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BUILDING CULTURALLY RESPONSIVE STEM PEER MENTORING RELATIONSHIPS
THROUGH VIRTUAL TRAINING: A CASE STUDY

By

Chelsie Marie Dubay

A Dissertation

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Doctor of Education

Major: Instruction and Curriculum Leadership

The University of Memphis

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DEDICATION

This manuscript is dedicated to racially minoritized women who agreed to participate in this study. Even after this study concludes, I will continue to lift and amplify your voices. In me, you will always find a supporter and an encourager.

ACKNOWLEDGEMENTS

This manuscript was a labor of patience, resilience, and love contributed to by several people in my life. I owe them many, many thanks. First, I would like to thank my committee members, Drs. Rockinson-Szapkiw, Curry, Seraphin, and Tawfik. I recognized the importance of partnering with supportive, encouraging mentors early in my doctoral journey. Dr. Rockinson-Szapkiw, thank you for all of the phone calls, email check-ins, and shared drives full of research and resources. Your expertise, mentorship, and support mean everything to me. Dr. Seraphin, thank you for guiding me towards a better and more culturally agile understanding of your experience as a black woman and scholar. The direction, advice, and perspective you warmly and freely shared with me gave this study the heart it lacked. Dr. Curry, thank you for your support and impressive recruiting tactics. Without you, I would not have had enough participants! Dr. Tawfik, thank you for helping me grow as an instructional designer both academically and technically. I loved every class you taught and appreciated your dedication to students as we hone the crafts of design and user experience.

My family also played a role in the completion of this study. To my son, Weston, I hope that I've instilled in you the resilience and grit to take on any challenge. I encourage you to do the difficult things. To my husband, Jason, thank you for the tough love and repeated reminders. To my sister, Deidra, thank you for always being my compass, my refuge, and my cheerleader. To my parents and in-laws, thank you for selflessly giving me the time I needed to complete this study. You are appreciated!

ABSTRACT

According to the National Science Foundation (2017), women who represent ethnically or racially minoritized backgrounds accounted for only 11% of earned bachelor's degrees in science and engineering. To better understand why racially minoritized women do not choose to pursue or fail to persist in STEM programs, one must delve into the intersectional barriers that create and contribute to these disincentives. Using a qualitative, field-based learning experience design following a multi-site case study approach, this study examined racially minoritized female STEM students' experiences within a virtual peer mentoring training program. The aim was to determine how, if at all, the training program design and the experience within the training influenced STEM mentors' and mentees' cultural responsiveness. The participants involved in this study were racially minoritized women recruited from STEM programs across two institutions and were selected to participate in a self-paced virtual training program. Data extrapolated from one-on-one interviews paired with information gathered from the pluralistic walkthrough provided justification and contextual, narrative support for how the training experience influenced the participants' cultural responsiveness. Four themes emerged through a categorical and thematic analysis that helped situate the training experience and its internal components to affect participants' cultural responsiveness: (a) mentoring as a conduit for giving back and catalyst for belonging, (b) reflective practice to acknowledge differences and promote awareness, (c) interactive instructional design elements as a measure of mastery, and (d) culturally responsive curriculum and aesthetics. The findings of this study push the limits of current learning experience design research through the applied incorporation of cultural and socioemotional components into instructional design practices aimed at supporting diverse learners.

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LIST OF ABBREVIATIONS

| | |
|-------|---|
| BFT | Black Feminist Thought |
| CRM | Culturally Responsive Mentoring |
| CrM | Culturally Responsible Mentoring |
| CRP | Culturally Responsive Pedagogy |
| CRT | Culturally Responsive Teaching |
| HBCU | Historically Black Colleges and Universities |
| LCD | Linguistically and Culturally Diverse |
| LXD | Learning Experience Design |
| MKO | More Knowledgeable Other |
| SCT | Sociocultural Theory |
| STEM | Science, Technology, Engineering, and Mathematics |
| STEMM | Science, Technology, Engineering, Mathematics, and Medicine |
| UX | User Experience |

CHAPTER ONE: INTRODUCTION

In the United States, advances in technology necessitate science, technology, engineering, and math (STEM) programs in academic and professional settings. According to Fayer et al. (2017), the number of professionals needed to fill these STEM roles will increase over the next several years. The same authors purported that over 70% of STEM jobs will require, at a minimum, a bachelor's degree. Unfortunately, the educational pipelines that lead students to these careers are far from equitable (Byars-Winston & Dahlberg, 2019). The number of women entering and completing STEM degree programs pales compared to men (NSF, 2019). Furthermore, over ten years, the number of racially minoritized women earning a bachelor's degree in computer science, mathematics, the physical sciences, and engineering has steadily declined. In contrast, this same population's numbers have risen in the social science and psychology fields (NSF, 2019). According to the National Science Foundation (2017), women who represent ethnically or racially minoritized backgrounds accounted for only 11% of earned bachelor's degrees in science and engineering. This disparity is complicated and demands an interdisciplinary effort to combat the intersectional, systemic barriers that have created this inequity.

To better understand why racially minoritized women do not choose to pursue or fail to persist in STEM programs, one must delve into the intersectional barriers that create and contribute to these disincentives. Research firmly upholds that women's intellectual ability and performance in STEM fields is equal to men's intellectual ability (Else-Quest et al., 2010; Stoeger et al., 2013; Wang & Degol, 2017) and black and brown women often cite moderate interest in pursuing STEM fields (Falk et al., 2017). Despite being able and interested, racially marginalized women receive limited opportunities to access the STEM pipeline. Sanchez et al.

(2019) argued that, “At each key point along the STEM educational pathway, Black women face structural forces and interpersonal gatekeepers that can limit their likelihood to develop interests in STEM and persist academically in STEM programs” (p. 298). Simply identifying and categorizing factors contributing to the underrepresentation of black and brown women in STEM without acknowledging the disparities rooted in institutional racism and sexism would render a study sanitized and incomplete. This study names the intersectional elements of race and gender as a root cause of the sociocultural issues plaguing the persistence of black and brown women in STEM and then offers a viable approach to influence the current climate positively.

Efforts to combat and dismantle the demographic disparities within the STEM community often lean toward identity-based resolutions. The research delves into establishing and fostering higher levels of self-efficacy, STEM self-efficacy, and technology self-efficacy to help bolster one’s confidence and “grit.” Operating under this assumption, if a black or brown woman with an interest in STEM wishes to pursue a STEM degree, all she needs is enough confidence in herself and her abilities paired with the perseverance to help her get through the difficult times to be successful in her endeavor. This approach is problematic because, while there is value in these efficacies, it remains deficit-based and these efforts perpetuate the current narrative. Scott (2018) described this as the “astronaut approach” because the efforts help people survive in an “uninhabitable” environment but do little in terms of improving the environment itself. As this study has supported, improving some of these metrics can improve persistence, but without changing the environment such efforts will remain inadequate.

Research traces evidence of the negative implications caused by complex institutional structures and unwelcoming environmental issues. Jensen and Deemer (2019) and Eddy and Brownell (2016) both contended that socio-environmental factors negatively influence women’s

feelings of self-efficacy in STEM. These lower self-efficacy levels can have a trickle-down effect. Hill et al. (2010) further noted that women representing racially minoritized backgrounds often exhibit lower self-efficacy levels related to their ability to succeed in STEM fields. Additionally, male-dominated STEM fields are often described as “chilly,” meaning unwelcoming to women (Hall & Sandler, 1982; Janz & Pyke, 2000). The unwelcoming cultural climate found within male-dominated STEM fields often impedes the sense of belonging that women, especially black and brown women, seek to find and cultivate (Fisher et al., 2019; Leath & Chavous, 2018). While they may explain why women are less likely to develop an interest in or persist in STEM degree programs, those low levels of self-efficacy are the by-product of environmental issues and institutional structures positioned to deter women from pursuing degrees and careers in these areas.

Moreover, women representing racially minoritized backgrounds struggle to develop an identity as a successful STEM professional because they do not share the same surface-level characteristics represented across STEM fields (Olson & Riorda, 2012). Feeling a lack of acceptance and belonging, highlighted by the scarcity of other women of color in the field, dissuades racially diverse women from pursuing STEM as a viable academic or professional path, perpetuating the lack of diversity across STEM fields. To combat these personal and institutional barriers and support STEM persistence, institutions leverage culturally responsive mentoring initiatives to support and encourage persistence in STEM programs while working to change the cultural climate (Byars-Winston & Dahlberg, 2019; Pfund et al., 2016).

One way to encourage racially minoritized women to pursue STEM degree programs and careers is through mentoring programs and, more specifically, peer mentoring programs. Davidson and Foster-Johnson (2001) noted that quality mentorship creates affirming experiences

that cultivate persistence and work to develop a community of inclusion. These peer mentor programs combat harmful influences that may inhibit self-efficacy, identity, sense of belonging, and, ultimately, persistence (Olson & Riordan, 2012). Not all peer mentoring relationships are effective, however, and some may not produce positive, measurable results.

Successful peer mentor programs include several components and both the mentor and mentee need to possess related core competencies (Byars-Winston & Dahlberg, 2019). One of the core competencies of effective mentoring is cultural responsiveness; the most effective mentoring relationships are culturally responsive. Cultural responsiveness describes both the mentor and the mentee's ability to be "capable of genuinely embracing, working with, and continually learning about cultural differences" (Ortiz, 2018, para. 4). Culturally responsive mentoring (CRM) requires that mentors recognize and validate the multifaceted influences on their mentee's identity (Pfund et al., 2016). Developing cultural competency and a CRM relationship requires that mentors and mentees receive adequate and effective training, and for a peer mentoring program to be effective, it must provide appropriate, culturally responsive training (Byars-Winston & Dahlberg, 2019; Gay, 2018; Gay, 2002; Johnson et al., 2005). It is imperative that mentorship training is culturally responsive.

