

Underrepresented Minority Women's Experiences in a Virtual eSTEM Peer Mentoring Program

Abstract

The purpose of this project was to examine the efficacy of a Virtual eSTEM Mentoring Program to assist underrepresented minority women (UMW) in developing mentoring skills that are culturally responsive; self-efficacy in STEM; science identities; and to promote their intent to persist in their STEM degree and subsequent STEM careers. During the Summer 2020, graduate and undergraduate students enrolled in STEM programs at two historically black institutions: University of the District of Columbia and Bethune-Cookman University were recruited to participate in a virtual mentorship program to broaden participation in science, technology, engineering and mathematics (STEM).

A total of 34 students participated in the program ($n = 8$ mentors, $n = 26$ mentees) and were assigned a role of mentor or mentee based on their qualifications for the program. Additionally, all participants completed a pre-test survey, post-test survey, mentor or mentee training (based on their roles), and were provided the opportunity to attend STEM webinars featuring UMWs with careers in STEM. Of the 34 program participants, twenty-two identified as underrepresented minority women (UMW) mentee participants (four were male; their experiences are reported separately), who were required to participate in focus groups and individual interviews once the program concluded during Spring 2021.

Following a mixed methods case study design, the current project examined the following research questions; 1) How, if at all, was participation in the online peer mentee program useful in furthering students' STEM self-efficacy?, 2) How, if at all, was participation in the online peer

mentee program useful in furthering students' sense of community in STEM?, 3) How, if at all, was participation in the online peer mentee program useful in furthering students' development of a STEM identity? And 4) 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?

Overall, mentee participants provided very positive feedback from their experiences in the eSTEM program.

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).

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]).

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, to unwelcoming climates, 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 the 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.) is significant as it may have a direct impact on diversity for the future STEM workforce.

Methodology

All female mentees were invited to participate in individual interviews during the final week of their program engagement. Interview data was analyzed using case study analysis methods (Yin, 2000) to identify: 1) how students' self-efficacy changed; and 2) to determine how the mentorship program components facilitated this change.

Following a mixed methods case study design, the current project examined the following research questions;

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?

Findings

Focus Group Interviews

Mentee participants provided very positive feedback from their experiences with the STEM Virtual Peer Mentorship Program. Mentees felt an overwhelming sense of belonging and were very excited to have participated in the program and made meaningful connections with their peers and other program participants. One mentee explained, "This experience provided resources. Every time there was a webinar, internship opportunity and scholarship, I liked having the resources (Female Mentee, Focus Group 1). Other mentees expressed, "I have a lot of problems and just being acknowledged made me want to pursue a STEM career" (Female Mentee, Focus Group 3), "I belong here, too" (Female Mentee, Group 3), and "It was great to be able to network and collaborate" (Female Mentee, Group 2). The majority of the female mentees were appreciative of the connections made and seeing other individuals who were interested in their majors and those who were already professionals in their fields when attending the STEM webinars.

Many of the mentees requested to continue in the program for a longer period of time, citing how much they enjoyed being a part of the virtual STEM community and having the opportunity to engage in mentoring activities with their peers and their mentors. "We met once a week, every Friday" (Female Mentee, Focus Group 3) and "We had zoom meetings scheduled two times a month, which I liked" (Female Mentee, Focus Group 1). They also commented on the feelings of pride they now have being connected with professional women who currently have careers in

STEM fields and shared their stories of persisting to complete their STEM degree and remain in a STEM career.

Persistence with STEM Degrees and Careers

There have been an overwhelming amount of interventions and programs that seek to increase STEM achievement and these programs, consequently have been implemented in classrooms and communities in an effort to increase STEM participation. (Rittmeyer & Beier, 2009). Mentees expressed that the eSTEM program encouraged their desire to persist in their current STEM majors and seek careers in their respective fields. A female mentee expressed, “I think just the community aspect of this program allowed me to be able to see that there are women that are pushing themselves to pursue careers in STEM and that makes me proud. It makes me happy because that's exactly what I want to do (Focus Group 1).”

When asked what they believed would be their likelihood to have success in their STEM degree and/or pursue a STEM career, one mentee expressed,

I think my likelihood is more after going through the program. It is a little bit higher, I think, in a sense. Just me being able to see other people doing it, gives me the motivation to be like, okay, well, you know, I can do it too. So, I think it increased my likelihood. Being able to find someone exactly in the profession that I wanted helped me to know that there is hope when I graduate and I won't be lost and will know who I can reach out to (Female Mentee W4).

