Supporting BIPOC Males in STEM: Insights from a Case Study on Online Peer Mentoring

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Biographical Statements

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Abstract

The current study explores the implementation and impact of online peer mentee training, part of a larger online peer mentoring program, on the science, technology, engineering, and mathematics (STEM) self-efficacy, sense of belonging, and STEM identity of Black, Indigenous, and Other People of Color (BIPOC) males enrolled in STEM degree programs at a historically Black institution. Framed by Bandura's Self-Efficacy Theory, Tinto's Institutional department Model, and Social Cognitive Career Theory, it examines participants' intent to persist in their STEM degree programs and subsequent STEM careers. Using a case study design, interviews and focus groups were analyzed. Five themes were identified: Development and Solidification of Identity, Increase in Confidence, Motivation to Make an Impact, Belonging, and Persistence and Retention through Developing Skills. The study is significant as it attends to the dearth in research that examines BIPOC males' experiences in an online peer mentoring program while enrolled in STEM degree programs at historically Black colleges and universities (HBCUs). The findings provide insight on one method for supporting the participation of BIPOC males in STEM—an historically underrepresented population within STEM degree programs and fields. The findings inform institutions seeking to broaden participation within STEM fields while simultaneously supporting the retention of underrepresented populations in STEM degree programs. The findings also inform future implementations of online peer mentoring programs within HBCUs.

Keywords: STEM, mentoring, male, BIPOC, self-efficacy, sense of belonging

Introduction

It is projected that, by 2060, one in three Americans (32% of the total U.S. population) will identify as a race other than White (Vespa et al., 2020). The percentage of those that identify as two or more races is projected to increase by 200% (Vespa et al. 2020). While the number of Black, Indigenous, and People of Color (BIPOC) completing a baccalaureate or graduate degree in science or engineering has increased slightly over the past decade (National Center for Science and Engineering Statistics [NCSES], 2021; 2023), the percentage of such individuals earning those degrees has remained fairly steady across science and engineering fields--with the exception of computer sciences, which has experienced an almost 2% decline. The data indicates that, while BIPOC individuals have earned a larger number of science, technology, engineering, and mathematics (STEM) degrees than in years past (NCSES, 2023), the proportion of the total degrees being awarded has not kept pace with the increasing diversity of the population (Jehangir et al., 2022; Prunuske et al., 2016); thus, if not attended to, will result in further disparity (Gasman et al., 2017).

Of special importance is the participation of BIPOC men in STEM fields. For instance, 12% of the total population within the United States is composed of Black men, with Hispanic or Latino men making up 18% of the total population (NCSES, 2023). However, the NCSES (2023) reports that only 9% of the total STEM workforce within the U.S. is composed of Black men, with Hispanic or Latino men making up only 15% of the total STEM workforce. While men comprise a slightly larger portion of the STEM workforce than women (52% as compared to 48%; NCSES, 2023), the participation of men—especially BIPOC men—remains inequitable.

Mentoring, however, has been shown to support the persistence, retention, and success of students enrolled in STEM degree programs, especially among racially and ethnically minoritized populations (Mondisa & Adams, 2022) including BIPOC men (National Academies of Sciences, Engineering, and Medicine [NASEM], 2019). Importantly, mentoring can assist in diversifying those who enroll in STEM degree programs and persist in STEM fields (Mondisa & Adams, 2022). Mentoring is defined within the literature as "a process in which an experienced individual (a mentor) provides emotional and psychosocial support (e.g., listening, empathizing, offering advice, providing affirmation or an objective perspective), and helps to educate, guide, and counsel a less experienced person" (Mondisa & Adams, 2022, p. 339). Peer mentoring—one type of mentoring--defined as "a reciprocal, dynamic relationship between or among peers where

one peer is usually more skilled or experienced than the other" (Rockinson-Szapkiw, Herring Watson et al., 2021, p. 2), has shown substantial promise in supporting STEM students (Graham & McClain, 2019; Pon-Barry et al., 2017; NASEM, 2019). Peer mentoring can be beneficial when the availability of faculty mentors is lacking (Mondisa, 2018; Wilton et al., 2021), when mentoring is needed outside of the research laboratory context, and when mentees are in need of models that are more relatable (i.e., similar stage of life, similar background, similar experiences to biases or other obstacles) (Mondisa & Adams, 2022; Zaniewski & Reinholz, 2016). Online mentoring can be defined as "mentoring in which all or most of the experience takes place utilizing online technology" (Rockinson-Szapkiw, Wendt et al., 2021, p. 174). Online mentoring can be beneficial when constraints such as geographic location or public health events (e.g., covid-19) create a barrier to traditional, face-to-face mentoring or when more flexibility is desired. In the post-pandemic era and with the steady increase in the use of technology, evidence-based practices that support effective online peer mentoring need to be explored.

The literature further highlights the misguided notion that successful mentoring relationships can develop organically simply because one individual is more experienced than another (Pfund et al., 2016; Sorkness et al., 2015). Indeed, the quality of the mentoring relationship can directly impact the effectiveness of mentoring practices. A large body of evidence shows that mentors and mentees need to be intentionally trained in how to engage in reciprocal and productive mentoring relationships (Pon-Barry et al., 2017; Sánchez et al., 2018; Wilton et al., 2021).

Thus, the current study is motivated by pilot research that developed and tested a model of online peer mentoring and peer mentor training and implemented it among BIPOC women at two HBCUs (see Rockinson-Szapkiw, Herring Watson et al., 2021; Rockinson-Szapkiw & Wendt, 2020; Rockinson-Szapkiw, Wendt et al., 2021). The overall purpose of the cumulative online peer mentoring program was to broaden participation of historically underrepresented populations in STEM degree programs and STEM fields by positively influencing students' interest in STEM, self-efficacy in STEM, sense of community, STEM identity, and intent to persist in STEM. Given this goal, the current study, therefore, extended our inquiry to examine the experience of BIPOC males enrolled in an online peer mentoring program, with a specific focus on the online peer mentee training component of the overall program.

The online program consisted of three key features: peer mentoring training, peer mentoring, and community engagement through STEM Webinars and the Slack platform. The training component had eight modules on the following topics: 1) an introduction to mentoring; 2) mentee reflection; 3) skills for building and maintaining trust; 4) skills for beginning a peer mentoring relationship; 5) skills for developing a peer mentoring relationship; 6) ethics in mentoring; 7) cultural responsiveness in mentoring; and 8) skills for engaging in online peer mentoring relationships. Each of the eight online peer mentee training modules included three components: 1) a topical discussion that provided an overview of the module and the related research pertaining to the module content (Figure 1); 2) a case study that provided a demonstration of how the module content could be applied, designed purposefully to encourage motivation, emotion, and volition (Figure 2); and 3) a personal application and reflection that provided an opportunity to apply the module content to mentees' experiences (Figure 3). The design process and usability study aligned with the module construction has been previously reported (see Gish-Lieberman et al., 2021). Online peer mentee training was self-paced, although a suggested schedule was provided to guide mentees. While completing the online peer mentee training, participants were simultaneously asked to engage with other peer mentees within an online community hosted on the Slack platform. Further, mentees were invited to attend three one-hour STEM Webinars which featured BIPOC women who had a demonstrated record of success in a STEM field.

