The Influence of Advisors' Advising Style on the Career Interests of Black and Latinx Students in STEM Graduate Programs

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Abstract

The advisor-advisee relationship can influence students' career choices, yet little is understood as it pertains to Black and Latinx graduate students in STEM (German et al., 2019). The purpose of this study is to investigate how graduate advisors' actions influenced the career interest of Black and Latinx students in STEM graduate programs. Critical Race Theory (CRT), specifically storytelling, was used to explore the experiences of Black and Latinx students at Predominantly White Institutions as it provides an in-depth understanding of the issues in postsecondary settings (Patton, 2006). Using a qualitative research approach, data were collected through six individual semi-structured interviews over three years with each participant. The interviews were audio-recorded, transcribed, and analyzed with emergent coding. This study's findings illustrated that Black and Latinx students benefited from advisors asking about career interests, discussing career options, being a role model, and assisting with networking and resources.

Keywords: STEM, Graduate Students, Advisor-advisee relationship, Black, Latinx, Careers

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Higher education institutions struggle to recruit and retain Black and Latinx students in STEM graduate programs (Carver et al., 2017), particularly at Predominantly White Institutions (PWIs) (Jones et al., 2002; McClain & Perry, 2017). Although several plausible factors may affect attrition in STEM graduate programs, previous scholars have highlighted the importance of graduate students building productive relationships with their advisors. Prior studies found that students of color benefit from advisor-advisee relationships that espouse care and concern for the individual and encourages advisees to persist through academic challenges (Davidson & Foster-Johnson, 2001; Patton, 2009; MacPhee et al., 2013). Recent research suggests that graduate students of color are more likely to succeed if their faculty advisors adopt a whole-person approach as part of their advising style (Bryson & Kowalske, 2021; Wilkins-Yel, et al., 2022). While these studies contribute to understanding the type of support historically underrepresented graduate advisees need to complete their doctoral degrees, less is known about how advisors influence the career choices of STEM graduate students of color (German et al., 2019).

Greater understanding of how advisor-advisee relationships influence career decisions among graduate students of color will better equip graduate advisors with the tools to support these students in STEM. Therefore, the current study examined how graduate advisors' actions influenced the career decisions of Black and Latinx graduate students in STEM doctoral programs. Informed by Critical Race Theory (CRT: Ladson-Billings, 1995), this research examined how vital the advisor-advisee relationship is to graduate students' success and how advisors can influence career aspirations.

Literature Review

The advisor-advisee relationship is a critical component to graduate student success (Austin, 2002; Patton, 2009; MacPhee et al., 2013). Graduate students prefer advisors who are accessible, caring, provide individual guidance for each student, serve as role models, and proactively integrate students into the profession (Bloom et al., 2007). In addition, students reported not preferring advisors who are inaccessible, unhelpful, and uninterested in their development as a graduate student (Barnes et al., 2010). Students benefited from advisors engaging with their mentees by attending student presentations, navigating through hostile environments, introducing students to research team environments, and collaborating with their research as critical ways to help them develop as scientists (Carpenter et al, 2015). While these studies provide evidence that students were able to articulate their preferences in the type of advisor they wanted, they focused on the preferences of White students whose needs might be different than students of color and who could easily find faculty advisors who shared a similar racial background.

Although advisors are beneficial to all graduate students (Barnes & Austin 2009; Noy & Ray, 2012; Sedlacek et al., 2007), several scholars highlight how vital advisor-advisee relationships are for students of color (Griffin et al., 2020; Griffin et al., 2011; Patton, 2009). Previous literature suggests that advisees benefit from advisors who are accessible (Bloom et al., 2007), supportive (Schlosser et al., 2003; McGee 2021), and encouraging (Richmond et al., 2019). Unfortunately, students of color tend to report negative experiences with their advisors when they are distant, unhelpful (Barnes et al., 2010; Thomas et al., 2007), and lack supportive skills (Cole & Espinoza; Thomas et al., 2007).

Although evidence suggests the advisor-advisee relationship is a must for success in graduate programs, students of color struggle to identify faculty to work with (Griffin et al., 2010; Patton, 2009; McGee 2021). Since students struggle with identifying a faculty member to work with, building a relationship with them is even more of a challenge. It is common for students of color to search for professors of color, yet in many STEM departments, there are few or no faculty of color (Griffin et al., 2011; Sedlacek et al., 2007). Students who were paired with a mentor of their race and gender reported receiving more help than students who were paired with a mentor from a different race and gender (Blake-Beard, 2011). Unfortunately, due to the lack of diverse faculty to choose from, students of color are often mentored by faculty outside of their race (Griffin et al., 2010; Patton, 2009) and as result, sometimes receive poor mentoring which impacts their overall graduate experience (Brunsma et al., 2017).