As the interview continued, another mentee also revealed that her likelihood of persisting in STEM also increased as a result of being a participant in the program.

Yeah, my likelihood increased as well. I'm just getting into my field and choosing the parts about it that I like. Everything won't be me doing it by myself. It's going to be a

collaborative effort, like, working with other people to come. To meet the same kind of people, I guess (Female Mentee W2).

STEM Identity and Self-Efficacy

One of the goals of this virtual peer mentoring program was to enhance STEM self-efficacy in hopes of encouraging degree and career persistence in STEM. Self-efficacy refers to “people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performances” (Bandura, 1986, p. 391). “I think just the community aspect of this program allowed me to be able to see that. There are women that are pushing themselves to pursue careers and that makes me proud. It makes me happy because that's exactly what I want to do. So, it just pushes me to success and to try it” (Female Mentee W5). Female Mentee W7 expressed, “I feel that I'm confident enough to compete, um, especially since I have a strong passion for my career field and so that will definitely help me” and Mentee Participant W6 said, “I feel like I can do it. I'm confident” and “Well, probably seeing other people's story, I'm getting encouraged about what I'm doing right now and feeling confident. I'll be successful later on.” Female Mentee W2 expressed, “I feel that I am confident enough to compete, especially since I have a strong passion for my career field and so this definitely helped me”, while another one expressed, “Yeah, I feel like I can do it. I am confident” (Female Mentee W4).

Mentees reported that the opportunity provided to be in this program encouraged them to remain in their STEM fields, graduate and pursue a career in STEM. There was an overwhelming consensus that being able to see other underrepresented minority women in STEM fields solidified their STEM identity. “The program was super inclusive and this helped me figure out what I wanted to do” (Female Mentee, Focus Group 3).

Mentor Characteristics and Communication

Communication emerged as one of the important aspects of the mentor-mentee relationship. Some expressed open communication between themselves and their mentors, while others expressed they expected more communication than they received. “I wouldn't say it hindered me or anything, but I would have liked to communicate and try to know each other more. We're both pursuing STEM and I thought we would communicate more” (Female Mentee WX). Female Mentee W9 expressed, “One thing that was perhaps ineffective was we used to communicate and I think that a lot of young people don't really check their group me messages, because it's not really like they're there.” One mentee was working on an assignment and expressed that her mentor was willing to assist her by communicating through zoom, which really helped her open up more.

I would say the same thing as well because I know there were a couple of assignments that were difficult for me. I was doing a computer program that I didn't finish all the way and she said that I can always reach out and we can always set up a Zoom call or things of that nature. So, like, it really helped me to open up and be willing to have others help me out when I need it (Female Mentee W2).

Female Mentee W4 shared, “One thing that will be most useful that I gained, would be my communicating and my communication skills. She just helped me. Be able to ask more questions because she talked with me and we were able to share and encourage me to let someone know I have trouble with this and I need help. So that is one thing I was able to get from it.”

Mentor characteristics emerged as a theme from the interviews and mentees found these characteristics extremely important in fostering a solid relationship with their mentors in the program. Guidance in the mentee-mentor relationship can be provided through great communication, allowing others to share, making them feel inclusive and being personable are

some of the many characteristics mentees expressed for establishing a good rapport with their mentors in the program. A female mentee in group 3 expressed, “being recognized and acknowledged”, while another in group 1 exclaimed, “my mentor let me talk and share concerns.” Others went on to say, “she helped me understand my work” and “she helped me learn how to navigate through STEM and sent me articles.”

The interviews went on and revealed one mentee's excitement, “I enjoyed my mentor, most definitely because she referred to us as young women and young ladies. She told us that being a woman is not a penalty against us, but because we are women that makes us stronger. That really makes us want to go and compete in a majority male career. That’s powerful!” (Female Mentee, Group 2).

STEM Inclusiveness, Loneliness and Not Belonging

Female mentees expressed the need for STEM fields to be inclusive of all people, regardless of sex or gender. It was interesting to learn that many participants, before participating in the Virtual Peer Mentoring Program, felt they were not being included due to their sex or gender and they expressed how important it is that STEM fields encourage diversity and inclusion during matriculation at colleges and in the work place. One mentee stated below,

In my opinion, I think that it does need some enhancement. I do remember there being questions about, you know, being able to be in a relationship with someone that has a different background or identity. I don't remember there ever explicitly being a question or a note queer, non-binary or LGBTQ Plus identity. Although I do believe that the other questions are important and should remain, 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 (Female Mentee W3).