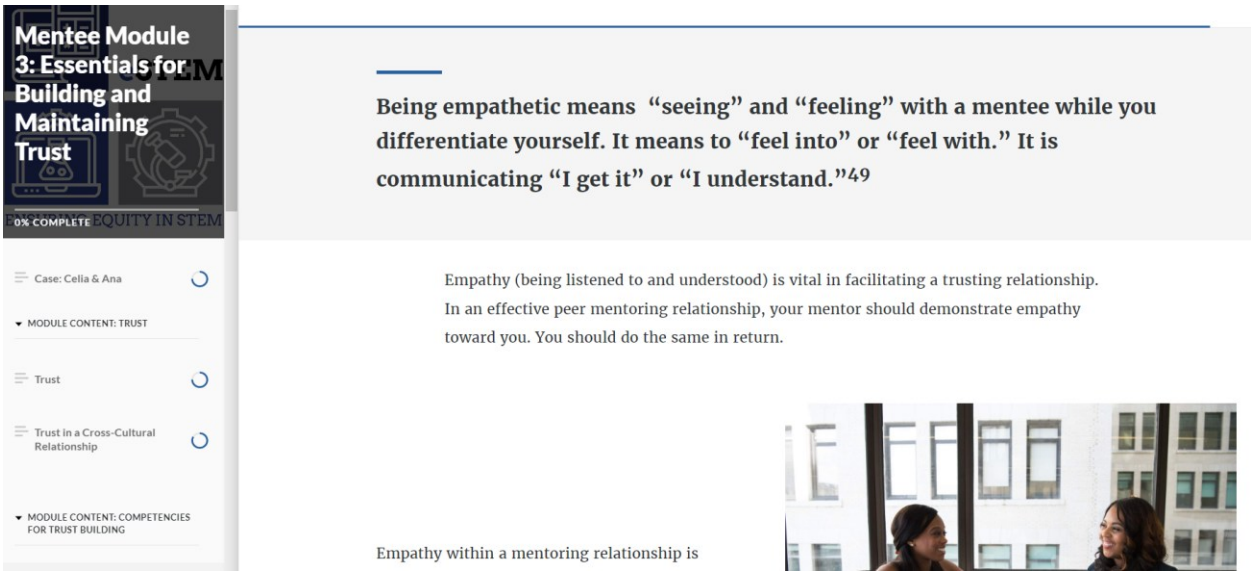

Figure 1. Screenshot of the overview component of one mentee training module.

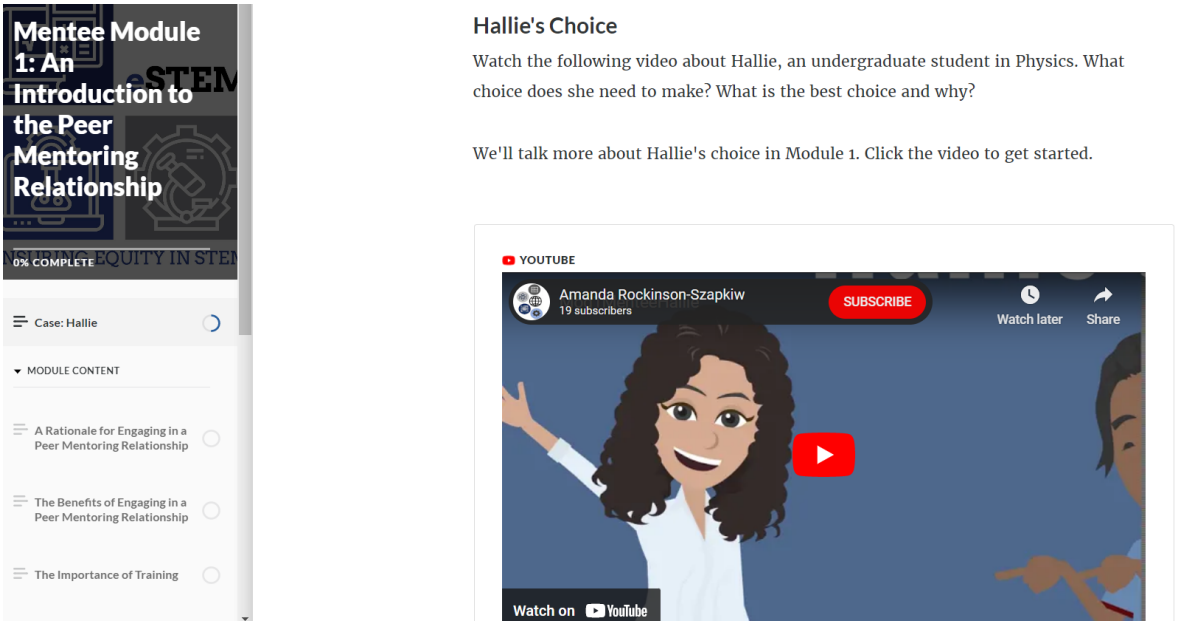

Figure 2. Screenshot of the case study component of one mentee training module.

