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Understanding the Peer Mentoring Experiences of STEM Mentees at Two HBCUs

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Abstract

Despite ongoing efforts to broaden participation in science, technology, engineering, and mathematics (STEM), women, especially those who identify as racial and ethnic minorities, continue to be underrepresented. This underrepresentation substantially limits the diversity of talent within the U.S. and limits the ability of the U.S. to remain competitive in the global arena. As such, numerous calls exist that support the need for developing and examining methods for encouraging broader participation in STEM. Peer mentoring is one intervention that has demonstrated promise. As such, the current study examines the impact of participation in a virtual peer mentoring program on female mentees' sense of belonging, confidence, STEM self-efficacy, STEM identity, and intent to persist in STEM.

Introduction

Recent reports continue to reiterate that participation in STEM degrees and career fields remains unrepresentative of the diversity found within the U.S. (NSF, 2021). Women who identify as racial or ethnic minorities remain underrepresented in STEM degree programs and career fields when compared to their male counterparts. However, peer mentoring is one method that has demonstrated promise for broadening participation in STEM. Peer mentoring is 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). The literature on mentoring supports the benefits that the strategy can yield (see NASEM, 2019; Pfund et al., 2015). However, most research on mentoring has been situated within the context of the research laboratory, and a dearth of research exists that examines the peer mentoring relationship outside of the research laboratory, utilizing a peer mentoring model, and within the context of historically black institutions (Rockinson-Szapkiw, Herring Watson et al., 2021; Rockinson-Szapkiw, Wendt et al., 2020). Thus, the current study sought to examine the impact of racially and ethnically minoritized women's engagement in an online peer mentoring program at two historically black institutions (also referred to as historically black colleges and universities [HBCUs]).

Conceptual Framework

The peer mentoring program (eSTEM Peer Mentoring Program; see https://www.udc.edu/estem/) was grounded in several theories: self-efficacy, identity, and mentoring research and theory (see Rockinson-Szapkiw & Wendt, 2020; Rockinson-Szapkiw, Herring et al., 2021; Rockinson-Szapkiw, Wendt et al., 2020; 2021). Social Cultural Career Theory (SCCT) (Lent et al., 1994), however, served as the primary foundation for the program. SCCT purports that a key component to promoting intention to engage in and persist in a degree or career, such as STEM, is interest (Fouad et al., 2016). Interest motivates action, which in turn provides feedback due to subsequent successes and/or failures. This feedback further impacts the development of self-efficacy and, eventually, performance outcomes (Shaub, 2004). Self-efficacy, defined as the belief that an individual has about her ability, in conjunction with her individual beliefs about the likelihood that engaging in a specific behavior will lead to a specific outcome, influence her levels of motivation, her goals, and her persistence toward a degree and/or career pathway. Individuals that demonstrate a high level of self-efficacy are more likely to engage in and persist in degrees and careers.

The research literature has supported that self-efficacy is related to the development of a science identity (Rockinson-Szapkiw, Herring Watson et al., 2021). The development of science identity can facilitate persistence in STEM (Hunter et al., 2007). Individual characteristics (i.e., gender, race, and ethnicity) may influence persistence (Chang et al., 2001; Johnson et al., 2011; Lent et al., 1994). Mentoring, however, is one strategy that can be utilized to support the development of self-efficacy as well as science identity, especially as they relate to social identities that must be negotiated in tandem with STEM identities.

Brief Literature Review

A substantial body of literature has examined variables associated with students' persistence in STEM degree programs. However, despite efforts to understand how to encourage participation in STEM, women, and women who simultaneously

identify as racial and ethnic minorities continue to engage in STEM degrees and career programs less frequently than their White male counterparts. Myriad reasons have been cited for this disparity in representation, from traditional views of gender roles, an unwelcoming climate, and competing responsibilities. However, research has indicated that the development of strong relationships with a mentor can assist in the development of a sense of belonging and, in turn, support participation (Ferreira, 2003). Additionally, research has noted that the phenomenon of stereotype threat and gender-related attitudes can undermine women's interest in and performance in STEM domains (Shapiro & Williams, 2012). When women, however, are exposed to role models with which they can identify and when they receive support from peers, their engagement in and persistence in STEM degree programs may be increased (Rockinson-Szapkiw, Herring Watson et al., 2021; Rockinson-Szapkiw, Wendt et al., 2020). The retention and success of underrepresented minority women (African American, Hispanic/Latino, American Indian, etc.) are significant as they may have a direct impact on diversity for the future STEM workforce.