There were more participants that had the same sentiments but expressed them differently than others. For instance, Mentee W3 expressed in response to another mentee's expression of inclusiveness that,

I would say, yes, I know that feeling; the feeling of being uninvolved, or disregarded as an experience that black queer people are no strangers to and in my relationship with my mentor, I definitely felt that way at times. It hindered me seeing any changes in that regard and made me more aware of the need for black queer, you know, people in STEM. And the need to move beyond just being more interrogating of Gender binaries in general

As the interview continued, the theme of inclusiveness became very important and the mentees shared very openly about their feelings of insecurity of not being included or being afraid they would not be included. As evidenced in the expression below, the mentee reveals how grateful she was to be able to identify with someone that "looked like me". She says,

My recent answer about ensuring that multiple identities, specifically those that are on the fringes be represented. You know, my mentor was black. I was really grateful to be starting a relationship with someone that looked like me in that regard. I remember before we even got to the mentorship relationship portion of the program, just seeing the facilitators that were a part of this program and wishing that more of them were black. I think that really opened my eyes up to know how that was also something lacking in the field and definitely made me hyper aware of my identity (Female Mentee W2).

Overall, the feedback from the mentee experience was extremely positive. As more was revealed in interviews, the sense of not belonging in STEM became evident. While there was no one

particular reason and some tied this feeling to their race or personal experiences, it is worth noting that UMWs may perceive initially that they do not belong in STEM.

I want to do medicine and it is really a very rare career path as a female to choose to go to and it comes with a lot of stress. Sometimes you feel like, Am I on the right path doing the right things? Should I be doing this? Is this right for me? Or am I going to be lonely? And you have a lot of doubts, and a lot of things that make you want to stop and make you want to question yourself. Do I want to really become a doctor? Because why do I want to be a doctor or why do I want to go into this long and arduous path? I think just being able to navigate through these struggling times has been good (Female Mentee, Focus Group 3).

Another mentee expressed, “Yeah, I truly understand where you're coming from as far as being an underrepresented minority woman or, you know, an African-American woman. Either way, we're all in this minority and even more so because of being a woman. I think you definitely have to know that this is what you want, because my experience was that I didn't have this experience at any time in my life. I haven't been a part of a mentoring group and I just hope that you all have started to understand how very important this could have been during my time when I was very lonely” (Female Mentee, Focus Group 2). According to another Female Mentee, “Well, just being a black woman who wants to pursue a career in medicine and knowing that less than 5% of doctors are black in this country, it's just like discouraging in and of itself and sometimes you are scared (Group 2).”, while another mentee expressed, “the immediate rejection that I received, that's kind of putting off, like, well darn, do you guys even want me here?” (Female Mentee, Group 1). There's a stereotype or a prejudice that most people share that I think mostly is STEM professionals or people who are in STEM are like, white or men,

predominantly. Just being able to see there are a lot of HBCU students who are talented and great in the STEM fields is encouraging and makes me want to stay (Female Mentee, Group 2).

Although they had pronounced feelings of not belonging or feeling lonely, participating in the virtual program allowed them to connect with the community and change their initial feelings about not belonging and solidifying their stance and encouraging persistence in STEM and their STEM careers.

Conclusion

Self-efficacy beliefs are encouraged and created by how one perceives their success with certain task outcomes and the experiences that are based on four primary sources of information: mastery experience, vicarious experience, social persuasion, and physiological reaction (Bandura, 1997; Gist & Mitchell, 1992; Pajares, 2005). College attainment and success among underrepresented groups in STEM is of urgent importance to our nation's economic survival and competitiveness across the world and the flourishing agendas of diversity and inclusion.

Diversity and inclusion agendas must bring together students of diverse backgrounds and STEM fields (Palmer et al., 2011). Overall, mentee participants provided very positive feedback from their experiences in the eSTEM program. Female Mentees felt an overwhelming sense of belonging, were very excited to have participated in the program, and made meaningful connections with their peers and other program participants. Female Mentees were appreciative of the connections made and seeing other individuals who were interested in their majors and those who were already professionals in their fields when attending the STEM webinars. Many of the female mentees requested to continue in the program for a longer period of time citing how much they enjoyed being a part of the virtual STEM community and having the opportunity

to engage in mentoring activities with their peers and their mentors. Female Mentees are excited to persist in their current STEM fields and look forward to graduating to pursue a STEM career.

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