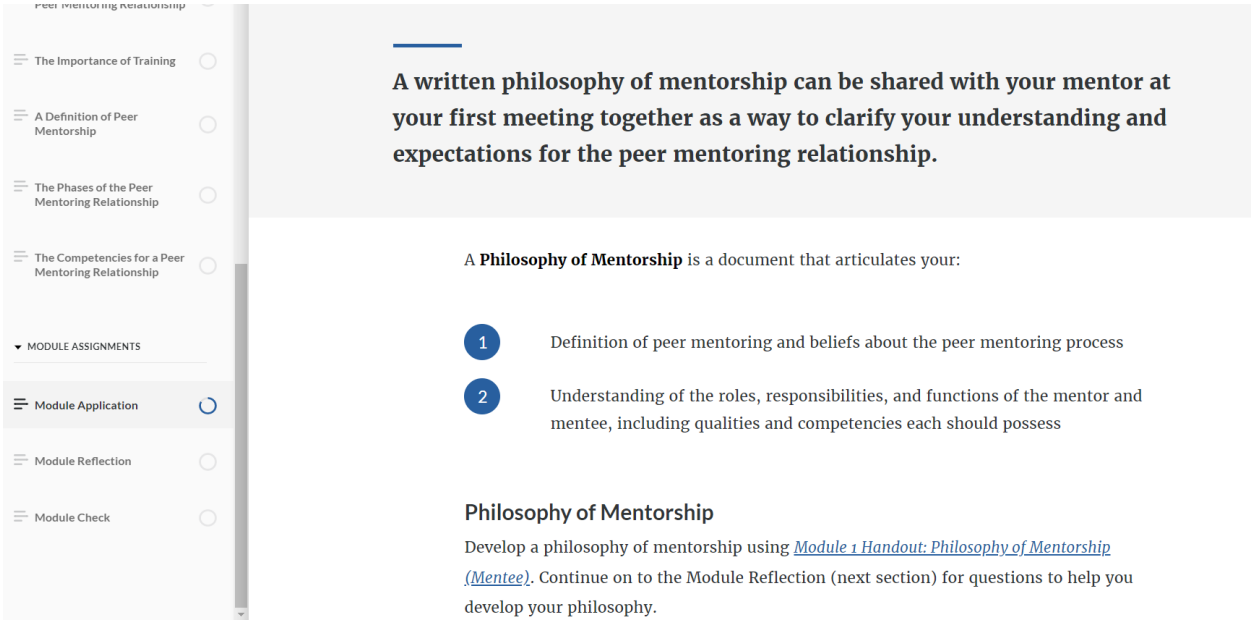

Figure 3. Screenshot of the application component of one mentee training module.

Figure 4. Screenshot of one STEM Webinar.

Theoretical Framework

The overall online peer mentoring program was grounded in multiple frameworks including Tinto's (1987, 1993, 2017) institutional departure model, Bandura's (1977, 1997) theory of self-efficacy, and Lent et al.'s (1994) social cognitive career theory (SCCT).

Institutional Departure Model

According to the institutional departure model (Tinto, 1987, 1993, 2017), each individual possesses personal attributes (such as gender, ethnicity, race, and culture), familial backgrounds (such as socioeconomic status and level of parental education), and prior experiences (such as academic experiences and socio-emotional experiences). When an individual enters an institution of higher education, it is the confluence of these attributes that influences students' ability (or inability) to integrate within the institution—both academically and socially. When an individual is unable to integrate, they may experience low levels of commitment, low levels of persistence, and low levels of a sense of community and belonging (Tinto, 1975). Thus, the institutional departure model suggests that the degree to which one integrates socially and academically into a particular community will directly influence their level of persistence, commitment, and sense of belonging within that community.

Studies have shown that activities that promote integration and the development of a sense of belonging - like opportunities for social interaction, social networking, and support - can be facilitated through peer mentoring. Peer mentoring can support integration through the provision of psychosocial support (where an individual's perception of competence is enhanced), instrumental support (where engagement, development of a sense of belonging, and goal achievement are encouraged through availability of resources), and academic support (where content-area knowledge and career skills development are facilitated) (Wilton et al., 2021). When considering the online peer mentoring training used in the current study, psychosocial support and instrumental support can be facilitated by intentional skills practice (e.g., applications and reflections), exposure to like others (e.g., case studies, vignettes, and STEM Webinars), and goal setting.

Social Cognitive Career Theory

SCCT (Lent et al., 1994) demonstrates that the value an individual attributes to a particular discipline, such as STEM (Clark et al., 2016), facilitates persistence, motivation, and engagement. If a discipline is perceived as having value, an individual is more likely to be motivated to engage and persist in that field. Engagement provides opportunities to gain new skills by attempting new tasks, thus contributing to mastery experience and skills development. As a result, self-efficacy and a sense of belonging are enhanced (Bandura, 1977, 1997). Self-efficacy can be further enhanced when mentees experience social and academic integration coupled with an enhanced sense of belonging--directly influencing their decisions, engagement, and persistence and, thus, influencing STEM outcomes. Self-efficacy serves as a mediating factor for identity development (Chemers et al., 2011). When considering the online peer mentoring training used in the current study, the value inherent to participation in STEM was emphasized through orientations to specific mentoring related topics and skills, providing instruction on obtaining such skills, and providing targeted opportunities for reflection and application to personalize the experience. Value was further emphasized through interactive components, including opportunities to network with peers and attend STEM Webinars where speakers described their journey and contributions to STEM.

Identity

Mentoring has also been shown to support the development of STEM identity (Clark et al., 2016). The development of STEM identity is foundational for encouraging participation and

persistence in STEM, setting up "additional processes by which individuals judge their competence and belonging" (Clark et al., 2016, p. 2). The development of STEM identity, as well as recognizing and reconciling intersecting identities, can lead to increased efficacy in goal setting, enhanced progress toward goal attainment, and more effective decision making that foster progress toward achievement of goals (London et al., 2011). In fact, identity development has been shown to predict an increased sense of belonging as well as increased levels of motivation (Clark et al., 2016).

Review of the Literature

While emerging research has explored the impact of peer mentoring on BIPOC women related to the aforementioned frameworks (see Rockinson-Szapkiw, Herring Watson et al., 2021; Rockinson-Szapkiw, Wendt et al., 2021; Jehangir et al., 2022), little research has examined the experiences of BIPOC men. Further, the literature calls for studies that specifically utilize qualitative approaches to further understand how mentoring can support the participation of minoritized populations in STEM (Jehangir et al., 2022). Importantly, understanding the contexts within which BIPOC men are effectively supported in STEM as well as interventions that can facilitate fruitful mentoring relationships are needed (Burt et al., 2019; Gasman et al., 2017; Sánchez et al., 2018).

Historically Black Colleges and Universities

Historically Black Colleges and Universities (HBCUs) have proven the ability to support the persistence of BIPOC individuals across STEM fields, producing a significant share of BIPOC graduates in STEM fields (NCSES, 2021; Thompson et al., 2016). Despite their success in supporting BIPOC students, there is a dearth of literature examining specifically how HBCUs support BIPOC males' STEM experiences at these institutions. Little is known about: (1) what specific initiatives, supports, and other strategies have been most effective in supporting BIPOC students' attainment of STEM degrees; (2) the relative generalizability of strategies demonstrated as effective across HBCUs (McGee, 2020); and, (3) how mentoring practices at HBCUs support the persistence and retention of minoritized students (Mondisa & Adams, 2022). Further, efforts should be devoted to examining how to support BIPOC males' experiences in STEM more broadly to attempt to mitigate the challenges inherent to STEM environments that, by and large, have been "designed to attract White men who are heterosexual, abled-bodied, Christian or atheist, middle-class and above" (McGee, 2020, p. 634). STEM environments

oftentimes present as chilly or hostile settings within which BIPOC men either have to "emulate or embody hegemonic values, navigate an environment that is hostile to their identities, or leave the field" (McGee, 2020, p. 634). When students are excluded or unsupported as a result of their gender, ethnicity, or race, this "leads to a loss of diversity in STEM fields that must be addressed" (Wilton et al., 2021, p. 1).