Problem of Practice

To increase the presence of minoritized women within STEM fields, culturally agile STEM-based support programs can create and sustain a more inclusive and equitable cultural climate. Culturally responsive peer mentoring situates itself as a potential change agent and often fosters mutually beneficial mentoring relationships correlated with increased self-efficacy, the development of scientific and academic identities (Carlone & Johnson, 2007; Hill et al., 2010; Lindsay-Dennis et al., 2011), and persistence in STEM degrees (Hathaway et al., 2002; Lindsay-

Dennis et al., 2011; Meschitti & Smith, 2017). According to Byars-Winston and Dahlberg (2019), mentoring is “a collaborative learning relationship and working alliance based on intentionality, trust, and shared responsibility” (p. 4). A mentoring relationship pairs together a mentee or protégé with a professional or expert in a similar field. In peer mentoring, mentees pair with a more experienced student/peer within a similar degree program (Colvin & Ashman, 2010) and are often similar in age and status.

The literature identifies specific characteristics of peer mentoring relationships that lead to rewarding outcomes. While mentees might prefer a mentor that shares surface-level similarities (Allen et al., 2005; Blake-Beard et al., 2011; Williams et al., 2016), these preferences may not always result in significant peer mentorship outcomes. Instead, culturally responsive peer mentorship relationships, in which the mentor shares the same value systems as the mentee, are responsive to the mentee’s cultural experiences and contexts, resulting in higher-quality outcomes (LaFromboise et al., 2016). One such effort, and the focus of this study, is to create a culturally responsive peer mentor training program to inform and educate mentors and mentees on how to improve their cultural responsiveness related to the mentorship relationship. The literature supports cultural responsiveness as essential for successful mentorship relationships. These relationships require opportunities for culturally responsive training and preparation, yet such programs are few. Without sufficient training programs positioned to prepare mentors and mentees on how to be culturally responsive, the mentoring relationship may not be successful.

Further, research on the few training programs geared toward improving learner cultural responsiveness is even more scarce. Scholarship surrounding mentoring typically involves the characteristics of successful mentorship relationships (Byars-Winston & Dahlberg, 2017). There is a dearth of literature on designing training and preparing mentors and mentees to engage in

fruitful, mutually-beneficial mentor relationships (Gandhi & Johnson, 2016; Pfund et al., 2014). Thus, this research sought to fill that void by providing an in-depth look into one such mentoring training program aligned to improve learner cultural responsiveness. This study is unique also due to its setting across multiple sites.

Purpose Statement

Using a qualitative, field-based learning experience design following a multi-site case study approach, this study examined racially minoritized female STEM students' experiences within a virtual peer mentoring training program. The aim was to determine how, if at all, the training program design and the experience within the training influenced STEM mentors' and mentees' cultural responsiveness and to provide a detailed and vivid description of the unique training experiences of the mentors and mentees at one HBCU and one predominately white institution (PWI) serving a large minority and female population in the U.S. (Denzin & Lincoln, 2005; Stake, 1995). The participants involved in this study were racially and ethnically minoritized women recruited from STEM programs across two institutions and were selected to participate in a self-paced virtual training program. Participants completed a survey that explored their cultural responsiveness before completing the virtual peer mentor training modules. The researcher also used one-on-one interviews and pluralistic walkthroughs to gain insight into the experiences of the mentors who completed the training modules. The setting of this study involved a PWI and an HBCU, which were both committed to providing the necessary support structures to encourage and increase persistence within a racially diverse student population (Harper, 2018). Providing virtual STEM peer mentor training within this specific student population across the two sites is advantageous because it aligns with many institutions' mission to serve diverse communities. Further, this study's virtual nature respected the

limitations imposed by the COVID19 pandemic and worked to increase availability and flexibility, making it more attractive to potential learners.

Theoretical and Conceptual Framework

Culturally responsive mentoring shares a theoretical and contextual framework with culturally responsive and culturally relevant pedagogies. Culturally responsive and culturally relevant pedagogies are instructional strategies that seek to ignite student motivation by recognizing and incorporating culture into instruction. Cultural referents embedded in teaching can empower learners intellectually, socially, emotionally, and politically (Gay, 2018; Gay 2002; Ladson-Billings, 1994; Rosinski, 2003). As such, a culturally responsive virtual STEM peer mentoring training program must also incorporate these strategies by utilizing its audience's cultural experiences (Han & Onchwari, 2018).

This study employed culturally responsive mentoring as a conceptual framework. Culturally responsive mentoring (CRM) is an approach to the practice of mentoring where, ideally, both the mentor and mentee acknowledge and leverage the intersection of each other's cultural background. Additionally, culturally responsive mentoring requires both parties to recognize and attend to the culturally-influenced information exchanged within the relationship. Culture is "a collection of information (or meanings) that is (a) nongenetically transmitted between individuals, (b) more or less shared within a population of individuals, and (c) maintained across some generations over a period of time" (Kashima, 2010, p. 177).

It is essential to recognize the role culture plays in determining how one sees and interprets the world and how one acquires and assesses information. In each of these actions, culture shapes and informs an individual's worldview. Culturally responsive mentoring promotes flexibility and adaptability. Instead of approaching a peer mentoring relationship with a singular

worldview, culturally responsive mentoring encourages mentoring participants to consider the multiple cultural contexts and value systems that each individual brings to the relationship and then leverage this information to connect and empower one another. Informed by benchmarks created by the Valentine Foundation (1990), Lindsay-Dennis et al. (2011) described nine benchmarks of culturally responsive mentoring programs for girls in primary settings:

- a safe space, both physically and emotionally;
- guidance from peers through dialogue that is emotionally aware and nurturing;
- opportunities to develop relationships based on trust;
- a focus on cultural strengths over risk factors;
- a comprehensive program that includes a myriad of content;
- opportunities to create positive changes;
- opportunities to engage the design, development, and implementation of the program;
- financial support and stability to ensure appropriate integration of the program benefits;
- active recruitment strategies.

These same benchmarks may apply to mentoring programs for racially minoritized women who are considering or pursuing STEM degrees in a higher education setting.

Specifically, establishing and cultivating trust and a safe environment prove paramount when empowering racially minoritized women to explore STEM degrees. Creating environments that showcase and celebrate racially minoritized women who continue to persist in STEM fields supports and encourages the persistence of their younger counterparts who may be considering or beginning a STEM program. Tackling chilly climate issues in male-dominated STEM fields by creating environments that showcase and celebrate racially minoritized women who continue

to persist in STEM fields supports and encourages the persistence of those younger racially minoritized women who may be considering or beginning a STEM program. Mentoring relationships, especially those mentoring relationships that are effective and culturally responsive, bolster the confidence and persistence of racially minoritized women explore these career options.

Culturally responsive mentoring training relies heavily on the principles and strategies of culturally responsive teaching. However, the ability to cultivate and foster a CRM relationship is not an inherited trait, but rather a skill that must be intentionally taught and thoughtfully practiced. Training a mentor or mentee on how to be culturally responsive requires appropriate and culturally responsive training.

A healthy body of literature supports and promotes mentoring as a viable way to encourage racially and ethnically minoritized women in STEM. Few studies focus on the training aspect of a mentoring relationship. Even fewer studies examine the efficacy of mentoring and mentoring training in the virtual environment.

Research Questions

This study aimed to advance knowledge in peer mentorship training, especially for STEM programs aiming to develop culturally responsive mentor training programs. (Gandhi & Johnson, 2016; Pfund et al., 2014). The following questions guided the study:

Central Research Question: How, if at all, did the racially minoritized women mentor and mentees' experience with the virtual STEM peer mentoring training program influence their cultural responsiveness?

- What, if any, instructional design elements within the virtual STEM peer mentoring training program did racially minoritized women perceive as efficient and satisfying?

- What, if any, instructional design elements within the virtual STEM peer mentoring training program contributed to racially and ethnically minoritized women’s cultural responsiveness development?
- What, if any, instructional design elements within the virtual STEM peer mentoring training program hindered racially minoritized women’s cultural responsiveness development?

Significance of the Study

This study examined the impact of a virtual STEM peer mentoring training initiative targeted at racially minoritized women enrolled in one HBCU and one PWI. The results of this study inform future peer mentor training programs on how to improve the cultural competence and cultural responsivity of both mentors and mentees engaging in peer mentor relationships.

Definitions

Mentoring. Although many definitions of mentoring exist, one central theme is guidance through care. For this study, mentoring described “a professional, working alliance in which individuals work together over time to support the personal and professional growth, development, and success of the relational partners through the provision of career and psychosocial support” (Byars-Winston & Dahlberg, 2019, p. 37). Throughout this study, the researcher referenced various configurations of mentoring. Specifically, this study focuses on peer mentoring. In a traditional mentoring relationship, the mentor is often older and more experienced than the protégé or mentee. For peer mentoring, the age difference between the mentor and mentee is significantly smaller. For this study, the mentor may be a more experienced or slightly older student in a peer mentor relationship.

Virtual Mentoring. Often called e-mentoring, virtual mentoring is mentoring that is conducted entirely or in part using electronic communication, such as email, text, social media, messaging applications, or computer platforms” (Kaufman, 2017, p. 4).

Culture. While a bit of an ambiguous term, culture is often defined as “a collection of information (or meanings) that is (a) nongenetically transmitted between individuals, (b) more or less shared within a population of individuals, and (c) maintained across some generations over a period of time” (Kashima, 2010, p. 177).

Cultural Competence. Cultural competence describes the “combination of awareness, knowledge, and skills needed to work effectively with individuals who are different from, and similar to, oneself” (Vaccaro & Camba-Kelsay, 2018, p. 88).

Cultural Responsiveness. Cultural responsiveness “us[es] cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse individuals to make... encounters more relevant and effective” (Gay, 2010, p. 31).

