajectories were tightly moderated and regulated by citizenship for these Afro-Caribbean women.

Opportunities to Reimagine Immigration Policies

As STEM becomes more globalized, and the doers and innovators of science continue to come from a lengthening list of nations and cultures, studies that address the construction of science identity, STEM pathways, and variables that contribute to STEM's glass ceiling become more valuable (Rahming, 2019a). The research presented here demonstrates that immigration status, citizenship, and nativity can impact the STEM trajectories for Afro-Caribbean women and operate as a type of glass ceiling limiting STEM career options for international women like them. Given that the Caribbean may produce Black women academically prepared to graduate and move into STEM careers in comparatively greater proportions than Black women in the United States, it may be prudent to study the

success of Afro-Caribbean women in their local environments more fully. We can see evidence of the incongruence in the number and proportion of women at the University of West Indies (UWI) studying STEM, for example, but with limited STEM majors and careers postgraduation options. UWI's (2018) institutional data reveals that Caribbean women have consistently enrolled in STEM at higher rates than their male counterparts in all STEM fields except engineering. The U.S. educational enterprise has struggled to successfully attract Black women to STEM and provide the support needed to enable them to persist and attain STEM degrees in the numbers called for by advocates of STEM diversity. The Caribbean has large numbers of Black women with the necessary qualifications to enter STEM degree programs. However, there are limited STEM major options at UWI and limited STEM occupational diversity in the local workforce.

The second group of women without dual citizenship or permanent residency status expressed a valid concern about the limitation citizenship placed on their success as scientists in the United States. If internships and research opportunities are indeed an essential component of a well-rounded future scientist's experience (Crisp et al., 2009), then the invisible barriers that immigration policy erected restricting their full participation seem unjust. Further, employers who are unwilling to engage in the OPT process also limit STEM career trajectories for international students (Nitzschke, 2016). Members of the STEM community cannot genuinely complain about declines in available STEM labor when industry, however unwittingly, plays a role in the diminution. Companies must recognize that STEM is not a local endeavor but a global and interconnected one. Limiting STEM participation in one place or enacting xenophobic and protectionist policies does not advance innovation, research, and development (Rahming, 2019a). The ability and capacity for Afro-Caribbean women to participate fully, especially when they have passed Homeland Security requirements to be in the United States, should be promoted (Rahming, 2019a).

Opportunities for Future Research

Discussions of minoritization for African American students have been ongoing in STEM research (Atkin et al., 2002). Fewer discussions center on how other Black women scientists who were previously members of the dominant racial group in their native countries adjust to numerical and social minoritization and career restrictions due to immigration status (Rahming, 2019a, 2019b). The work is generative and additive rather than substitutive to the research on African American students. A new branch of theory generated by this project is immigration status as a glass ceiling for some women's STEM trajectories and, therefore, immigration status should be considered as another variable in STEM evaluative instruments. This research showed that immigration status had an unforeseen influence on Afro-Caribbean women's aspirations to a multitude of STEM major options and may hold similar implications for other international women considering STEM in the United States. It is imperative to consider the factors critical to the success of this group of women in STEM.

CONCLUSION

STEM has a glass ceiling, and the invisible barrier is held in place by the bolts of capitalism, imperialism, xenophobia, and structural racism. Research on STEM career trajectories is incomplete without the exposure and further exploration of this new theoretical area. This empirical project is the beginning of what I hope will be ongoing research into international Black women's experiences in STEM to develop a substantive theory that explains their STEM trajectories and the influence of immigration status more fully. Inviting more subaltern voices in STEM to participate in STEM experience research by including their stories and perceptions would expand our understanding of difference, persistence, and retention. Evidence-based interventions in STEM programs and industries might then create an all-embracing community of practice, shattering glass ceilings and ensuring the accomplishment of STEM for all.