Among the available literature, one study examined the experiences of 30 Black men in engineering degree programs to determine what factors best supported their persistence (Burt et al., 2019). The findings indicated that mentoring was one key factor, along with parental and familial support, spirituality, and religion that contributed to students' persistence. These findings are important as they demonstrate the potential utility of providing not only academic support to Black men, but also psychosocial support—both of which can be obtained through mentoring relationships (see Rockinson-Szapkiw et al., 2020; Rockinson-Szapkiw, Herring Watson et al., 2021; Rockinson-Szapkiw, Wendt et al., 2021; Wendt & Jones, 2024). Another study examined mentoring among Hispanic students and showed a relationship between social comfort and belonging within the mentoring relationship and students' academic outcomes, including persistence (Daniels et al., 2018). These findings further support the benefits of mentoring on academic and psychosocial outcomes. Martin and colleagues' (2019) systematic review of the literature further verified the positive impact of mentoring on the success of Latinx STEM students, in particular, at 2-year institutions, indicating the utility of mentoring for enhancing academic outcomes.

In the context of HBCUs, Gasman and colleagues (2017) explored how one HBCU, Morehouse College (an all-male institution), cultivated Black male achievement in STEM. They purported that the underrepresentation of BIPOC males in STEM is due to myriad factors, including lack of access to quality, rigorous K-12 education, susceptibility to negative stereotypes, and disadvantaged backgrounds. HBCUs, given their mission "to mediate and support the achievement of Black students" (p. 184), assist in mitigating the negative impacts of these factors. However, BIPOC men are still in need of mentors and quality mentoring relationships, even within the context of HBCUs (Gasman et al., 2017)—simply attending an HBCU is not sufficient in meeting the academic and psychosocial needs of BIPOC male students. It was the relationships with peers of the same race that were deemed essential to their success. "Same peers and faculty are perceived to be more open sources of support because

oftentimes they are more sensitive to the struggles encountered by (other) Black students" (p. 184).

Supporting Students through Mentoring

Psychosocial constructs, such as social integration, fostered interest, self-efficacy, and identity development have been cited as foundational to supporting BIPOC student retention in STEM (Jehangir et al., 2022; Wilton et al., 2021). Jehangir and colleagues (2022) explained that the development of identity, especially within the context of intersectional identity, is key to supporting minoritized students' interest in and persistence in STEM. Underlying factors such as being a first-generation college student or of a lower socioeconomic class—both underrepresented within the general population but common among minoritized populations—contribute to identity. "Structural systems of dominance and subjugation related to students' marginalized social identities (e.g., gender, class, race, ethnicity, immigration status, among others) play a significant influence on the STEM participation and persistence" (Jehangir et al., 2022, p. 90) among minoritized populations.

Mentoring has the capability, however, of providing structured support that attends to social integration, interest, and self-efficacy (Rockinson-Szapkiw, Herring Watson et al., 2021; Rockinson-Szapkiw, Wendt et al., 2021; Wilton et al., 2021; Wendt & Jones, 2024). The degree to which students receive such support plays a role in their decisions to remain within the institution and within their degree programs (Wilton et al, 2021) as well as in negotiating their identity (Jehangir et al., 2022). "Mentorship supports integration through psychosocial support, instrumental support, and academic support" (Wilton et al., 2021, p. 2)—each of which contribute to persistence. Further, mentorship can result in enhanced career outcomes including "career planning, career involvement, income, and promotions" (Saffie-Robertson, 2020, p. 567), contributing to increased career capital and generational wealth—both of which have been identified as inequitably distributed among those racially and ethnically minoritized. Mentoring is foundational for supporting diverse representation in STEM by attending to issues of retention, success, personal well-being, and bias within STEM fields (Deanna et al., 2022; Mondisa & Adams, 2022).

Despite the literature supporting the benefits of mentoring, the dearth in BIPOC individuals attaining terminal degrees in STEM (7%) compared to the total population (14%; NCSES, 2023), compounded by the dearth of BIPOC individuals serving in faculty roles at

colleges and universities, can often make it difficult for students to find faculty mentors. Thus, peer mentoring may be beneficial in supporting BIPOC males' persistence and integration in STEM. In a previous pilot study that focused on broadening participation among BIPOC women enrolled in STEM degree programs at two HBCUs, findings demonstrated that online peer mentoring can support the development of interest in STEM, STEM self-efficacy, and persistence in STEM among both peer mentors and peer mentees (Rockinson-Szapkiw, Herring Watson et al., 2021; Rockinson-Szapkiw, Wendt et al., 2021). However, in the previous study, training for effective online peer mentoring relationships was only developed and provided to peer mentors—peer mentees were not provided the same opportunity. And, perhaps most importantly, previous study included only BIPOC women—not BIPOC men. Thus, there is a need to explore the impact of experiences in online peer mentoring at HBCUs among BIPOC men in particular. The current study, therefore, focuses on the implementation of peer mentee training to support BIPOC students enrolled in STEM degree programs at HBCUs with a specific focus on the experiences of BIPOC men.

Current Study

As aforementioned, the current study extended a peer mentoring model developed in a previous pilot study (see Rockinson-Szapkiw, Herring Watson et al., 2021; Rockinson-Szapkiw, Wendt et al., 2021) to understand the extent to which online peer mentee training impacts students' STEM self-efficacy, sense of community, STEM identity, and intent to persist. The current study was motivated by the following guiding questions:

RQ1: How, if at all, was participation in the online peer mentee training useful in furthering BIPOC male students' STEM self-efficacy?

RQ2: How, if at all, was participation in the online peer mentee training useful in furthering BIPOC male students' sense of community in STEM?

RQ3: How, if at all, was participation in the online peer mentee training useful in furthering BIPOC male students' STEM identity?

RQ4: How, if at all, was participation in the online peer mentee training useful in furthering BIPOC male students' intent to persist in a STEM degree program and, ultimately, their intent to pursue a STEM career pathway?