Methodology

The current study extended a peer mentoring model developed in a previous pilot study (see Rockinson-Szapkiw & Wendt, 2020; Rockinson-Szapkiw, Herring Watson et al., 2021; Rockinson-Szapkiw, Wendt et al., 2021). Within the current study, a series of eight virtual training modules were developed to prepare individuals enrolled in STEM degree programs for engaging as peer mentees in an online peer mentoring program. Each of the eight modules included three major components: 1) a topical discussion that provided an overview of the module and the related research pertaining to the module content; 2) a case study that provided a demonstration of how the module content could be applied and that was intentionally designed to encourage motivation, emotion, and volition; and 3) a personal application and reflection that provided an opportunity to apply the module content to the individual's personal experience and situation. In addition to the online training modules, participants engaged in an online community hosted on the Slack platform to facilitate networking, reflection, and the building of community. Participants also attended up to three STEM Webinars featuring successful women in STEM fields. Each of these program components aligned with the theoretical framework on which the study was grounded to encourage interest in STEM, motivation to persist in STEM, and self-efficacy (see Rockinson-Szapkiw, Wendt et al., 2020). The current paper focuses on the experiences of the racially and ethnically minoritized women as peer mentees engaged in the overall eSTEM Peer Mentoring Program.

In Summer 2020, participants were recruited at two historically black institutions (N = 34; n = 8 mentors, n = 26 mentees). Participants were required to be enrolled in a STEM degree program at one of the participating historically black institutions, identify as a racial or ethnic minority, and possess a GPA of 2.0 or higher. After a rigorous application process, participants were selected and asked to complete the series of virtual training modules in Summer 2020 and Fall 2020. They were then assigned to peer mentoring groups in which they engaged in peer mentoring relationships during Spring 2021. Participants had the opportunity to attend the STEM Webinars during both the Fall 2020 and Spring 2021 semesters. The current paper and related presentation focus on the experiences of racially and ethnically minoritized women peer mentees (n = 22). 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 implementation of the program above and beyond, extending the amount of time allotted to complete the online training. After completing the online training modules and engaging in peer mentoring relationships (total cumulative time = one academic year), the participants completed focus groups and individual interviews.

Using a case study approach, with the female peer mentees serving as the case, open-ended interviews and focus groups were conducted, and data was collected and transcribed for analysis. Using a grounded theory approach (Strauss & Corbin, 1990), emergent codes were first identified through a memoing process that occurred during transcriptions, gaining an overall feel for the data. These codes were used to organize the data before grouping codes around identified axial codes, from which emergent themes were identified to address the central purpose of the research.

The following research questions were examined:

- RQ1: How, if at all, was participation in the online peer mentee program useful in furthering students' STEM self-efficacy?
- RQ2: How, if at all, was participation in the online peer mentee program useful in furthering students' sense of community in STEM?
- RQ3: How, if at all, was participation in the online peer mentee program useful in furthering students' development of a STEM identity?

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

Results and Findings

Across the focus groups and individual interviews, the majority of participants expressed a sense of satisfaction with the program, finding common ground in identifying how it boosted their confidence, gave them a sense of belonging, and provided resources to persist and succeed in their development of STEM identity.

Confidence, Self-Efficacy, and Sense of Belonging

The data suggests that the most beneficial aspect of participating in the program, as reported by participants, was the opportunity to see others like them in STEM careers. These opportunities were provided through attendance at the STEM Webinars and through peer mentoring relationships. Even though the participants did not meet others in person given the COVID-19 pandemic, the experience of participating in the online peer mentoring program helped participants develop confidence, self-efficacy, and a sense of belonging. As one participant explained, they came to feel that "STEM is my community, and I do have a right to be a part of it" (Woman 1, Individual Interview). Another participant noted that it was "very reassuring to see three other Black women still pursuing their own STEM majors and… keep pushing through during a pandemic. So, like, just interacting with them. I feel like I, I belong here too" (Woman 8, Focus Group 3). Seeing others in STEM fields and hearing the stories of others who looked like them that struggled and later succeeded generated a sense of belonging. This also increased participants' confidence that they, too, could be successful in STEM, belonged in STEM, and were not alone in their journeys through a STEM degree program. Their own stories found a voice. As one participant noted, "Yeah. I feel like I can do it. I'm confident" (Woman 6, Focus Group 1)