REFERENCES

- Abdalla, I. H. (1997). *Islam, medicine, and practitioners in Northern Nigeria*. Edwin Mellen Press.
- Asher, N. (2010). How does the postcolonial, feminist academic lead? A perspective from the US South. *International Journal of Leadership in Education*, 13(1), 63–76. <https://doi.org/10.1080/13603120903242915>
- Atkin, A. M., Green, R., & McLaughlin, L. (2002). Patching the leaky pipeline. *Journal of College Science Teaching*, 32(2), 102–108. <https://doi.org/10.1038/nj6975-657a>
- Atkinson, R. (2007). The life story interview as a bridge in narrative inquiry. In D. J. Clandinin (Ed.), *Handbook of narrative inquiry: Mapping a methodology* (pp. 224–245). SAGE.
- Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching*, 44(8), 1187–1218. <https://doi.org/10.1002/tea.20237>
- Celeste, M. (2016). *Race, gender, and citizenship in the African diaspora*. <https://doi.org/10.4324/9781315691824>
- Cole, D., & Espinoza, A. (2008). Examining the academic success of Latino students in science technology engineering and Mathematics (STEM) majors. *Journal of College Student Development*, 49(4), 285–300. <https://doi.org/10.1353/csd.0.0018>
- Crisp, G., Nora, A., & Taggart, A. (2009). Student characteristics, pre-college, college, and environmental factors as predictors of majoring in and earning a STEM degree: An analysis of students attending a Hispanic serving institution. *American Educational Research Journal*, 46(4), 924–942. <https://doi.org/10.3102/0002831209349460>
- Crossley, M. (2000). *Introducing narrative psychology: Self, trauma, and the construction of meaning*. Open University Press.

- Di Palma, S. L., & Topper, G. G. (2001). Social work academia: Is the glass ceiling beginning to crack? *Journal of Women and Social Work, 16*(1), 31–45. <https://doi.org/10.1177/08861090122094127>
- Do Nascimento, A. (1980). An Afro-Brazilian political Alternative. *Journal of Black Studies, 11*(2), 141–178. <https://doi.org/10.1177/002193478001100201>
- Ebaugh, H. R., & Curry, M. (2000). Fictive kin as social capital in new immigrant communities. *Sociological Perspectives, 43*(2), 189–209. <https://doi.org/10.2307/1389793>
- Edwards-Joseph, A., & Baker, S. (2014). Factors Caribbean overseas students perceive influence their academic self-efficacy. *Journal of International Students, 4*(1), 48–59. <https://doi.org/10.32674/jis.v4i1.496>
- Ellis, J., Fosdick, B. K., & Rasmussen, C. (2016). Women 1.5 times more likely to leave STEM pipeline after calculus compared to men: Lack of mathematical confidence a potential culprit. *PLOS One, 11*(7), e0157447. <https://doi.org/10.1371/journal.pone.0157447>
- Fagenson, E. A. (1993). *Women in management: Trends, issues and challenges*. SAGE. <https://doi.org/10.5465/ame.1993.9503103252>
- Flint, K. E. (2008). *Healing traditions: African medicine, cultural exchange, and competition in South Africa, 1820–1948* (Vol. 103). Ohio University Press.
- Gilroy, P. (1987). *There ain't no Black in the Union Jack: The cultural politics of race and nation*. Hutchinson.
- Ginther, D. K., Schaffer, W. T., Schnell, J., Masimore, B., Liu, F., Haak, L. L., & Kingston, R. (2011). Race, ethnicity, and NIH research awards. *Science, 333*(6045), 1015–1019. <https://doi.org/10.1126/science.1196783>
- Glazer-Raymo, J. (1999). *Shattering the myths: Women in academe*. Johns Hopkins University Press.
- Grossman, J. M., & Porche, M. V. (2014). Perceived gender and racial/ethnic barriers to STEM success. *Urban Education, 49*(6), 698–727. <https://doi.org/10.1177/0042085913481364>
- Hahamovitch, C. (2011). *No man's land: Jamaican guestworkers in America and the global history of deportable labor*. Princeton University Press. <https://doi.org/10.1515/9781400840021>
- Halcomb, E. J., Gholizadeh, L., DiGiacomo, M., Phillips, J., & Davidson, P. M. (2007). Literature review: Considerations in undertaking focus group research with culturally and linguistically diverse groups. *Journal of Clinical Nursing, 16*(6), 1000–1011. <https://doi.org/10.1111/j.1365-2702.2006.01760.x>
- Hall, R. M., & Sandler, B. R. (1982). *The classroom climate: A chilly one for women?* Project on the Status and Education of Women, Association of American Colleges.
- Hill, F. (2004). Shattering the glass ceiling: Blacks in coaching. *Black Issues in Higher Education, 21*(4), 36–37.
- Ho, C. (1993). The internationalization of kinship and the feminization of Caribbean migration: The case of Afro-Trinidadian immigrants in Los Angeles. *Human Organization, 52*(1), 32–40. <https://doi.org/10.17730/humo.52.1.h424j806m023r464>