While the training modules, and the overall mentoring program, were primarily designed for addressing the needs of BIPOC women, BIPOC men were also encouraged to participate because

the inclusion of "men of color does not have to mean that other groups are not receiving support and attention" (Hrabowski, 2015, p. 1058). Out of a total of 26 peer mentee participants, a total of four individuals self-identifying as men were enrolled in the program as mentees. Thus, the current paper focuses on the BIPOC men who participated in the online peer mentee training, which encompassed completion of eight online modules, participation in an online Slack community, and attendance at three STEM Webinars. Despite the small number of BIPOC men participating, the current study is significant in that it attends to a persisting gap within the current research literature. The experiences of mentees that identified as women and peer mentors is reported separately (see Wendt & Jones, 2024).

Participants

Prior to recruitment, Institutional Review Board approval was obtained (University of the District of Columbia, IRB Approval # 1414247). In Summer 2020, participants were recruited from two HBCUs ($N = 33$; $n = 7$ mentors, $n = 26$ mentees). Participants were required to be enrolled in a STEM degree program at one of the participating HBCUs, identify as a racial or ethnic minority, and to possess a GPA of 2.0 or higher. After applying, participants were selected by the researchers and an advisory board consisting of STEM faculty and asked to complete the online peer mentee training in Summer 2020 and Fall 2020. During this same time period, participants were asked to participate in an online community on the Slack platform. Further, participants were invited to attend three hour-long virtual STEM Webinars, offered in Fall 2020 and Spring 2021, each featuring a talk given by a BIPOC woman who has forged a successful career in a STEM field.

The current paper and related presentation focus on the experiences of one cohort of mentees ($n = 4$) who self-identified as male and as BIPOC, all of whom were enrolled in undergraduate degree programs (e.g., biology, cybersecurity, computer engineering, and political science) at the same HBCU. This cohort was selected because it was the only cohort that consisted entirely of BIPOC males. The cohort participants identified as Black ($n = 2$), Arab ($n = 1$), and Hispanic/Latino ($n = 1$). It should also be noted that the participating institutions were engaged in emergency remote instruction due to the covid-19 pandemic which, while certainly impacting the participants, did not impact the overall implementation of the program above and beyond extending the amount of time allotted to complete the online training.

Methods

Using a case study design (Merriam, 2009) with the BIPOC male cohort serving as the case, hour-long individual interviews and one hour-long focus group was conducted in Spring 2021 using open-ended questions (see Appendices A & B). Data were then transcribed and transcriptions were entered into the Delve qualitative analysis program. A combination of inductive and deductive coding was used to code the data within Delve. The use of Delve allowed for simultaneous coding (where the same passage could have more than one code applied to it) and nested coding (where a large passage could include embedded or subcodes) (Saldaña, 2016). The use of deductive coding allowed the researchers to assign codes to passages that attended to the guiding questions and theoretical framework while inductive coding allowed "emergent, data-driven" (Saldaña, 2016, p. 75) codes to be assigned. Using a combination of these approaches, in vivo codes were generated which were then aligned with process codes (Saldaña, 2016). Two rounds of coding were conducted by two different researchers, ensuring agreement and, thus, reliability. Codes were then organized into themes, bringing "meaning and identity to a recurrent [patterned] experience and its variant manifestations" (Saldaña, 2016, p. 199). Overall, five salient themes were identified and agreed upon by the researchers.

When coding data, phrases that attended to the guiding research questions were identified. For instance, the in vivo code 'belonging' was assigned to passages such as "I think that belonging you know like friends, people that looked like me in STEM is what kinda drew me in" (Male 3 Interview)—aligning with the institutional departure model (Tinto, 1987, 1993, 2017) and SCCT (Lent et al., 1994). Simultaneously, the process code 'like others' was assigned to passages such as "It was good to see people that look like me although they were all female" (Male Focus Group)—aligning with identity theory (Chemers et al., 2011; Clark et al., 2016) as well as Tinto's (1987, 1993, 2017) institutional departure model (e.g., integration). Both of the codes in these particular examples were then organized into the theme of 'Belonging (I Belong Here)'. As another example, the in vivo code 'identity' was assigned to passages such as "I identify as, you know, Latino" (Male 2 Interview), and the process code 'major' was assigned to passages such as "I'm a political science major" (Male 3 Interview). Both 'identity' and 'major' were combined into the theme of 'Development and Solidification of Identity'. Table 1 provides additional examples of the alignment between the research questions, codes, and themes.

The use of individual interviews and focus groups as multiple methods of data collection served to strengthen the trustworthiness of the data (Merriam, 2009) in tandem with member

checking to allow for triangulation. Trustworthiness was further attended to through the process of personal bracketing where researchers used annotation to identify and document biases, seeking to remove personal biases to the furthest extent possible. Dependability was also attended to by memoing which allowed for transparency in decision making (e.g., rationale for coding passages in a certain way; Creswell, 2013).

Findings

Overall, the participants reported overwhelmingly positive experiences in the online peer mentee training and STEM Webinars. Several participants reiterated that they were excited about the training, that the training and STEM Webinars exceeded their expectations, and that they believed that without the training and STEM Webinars, they would not have had similar opportunities to engage in a community of like-minded individuals. Participants noted that "this is an extremely wonderful program…and I'm so grateful that you [the study facilitator] put it

Table 1.

Alignment of Research Questions with Example Codes, Themes, and Passages

Research Question	Code	Theme	Example Passage
RQ1: How, if at all, was participation in the online peer mentee training useful in furthering students' STEM self-efficacy?	Navigating Workforce	Increase in Confidence	"They gave me valuable information I feel like I'll be able to use in, like, navigating my career in STEM" (Male 4 Interview).
RQ2: How, if at all, was participation in the online peer mentee training useful in furthering students' sense of community in STEM?	Belonging	Belonging (I Belong Here)	"I think that belonging, you know, like friends, people that looked like me in STEM…this is what kind of drew me in" (Male 3 Interview).
RQ3: How, if at all, was participation in training useful infurthering students' STEM identity?	Identity	Development and Solidification of Identity	"Being able to identify with them just from the online peer mentee my personal identity as a Black man. A Black gay man." (Male 3 Interview)
RQ4: How, if at all, was participation in the online peer mentee training useful in furthering students' intent to persist in a STEM degree program and, ultimately, their intent to pursue a STEM career pathway?	Skills	Persistence and Retention Through Developing Skills	"You know, like you can get all the schooling in the world, but if you don't know how to interact with others…then you end up not being able to hold a job, you know, for a long time…. I feel like this program can help with that" (Male 3 Interview).
Development of Additional Theme	Inspiring Others	Motivation to Make an Impact	"I'm here to help everybody that needs help" (Male Focus Group).

together" (Male Focus Group), "everybody wanted to be a part of the program and that made it very, very beneficial" (Male 4 Interview), and "this program is one of the best programs I have ever been in" (Male Focus Group). Participants shared that the incentives to participate in the training, including a free laptop and a nominal stipend, were beneficial in supporting their work both within the training and in their academic efforts.