Culturally Responsive Teaching (CRT). CRT uses the cultural characteristics, experiences, and perspectives of ethnically diverse students as conduits for teaching them more effectively” (Gay, 2002, p. 106).

Culturally Responsive Mentoring (CRM). CRM includes a mentor relationship that demonstrates the responsiveness to “validate students’ various identities and help them navigate invalidating experiences encountered while simultaneously reinforcing their self-efficacy in their field” (Byars-Winston & Dahlberg, 2019, para. 2).

Culturally Responsible Mentoring (CrM). CrM is an “approach which helps preservice teachers become critical thinkers about the cultural and social contexts in which they work, so

they can take steps toward developing equitable and inclusive—culturally responsible—practices for their particular students” (Zozakiewicz, 2010, p. 139–140).

Racially Minoritized. This study uses the term racially minoritized to describe persons who identify with one or more of the following racial and ethnic groups: Blacks or African Americans, Hispanics or Latinos, American Indians or Alaska Natives, Native Hawaiians, and other Pacific Islanders (NSF, 2017). The use of this term was intentional. I chose to use racially minoritized to describe those participants who are non-white women of color to further remind the reader that their marginalization was not of their own choosing. Instead, black and brown women are marginalized by and through systemic inequities found within the fibers of racism and sexism. They receive and bear the action of marginalization.

CHAPTER TWO: LITERATURE REVIEW

Mentoring has become an intervention to promote STEM engagement, matriculation, and persistence for underrepresented populations (Byars-Winston & Dahlberg, 2019; Carlone & Johnson, 2007; Hill et al., 2010). Moreover, virtual peer mentoring is swiftly becoming a mentoring approach that enables women and persons of color the opportunity to participate in this type of intervention (Zambrana et al., 2015). Virtual peer mentoring provides mentees with an opportunity to pair with mentors who match their demographic characteristics without the barrier of geographical limitations. Virtual mentoring opportunities also provide the flexibility and convenience these underrepresented populations often need to access such programs. Historically, higher education institutions do not have a positive history of accounting for the needs of women and racially minoritized populations. Busy schedules, obligations related to caregiving, and other personal constraints often make it difficult for women and minoritized populations to take advantage of programs and initiatives, like mentoring opportunities, offered outside of the typical workday. These virtual mentoring opportunities are more accessible to women and minoritized populations and can improve educational success and persistence (Byars-Winston & Dahlberg, 2019).

Peer mentoring programs and mentoring training that employ virtual (online or blended) approaches are only beginning to be developed and piloted (Haggard et al., 2011; Leidenfrost et al., 2014; Watts et al., 2015). Little research exists on the outcomes of these online and blended STEM peer mentoring programs for either the mentor or mentee, especially in STEM (Byars-Winston & Dahlberg, 2019). The research documenting the benefits of mentoring for women in STEM and higher education has focused chiefly on face-to-face modality (Dawson et al., 2015)

or within research laboratories at predominately White institutions (PWIs) (Byars-Winston & Dahlberg, 2019).

Virtual peer mentoring programs are significantly different from face-to-face ones, particularly in terms of the user interface. In a traditional face-to-face mentoring experience, the mentor and mentee interact in person without the use of a virtual platform. Granted, some communication may take place electronically, via email, private message, or other applications, but the primary mode of communication and sharing happens in real-time and face-to-face. Persons within a virtual peer mentoring relationship, however, communicate across a variety of electronic mediums. Thus, it is important to study the user's experience when developing virtual programs; research in human-computer interaction has demonstrated that the intersection of user experience and interface shapes the user's perceptions of usefulness (Kaptelinin & Nardi, 2018). Studying user experience can also help researchers better understand how the program does or does not meet the intended outcomes.

Usability and learning experience design studies also provide insight into how the program elements and the virtual interface hinder or support the program's intended results. For this study, one outcome of interest was the growth of a mentor or mentee's cultural responsiveness. By investigating the mentoring training user experience (UX) and how that experience intersects cognitively, emotionally, and pedagogically with the interface, scholars can better understand which elements impacted a learner's cultural responsiveness and then incorporate those into future training. Due to the virtual modality of the primary research site, learning design experience (LDX) will inform and expand this study's approach.

This literature review focuses on peer-reviewed studies and substantial published works that address mentoring and mentoring training through the lens of cultural responsiveness. It opens

with a discussion of culturally responsive teaching (CRT) and how this teaching strategy can inform and benefit culturally responsive mentoring (CRM) training. The literature supports CRT and CRM as ways to increase persistence. As such, the review will also include a brief synopsis of persistence literature as it relates to culturally responsive mentoring and culturally responsive mentoring training programs. Because this study employed usability and learning experience design strategies to engage in dialogue with the study subjects, a brief account of usability studies concentrating on training programs has also been included. Ultimately, the review demonstrates a need for this study to inform future studies involving the support of racially minoritized women in STEM fields.

Conceptual Context

Culturally Responsive Teaching

Culturally responsive teaching (CRT) is an instructional strategy that utilizes cultural and personal connections to optimize engagement and learning. Scholarship in neuroscience explains that when the brain encounters information, either through reading or through a learning scenario, it is instinctually looking to forge connections between the new information presented and personal relevance (Hammond, 2015). CRT engages learners by depositing evidence of a personal connection to the material through cultural references and instruction that mirrors personal experiences specific to a particular sociocultural group. A learner establishes meaning based on a cultural frame of reference (Jackson, 2011, as cited in Hammond, 2015). This frame of reference aids the learner in “interpreting and inferring meaning” (p. iv).

CRT is rooted in Vygotsky’s (1978) sociocultural theory (SCT). According to Vygotsky, learning occurs through meaningful interactions with others and then through an individual process. He explained:

Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside the child (intrapsychological). This applies equally to voluntary attention, logical memory, and the formation of concepts. All the higher functions originate as actual relationships between individuals. (p. 57)

Learning occurs within social interactions from guided learning in the zone of proximal development (ZPD) (Vygotsky, 1978). ZPD is the area in which a learner can grow and develop with the assistance and encouragement of a more knowledgeable other but cannot grow and develop in this space independently. A more knowledgeable other (MKO) can provide the learner with scaffolding to support this growth and development, such as activities aimed at helping the learner solve a task or reach a goal. Scaffolding activities would initially involve the control, manipulation, or removal of elements beyond a learner's current area of mastery. Then, as the learner progresses, the MKO removes or reduces the scaffolding supports until the learner achieves mastery of the skill or task.

Informed by Vygotsky's (1978) sociocultural theory, Gay (2000, 2002, 2010a, 2010b, 2018) developed culturally responsive pedagogical principles, incorporating students' sociocultural influences into their instruction. More explicitly, culturally responsive teaching (CRT) is a pedagogy that uses "the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more salient to them. It teaches to and through the strengths of these students" (Gay, 2018, p. 36-37). Listed below are the five principles, along with multi-modal examples that Gay (2002) outlined, that create the foundation of culturally responsive teaching:

- the development of a cultural diversity knowledge base;

- the design of culturally relevant curricula;
- the demonstration of cultural caring and building a learning community;
- the establishment of cross-cultural communications; and
- the application of cultural congruity in classroom instruction.

First, teachers must develop or expand their knowledge base to include a more culturally diverse reference frame. This expansion requires dedicated and intentional efforts to learn more about a school or community's sociocultural diversity. Developing and diversifying a cultural knowledge base includes reading and investigating the literature of various cultures to understand their heritage, traditions, and value systems. For example, a teacher in an ethnically diverse school system may attend students' community events and then use them to open a dialogue.

Developing culturally relevant curricula demands that instructors step away from relying on standard textbooks and engage students and the community in the instructional content. Culturally appropriate instruction is both meaningful and student-centered. One way an instructor could create culturally relevant curricula is by selecting topics from within students' communities. Instructors could ask students to interview members of their communities and report back on the findings. Together through engaged discussion, the instructor could then share alternative viewpoints by demonstrating how to engage with and leverage that community knowledge. Instructors may employ these principles in the teaching of diverse learners. These same principles can be extended into the online instruction space to train mentors and mentees on how to be more culturally responsive within their mentoring relationships.

Care may be the most critical principle of those cited by Gay (2002). One must distinguish between superficial and authentic care, emphasizing the latter. Demonstrating

cultural caring and fostering a community of learning goes beyond merely “caring” about the students. Instead, cultural caring encourages instructors to invest in reciprocal relationships with their students, taking time to learn about their students and then using that knowledge within the instruction. To do so, instructors can capture their students’ interests and strengths and use those interests as a catalyst for learning. By taking a strengths-based approach to instruction, instructors can help students forge connections between new knowledge and academic success. One additional way to cultivate cultural caring in teaching is to provide students with multiple assignment submission options. This flexibility recognizes differences among student preferences and empowers students to select mediums that best demonstrate their interests and mastery.

Communication involves more than the written or spoken word. Instead, communication includes the exchange of information as well as the presentation and delivery of that information. It is truly a multi-modal experience. To ensure that communication is culturally responsive, instructors must invest in the cultural vocabulary of their students. While much debate exists surrounding the use of “academic English” versus the use of vernacular dialects in the classroom, a better and more culturally aware approach would be guiding students’ ability to appraise a situation for code-switching opportunities (Gay, 2018). Code-switching is the ability to speak in both cultural vernacular and “standard” English based on the platform and audience. Instruction to introduce and improve code-switching as a means of cross-cultural communications can empower students to embrace their dialects while also encouraging them to establish comfort in other vernaculars.