- Huang, G., Taddese, N., & Walter, E. (2000). Entry and persistence of women and minorities in college science and engineering education. *Education Statistics Quarterly*, 2(3), 59–60.
- Hunter-Johnson, Y., & Niu, Y. (2019). Bahamians as international adult learners determined for academic success. *Journal of International Students*, 9(4), 1038–1054. <https://doi.org/10.32674/jis.v9i4.606>
- Johnson, D. R. (2012). Campus racial climate perceptions and overall sense of belonging among racially diverse women in STEM majors. *Journal of College Student Development*, 53(2), 336–346. <https://doi.org/10.1353/csd.2012.0028>
- Leggon, C. B. (2006). Women in science: Racial and ethnic differences and the differences they make. *The Journal of Technology Transfer*, 31(3), 325–333. <https://doi.org/10.1007/s10961-006-7204-2>
- Lim, S., & Simmons, W. O. (2015). Do remittances promote economic growth in the Caribbean Community and Common Market? *Journal of Economics and Business*, 77, 42–59. <https://doi.org/10.1016/j.jeconbus.2014.09.001>
- Maume, D. J., Jr. (2004). Is the glass ceiling a unique form of inequality? Evidence from a random-effects model of managerial attainment. *Work and Occupations*, 31(2), 250–274. <https://doi.org/10.1177/0730888404263908>
- Medecins Sans Frontiers. (2021, March 9). *Countries obstructing COVID-19 patent waiver must allow negotiations to start*. <https://www.msf.org/countries-obstructing-covid-19-patent-waiver-must-allow-negotiations>
- Meyer, J., & Land, R. (2003). Threshold concepts and troublesome knowledge: Linkages to ways of thinking and practising within the disciplines. In C. Rust (Ed.), *Improving student learning—Ten years on* (pp. 412–424). University of Edinburgh.
- Meyer, J. H., & Land, R. (2005). Threshold concepts and troublesome knowledge (2): Epistemological considerations and a conceptual framework for teaching and learning. *Higher Education*, 49(3), 373–388.
- Mizelle, C. (2020). *Establishing a fixed time period of admission and an extension of stay procedure for nonimmigrant academic students, exchange visitors, and representatives of foreign information media*. <https://s3.amazonaws.com/public-inspection.federalregister.gov/2020-20845.pdf>
- Morgan, L. A. (1998). Glass-ceiling effect or cohort effect? A longitudinal study of the gender earnings gap for engineers, 1982 to 1989. *American Sociological Review*, 63(4), 479–493. <https://doi.org/10.2307/2657263>
- Morrison, A., & Von Glinow, M. (1990). Women and minorities in management. *American Psychologist*, 45(2), 200–208. <https://doi.org/10.1037/0003-066x.45.2.200>
- National Science Board. (2018, January). *Higher education in science and engineering*. <https://www.nsf.gov/statistics/2018/nsb20181/report/sections/higher-education-in-science-and-engineering/highlights>
- Nero, S. J. (2014). De facto language education policy through teachers' attitudes and practices: A critical ethnographic study in three Jamaican schools. *Language Policy*, 13(3), 221–242. <https://doi.org/10.1007/s10993-013-9311-x>