They also shared that, if given the opportunity, they would participate in the training and STEM Webinars again. One participant shared, "If I had to do it all over again, I would love to do it" (Male 3 Interview). Another participant shared, "If this program will be again, next year, I want to be there" (Male Focus Group). The participants frequently discussed their belief that it is imperative for the training and STEM Webinars to continue, with one sharing "It's very important to keep that, to keep this program going as long as possible" (Male 3 Interview). Participants frequently articulated their beliefs that, if it were not for the current training, they likely would not have had an opportunity to gain knowledge and skills about effective peer mentoring relationships and to further reflect on and develop their individual goals. One participant said,

> I feel like I got more out of it than I really would have otherwise, what I think just would have on my own. If that makes sense. I attribute that largely, I think, to just the way that the curriculum was really set up to get us to think about our own goals. Maybe where we see ourselves and the sort of work that we're doing now in service to those goals. (Male 2 Interview)

Further, the data supports that the overall experience in the online peer mentee training and STEM Webinars as a part of the overall online peer mentoring program was powerful in developing the participating BIPOC males' STEM self-efficacy, sense of community, and intent to persist in STEM. Several salient themes were noted, including Development and Solidification of Identity; Increase in Confidence; Motivation to Make an Impact; Belonging (I Belong Here); and Persistence and Retention through Developing Skills.

Development and Solidification of Identity

All of the participants reported that their engagement in the peer mentee training and STEM Webinars assisted them in either developing or solidifying their identities. In speaking about the STEM Webinars in particular, one participant said,

> I think it was the very first speaker. I think, as they were sharing their story, you know, and just seeing that the person was, I think, it was a Black woman, you know she was young, and I just, I just, I identify with Black women…. As she was sharing her story, it just, I think that just, that identity…being able to identify with them just from my personal identity as a Black man. A Black gay man. (Male 3 Interview)

Three of the participants reported that their identities as BIPOC individuals were reaffirmed through the STEM Webinars and that they experienced a sort of relief at feeling as if the space within the peer mentoring program and the HBCU community was a supportive and safe space for them to be their unique, whole selves. Male 2 expressed in his interview,

> You know, I identify, as you know, Latino. I'm gay. Uh, you know I'm male. I think there were anxieties about what it would mean, like given the way that, like maybe I physically present, like, you know, would this be, would this be treated, would I be treated differently…?

Another participant summarized the general consensus of the participants and their appreciation of the emphasis of the peer mentoring experience on respecting and recognizing diverse identities by sharing,

> I like sort of being recognized as a whole person, right? Like, we're all complex, full people, but going through this program, I feel like there was such an emphasis on diversity, that I can't imagine what this program would have been, if it would have been successful for me, if it was just a 'general people in STEM' feel. (Male Focus Group)

When considering participants' STEM identities, one participant shared several times that he did not at first identify as a STEM student, despite being enrolled in a STEM degree program (political science),

> It [the experience] helped me narrow down to, you know, political science is actually a part of the STEM community—so now I definitely identify as a member of the STEM community. So now I started to seek out, you know, like, STEM programs and, you know, different, like when I'm doing job searches and things. (Male 3 Interview)

Another participant echoed that his experience in the peer mentoring training helped him solidify a STEM identity,

> This program helped me solidify that trajectory…. I had a science background. I didn't know that. It was really an entry point for me for STEM, and so I started doing more IT

> [information technology] work. And, then, kind of through that discovered, like, cyber security…. Yes, the program really helped me get a better sense of, like, okay, like what I am here. (Male Focus Group)

In the focus group, one participant shared "I'm 100% or maybe 1000% sure about the STEM program". Participants' development and solidification of their personal identities, including a STEM identity, in turn, led to an increase in confidence and, thus, development of STEM self-efficacy.

Increase in Confidence

All participants agreed that their experience in the training led to an increase in their level of confidence in engaging in STEM and navigating the STEM landscape, especially as BIPOC males and, for some, members of the LGBTQ community. When reflecting on his experience, one participant shared, "I don't know that I would have, I would have found that confidence if I wasn't in a space where, like, I was able to talk about my race or my background as openly and honestly" (Male Focus Group). Another participant shared how his confidence in navigating the STEM landscape was increased through the STEM Webinars,

> They were really die-hard activists [the STEM Webinar speakers]…. So, I really, I appreciated them—their experiences and how, particularly, more importantly…how they chose to navigate their particular careers in the workplace, which I feel like I'll definitely be able to use and, like—like, they gave me valuable information I feel like I'll be able to use in, like, navigating my career in STEM. (Male 4 Interview).

Male 2 indicated in his interview that the training and STEM Webinars shaped his confidence in his identities and in belonging in STEM, which would in turn alter his confidence in navigating the STEM landscape, sharing, "the sort of way that I navigate the world may be different"—thus demonstrating the impact that participation had on his STEM self-efficacy and sense of belonging.

Several times participants discussed the value of the HBCU setting within which the training was situated in increasing their confidence, especially through appreciation of the opportunities to openly discuss their various identities,

> Being at an HBCU, when it comes to sort of like intersectional identity. I still have the impression that, like, race at the end of the day is kind of like the primary concern. So, when it comes to, like, meeting other, like, mentees, who, you know, are sort of also

> navigating these fields. I feel like the sense of, like, uplift is largely based in, in race, right? Like, we want to see other people who look like us being successful and making money and getting in positions of power. Right? (Male 2 Interview)

All participants indicated that their confidence to engage in "tricky space[s] to navigate" (Male 4 Interview) was increased. This also led to them reflecting on the types of challenges they might encounter in the STEM workforce and the need to diversify STEM--"STEM needs to diversify…it's largely White" (Male 2 Interview).

Motivation to Make an Impact

Each of the participants shared a desire to make an impact, which was influenced by their participation in the training. This was apparent through their individual interviews, but also during the focus group where, at one point, the group began to share resources and opportunities from a local professional organization with each other and to engage in networking. During this particular moment, one participant shared,

> I'm like this open book that I can help anybody…because I believe one thing. I believe that we are human beings…. We are one person, that we have, like—it's like one body that we have to function together in order to survive. (Male Focus Group)

Another participant echoed, "I'm here to help everybody that needs help" (Male Focus Group), while another shared, "I want to improve myself, to give back to society" (Male Focus Group).