Finally, Gay (2002) promoted cultural congruity as a mechanism for learning in a diverse classroom. Cultural congruity is the practice of identifying diverse student learning styles and

matching instructional strategies to those styles. How one approaches learning and knowledge acquisition is a culturally informed trait. The way a student works through a task and how a student musters motivation to complete the task are both culturally informed. Creating cultural congruity in the classroom may involve incorporating case-study and case-based learning scenarios where the instructor can explain and illustrate how the knowledge, concepts, or principles apply to practice (“in real life”). By demonstrating the connection between learning and the applicability of that knowledge, a student may be more motivated to learn and be engaged throughout the lesson.

The five components of culturally responsive teaching integrate well into both face-to-face and online teaching modalities. The virtual instruction space provides a platform where instructors may create personalized, flexible learning pathways culturally relevant to the learner. In creating a virtual STEM peer mentoring training program featured in this study, instructional designers provided case-based learning scenarios, culturally and ethnically diverse imagery, and cultural congruity deposits to maximize engagement and usability.

Gay’s preliminary CRT strategies share a similar framework with multicultural education research published in the mid-1990s. During this same time, Ladson-Billings (1995a, 1995b) also published a seminal study that introduced the development of the theory of culturally relevant pedagogy. Here, culturally responsive teaching recognizes that “a pedagogy that acknowledges, responds to, and celebrates fundamental cultures offers full, equitable access to education for students from all cultures” (Brown, 2020). Both Gay and Ladson-Billings emphasized the importance of continued professional development for teachers to encourage culturally responsive teaching strategies. In line with Gay and Ladson-Billings, the current study

promotes and supports creating mentoring training programs to educate mentors and mentees on engaging in a culturally responsive mentoring relationship.

Culturally Responsive Mentoring

Culturally responsive mentoring shares many of the same tenets of culturally responsive teaching. Yet, the differences between the two practices demand individual research and scholarship. Zozakiewicz (2010) was one of the first scholars to name the practice of incorporating the theoretical ideologies of culturally aware reflective supervision within a mentoring context. Culturally *responsible* mentoring (CrM), according to Zozakiewicz (2010), is an “approach which helps preservice teachers become critical thinkers about the cultural and social contexts in which they work, so they can take steps toward developing equitable and inclusive—culturally responsible—practices for their particular students” (pp. 139–140). In this context, CrM refers to pre-service teachers' training to be better equipped and prepared to cultivate community and connection with their diverse students. This effort ensures that preservice teachers may approach instruction and classroom management diversely and equitably.

Culturally responsive mentoring (CRM) expands beyond preservice teachers' scope and lends itself to helping diverse students foster self-efficacy in academia and professional settings (Shen et al., 2020). Byars-Winston and Dahlberg (2019) defined culturally responsive mentoring as a mentoring relationship “whereby mentors show curiosity and concern for students’ cultural background and their non-STEMM [science, technology, engineering, mathematics, and medicine] social identities” (p. 62). Much like culturally responsive teaching, culturally responsive mentoring is an intentional and intimate practice. CRM requires that both the mentor

and mentee exhibit attitudes and behaviors that allow mutual collaboration among those with different cultural backgrounds (Sanchez et al., 2014).

Additionally, CRM requires both persons involved in the mentoring relationship to acknowledge and understand the power dynamics and consequences of systemic oppression (Felder & Barker, 2013; O'Meara et al., 2013). The literature illustrates correlations between inadequate or unfulfilling mentoring relationships and a lack of cultural responsiveness (Jimenez et al., 2019; Lovitts, 2001; Turner & Thompson, 1993; Wang, 2019). For this mentoring relationship to be successful, mentors and mentees both must first receive adequate training to prepare for the mentoring relationship. Ideally, this mentoring relationship will be culturally responsive, meaning that both the mentor and mentee can identify and advocate for the use of culturally significant exposures and realign those exposures to act as resilience mechanisms that support persistence.

Persistence and Cultural Resilience

In light of the cultural sensitivities CRT and CRM acknowledge, this study also borrows from the frameworks of persistence and resiliency. More specifically, it used the lens of cultural resiliency to understand how women from minoritized backgrounds can successfully leverage Tinto's (1993, 2015, 2016, 2017) integration theory through culturally responsive mentoring to promote persistence in STEM fields. Tinto's integration theory purports that a "student's pre-entry attributes, which include the student's family background, skills and abilities, and prior schooling, shape these initial goals and commitments" (p. 6). Tinto's (1993) theory also suggests that academic integration supports persistence through the receipt of positive reinforcement.

Clauss-Ehlers (2008) described cultural resilience as "the degree to which the strengths of one's culture promote the development of coping. This type of resilience has many aspects,

including a developmental trajectory within a cultural matrix composed of norms, family structure, and peer relationships” (p. 198). Culturally responsive mentoring promotes these tenets by identifying and incorporating a mentor or mentee's past sociocultural exposures and experiences as channels of persistence and resilience. The framework of resilience, and more specifically, cultural resilience, looks to award those cultural nuances and support systems. Clauss-Ehlers (2008) noted that “sociocultural supports include cultural legacies and as such can influence adaptive development because the coping strategies gain significance in part from the cultural milieu in which the individual learns about stressors, how to react, what is harmful, and how to state their goals” (p. 207). As evidenced by Clauss-Ehlers (2008), this sociocultural infrastructure's impact can then translate as a coping mechanism and primary motivator for student persistence.

Recognizing the impact of sociocultural influences on a student’s ability to cope can have lasting effects on their ability to persist, academically or otherwise. These persistence and resilience mechanisms are crucial for racially minoritized women to leverage as they pursue a STEM degree. Approaching the degree from a strength-centric mindset that employs and appreciates the cultural value systems and traditions racially minoritized women represent while leaning on their peer mentors' successes and persistence can warm the chilly climates these programs may produce. It is imperative to note that, while this study names and provides context and documented support through the literature for the use of culturally responsive mentoring and its related lenses as a scaffold for women of color pursuing STEM degrees, this study does not operate with the understanding that culturally responsive mentoring absolves institutionalized racism, sexism, and intersectionality.

Provided below is a brief review of the literature that traces mentoring through various audiences and modalities. The purpose of this review to promote and support the case for culturally responsive, virtual peer mentoring training programs as a potential avenue for increasing the presence of racially minoritized women in STEM.

Mentoring

Research literature supports mentoring as a central conduit for developing peer mentors' and mentees' STEM persistence (Byars-Winston & Dahlberg, 2019; Carlone & Johnson, 2007; Hill et al., 2010). The impact of effective mentoring relationships traces through the prevalence of more diverse degree programs, research opportunities, and teams within a workplace, and this diversity often produces research that carries a higher impact (Byars-Winston & Dahlberg, 2019). The mentoring literature demonstrates that there is no single, consistently recognized definition of mentoring. This lack of a consistent definition and naming convention (e.g., coaching, role model, etc.) can be problematic when corraling scholarship. Therefore, this study will use the Byars-Winston and Dahlberg (2019) definition of mentoring as “a professional, working alliance in which individuals work together over time to support the personal and professional growth, development, and success of the relational partners through the provision of career and psychosocial support” (p. 37). Also, this work recognizes three shared characteristics of mentoring across the literature. First, mentoring includes assistance, in a variety of forms, aimed at promoting and supporting growth. This variety of formats forms the second pillar, which includes the multiple mediums whereby mentoring may occur. Last, mentor relationships are person-centric and rely on a connection established between the mentor and the mentee.

Mentoring is commonly used in higher education STEM programs to encourage women and racially minoritized scholars to pursue STEM degree programs (Byars-Winston & Dahlberg,

2020; Meschitti & Smith, 2017). Racially minoritized women mentees often struggle to find mentors who share a similar racial, ethnic, or cultural makeup. Therefore, many higher education institutions are developing peer mentoring programs as a suitable alternative. Peer mentoring is a mentoring relationship where the mentor has “lived through a specific experience,” and the mentee is “new to such an experience” (Griffiths et al., 2018, p. 95). The mentor in a peer mentoring relationship is often older and more experienced than the mentee (Byars-Winton & Dahlberg, 2019; Collier, 2015). This study situates peer mentoring relationships within an academic context. As such, the mentor is typically an upper-class racially minoritized female student who is pursuing a STEM degree program. The mentee generally is an underclass racially minoritized female student who is either undecided or new to pursuing a STEM degree program.

Peer mentoring relationships enjoy several additional benefits compared to traditional mentoring relationships. Namely, peer mentor relationships often exhibit higher levels of trust and self-disclosure (McGee, 2016). Furthermore, peer mentoring relationships often extend beyond academia's boundaries to offer guidance and support in social and emotional contexts (Cree-Green et al., 2020; Moschetti et al., 2017). Adaptability and support are attributes of peer mentoring relationships that are particularly helpful for underrepresented student populations. Engaging in a peer mentoring relationship fosters a sense of belonging, crucial to women of color exploring STEM degrees. Peer mentoring can help cultivate this sense of belonging by supporting the new students as they acclimate to an unfamiliar academic environment (Byars-Winton et al., 2015; Carlone & Johnson, 2007; Hathaway et al., 2002; Hill et al., 2010). Additionally, peer mentoring relationships help to build and solidify participants' academic identities. For this study, a student's STEM identity is of importance. A mentee who can interact

with and learn from a mentor who embodies similar cultural values and similar physical attributes helps build a strong STEM-identity that impacts self-efficacy and persistence.

Virtual Mentoring

The bulk of literature surrounding successful mentoring examines traditional, face-to-face mentoring that requires the mentor and the mentee to interact in person in the same location (Collier, 2015; Crisp & Cruz, 2009; Cohen & Galbraith, 1995; Lombardo et al., 2017; Vandal et al., 2018). This traditional mentoring model has proven successful in fostering academically beneficial relationships that inspire persistence. An extension of conventional mentoring, virtual mentoring removes the physical and geographical boundaries that often limit face-to-face mentoring. Virtual mentoring, also called e-mentoring, is mentoring that occurs in an electronic modality (Neely et al., 2016; Rowland, 2012). This electronic modality relies on technology-mediated communication mediums that may include text, email, social media platforms, chat programs, or web conferencing tools (Neely et al., 2016). With advances in technology and the impact of COVID-19 on the availability of and exposure to technical resources, virtual platforms and web-based conferencing programs have drastically altered the mentoring landscape.