- Nitzschke, P. (2016). Building bridges: Why expanding optional practical training is a valid exercise of agency authority and how it helps F-1 students transition to H-1B worker status. *American University Law Review*, 66(2), 593–633.
- Ogbu, J. U. (1992). Adaptation to minority status and impact on school success. *Theory into Practice*, 31(4), 287–295. <https://doi.org/10.1080/00405849209543555>
- Ogilvie, D., & Jones, K. (1996). *African American women executives' communications strategies: Using the power of the word to break through concrete ceilings* [Paper presentation]. 18th Annual National Black MBA Association, Inc. National Conference, New Orleans, LA.
- Ong, M., Wright, C., Espinosa, L., & Orfield, G. (2011). Inside the double bind: A synthesis of empirical research on undergraduate and graduate women of color in science, technology, engineering, and mathematics. *Harvard Educational Review*, 81(2), 172–209.
- Powell, G. N., & Butterfield, D. A. (1997). Effect of race on promotions to top management in a federal department. *The Academy of Management Journal*, 40(1), 112–128.
- Powell, G. N., & Butterfield, D. A. (2002). Exploring the influence of decision makers' race and gender on actual promotions to top management. *Personnel Psychology*, 55, 397–428.
- Rahming, S. G. (2019a). *Black women in white coats: Science identity construction in anglophone Afro-Caribbean women* [Unpublished doctoral dissertation]. The Florida State University.
- Rahming, S. (2019b). Social support and stress-related acculturative experiences of an English-speaking Afro-Caribbean female student in US higher education. *Journal of International Students*, 9(4), 1055–1073. <https://doi.org/10.32674/jis.v9i4.343>
- Rahming, S. (2021–present). STEM for all (Part 1) [Audio podcast]. Labster Podcast. <https://www.labster.com/podcast#the-labster-podcast-episode-7>
- Reskin, B. F., & Padavic, I. (1994). *Women and men and work*. Pine Forge Press.
- Reskin, B. F., & Padavic, I. (2002). *Women and men at work* (2nd ed.). Pine Forge Press. <https://doi.org/10.4135/9781452233857>
- Rodriguez, S. L., Cunningham, K., & Jordan, A. (2016). What a scientist looks like: How community colleges can utilize and enhance science identity development as a means to improve success for women of color. *Community College Journal of Research and Practice*, 41(4–5), 1–7. <https://doi.org/10.1080/10668926.2016.1251354>
- Rogers, R. R. (2001). Black like who? Afro-Caribbean immigrants, African Americans, and the politics of group identity. *Afro-Caribbean Immigrants and the Politics of Incorporation* (pp. 170–202). <https://doi.org/10.1017/cbo9780511606694.007>
- Rollock, N. (2012). The invisibility of race: Intersectional reflections on the liminal space of alterity. *Race Ethnicity and Education*, 15(1), 65–84. <https://doi.org/10.1080/13613324.2012.638864>

- Seymour, E., & Hewitt, N. M. (1997). *Talking about leaving: Why undergraduates leave the sciences*. Westview. <https://doi.org/10.5860/choice.34-5652>
- Shakeshaft, C. (1995). Reforming science education to include girls. *Theory into Practice*, 34(1), 74–79. <https://doi.org/10.1080/00405849509543660>
- Simpson, R., & Holley, D. (2001). Can restructuring fracture the glass ceiling? The case of women transport and logistics managers. *Women in Management Review*, 16(4), 174–182. <https://doi.org/10.1108/09649420110392154>
- The University of the West Indies. (2018). *Statistical digest 2012/13 to 2016/17*. <https://www.mona.uwi.edu/opair/statistics/2016-2017/C.P6d%20%20The%20UWI%20Statistical%20Digest%202012-13%20to%202016-17.pdf>
- Tesch, B. J. (1995). Promotion of women physicians in academic medicine. *JAMA*, 273(13), 1022. <https://doi.org/10.1001/jama.1995.03520370064038>
- U.S. Immigrations and Custom Enforcement. (n.d.-a). *STEM students by gender*. Retrieved October 5, 2015, from <https://ice.gov>
- U.S. Immigrations and Custom Enforcement. (n.d.-b). *STEM students by gender*. Retrieved March 7, 2016, from <https://ice.gov>
- Willinsky, J. (1998). *Learning to divide the world: Education at empire's end*. University of Minnesota Press.
- Young, R. (2004). *White mythologies*, 17–47. <https://doi.org/10.4324/9780203461815-4>
- Zaslavsky, C. (1999). *Africa counts: Number and pattern in African cultures* (3rd ed.). Chicago Review Press.

SOPHIA RAHMING, PhD, is an associate director in the Center for the Advancement of Teaching (CAT) at Florida State University. Dr. Rahming oversees the Learning Assistant Program at CAT. She also serves as the Mentorship Lead for the Gulf Scholars Program through a NASEM grant at the FAMU-FSU College of Engineering. She graduated from the higher education PhD program at Florida State University where she received Florida State University's Fellow's Society Dissertation Fellowship, the W. Hugh Stickler Award for the Enhancement of Dissertation Research, the Legacy Fellowship, and other major graduate awards. She served formerly as the Deputy Director for Research on Equity in Science, Engineering, and Technology, a project focusing on Black women and men in engineering. She also served as a research assistant for the Center for Postsecondary Success on multiple mixed-method studies funded by the Bill and Melinda Gates Foundation and the Institute of Education Science. Her research interests include science identity construction in international women of color; migration experiences of international women of color; gender in education and development; broadening participation in STEM; and simulation use in STEM education in small and developing nations. Email: sg14@my.fsu.edu