Two participants indicated their desire to mentor someone in the future. One shared that, "I hope, like, in the future, I might be able to do something like this for somebody else" (Male 2 Interview). Another participant stated, "Now I can see myself, I can be a mentor, because I have this experience" (Male 1 Interview). In discussing future mentoring relationships, the participants also shared the importance of a reciprocal relationship so that both mentor and mentee can benefit and have an impact on the other. During the focus group, one participant affirmed, "It's supposed to be mutually beneficial. You know, mentor-mentee relationship, it's supposed to be, like, symbiotic".

One participant shared on several occasions that he felt a personal responsibility to give back and make an impact based on his experience in the program, "I want to be that person that does positive, like, around people, like to give them this light" (Male 1 Interview). He shared that he felt a deep appreciation for the opportunity to engage in personal learning and growth, and that his appreciation in turn meant that he had on obligation to reciprocate, "I'm responsible for

myself and for community, for other people around me." (Male 1 Interview). Participants, thus, appeared to experience an enhanced sense of altruistic purpose as a result of participation in the program, which further supported their intent to persist in their respective STEM degree programs and future STEM careers.

Belonging (I Belong Here)

All of the participants shared that their experience in the peer mentoring training and participation in the STEM Webinars supported and encouraged their development of a sense of belonging. The STEM Webinars appeared to be especially instrumental in developing a sense of belonging. Participants shared that they appreciated seeing 'like others' in STEM careers and roles. One participant noted, "I think that belonging, you know, like friends, people that looked like me in STEM…this is what kind of drew me in" (Male 3 Interview). This same participant continued, when describing the benefits of the STEM Webinars, "That's what gave me the sense of belonging, because I could identify with each of their [the STEM Webinar speakers'] stories. I kinda identified how it relates to where I am or what my journey may be or where I want to go." While the STEM Webinars featured women, each of the male participants shared that they could identify with the experiences that these women had in their journeys to a STEM career, including their experiences with stereotypes and microaggressions. Another participant shared,

> Hearing from people who, like, look like you or who have experienced some of the similar things as you…Telling you that, like, what you want from your life is valid like, you are deserving of a place at whatever table like, you know, you have in mind like that. That's so important to hear. (Male Focus Group)

Male 3 reaffirmed in his interview, "I think seeing they were primarily Black women…any minority can struggle, you know…telling their struggle makes things feel like it's not just you." Participants concurred that seeing others who had experienced success despite myriad challenges was encouraging and, importantly, assisted them in recognizing that their journeys, while each individually unique, were not journeys that they were taking in isolation—that, in fact, they were not alone. This enabled them to develop a stronger sense of belonging, both within their HBCU and within their respective STEM degree programs.

One participant also shared how his overall experience in the peer mentoring program assisted in his development of a sense of belonging through creation of friendships that may have otherwise not been possible, "I've made friends from this program that I never thought I would

make, that I never made in class" (Male 2 Interview). These friendships assisted him in not only building his social network, but also in feeling that he was in a space that was welcoming—a space in which he belonged. Male 1 indicated, when reflecting on his first interaction with one of the study facilitators, "I remember the first meeting when I came to pick up the computer and [the facilitator] told me that [she had] a biology background, when I told [her] I'm a biology major…So it says here, and she's a doctor, and she's talking like normal, normal because [she was] like an example, and that's exactly what we need". Throughout each aspect of the program, the participants indicated that they felt welcomed, encouraged, and perceived that the space they occupied was a space in which they belonged.

Persistence and Retention Through Developing Skills

Several times in the individual interviews and the focus groups, participants reflected on skills that they learned through the peer mentee training and STEM Webinars that they perceived as critical to their future success in STEM careers and, thus, furthered their beliefs that they could and should persist in their STEM trajectories. Male 3 indicated in his interview,

> I just think that the program…like these are very important skills, because we do have, there is a, there's a soft skill gap. There's a soft skills gap, you know, amongst the workforce now, and I think programs like this are vital to being able to bridge or help bridge that gap.

This same participant continued,

> You know, like you can get all the schooling in the world, but if you don't know how to interact with others…then you end up not being able to hold a job, you know, for a long time…. I feel like this program can help with that, and so I think that it's vital especially going into the STEM community. (Male 3 Interview)

Another participant shared,

> The program really helped me kind of think about the sorts of important questions and issues that I would want to maybe ask a hiring manager, or maybe as I'm networking on LinkedIn asking a current employee to just have an honest conversation. Like, you know, is diversity sort of like an issue? Is it a value there? (Male 2 Interview)

In addition to the development of soft skills, such as communication skills and questioning skills, participants mentioned that the reflective components of the peer mentee training were beneficial in developing skills for STEM persistence and retention. One participant

likened the training to a foundation, "I think without this program as, like, a foundation, I really wouldn't have thought that out on my own. I don't think I would have known" (Male Focus Group). Another appreciated the opportunity to reflect on future goals and engage in goal setting, sharing, "this program really got me to examine, what do I want from, like, a future program?" (Male 2 Interview). This same participant continued "I think with this program, it was the first time that I feel like I actually had—had to kind of plan out what my next steps were." In engaging in reflection, goal setting, and planning, participants further strengthened their resolve to continue in STEM degree programs and careers. This also further supported their development of a STEM identity, their sense of belonging, their perceptions of self-efficacy.

Recommendations for Future Implementation of the Program

While not identified as a theme, participants also shared several suggestions for the training. All participants indicated that, while they appreciated the online nature of the training—especially given that program implementation occurred during a shift to emergency remote instruction at the participating institution due to the covid-19 pandemic—they desired more face-to-face interaction. In fact, several participants shared that they felt that they missed out on potential support and collaboration with each other during the training since they had not had the opportunity to meet in a face-to-face setting. These participants expressed a desire to meet and to serve as a source of encouragement for each other once the pandemic subsides. To address these concerns as this program evolves, although online, regularly scheduled meetings between mentees and mentors should be arranged. Elements such as a social gathering or meet-up can be implemented to attend to the face-to-face needs reported by participants.

Participants in the current study also suggested that a more flexible platform be utilized for cross-cohort communication in subsequent iterations of the program other than the Slack platform. The participants indicated a desire for a more interactive communication platform. Overall, while the Slack platform allowed for communication, it was not perceived by participants as overly effective or easy to use. **Discussion**

The current study adds to the body of literature by examining the experiences of BIPOC men as they engaged in online peer mentee training, intentionally engaged in reflection and action directly related to a STEM career path, and gained experience in navigating resources—both human and otherwise—related to STEM. The study attends to Gasman and colleagues' (2017) call to action—

> ameliorating the bleak prospects for Black males interested in STEM degrees and the shortage of STEM graduates across the nation rests in no small measure on understanding what educational experiences provide openings to Black male achievement in STEM and how these openings address the gaps in STEM education and, ultimately, the workforce. (p. 182)

While not all individuals within the male cohort identified necessarily as Black, they all identified as BIPOC and reported similar experiences related to the challenges of navigating STEM fields as individuals of color.