The literature has traced a ten-year surge of virtual mentoring as a credible option for facilitating peer mentoring (Haggard et al., 2011; Knouse, 2013; Ladyshevsky & Pettapiece, 2015; Ruane & Koku, 2014; Smailes & Leary, 2011). Most notably, the emergence of virtual mentoring extends mentorship opportunities to racially minoritized students in academia. A virtual modality allows for underrepresented racial minoritized groups and women to connect with a mentor or mentee who shares their physical or demographic characteristics (Espino & Zambrana, 2019; Zambrana et al., 2015). A virtual platform also allows for extended and increased communication opportunities. These additional communication opportunities often

result in increased interpersonal skills (Adams & Crews, 2004), self-efficacy, and career self-efficacy (DiRenzo et al., 2013). Mentors and mentees using a virtual platform for peer mentoring would benefit from training and support within the same modality. This study will focus on a virtual training program for peer mentoring as part of a more extensive virtual peer mentoring program.

Mentor Training

The literature traces a consistent correlation between the availability of mentoring opportunities and racially minoritized women's persistence in STEM degree programs (Cole, 2014; Elliot et al., 2020; Petersen et al., 2020; Saffie-Robertson, 2020). This correlation assumes that mentoring relationships are effective (McGhee, 2016; Meschitti & Smith, 2017). Because the efficacy of mentoring relationships directly impacts the arrangement's positive outcomes, adequate and culturally responsive mentoring training programs are essential. Mentorship training programs provide training and reflective opportunities to ensure that both mentors and mentees receive the skills needed to participate in the mentoring relationship effectively (Byars-Winston & Dahlberg, 2019; Collier, 2015; Galbraith & Cohen, 1995; Gandhi & Johnson, 2016; Pfund et al., 2014; Pon-Barry et al., 2017). Unfortunately, most mentorship training programs focus solely on the mentor's role in the relationship, leaving the mentee untrained. Current research recommends extending scholarship to consider creating and evaluating mentoring training programs (Pon-Barry et al., 2017). Emerging literature supports that providing a holistic mentorship training program, including education and training for both the mentor and mentee roles, may increase the mentoring relationship's productivity and efficacy (Nearing et al., 2020).

While some individuals enter into mentoring relationships with a natural inclination to mentor or be mentored successfully, other individuals may require additional education and

preparation. Because the act of mentoring is akin to a skill, all participants, regardless of past mentoring exposures, benefit from training and reflective learning opportunities (Byars-Winston & Dahlberg, 2019). Past research has recognized an absence of mentorship training and education (Keyser et al., 2008; Silet et al., 2010). Recent studies have traced the emergence of respected, formal mentor training programs such as Entering Mentoring (Handelsman et al., 2005; Pfund et al., 2015); Culturally Aware Mentoring (CAM) (Byars-Winston et al., 2018), and Promoting Opportunities for Diversity in Education and Research (PODER). Each of these programs encourages a proper understanding of the role mentoring plays and promotes inclusive, culturally responsive practices within mentoring.

Mentoring and Cultural Responsivity

The literature supports cultural responsivity as the defining characteristic of a mutually beneficial, effective mentoring relationship (Byars-Winston & Dahlberg, 2019), yet few mentoring programs include adequate training or opportunities to explore cultural competence. Training in cultural competence presents skills that help mentors and mentees understand how to interact effectively with those from different cultural backgrounds (Sanchez et al., 2014). Cultural competence training broadens and improves one's cultural responsivity, meaning that, after cultural competence training, the learner should recognize a mentor or mentee's cultural attributes through a strengths-based approach (Sanchez et al., 2014; Suffrin, 2014). This approach often allows mentors and mentees to recognize and frame cultural attributes as resilience mechanisms. The mentor and mentee's ability to be culturally responsive is essential in racially minoritized women's STEM mentoring relationships.

Developing a culturally responsive mentoring relationship is a process. One approach to cultivating this type of mentoring relationship is through the ARCS model (Figure 1). Based on

the scholarship of culturally responsive pedagogy (Ladson-Billings, 1995), ARCS provides a framework for mentors and mentees to follow and practice as they work together to become more culturally aware. The ARCS culturally responsive mentoring process involves four critical steps: awareness and acknowledging differences, respect and responsive, celebrating difference and communicating high expectations and confidence, and scaffolding (Rockinson-Zapkiw et al., 2020, p. 8).



Figure 1

ARCS Culturally Responsive Mentoring Process

Note. From “Being Culturally Responsive in a Peer Mentoring Relationship” (p. 8), by A. J. Rockinson-Szapkiw, L. Sechrest-Ehrhardt, C. Dubay, C., & N. D. Mizelle. In A. J. Rockinson-Szapkiw, J. Wendt, & K. Wade-Jaimes (Eds.), *Navigating the Peer Mentoring Relationship: A Handbook for Women and Other Underrepresented Populations in STEM*. Kendall Hunt. Copyright 2020 by Amanda Rockinson-Szapkiw. Used with permission.

The first step of the ARCS process, awareness and acknowledging differences, involves active and intentional recognition of both the mentor’s and mentee’s cultural value systems and

implicit biases. Here, mentors and mentees may engage in conversations and explorations about their respective cultural backgrounds. Using the ARCS framework, the mentoring pair can explore the three levels of culture (artifacts, values, and assumptions) so that both participants can accurately identify and describe their cultural lenses (Rockinson-Szapkiw et al., 2020). Reflective practice is a crucial component of gaining awareness of one's cultural identity and self-awareness plays a pivotal role in successful, culturally responsive peer mentoring relationships (Rockinson-Szapkiw et al., 2020). Training programs for culturally responsive mentoring should include opportunities for mentor and mentee reflection on their unique cultural identities. Activities to explore cultural identity may consist of working together to complete cultural diversity questionnaires and guided conversations between mentors and mentees.

Identifying and confronting bias is another critical step in gaining awareness and acknowledging differences. Every person enters a relationship with a set of implicit and explicit biases informed by their cultural background and identity. These implicit biases are often so ingrained in a person's identity that their presence is subconscious (Staats, 2016). Reflective practices and constructive, open dialogue are both tactics for identifying, combatting, and overcoming personal biases and prejudices.

The second step of the ARCS process is to be respectful and responsive to establish and cultivate trust. Mentors and mentees can progress to this step only after identifying and acknowledging their own cultural identities and implicit biases. After that acknowledgment, the next action requires intentional curiosity and education on cross-cultural knowledge. While reading through the literature on culture and diversity can be helpful, mentors and mentees could participate in academic and social activities that promote and exhibit cultural and racial diversity. These activities can expose mentors and mentees to various cultural traditions and customs and

introduce diversity in thought and action. These actions are evidence of responsiveness. Respect is also an integral part of creating trust within a culturally responsive environment (Hammond, 2015). Here, respect is caring, or the act of valuing your peer in the mentoring relationship, even in times of disagreement. Respect and responsiveness are the cornerstones for establishing trust.

The third step in the ARCS process, celebrating differences and communicating high expectations and confidence, requires peers to engage in activities and other opportunities that incorporate various cultural traditions. This mindful incorporation of cultural practices should not be confused with cultural appropriation but instead acts as a celebration of diversity. Accountability also plays an essential role in the celebration of differences. This celebration cannot be one-sided. Instead, the mentor and mentee must communicate high expectations of one another so that both make an intentional effort to incorporate and celebrate their differences. Additionally, mutually communicating high expectations also reinforce persistence and self-efficacy. Mentors and mentees can engage in practices that promote goal setting and support through the goal achievement process. This peer support is paramount in the persistence of racially minoritized women in STEM.

The last phase of the ARCS process is scaffolding. Scaffolding is an information storage and retrieval system used to promote mastery of a task (Bruner et al., 1976). As referenced in Chapter One, Vygotsky's (1978) sociocultural theory introduced the concept of providing learners with a dynamic support structure that increases or decreases based on proximity to mastery of a skill or concept. For mentoring, scaffolding includes the mentor's ability to help the mentee process information and ideas. This assistance may take the form of presenting new information or helping to brainstorm alternative solutions or directions. Also, scaffolding may include forging connections between the mentee and other culturally similar role models.

Identifying additional role models is critical for racially minoritized women exploring STEM degrees.

Culturally responsive mentorship correlates with mentor and mentee sense of belonging, which challenges the barriers racially minoritized women often face when exploring STEM degree programs. As discussed in Chapter 1, the chilly climate of many STEM degree programs and professional career avenues often dissuade women of color from exploring these paths as viable career options. Working within a culturally responsive peer mentoring relationship often satisfies the needs of racially minoritized women exploring STEM degrees by validating their cultural identities and modeling success, thus confronting issues with oppression and privilege that they may have encountered (Byars-Winston et al., 2010; Felder & Barker, 2013; O'Meara et al., 2013).

Culturally Responsive Learning Experience Design

The primary setting for this study, discussed in detail in Chapter 3, was a virtual training environment comprised of eight modules to improve racially and ethnically minoritized women's culturally responsive mentorship and leadership skills, STEM self-efficacy, and persistence in pursuing STEM degrees and careers. The central premise of learning experience design focuses on achieving the desired outcome through a human-centered and goal-oriented learning encounter. A learning encounter includes so much more than the technical elements used to facilitate content and interaction, involving a combination of user experience and interface, as well. (Bardzell, 2011).