McCoy et al. (2015) found that White faculty members treated all of their students the same regardless of race and gender. Due to the lack of experience working with students of color, White faculty believed that treating all students the same was fair and would limit bias or racism. This assumption puts students of color at a disadvantage because their graduate experience is not the same as all other graduate students. Students of color not being adequately mentored can lead to psychological challenges, including low self-efficacy beliefs and stereotype threat (Perna et al., 2009). Due to the low number of

faculty of color in higher education, all faculty need to be appropriately trained to mentor students of color because the probability of graduate students being paired with a faculty member of color are low . Given the importance of the advisor-advisee relationship for the personal and professional growth and development of graduate students, it is important to have advisors trained to advise graduate students of color (Hernandez et al., 2017; Willis & Davis, 2007).

Mentoring has been found to positively impact career commitment (Hernandez et al., 2017; Paglis et al., 2006). Advisors can provide valuable knowledge to graduate students to facilitate their growth as researchers and scholars (Hernandez et al., 2017; Noy & Ray, 2012). Prior research has suggested that advisors may assist graduate students with self-esteem, competence, and career efficacy (McGee 2021; Paglis et al., 2006). It is beneficial for students' career aspirations when advisors introduce them to experts in their field and encourage them to attend conferences and discuss career options (Bloom et al., 2007). Advisors serve as role models and are central to helping students with networking (Hernandez et al., 2017; Patton, 2009). Students whose advisors provide career guidance have a higher chance of pursuing careers in STEM (Prime et al., 2015; Welde & Laursen, 2008). Specifically, STEM students who are mentored by faculty in the academy are encouraged to apply to academic positions (Sauermann & Roach, 2012). These mentoring activities are essential to graduate students pursuing STEM careers.

Although several studies have indicated the importance of advisors providing career guidance, it is not always done. Scholars reported that students received few opportunities to interact regularly with faculty to discuss and explore career options (Austin 2002; Thomas et al., 2007). When students do not have the chance to discuss career options with their advisors, they tend to miss out on opportunities due to lack of awareness (Thomas et al., 2007). Similarly, Davis and Fiske (2000) found that 37% of their respondents reported receiving little academic career guidance. In many cases, when students reported not receiving career guidance, it was linked to having unsatisfactory relationships with their advisors (Welde & Laursen, 2008; Thomas et al., 2007). When students did not prefer their advisor's advising style, it negatively impacted their career path (Lechuga, 2011; Russell et al., 2018) because negative experiences often led to diminished career prospects (Maher et al., 2020).

Theoretical Framework

Critical Race Theory (CRT) epistemology focuses on the shared historical conditions and collective experiences and standpoints of and for people who have been systematically oppressed (DeCuir & Dixson, 2004; Crenshaw 2019). Ladson-Billings and Tate (1995) posited that CRT analyzes the role of race and racism in perpetuating social disparities between dominant and marginalized racial groups. CRT collectively acknowledges the underrepresented group's experiences without classifying them as a homogenous group, recognizing the multitude of varying characteristics held by individuals such as race, gender, sexuality, religion, and more (Patton, 2016). Additionally, CRT gives a voice to marginalized racial groups who share similar experiences to better understand their viewpoint (DeCuir & Dixson, 2004; Crenshaw 2019). CRT provides a lens through which researchers question, critique, and challenge the manner and methods in which race, white supremacy, supposed meritocracy, and racist ideologies have shaped and undermined policy (Harper et al., 2009). This approach acknowledges racism as a normal part of everyday life in America for all Americans (Yosso et al., 2001).

Students of color in graduate programs tend to have a unique set of experiences (Thomas et al., 2007). In alignment with the study's purpose to gain a perspective on advising from the standpoint of students of color STEM graduate programs, CRT places participants at the center of this analysis by prioritizing their lived experiences. To further disrupt academic prose in higher education, CRT has several tenets central to the design of this study: (a) the concept that a shared group experience exists among marginalized people and that the expressions of such experiences are unique and different according to everyone, (b) counter-stories and the voices of students of color were used to analyze higher education's climate, (c) "rejection of a colorblind society" and (d) used as an epistemological lens for studying and transforming higher education as part of a larger social justice agenda.

To capture a better understanding of how STEM graduate advisors influence Black and Latinx students' career interests, narratives from counter-stories were used. Drawing from CRT, the guiding research questions are as follows:

1. How does the advisor-advisee relationship impact Black and Latino/a/x STEM graduate students' career choices?
2. How do the experiences during graduate school influence career interest of Black and Latino/a/x STEM graduate students?

Method

Participants

This paper's data was derived from a more extensive mixed-methods study focused on identity integration for URM STEM and Social, Behavior, and Economic Sciences (SBE) graduate students as they joined a disciplinary community of practice (Blinded). Through a longitudinal approach, data was collected and analyzed to develop an in-depth understanding of factors critical for retention of students of color in STEM graduate programs and their transition into their professional communities. A total of 30 participants completed the larger study. Nineteen (N = 10 Women and N = 9 men) graduate STEM students were selected from the larger study for the analysis presented here. They self-identified as Black (N = 5) and Latinx (N = 14). See Table 1 or more details.