When considering the research questions, the current study demonstrated that the peer mentee training was indeed useful in furthering students' STEM self-efficacy, sense of community in STEM, STEM identity, and intent to persist in a STEM degree program and career among this particular sample population of BIPOC male students. The study also showed that the peer mentee training can support BIPOC males at one HBCU in identifying mentors, engaging in collaborative relationships with like others, degree and career planning, development of soft skills, and finding opportunities for career advancement. These findings support Tinto's (1987, 1993, 2017) institutional departure model, which demonstrates that both academic and social integration are necessary components for ensuring engagement, skills development, and retention in STEM.

The current study demonstrates the desire for interactions with like others, highlighted by participants' statements about how they identified with the BIPOC women providing the STEM Webinars, so that BIPOC males can see and engage with individuals that have experienced success even when presented with struggles similar to their own. This finding is supported by previous study which reiterated "a widely shared consensus that peer interactions affect student engagement and progress" (Gasman et al., 2017, p. 189), especially related to BIPOC male achievement in STEM. Burt and colleagues (2019), for instance, found that having a "physical example of success" (p. 62) was most important for supporting Black men in persisting in their STEM degree programs. Interactions with like others can facilitate a sense of belonging, improving students' understanding of their 'in group' as it pertains to STEM performance and encouraging enrollment in STEM and persistence in STEM (Walton et al., 2015; Murphy et.al., 2020).

Related to gender-STEM identity, the participants in the current study stated multiple times the benefit of feeling as if they were in a safe and welcoming space that embraced their intersecting identities. Two participants noted that they identified not only as BIPOC men, but also as gay. Their comparison of previous experiences to their current experiences indicated that the openly diverse and welcoming environment of the program, including the representation of diverse individuals within the peer mentee training, supported their development of identity as BIPOC gay men. In fact, they shared that they felt a close identification with the BIPOC women portrayed in the mentee training modules as well as the women featured as speakers for the STEM Webinars as gay individuals. This is significant because, if institutions are to fully support the participation and persistence of BIPOC men in STEM programs, they must also consider how to support those who identify as gender diverse (Sibley & Crane-Seeber, 2020). While it is recognized that those who identify as gender diverse experience increased barriers to STEM participation and success (Hughes, 2018; Sibley & Crane-Seeber, 2020; Stout & Wright, 2016), more research is needed to determine what factors and supports are most influential for men identifying as such within STEM. The current findings also reiterate the impact of mentoring on the development of identity, including STEM identity (Atkins et al., 2020; Jehangir et al. 2022).

The findings of the current study echo previous research that reiterated the importance of connection to a higher purpose—characterized as spirituality and religion—to BIPOC men's persistence in STEM (Burt et al., 2019). In the present study, one mentee frequently referenced that "we are one person…one body", drawing on his spirituality and perceptions of being called to a higher purpose. This obligation to contribute to society for mutual benefit in a meaningful way clearly acted as a driving force for his motivation and intent to persist no matter the obstacles faced. Overall, the benefit of the online peer mentee training was solidified, with participants sharing how their participation in the training enhanced their confidence, sense of belonging, and skills development. These findings are in alignment with the literature supporting the need for training for both mentors and mentees, especially in relation to efforts to broaden participation in STEM among minoritized populations (Deanna et al., 2022; Rockinson-Szapkiw et al., 2020). Importantly, the current study adds to the body of literature that, to date, has not yet explored the impact of participation in online peer mentoring programs on BIPOC men enrolled in STEM degree programs at HBCUs.

Recommendations for Future Research

While the population size for the cohort examined in the current study was small, lessons can be gleaned that can inform future mentoring efforts. One future recommendation for research is to implement an online peer mentoring training program that includes a larger sample population of BIPOC males or, perhaps, is dedicated exclusively to BIPOC males to enhance richness of data and to determine generalizability of the current findings. It is also recommended that the population for program recruitment be widened to include a larger number of HBCUs to determine the extent to which the current findings can be generalized to other geographic locations and contexts. By conducting research at several HBCUs, this will allow cross-comparison that could strengthen the themes of the current research, as well as give rise to new themes, to further inform the research in this field. Longitudinal study would also provide insight into the impact of the current online peer mentoring program.

Future implementation of the online peer mentoring program could also include STEM Webinars where BIPOC men were highlighted as featured speakers. Importantly, given challenges related to the covid-19 pandemic, the current cohort of BIPOC men were only able to complete the online peer mentoring training phase of the project. Future research should examine the impact of engagement in mentoring relationships after the training among BIPOC men. Importantly, while the online peer mentoring program was designed prior to the covid-19 pandemic and was intentionally created to be conducted online, the pandemic prevented participants from electing to meet in the face-to-face environment. Given the isolating nature of the pandemic and the participating institution adopting a posture of emergency remote instruction, future study should explore whether any differences are noted among the online peer mentoring experience outside of the pandemic with restrictions on face-to-face contact lifted. Future implementation might utilize enhanced methods for cross-cohort communication as well, (e.g., other than the Slack platform) and consider a hybrid structure that allowed for the option to engage in face-to-face interaction among program participants.

It should also be noted that the participants in this case study were representative of multiple identities, including gender identities. As such, future study could explore more fully the impact of diverse identities by purposefully recruiting participants with varied gender identities. This would also further attend to a disparity in representation within the research literature (Sibley & Crane-Seeber, 2020).

Conclusion

This study makes a vital contribution to diversifying STEM and addressing inequities by examining the impact of intentional online training for BIPOC male students in STEM programs at HBCUs. While being one of only a few studies that explore male students' experiences at HBCUs, it adds specifically to the limited but growing body of knowledge on online peer mentoring interventions designed to broaden participation in STEM. It is imperative that, given the projected needs for a diverse workforce, institutions explore methods to determine ways in which participation within STEM can be broadened and, most importantly, become more representative of the diverse U.S. population at large, lending itself to creating an inclusive environment. This study demonstrates that the online peer mentee training is beneficial in assisting HBCUs in supporting BIPOC male students' STEM self-efficacy, sense of belonging, STEM identity, and intent to persist in STEM among the sample population studied. Importantly, this study also attends to the need to support students who are not only racially minoritized, but also those with diverse identities as they navigate STEM fields. The study also brings attention to the importance of providing support that broadens participation in STEM, which will allow students of varied experiences and demographic populations to persist and excel in STEM fields. In return, STEM fields may in the future become representative of the population—one that showcases the full spectrum of talent within U.S. society.

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