This study observed how racially minoritized women interacted with the training platform to understand their experience better. According to the literature, interaction and platform aesthetics helps inform or alter a user's perception of the overall usability or

applicability of the learning experience (Kaptelinin & Nardi, 2018). Because culture played such a vital role in this study, the researcher also considered how culture impacts learning experience design and user experience. According to Cimpan (2020), “Users prefer digital products that reflect their cultural characteristics” (para. 3). But, learning experience design involves more than culturally diverse avatars and stock photos. Cross-cultural user experience design, also termed culturally responsive online design, is a framework that informs learning experience designers on how to create content or other learning collateral that appropriately addresses and integrates dynamic and respectful experiences that engage and promote cultural responsiveness (Lachner et al., 2015; Morong & DesBiens, 2016).

To create an actionable framework that welds together the principles of culturally responsive teaching (CRT) with user experience (UX) design, Eugene et al. (2009) created the Cultural Relevance Design Framework (Figure 2).



Figure 2

The Cultural Relevance Design Framework

Note. From *This is Who I Am and This is What I Do: Demystifying the Process of Designing Culturally Authentic Technology* (p. 25), by Eugene, W., Hatley, L., McMullen, K., Brown, Q., Rankin, Y., Lewis, S. (pp. 19–28). In N. Aykin (Ed.), *IDGD 2009*. LNCS, Vol. 5623. Copyright 2009 by Springer.

This framework assists designers in conceptualizing the primary considerations that create culturally responsive educational technology. This framework highlights two dimensions (what we do and who we are) within four themes (practices, ontology, representation, and tasks). Combining respected multimedia design processes that include the Instructional Design Framework (Herrington & Oliver, 2000) and the Culture Modeling Design Framework (Lee, 2008), the Cultural Relevance Design Framework bridges the gap between culturally responsive pedagogy and culturally responsive multimedia design principles. Table 1 is an overview of the four major themes in the cultural relevance design framework and offers examples of their execution within a virtual training platform.

Table 1*Cultural Relevance Design Framework: Defining and Applying*

| Theme | Definition | Application to Virtual STEM Mentoring Training |
|----------------|---|---|
| Practices | A collection of socio-cultural norms, traditions, and activities specific to the target culture. | Using a case-based learning model, designers may create scenarios surrounding a specific cultural holiday or tradition. |
| Ontology | An understood and accepted dialect or language used by the target culture. | Using a case-based learning model, designers may create scenarios that employ dialect patterns and vocabulary familiar to the target culture. |
| Representation | “The visual and physical manifestations commonly accepted within a culture” (Eugene et al., 2009, p. 23). | Incorporate images that depict the same visual and physical appearances of the target culture. For example, within the platform, incorporate photos of a woman wearing a braided hairstyle or cosmetics reflecting the target cultural or ethnic group. |
| Tasks | The shared goals or activities of a target culture. | Incorporate images that depict normal activities in which the target culture engages. For example, within the platform, incorporate photos of women engaged in activities familiar to the target culture. |

Applying the cultural relevance design framework when creating a virtual STEM mentoring training platform works to engage mentors and mentees. These design elements are also helpful in assessing the efficacy and perceived authenticity of the training. Developing instructional content for an online audience is an iterative process. It requires usability testing to ensure that a user can effectively engage with the interface, supporting a satisfactory experience (Perez Medina et al., 2019).

Ensuring that learners perceive the activity as an authentic representation of their racial and cultural identities supports their persistence. By implementing strategies focused on persistence and engagement, learners' likelihood of completing the training and perceiving the training as valuable and relevant increases. As discussed previously, collecting feedback on mentors' and mentees' experiences completing the training provided helpful insight into the training design's success. Through usability testing and multiple walkthroughs, the researcher collected feedback to apply to future iterations of the training to ensure and promote persistence. These persistence and engagement structures work to encourage community and inclusion in the mentoring program. This inclusion can influence and increase the representation of racially minoritized women in these STEM degree programs and fields by producing culturally responsive mentors and mentees who may continue to diversify the STEM degree and career populations.

Summary

Providing adequate and culturally responsive mentorship training to both mentors and mentees is critical in the success of racially minoritized women exploring STEM degrees. This literature review traced the evolution of mentoring across different compositions and modalities and how this mentorship progression is positioned to drastically improve the pursuit and

persistence of racially minoritized women completing STEM degrees. Cultural responsiveness is paramount in any successful mentoring relationship, especially when exploring racially minoritized women's STEM persistence. The literature articulates and supports the success of mentoring programs targeted to these students and others exploring STEM degrees who may enter a program at a disadvantage. Virtual peer mentoring is one option that may provide racially minoritized women with the training and support needed to build and foster the interpersonal and culturally responsive skills that cultivate persistence within underrepresented groups.

Positioning mentoring training programs as a cornerstone of mentoring program success cannot be understated. Many of the skills required for effective mentoring relationships are not inherited but are instead learned. Completing training on effective mentoring relationships in both the mentor and mentee positions equips students with beneficial skillsets that reach far beyond the mentoring relationship's scope. Leadership experience, interpersonal communication skills, and the ability to work effectively with a diverse audience are all attributes that foster persistence and work as a catalyst for STEM professions. Because of the underrepresentation of black and brown women in STEM degree programs, building virtual mentoring training programs that target self-efficacy and cultural competence provides the resources and opportunities to connect with fellow women of color who share similar demographics and cultural experiences. A mentoring training program's virtual nature can transcend time and location barriers, which stands to broaden these mentoring training programs' reach, impacting racially minoritized women in pursuing a STEM degree.

A plethora of literature exists that traces the reach of traditional mentoring programs in STEM and beyond. Few studies, however, focus on the role of cultural responsiveness training included in mentoring training that stands to improve persistence of racially minoritized women

in STEM degree programs. The opportunities for future research in the areas of culturally responsive training and mentoring opportunities targeted to black and brown women demand exploration. Through these prospective studies, scholars may collect and explore racially minoritized women's experiences completing mentoring training programs focused on cultivating cultural responsiveness to increase STEM persistence for these women.

CHAPTER THREE: METHODOLOGY

Scholarship on mentoring makes clear how cultural responsiveness is a key attribute of most successful STEM mentorship relationships (Byars-Winston & Dahlberg, 2019). One assumption is that racially minoritized women entering into culturally responsive peer mentoring relationships enjoy more effective peer mentoring relationships, leading to STEM persistence. Creating and cultivating a culturally responsive peer mentoring relationship requires sufficient and thoughtful training to facilitate the development of this same responsivity (Byars-Winston & Dahlberg, 2019). Therefore, this learning experience design (LXD) research used case study methods and data collection procedures focused on racially minoritized women's experiences completing a virtual STEM peer mentoring training program that promoted culturally responsive mentoring practices. This chapter describes how the primary research question and sub-questions are answered:

Central Research Question. How, if at all, did the racially minoritized women mentor and mentees' experience with the virtual STEM peer mentoring training program influence their cultural responsiveness?

- What, if any, instructional design elements within the virtual STEM peer mentoring training program did racially minoritized women perceive as efficient and satisfying?
- What, if any, instructional design elements within the virtual STEM peer mentoring training program contributed to racially minoritized women's cultural responsiveness development?
- What, if any, instructional design elements within the virtual STEM peer mentoring training program hindered racially minoritized women's cultural responsiveness development?

This chapter describes the design of the study, including the participants, setting, research intervention, instrumentation, data collection, and analysis. It ends with an explanation of the study's limitations and a researcher subjectivity statement.

The Investigation Plan

Using a learning experience design-informed approach and employing a qualitative, case study design, this research investigated racially minoritized women's experiences in a virtual STEM peer mentoring training program created to enhance, in part, their cultural responsiveness. I examined how content, paired with the instructional design and presentation of that content, supports identified, self-reported cultural responsiveness outcomes within a peer mentoring relationship. The following section describes the research methodology and design along with support from current literature.

Research Method

The literature shows little agreement about how to examine learners' experiences within learning spaces and environments nor on the best measures and methods to use (Hassenzahl & Tractinsky, 2006; Rubin & Chinsnell, 2008). Learner experience has been examined through quantitative and qualitative methods (e.g., surveys or interviews) (Hassenzahl, 2004; Shin, 2017). Some researchers have used experimental procedures to understand the manipulation of aesthetics (e.g., color, layout, typography) (Kumar & Garg, 2010; Tuch et al., 2012), eye-tracking, and cognitive think-aloud procedures (Alhadreti et al., 2017; Wolff et al., 2016). In the best interest of the research questions, and supported by the literature, this study welds together the methodologies from two different approaches to create a learning experience design-informed, qualitative case study design. Components of each methodology will be discussed in the sections that follow.

This study employed a qualitative approach. Merriam and Tisdell (2016) defined qualitative research as a method of inquiry that involves "understanding how people construct their worlds, and what meaning they attribute to their experience" (p. 6). To select an appropriate method, a researcher needs to distinguish between quantitative and qualitative methods and how they leverage theory. Qualitative studies help the researcher understand the nuances or the multifaceted nature of a phenomenon, unlike quantitative studies that explain or predict variables or outcomes. Creswell and Guetterman (2019) described qualitative studies as a way to study "culture-sharing" behaviors. Therefore, because this study focused on cultural responsiveness experiences in virtual STEM peer mentoring training, a qualitative methodology aligned best with its purpose and focus. A qualitative method was most appropriate, given my desire to better understand the participants' experiences of completing and interacting with the interfaces of the virtual STEM peer mentoring training in the field.

Design

This study investigated how, if at all, racially minoritized women mentors' and mentees' experiences with a virtual STEM peer mentoring training program influenced their achievement of learning objectives of the training, including their cultural responsiveness. The approach used for this study was informed by learner experience design (LXD). Like usability studies (UX), LXD often assesses a learning environment using the principles of usefulness, usability, and desirability, which Zhang and Adipat (2005) noted can be applied to field studies and laboratory experiments. This study sought to examine user experience in the real-life implementation of a virtual STEM peer mentoring training program, so a field-based approach was selected and a qualitative method guided the design of the study.