Research Design

For the study described here, a qualitative research design (Creswell, 2009) was utilized to allow for a more in-depth examination and understanding of how the advisor-advisee relationship may have impacted STEM graduate students' career interests. Specifically, a phenomenological approach (Anandavalli et al., 2021) was used to understand how different advising experiences and the experiences students of color had in graduate school influenced their career decisions. A multisite case study approach was utilized to capture a diverse range of experiences from our population (Merriam, 2009). Integrating CRT framework suggests the study's design and the data analyses will be conducted using an intersectional lens, including race and gender (Crenshaw, 1991).

Phenomenology aligns with CRT in rejecting the notion that one can and must decontextualize one's race, gender, and class as a detached observer to produce credible, scientific evidence (Crenshaw, 2019). CRT was used to gain a better understanding of the impact of the advisor-advisee relationship on career choices using a critical lens. The study was designed with the understanding that students of color have a unique set of experiences while enrolled at PWIs, and that these experiences as a minoritized group can inform our understandings of graduate education and the advisor-advisee relationship in ways that would not otherwise be exposed. The use of participants lived-experiences and derived meanings contributed to capturing the importance of the advisor-advisee relationship for career interests among students of color in STEM graduate programs.

Sampling Procedures

Participants were recruited from three PWIs located in the Midwest region of the United States. Selection criteria for this study included: (1) STEM students, (2) first- or second-year graduate students at the time of study enrollment, and (3) self-identified as Black or Latinx. Three institutions were included in the more extensive study with STEM and SBE graduate students; however one institution with a small graduate population did not have any participating STEM students. Therefore, the STEM graduate students for the current study are from two PWIs in the Midwest. Purposeful sampling (Patton, 2002) was used to select the nineteen STEM participants for this study, excluding students enrolled in SBE graduate programs. The PI accessed students for recruitment through the institutional registrars' offices. After approval from the Human Subjects Institutional Review Board, a recruitment email was sent to all students who met the

Name	Program	Gender	Race
James	Life Sciences	Man	Latinx
Angela	Engineering	Woman	Latinx
Ismael	Engineering	Man	Latinx
Dan	Engineering	Man	Latinx
Adriana	Earth Sciences	Woman	Latinx
Laura	Chemical Sciences	Woman	Latinx
Seth	Chemical Sciences	Man	Black
Caroline	Chemical Sciences	Woman	Latinx
Ruth	Life Sciences	Woman	Black
Courtney	Engineering	Woman	Black
Nathan	Chemical Sciences	Man	Latinx
Ethan	Engineering	Man	Latinx
Tony	Life Sciences	Man	Latinx
Robin	Life Sciences	Woman	Black
Scott	Engineering	Man	Latinx
Nicole	Life Sciences	Woman	Latinx
Paul	Engineering	Man	Latinx
Cody	Engineering	Woman	Black
Erika	Life Sciences	Woman	Latinx

Table 1. Demographic Characteristics of the Participants

inclusion criteria. Students received a pre-survey, which included demographic information, identity scales, and social support scales after consenting to participate. After completing the survey, participants were given the option to provide their contact information in an unlinked online form to indicate interest in the study's interview portion. All students who expressed interest in participating in the study were contacted, and interviews were scheduled.

Data Collection

Six semi-structured interviews were conducted to gather data that captured how the advisor-advisee relationship influenced students' career decisions. Interviews were conducted approximately every six months over a 3-year period by a team of five interviewers. Most interviews were conducted in person at various locations selected by the participants on or near the university campuses. Interviews were conducted by video conference if participants were unable to meet in person and participants received incentives. Interviews lasted 30- to 154-minutes.

There were unique protocols used for each of the six semi-structured interviews, although each protocol included questions about participants' relationship with their advisor. As participants progressed in their programs, the protocols included questions targeted towards their career plans. These included prompts asking about their advisors and how they assisted with career aspirations, who was helping them build their professional network and advance in their field, how their career plans had changed since entering their programs, and how people in their support networks felt about their career plans. Discussing career decisions and advisor relationships allowed researchers to gain an in-depth understanding of how advisors may have influenced career interests. For instance, participants were asked "How has your advisor been helping you with professional networking and progressing your career (encouragement to attend conferences, submit papers, etc). Upon completion of data collection, audio-recorded interviews were professionally transcribed using GMR Transcription. Transcriptions were entered into Dedoose, a software program for managing and coding qualitative data, for data analysis.