STEM Persistence

By the end of the program, all participants expressed the desire to continue in their STEM degree program and career trajectory, with many saying that participation in the program increased their likelihood of persisting. One participant commented that "…I'm excited to see what the future holds in the STEM career." (Woman 10, Focus Group 1). Another participant shared, "It was very reassuring to me to see that, like, other students are going through similar hardships that I'm going through. It doesn't mean that I should quit" (Woman 8, Focus Group 3). Participants noted that the mentors were integral to solidifying their intent to persist by establishing a rapport with them as mentees that enabled a sense of goal development and direction. One participant summarized a common sentiment, saying,

> I feel like some of the exercises that we did, such as goal setting, helped me to figure out what my passions were, what my strengths were, and what I like to do, which helped me to eventually figure out what major I wanted to go into. (Woman 5, Focus Group)

Another explained the power of the mentor as "[pushing] that narrative for me to say, you know, this is my identity, and this is what I want to do" (Woman 1, Focus Group 3).

STEM Identity

Participants' development of a STEM identity was supported by their interactions with others like them, both within the mentoring relationship and as a product of attending the STEM Webinars. That is, seeing others from STEM fields and hearing their stories provided a strong motivator for their own story development, driving a sense of who they were becoming. As one participant shared, seeing a role model was important, explaining "…working with my peers, my colleagues, and mentors--listening to other people's stories and really challenging myself to see what my strengths and weaknesses are. So that I can determine which path to take" (Woman 10, Focus Group 1). The participants noted that mentors provided representation of STEM identities that the mentees aspired to embody. Another participant explained that.

> Just watching my mentor, like, we have some of the same identity as well. So just seeing her being able to - push through, and I guess show me what it's like to be in my major as a female, I think that helped me develop or enhance the identities I already had working. (Woman 4, Focus Group 2)

Critiques

The mentoring program was not without critique from participants, however. The primary criticism focused on the peer mentoring relationship—specifically, the frequency of meetings with their mentors, which varied across the peer mentoring groups. Although participants indicated that the frequency of meetings with their mentors did not take away from the overall positive reactions to the program and its impact, many felt this was an aspect of the program that could be improved. However, participants were cognizant that the frequency of meetings with their mentors might have been increased if their institutions were not engaged in emergency online instruction given COVID-19. A majority of participants mentioned they desired additional time and interaction with their mentor, they looked for a stronger relationship with their mentor, and they wanted a stronger bond with their mentor. They felt that these enhancements to the peer mentoring relationship would strengthen their own confidence and identity development. One participant explained that "I feel like whenever I build my confidence, is whenever I have more interaction with my mentor" (Woman 10, Focus Group 1).

One gap that was identified in the thematic analysis was related to those who identified as LGBTQIA+. One participant noted that, in relation to a question about demographic identities on a survey that was provided as part of the overall program (and reported elsewhere), that they did not

> remember there ever explicitly being, um, you know, a question or a note about, uh, queer, non-binary or LGBTQ+ identity. And so, you know...I think there could be more intentional and specific questioning about various identities and backgrounds, especially those that are on the fringes and not represented (Woman 3, Focus Group 2).

The participant went on to explain that

> mentors with those identities and, um. You know, guest lectures and speakers that can speak to, you know. Being in - being those identities, and also doing research in those fields. I think could also highlight the need for. Um, you know, not just recognition, but research. And just care. Period. Um, yeah (Woman 3, Focus Group 2).

Conclusion

Overall, the results presented in this paper suggest that participation in the online peer mentoring program (eSTEM Peer Mentoring Program; see https://www.udc.edu/estem/) was effective in imparting positive benefits for mentees enrolled in STEM degree programs at two historically black institutions. Benefits included the development of self-efficacy, belonging, STEM identity, and intention to persist in their STEM degree programs and career trajectories. While the findings of the current study demonstrate the potential promise of the overall program, further research is needed to determine the generalizability of the findings to other institutions, including other minority-serving institutions. Future study should also consider enhanced acknowledgment and supports of individuals who identify as LGBTQIA+, although some components of the mentee training attended to these identities. Overall, however, the current study supports the benefits of the program as one means to support efforts to broaden participation in STEM among women mentees at two historically black institutions.

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