LXD is a relatively new approach to assessing the experience of participating in a virtual learning environment. Grounded in cognitive load theory (Sweller et al., 1998), distributed cognition (Hollan et al., 2000), and activity theory (Kaptelenin, 1996), LXD layers usability and instructional design frameworks to produce a more comprehensive assessment of both the interaction and pedagogical usability within a learning environment (Tawfik et al., 2020). These theories work in conjunction with studies in human and computer interactions (HCI) to produce an approach encompassing the total experience of a learning design, including interface considerations as well as opportunities for knowledge engagement and content mastery. LXD transcends current theoretical approaches that offer a singular analysis into usability, cognition, and technology adoption (Schmidt et al, 2020; Tawfik et al., 2020). Current LXD research fails to holistically define this concept. Some scholars identify the intersection of usability and pedagogical usefulness as the foundation of LXD studies. Unique to this study, and as the data will support, is the incorporation of a cultural component. Chapter Five will expand on how this study's findings position cultural influence as an integral part of content creation and delivery, extending the LXD definition to reach beyond cognition and usability to incorporate a cultural component with the intention of helping the learner or end user forge an emotional connection to the materials. With a more intersectional approach, LXD positions itself as an optimal approach to guide this study. As explained earlier, the content modules were purposefully designed to be not only culturally responsive but also responsive to the technology adoption frameworks, usability guidelines, and cognitive limitations that feed into solid learning experience design. As such, an LXD-informed approach is particularly appropriate.

A case study design was chosen based on the complex nature of cultural responsiveness paired with the multiple bounded systems identified and used within this learning experience

design (Creswell 2003; Yin, 2017). Stake (1995) described a case study as "the study of the particularity and complexity of a single case, coming to understand its activity within important circumstances" (p. xi). Others described a case study design as a way to examine a complex issue in a "real world" setting (Harrison et al., 2017). Further, Yin (2017) recommended that researchers employ a case study design when the research questions are seeking to explain "how" or "why" a particular phenomenon works. As such, this study leveraged a qualitative case design to explore racially minoritized women mentors' and mentees' experience with a virtual STEM peer mentoring training program. Utilizing a case study approach allowed the researcher to focus on bounded systems (HBCU and PWI) and an online training program inclusive of two interfaces to explore, in-depth, the racially minoritized women's experiences completing the virtual STEM peer mentoring training in the field.

The rationale for implementing a case study design is also appropriate given the bounded systems and participants the study included. Stake (2006) described a case study as an appropriate design for learning about underrepresented groups or individuals. This study included racially minoritized women interested in exploring STEM degrees, which aligns with Stake's rationale. Further, case studies encourage the researcher to isolate a particular program or incident by location, time, or another variable (Creswell, 2007; Creswell & Guetterman, 2019; Stake 1994, 2006; Yin 2017). The use of two bounded systems does adhere to this recommendation while also providing the study with diverse participant perspectives. This way, the study could isolate the experience of completing virtual training while considering the participants' sociocultural and other contextual understandings across multiple sites.

This diversification of participant experiences while still held within a two-site bounded system provided an optimal case study. However, this method and design are not without

limitations. First, the scholarship is quick to identify the subjective nature of qualitative research as a possible limitation (Stake, 1995, 2006). Additionally, case study research does invite concerns with reach and applicability. Critical for successful case study design, the bounded systems may limit the study's breadth or transferability onto a different population of participants in a different setting.

Participants

Participants for this study were selected using convenience and purposeful sampling techniques and were drawn from the pool of students participating in a project as peer mentors or mentees. In line with the current research on learning experience design and usability testing, this study recruited five participants (Nielsen & Landauer, 1993). An initial convenience sample was drawn from participants in STEM programs across an HBCU and a predominately white institution (PWI) in the southeastern United States. This participant population was delimited to select racially minoritized students who identified as female, were pursuing a STEM degree, as defined by NSF (2019), and were willing to complete a virtual STEM peer mentoring training program.

The researcher requested participation via email invitation to racially minoritized women enrolled at the HBCU or PWI. The email invited the student to participate in this research inquiry and interested students were asked to respond to confirm their participation in the study. The researcher then employed a purposeful sampling approach to identify participants who satisfied the following criteria:

1. The participant was enrolled in a STEM degree program.
2. The participant identified as a black or brown female student.
3. The participant agreed to complete a virtual STEM peer mentoring training program.

As noted, this study included a predominantly white institution (PWI) with a large percentage of racially minoritized students. While not an official minority-serving institution, as defined by the Department of Education, this institution does qualify for Title III funding under Part A of the HEA: Strengthening Institutions Program (SIP) due to the population of low-income students. The PWI was referred to as case one for this study and the HBCU was referred to as case two. Table 2 provides an overview of the participants and their demographic presentations, degree completion status, and role in the mentoring project. The participant names are pseudonyms to protect anonymity.

Table 2

Participant Demographics

*Note. *UG symbolizes undergraduate student. G symbolizes graduate student.*

| Pseudonym | Case | Race/Ethnicity | Program of Study | Level* | Role |
|-----------|------|------------------------|------------------------|--------|--------|
| Amy | 1 | Black/African American | Biology | UG | Mentee |
| Cassie | 1 | Black/African American | Computer Science | UG | Mentor |
| Dana | 1 | Black/African American | Computer Science | UG | Mentee |
| Janelle | 1 | Black/African American | Biology | UG | Mentor |
| Katherine | 2 | Black/African American | Engineering | UG | Mentor |
| Lilly | 2 | Other | Earth Sciences | UG | Mentor |
| Mary | 2 | Black/African American | Biomedical Engineering | UG | Mentor |
| Octavia | 2 | Black/African American | Engineering Management | G | Mentor |

Setting

Historically Black Colleges and Universities (HBCUs)

Site One of this study was situated in a Historically Black College or University (HBCU). The literature identifies HBCUs as institutions established before 1964 that share a mission to educate Black Americans (NCES, 2010). At the time of this study, over one hundred higher

education institutions were considered HBCUs and accounted for 2.3% of degree-granting postsecondary institutions (TMCF, 2019) and over 28% of Black bachelor's degrees (Albritton, 2012). Women accounted for 62% of the enrollment across HBCUs (NCES, 2020). HBCUs also accounted for 46% of racially minoritized students who earned degrees in a STEM discipline (Harper, 2018; UNCF, 2020).

The HBCU represented a robust and long-standing effort to provide educational and advancement opportunities to racially minoritized students so that graduates may achieve their highest human potential. These educational and advancement opportunities include academic, social, and financial support (Harper, 2018). Most importantly and closely related to this study, HBCUs provide an academic atmosphere where underrepresented racial and ethnic minorities can identify and observe successful men and women who represent diverse populations. Creating and cultivating a climate that supports and encourages persistence through this community is a cornerstone of the HBCU selected for this study.

Predominantly White Institutions (PWIs)

Site Two of this study was situated in a Predominately White Institution (PWI). The decision to include students enrolled in a PWI helped to triangulate the data collected from participant interviews. Arguably, racially minoritized women who pursue STEM-related degrees at a PWI will encounter the same conditions that this study has identified as problematic barriers to the potential success of racially minoritized women including, but not limited to, a "chilly" environment composed mostly of male professors, few women of color in either faculty or staff roles, and a low number of racially minoritized students enrolled in the STEM degree program (Ford, 2013; Walton et al., 2015; Wilkins-Yel et al., 2019; Young et al., 2017).

This particular PWI, as previously mentioned, included a significant percentage of non-white students (over 50%) across several demographic categories. Additionally, it qualified as a Title III school based on the number of enrolled students from low-income households. Being able to juxtapose the experience of a student enrolled at an HBCU, where her peers are primarily racially minoritized students, to the students enrolled at a PWI provided depth and perspective to the study.

Virtual Training Environment

This study, which focused on virtual STEM peer mentoring training, was, in part, connected to a larger mentorship program that sought to increase STEM self-efficacy, science identities, and to promote STEM degree and career persistence. The program included virtual STEM peer mentorship training to equip mentors and mentees with the skills needed for an effective mentoring relationship. Virtual mentoring, or e-mentoring, is mentoring facilitated in a virtual (online) environment (Collier, 2015). Likewise, virtual training is instruction delivered in an online or virtual environment that eliminates barriers of location, scheduling, and other obstacles that may dissuade traditional participation. The virtual nature of both the mentoring program and the training program that prepared participants for mentoring allowed for flexibility that could not be provided in a traditional, face-to-face environment.

Peer mentoring training is paramount for an effective peer mentoring relationship. This training ensured that both the mentor and mentee developed and demonstrated the application of specific mentoring competencies, which included understanding the role of both the mentor and mentee and that both positions were exposed to the mentoring process (Cohen & Galbraith, 1995; Gandhi & Johnson, 2016; Pfund et al., 2014). For these reasons, virtual training was required of participants enrolled in this study

Eight interactive, online modules were developed that provided 10 to 15 hours of self-paced, formalized instruction for mentors and mentees. The modules were created using the Rise 360® course authoring software and was hosted on a website using a WordPress theme (Figures 3 and 4) . The design of each module aimed to provide the participants with mentoring competencies and influence each of Bandura's (1977, 2005) four sources of self-efficacy as well as their cultural responsivity within the peer mentoring relationship. Each learning module was comprised of the following components: 1) case study (Figure 5), 2) content (Figure 6), and 3) questions for reflection and discussion.