Data Analysis

The data analysis for the current undertaking was steeped in a phenomenological grounded approach. Once interviews were thoroughly read, participants' responses were analyzed, and emergent codes were developed by the research team. Each researcher was trained to read each transcript and apply the codebook, including participating in a rigorous and lengthy intercoder agreement and codebook refinement process. Intercoder reliability was assessed before coding all transcripts. Fleiss' Kappa coefficient (Schaer, 2012) was used to calculate the research team intercoder reliability. Given that the data was coded by five trained researchers, ReCal3, an online tool, was used to calculate reliability. This online tool is used for instances where there are three or more coders (Freelon, 2010). Our research team's scores ranged from 0.61 to 0.80, which indicated "substantial agreement" using the kappa statistics agreement measures for categorical data scale (Landis & Koch, 1977, p. 165).

The five-member research team generated a codebook with thirteen code names, definitions, and example codes. Each transcript was coded and discussed by five researchers to increase accuracy, limit bias, and ensure an intercoder agreement was met. The findings presented here emerged from the advisor-advisee relationship code, which was further divided into subcodes capturing the participants' feelings about the relationship, Good Match, Mismatch, and Neutral, as well as two additional codes, Advisor Influence on Career Interest and Career Pathway/Career Plan to capture how the advisor influenced participants' career interests.

Once the thirteen codes were refined into subcodes, the first author re-coded the data based on how the advisor interacted with their advisor as it pertained to career support. An in-depth analysis of the subcodes were done to gather a better understanding on how advisors' advising styles influenced the career interests of Black and Latinx participants in this study. Pseudonyms were assigned to each participant, and identifying characteristics were removed from the transcripts.

Credibility and Validity

In keeping with Rolfe's (2006) strategies for rigor and trustworthiness for phenomenological methodology, reflexivity was used throughout the study by having weekly discussions with our research group and internally

reflecting while coding. This was important because the first author was a STEM graduate student of color during the study and brought her own perspectives about the advisor-advisee relationship and experiences with a white advisor (second author) to the data. Being reflective and regularly discussing findings with her advisor allowed her to separate her experiences and opinions from those of the participants.

Overall rigor was obtained through multiple avenues. One of the codes that was selected and created into five subcodes to explore the influences that advising styles had on Black and Latinx graduate students' career interests. The researchers engaged in member checking and peer debriefing to enhance the trustworthiness of the analysis (Carspecken, 1996; Marshall & Rossman, 2011; Merriam, 2009). It is important to note that we coded the transcripts individually before discussing our thoughts with other members of the research to limit possible influence (Carspecken, 1996), yet engaged in open and honest discussion and debate of the data and its analysis to ensure multiple viewpoints were included in our meaning-making. These steps were critical for establishing the credibility and validity of the study.

Positionality and reflectivity

The data analysis and writing team consisted of four authors in this study. The first author identifies as a Black woman who is a first-generation college student. It is important to know she was a graduate student in a STEM field, like the study participants while collecting and analyzing the data. The second author is a Chemistry faculty member who identifies as a White cisgender woman. The third author identifies as a Black immigrant woman who is an Assistant Professor in counseling psychology. Her positionality was formed by her experiences as a Black woman working and residing in predominantly white spaces, her expertise as a trained counseling psychologist, and her intersectional approach to promoting holistic persistence among graduate WOC in STEM. The fourth author is a current doctoral student in a higher education program whose research focuses on students of color in STEM. The first and second researchers were properly trained on how to conduct semi-structured interviews prior to interacting with the participants. It is critical to qualitative research that interviewers capture the clarifying participants' experiences and perspectives. Collectively, the team highlighted the important role the advisor has on the career interests of the advisee. Each of the four authors share the identity of women who have completed graduate studies and have a clear understanding of what occurs in graduate education as it pertains to the advisor-advisee relationship. Our interdisciplinarity is a strength because it includes representation and expertise of students, faculty, STEM, and WOC. We believe the various perspectives allowed us to view the experiences shared by the participants in multiple ways.

Results

The findings from this study illustrate how the advisor-advisee relationship influenced Black and Latinx STEM graduate students' career decisions. This section is organized around four interrelated themes: 1) asking about career interests, 2) discussing career options, 3) being a role model, and 4) assisting with networking and resources. It is important to note that students spoke about various networking and resources; however, this paper is focused solely on the networking and resources provided by the advisor as it pertains to students' career decisions. The four interrelated themes are presented below with illustrative excerpts from participants' narratives.

Theme 1: Ask About Career Interests

The data suggested advisors and advisees benefited from conversations centered around careers. Students preferred advisors to ask them questions about their career aspirations rather than them initiating the conversation. When advisors asked about their advisees' career interests, participants interpreted their advisors' inquiries to mean that the advisor was supportive and cared about them. Unfortunately, some advisors did not have career conversations with their advisees. When advisors assumed their advisees preferred one career over another rather than asking, they did not provide proper advising. Paul, a Latinx man in Engineering, and Seth, a Black man in Chemical Science, mentioned that their advisors did not ask about the career goal; they just assumed. When they asked if their advisors spoke to them about career options, Seth said, "I never said I wanted to work in the industry until very recently, when my boss always assumed that I was doing that. I never told him that. He just assumed I was going into industry." Similarly, Paul shared that his advisor was "surprised" when he shared that he was interested in going into industry. He expounded on her reason for being surprised by saying, "She said she thought that the way I think and approach problems is very much the way an academic does, and why. . .because of that she thinks academia is a better fit for me."

Theme 2: Discuss Career Options

Participants benefited from advisors discussing career options with them. Many participants were first-generation college students and leaned on their advisors to expose them to unknown career possibilities. Advisors who discussed career opportunities with their advisees exposed them to different options they were not aware of. For instance, Caroline, a Latinx woman in Chemical Science, had an interest in academia but did not want to work at an R1 institution. Below is Caroline's response to her advisor's career guidance, which included resources about postdoc positions and different types of universities about which she had little to no prior knowledge. Caroline said,

> He's also really great to talk to about the future, like about different postdoc opportunities, what kind of different fellowships are available; teaching versus research-oriented postdocs, all these kinds of things about when is it time to start thinking about this, and who are the people to start thinking about for postdoc advisors, and what are the benefits to working at an R1 versus R2 versus R3 institution, and all those types of things.

Similarly, Ethan, a Latinx man in Engineering, mentioned that he spoke to his advisor about a career as a professor. He said, "Yeah, I mean that – we did talk about things like that, and I do see – I mean, like, if I could have his job, it would be something great." On the other hand, when advisors did not talk to students about career options, students felt uncertain and did not receive answers to unknown questions. For example, Scott, a Latinx man in Engineering, did not speak to his advisor about career options and felt their relationship was research only. Here is how he responded when asked if his advisor talked to him about postdocs and careers,

> Absolutely not. Absolutely not. No, no. It's a strictly research relationship and I think it has to be, except for the occasional query on the family. It's like, no. Maybe, because I haven't brought it up, because I want to get my paper done, you know. Work on this, have time for this. So, no, that's never come up and, that probably needs to come up. I have an idea career wise of what I want to do. I think I want to do like a teaching, like a smaller school, I don't think I want this type of R1 experience.

Theme 3: Being a Role Model

Advisors are role models for their advisees. Unfortunately, advisors can be positive or negative role models. Advisors should be cautious with how they display their faculty role because the advisors' actions influenced participants in this study. For instance, Seth, a Black man in Chemical Science, enjoyed writing and was interested in the flexibility he saw his advisor having as faculty. He stated, "you do your own research on what you find important and write your own grants. I really do still like writing a lot. The idea is kind of cool. You fly all over the world. He's in Boston now."

Advisors who expressed their passion and joy for their careers showed students the positive part of academia. When participants saw their advisor enjoying their job, it sparked an interest. Adriana, a Latinx woman in Earth Science, felt her advisor liked his job and highlighted how he had more flexibility as a researcher than a professor. Adriana said,

> I have talked to a lot of professors and asked them if they like their job and what they do. Being here, I've talked to my mentor, who is a research scientist. He

constantly tells me he loves his job and it's great. He's like, "Once you get to be more experienced, you just have so many meetings it's exhausting." Last time we talked, he was frustrated because he wanted to go to a seminar but he couldn't because he had a teleconference. I'm like, "Oh, that sucks.""Yeah, this is the second meeting of my day and I still have another one." I'm like, "Well, have they at least been productive?" "Well, this one has." It made me feel good. It was one of the positive meetings of the day. But, I can see how he's not being pulled in all directions as much as being professor, but he's still very, very busy. Again, this positive energy. He still loves his job and he wouldn't trade it for anything. He loves having such a flexible schedule. He has a new baby, so he has to go home. Or, if he's sick he can leave. That sounds pretty great.

Although Scott, a Latinx man in engineering, was interested in being a professor, he mentioned he was second-guessing his decision to become a professor because of the crazy lifestyle. Scott's perception of his advisor was that he worked a lot and did not have much time for his family. He explained,

> Yeah, I really don't know at this point. The reason I don't say professor is because it's just such a huge time, work commitment, and it's really hard, as you know, I'm sure to take that much time away from your family so... I don't know. Then there's also my wife who has her career goals so, yeah, it's hard to really pinpoint at this point what the future is going to hold.

Students interested in pursuing a career in the academy struggled with seeing the positive side of a faculty career when their advisor did not demonstrate positive behavior. Students questioned if they wanted to pursue science-related fields when they did not prefer their relationship with their advisor, did not like what they saw from their advisor, or did not like who their advisors were as people. Many students wanted to avoid being like their advisors or having to work with people like their advisors. When asked about pursuing a career as a professor, Erika a Latinx women in Life Science, responded,

> I don't think I ever, I don't think I have…. I do have career goals, but I don't think I know exactly what they are. I don't know if I wanna be a professor, or if I wanna be a scientist. I don't really know what I wanna do with my degree. Because I'm not sure, maybe if I wanted to be a professor, and I'm dealing with this stuff it would make me realize that I don't want, I know that I don't wanna be like him. And that's what I've learned from all this situation. He really pisses me off. He really… And so, I don't want that. I don't wanna be like that. I use the way he treats me as an example of what I don't wanna be.

Similarly, Courtney, a Black woman in Engineering, was undecided between pursuing a career as a researcher and professor. When asked which important key things have happened since she started her graduate program that have made her change her idea about a future job, she replied,

> This was my third advisor switch. So, three of those. Then also my first two advisors I had were women, and those were not good experiences. I don't feel like I got…Even some of the other women faculty in my department, I haven't really had, I'd say, a mentor relationship with. I think, as a woman, I think that's problematic.

She continued to speak about her first advisor and said,

> So my previous one, I think, initially, I really admired her, and now it's completely different, it's the complete opposite. I think she's almost everything I wouldn't want to be if I decided to do a track in academia, but initially I really thought that she was just this powerhouse and just amazing, and "I want to be like her," but completely opposite.

Theme 4: Assisting with Networking and Resources

The data suggested it was beneficial to students when their advisor provided them with networking and resources to assist with career options. When advisors introduced students to experts within their field, it increased the chances of making connections that could benefit them in searching for what's next. Although Paul, a Latinx man in Engineering, advisor assumed he was going into education because she felt like that was a better fit for him, once she found out his interest was working in industry, she assisted with networking on his behalf. When asked how his advisor assisted with networking he said,

> But a few weeks later, when she did one of her travels, work travels, she went and talked to a research lab, and it happens to be in [state], far away, and she mentioned that they're looking for PhD students to intern for the summer. And so when she came back to town she told me, individually, that this is a possible thing that I could do next summer. So she's looking out now for my interests, if I want to get industry experience through doing an internship as a PhD. It's an option. I'm not sure that I'm going to take it, but it's a sign that, that she's now somewhat thinking about, or looking to support, the next step in my career, which is very positive.

Students who participated in research collaborations initiated by their advisors were able to expand their networks. Students felt more comfortable speaking to scientists and using specific terminology. Cody, a Black woman Engineering, indicated,

> Yes. So right now, I'm collaborating with a professor from the University of [State] and also a professor from the University of [State]. These relationships were facilitated through my advisor and my department. These two people that I'm collaborating with has, well, one of them they do research similar to what I do. Well, I've learned, I'm learning how to communicate with research scientists who've been doing this for a while. As a grad student, you may not be comfortable using certain words. You don't want to sound dumb but you have to force yourself to craft an email to sound like you know what you're talking about. So it's going.

In contrast, students who did not have an advisor who assisted with networking struggled to make those meaningful connections essential for career exposure. Participants felt advisors who were not assisting with professional networking were not supportive and not beneficial to their career. Erika, a Latinx woman in Life Science, said,

> No, I went to a conference, and it was the weirdest, like, I've been to conferences with other professors. And they have dinner with you, and they talk to you, like, invite and then they have, like, they introduce you to other professors, and he would like look at you at a conference and it was, like, he didn't even know you. Like, he was out to get his own network, I think, and then it was the weirdest conference.

Additionally, it is important to note that participants utilized their advisors' networks when considering career options. For instance, Nathan, a Latinx man in Chemical Science, implied,

> Yeah, that's why I want to get the pharmacology side because my advisor has a very, very strong list on the pharmacology side – he knows some of the biggest names in breast cancer and pharm – so I want to try as much as I can to get my name in that sector if he thinks that's an option, probably not anything fast.

Building professional networks and having access to opportunities such as teaching assistantships are beneficial to students when exposing them to careers, specifically in academia. Participants who were able to teach during graduate school had a chance to experience a career in the academy. Ismael, a Latinx man in Engineering, was thinking about becoming a professor. When asked if he had decided on a career path, he replied, "I am still thinking on it; however, this TA experience has strengthened my idea of becoming a professor. Unfortunately, all of the students did not have the opportunity to have a TA experience, but still they saw the benefit of this experience for those interested in a faculty career." Nathan, a Latinx man in Chemical Sciences, applied twice for a Graduate Student Instructor position and was rejected both times. Because a limited number of available teaching opportunities existed in Nathan's area of specialization, his advisor offered him a chance to train an undergraduate student. He replied, "The one time I actually want experience, I, of course, didn't get it and, hopefully, now mentoring this student might help at least that component."

As previously mentioned, Caroline, a Latinx woman in Chemical Sciences advisor discussed career options with

her. The advisor spoke to her about various types of research and teaching institutions. Her advisor encouraged her to participate in the Preparing Future Faculty program. The program helped Caroline better understand different types of institutions through campus visits, particularly in learning about R-2 institutions. Caroline said,

> I'm not sure because I recently talked to my advisor – he was talking about how an R-2 might be a good fit for me – and I was already thinking, "That seems like too much research," and getting worried about it because I didn't know what an R-2 institution looked like or what that workload was like. So, I don't think it really was until we did this campus visit that I was like, okay, here are the different degrees of research and teaching, and how they lend itself to one another, and what a lab basically would look like, or what the students would look like at these particular institutions which I didn't really think about as much until I did this visit.

Summary of Results

Through CRT, the voices and experiences of students of color in STEM graduate programs can be heard, which may provide a counter understanding to dominant narratives often portrayed. The Black and Latinx students in this study benefited from advisors asking about career interests, discussing career options, being role models, and assisting with networking and resources. When advisors asked their advisees about their career interests, they provided career guidance and showed care for students as opposed to advisors who did not ask but assumed. Participants benefited from discussing career opportunities with their advisors. Many Black and Latinx students in this study were first-generation college students and did not benefit from their peers' social capital. Therefore, these discussions exposed participants to various options that may not have been explored if they did not receive this information from their advisors. Advisors are role models to their graduate students; students view them as positive or negative depending on how the advisees view their advisor's behavior. It is important to note that students who viewed their advisors positively were more interested in pursuing a career in the academy. Also, the findings suggest participants benefited when advisors provided them with networking and resources that pertained to career development.

Discussion

This study focused on a critical aspect of the career decision-making process for Black and Latinx graduate students in STEM, exploring how advisor-advisee relationships influenced Black and Latinx graduate students' career interests. Whereas previous research acknowledges the strong influence of the advisor on degree completion, by focusing on nineteen Black and Latinx graduate students in STEM at two PWIs in the Midwest, this research provides insight from Black and Latinx students' perspectives on advisors' influence on their career interests. Through a CRT approach, we were able to capture how advisors' actions influenced students of color in STEM. This research looks beyond degree completion, focusing on career decisions for those who were completing graduate degrees. Although Black and Latinx students in this study were enrolled in various STEM academic programs, their collective experiences regarding their advisor-advisee relationships pertaining to career influences highlighted its significance. Themes of asking about career interests, discussing career options, being a role model, and assisting with networking and resources emerged as central to how advisors influenced graduate students' career interests in this study. Our findings support previous research that has identified advisors as the central component in students' graduate school experiences (Bain et al., 2011; Patton, 2009; Lechuga, 2011).

Overall, the participants confirmed that their relationships with their advisors influenced their career interests. This finding was similar to Gibbs and Griffin (2013), who reported the advisor's role may influence advisee's individual perceptions of a career path and may impact career preferences. These results show that students welcomed questions about their career aspirations and found it beneficial when advisors asked graduate students about their career aspirations. These findings were supported by Crisp and Cruz (2009), who indicated professional and career development assistance was beneficial to students. Students received direct advising about their future goals when advisors were aware of what career paths advisees desired. Participants felt their advisors cared about them when they asked about their career interests. An advisor who did not initiate conversations with participants about career options was viewed as not supportive, which was also seen in Waldeck et al. (2007).

Although students preferred that their advisors be proactive in asking about their career aspirations, participants benefited from the discussion even if they started it because it provided them with an opportunity to ask questions and receive information about career opportunities. These findings were consistent with Sauermann and Roach's (2012), who noted that advisors who talked to their advisees about the job market led to advisees who were more likely to apply for tenure-track positions. Because the majority of the study participants were first-generation college students, their advisors' career discussions were critical in helping them navigate the decision-making and application process. Students who had conversations about career options were able to seek additional resources to further their search for possible careers. This echoes Pinher et al.'s (2017) earlier findings which suggested advisor involvement in the job search process is crucial in academic careers.

Participants looked at their advisors' lifestyle when questioning if academia was a career option for them. Participants whose advisors appeared to enjoy their jobs were more open to pursuing a career in academia than students who felt their advisors did not have enough time or struggled with work-life balance. This was similar to results from Crisp and Cruz, 2009, who found that advisors played a key role when pursuing careers at research-oriented universities. Students who did not prefer their advisors' advising style expressed not wanting to be like their advisors. These participants tended to be undecided about pursuing a career as a professor. If increasing the number of faculty of color in STEM departments is an institutional goal, it may be wise for faculty to build effective relationships with their advisees and model behaviors and lifestyles that would inspire future faculty. Although students might initially enter graduate school because they want to pursue a career in academia, previous research has found that graduate students tend to be less interested in faculty positions as time progresses (Sauermann & Roach, 2012; Pinher et al., 2017).

When advisors assisted students with professional networking, it was beneficial for advisees' career development. Zhao et al. (2007) found that students desired career development and reported students in science fields were more likely to report advisors assisted with career development than students in humanities. Participants whose advisors helped with networking were able to expand their own professional network. Participants who had a more expansive network were able to collaborate with faculty from other institutions and build relationships with people in industry. Advisors who introduced students to their professional networks ultimately introduced students to career options (Welde & Laursen, 2008). Building an external network allowed students to develop their identities as scientists. These findings were consistent with Welde and Laursen (2008), who indicated that students who receive career guidance from their advisors tend to explore careers in STEM fields.

Resources such as teaching assistantships, faculty preparation programs, and research collaborations facilitated by the advisor were appreciated and beneficial. Resources assisted students in exploring career options. For instance, Caroline was able to participate in Preparing Future Faculty, which provided her with a better understanding of what it would be like to be a professor at an R2 institution. After her advisor discussed an R2 as an option, Caroline was uncertain about this career path; however, physically visiting the campus and speaking to professors gave her a better understanding of how R2 institutions operate. These institutional resources were beneficial because they helped advisees prepare for more than one career pathway (Welde & Laursen, 2008). Students who had the opportunity to teach a course were more open to pursuing an academic career. The TA experience allowed students to have a better sense of what being a professor would feel like, mainly because they were teaching and

conducting research simultaneously. Commonly, studies that explored the advisor-advisee relationship did not indicate how advisors utilized institutional resources to expand students' career options. In this study, however, resources provided by advisors assisted with career guidance for the participants.

Limitations of the Study

There are several limitations to this study. Several stemmed from the low numbers of Black and Latinx students enrolled in STEM graduate programs in the U.S. The small number of Black and Latinx students in graduate STEM programs makes it difficult to identify participants. They are also over-sampled regularly, which may lower interest in participating in another study. To increase the likelihood of recruiting and retaining participants, we sent out multiple recruitment emails and offered incentives to complete each data collection activity in our study. This yielded a participant pool of nineteen Black and Latinx students who completed all six interviews. Despite being a longitudinal study, the whole graduate student experience was not captured for participants. Some students began the study in their second year, so the initial interaction with their advisor was not discussed as much. On the other hand, students who started in their first year did not reach the end of their program by the sixth interview and may not have discussed careers at length with their advisors. Finally, there was limited geographic diversity since, the study was conducted at two PWIs in the Midwest, though participating students represented a variety of geographical backgrounds. Nationwide research could increase our access to students of color in STEM graduate programs and better capture varying attitudes towards racial diversity across the U.S.

Future Research

The results from this study highlight the benefit of understanding the experiences of Black and Latinx STEM graduate students through their entire graduate education. This will allow for a deeper exploration of how the advisor-advisee relationship impacts career interests over students' time in graduate school, particularly how the developing advisor-advisee relationship impacts discussions about STEM career options. It would also be beneficial to longitudinally track students' careers after completing graduate school which could show the interplay between career knowledge, interests, professional networks, job availability, job interviews, job offers, and job acceptances. Another option may be to study the experiences of Black and Latinx STEM professionals who have completed their terminal degrees and have entered the workforce to better understand their career pathway and career decision-making process, including exploring the impact of their relationship with advisor on their career decision. why they selected their careers.

Implications and Conclusions

This research contributes to the anti-deficit focus on systemic issues across graduate education that present barriers for STEM graduate students of color. This project focused on how advisor-advisee relationships and specific advisor actions influenced nineteen STEM graduate students' career interests at two Midwestern PWIs. Asking about career interests, discussing career options, being a role model, and assisting with networking and resources were advisor actions that increased career options identified and knowledge about STEM careers for STEM graduate students of color in our study. One implication that emerged from the finding is advisors should engage students in discussions about their career interests. Participants indicated they received more relevant advising when their advisors were aware of their career interests. Participants whose advisors discussed career options were able to ask questions and learn about various STEM careers, leading to expanded views of careers. The second implication from this study is advisors should be cautious in how they view their career as a professor. Students tended to view their advisors as both positive and negative role models, which directly impacted their views of research-intensive academic careers. Specifically, students who were considering academic careers viewed the lifestyle of their advisors as primary examples. Another implication, advisors should assist their advisees with networking and resources. Participants whose advisors helped with networking were able to collaborate with scientists from other universities and industries. Teaching assistant opportunities, collaborations, and networking allowed participants to expand their knowledge of and experience in possible STEM careers. These opportunities provided hands-on experience for Black and Latinx students to gain the knowledge and skills to continue withing STEM fields.

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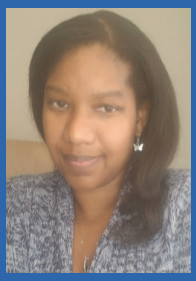

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