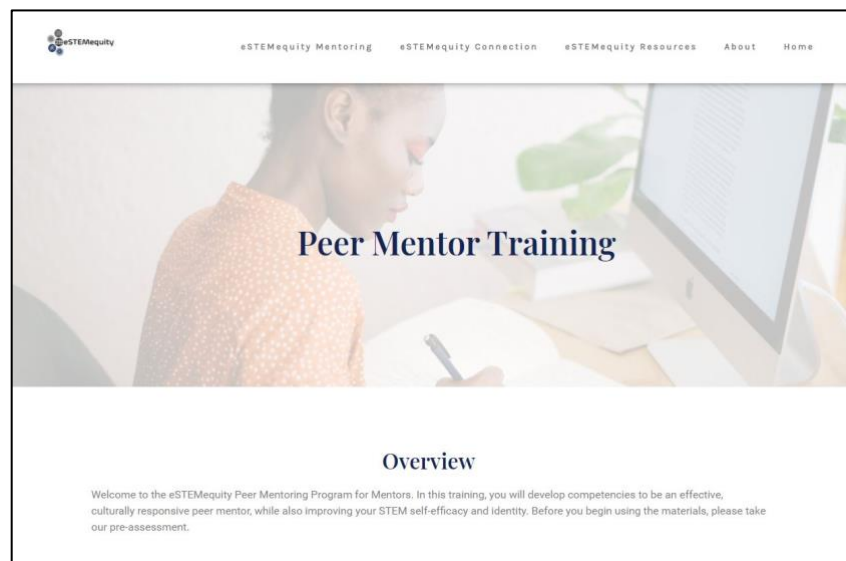


Figure 3

Screenshot of WordPress Site for Training



- Objectives**
In this module, you will:
- (1) Identify the benefits of participating in a peer mentoring relationship
 - (2) Define peer mentorship
 - (3) Identify the phases of a peer mentoring relationship
 - (4) Identify the characteristics, roles, responsibilities, and competencies of peer mentors and mentees
 - (5) Develop a philosophy of mentorship
- Case Study**
- A Rationale for Engaging in a Peer Mentoring Relationship
 - The Benefits of Engaging in a Peer Mentoring Relationship

Figure 4

Screenshot of Mentor Module 1

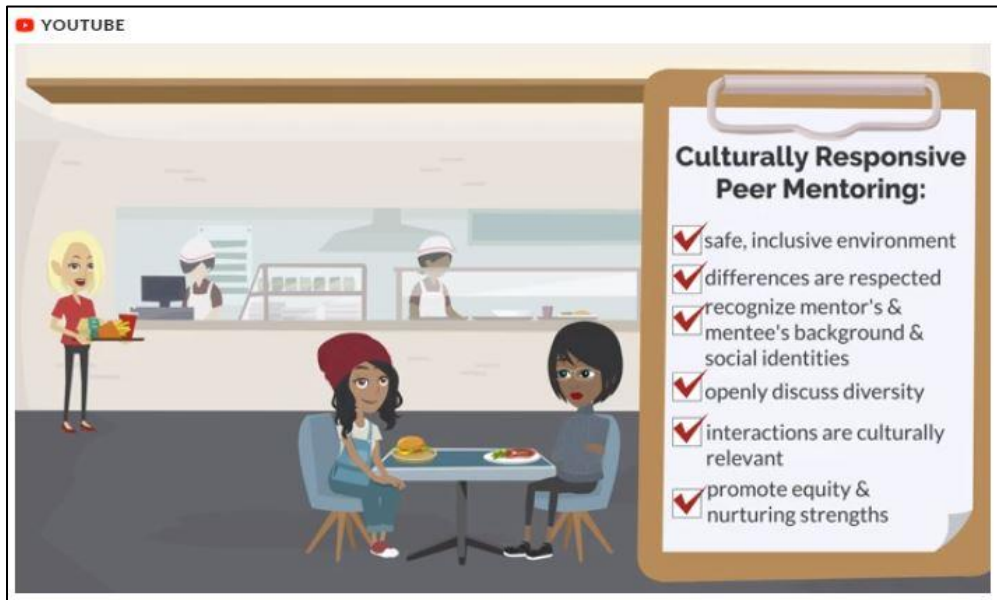


Figure 5

Screenshot of Case Scenario Video

The Problem Solving Process

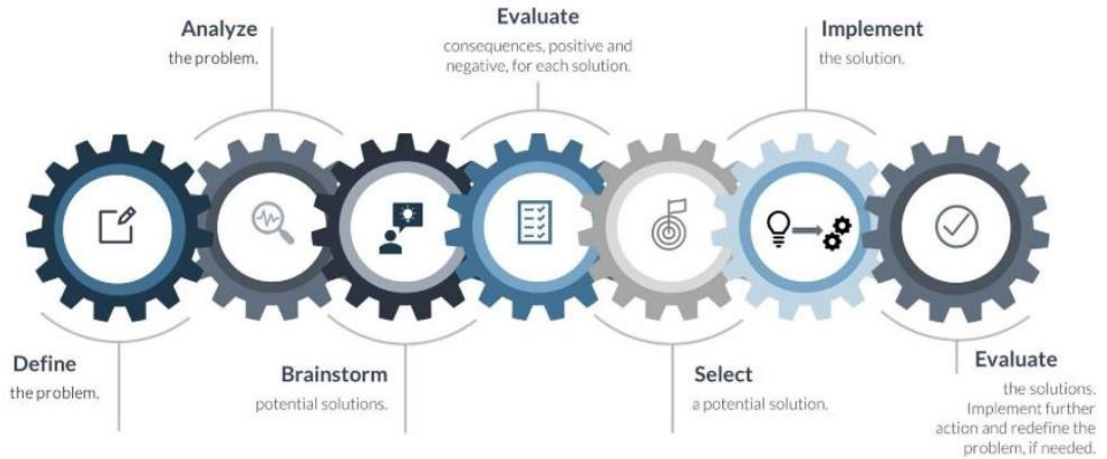


Figure 6

Screenshot of Module Content

A series of questions encouraged personal reflection in both a reflection journal and within a discussion housed inside a virtual mentoring community (Figure 7). Through engagement and participation in the modules across each of the three components, mentors and mentees developed the knowledge, skills, and ability to participate in an effective mentoring relationship.



Let's Reflect Image (Book and Pen)

Let's Reflect

In your reflection journal, reflect on the following:

What is inclusion?

Write your own definition.

What might inclusion look like in a peer mentoring relationship?

Why is inclusion important in a peer mentoring relationship?

Figure 7

Screenshot of Reflection Activity

Table 3 provides an overview of the module topics and objectives that provided a solid theory-based foundation supporting both the mentor and mentee training programs.

Table 3

Virtual STEM Mentoring Training Module Details

| Module Topic | Module Objectives |
|---|---|
| Module 1: An Introduction to the STEM Peer Mentoring Relationship | <ol style="list-style-type: none"> 1. Identify the benefits of participating in a peer mentoring relationship 2. Define a peer mentorship 3. Identify the phases of a peer mentoring relationship 4. Identify the characteristics, roles, responsibilities, and competencies of peer mentors and mentees 5. Develop a philosophy of mentorship |
| Module 2: The Reflective Mentor/Mentee | <ol style="list-style-type: none"> 1. Identify the role of reflection in the peer mentoring relationship 2. Reflect on present and past experiences 3. Develop a reflective journal |
| Module 3: The Essentials for Building and Maintaining Trust | <ol style="list-style-type: none"> 1. Identify relational and interpersonal competencies to build and maintain trust 2. Practice relational and interpersonal competencies to build and maintain trust 3. Reflect upon current relational and interpersonal competencies to build and maintain trust |

Table 3 (continued)

| Module Topic | Module Objectives |
|--|---|
| Module 4: The Essentials for Beginning a Peer Mentoring Relationship | <ol style="list-style-type: none">1. Identify the purpose for your peer mentoring relationship2. Facilitate the development of an individual development plan, including self-assessment, goal setting, and goal planning (Mentor)3. Develop a personal development plan, including self-assessment, goal setting, and goal planning (Mentee)4. Identify the importance of scheduling regular meetings5. Identify the importance of aligning relational and communication expectations6. Develop a peer mentoring relationship agreement |
| Module 5: The Essentials for Facilitating Development of the Peer Mentoring Relationship | <ol style="list-style-type: none">1. Identify competencies needed for instrumental and psychosocial development2. Practice skills to facilitate, inform, instruct, connect, challenge, model, and motivate3. Reflect upon current skills, knowledge, and abilities needed for a productive peer mentoring relationship |
| Module 6: Essentials for Organizing an Ethical Peer Mentoring Relationship | <ol style="list-style-type: none">1. Identify the three parts to every peer mentoring meeting2. Identify the importance of documentation in a peer mentoring relationship3. Discuss ethical behavior for a peer mentoring relationship4. Identify three necessary components to ensure a good ending to the peer mentoring relationship |
| Module 7: Essentials for a Culturally Responsive Peer Mentoring Relationship | <ol style="list-style-type: none">1. Define diversity, inclusion, culture, and cultural responsiveness2. Identify how diversity affects the peer mentoring relationship3. Identify strategies to foster an inclusive and culturally responsive peer mentoring relationship |
| Module 8: The Essentials for Engaging in an e-Peer Mentoring Relationship | <ol style="list-style-type: none">1. Define e-mentoring2. Identify ways technology can be beneficial and challenging in peer mentoring relationships3. Identify technologies that can facilitate communication in peer mentoring relationships4. Create Slack and Zoom Accounts5. Make a Technology Plan for your peer mentoring relationship |

Additionally, the training provided access to a virtual community via Slack® multi-function communication platform. The private virtual community's purpose was to establish and cultivate a community of learning and reflection among the mentors, mentees, and researchers. This virtual community was also used to disseminate updates, information, and reminders to the participants and provide mentors and mentees with a safe place to share reflections and reactions to their learning. I did not have access to the virtual community shared among the HBCU participants, although I created and managed the virtual community for the PWI students.

Data Collection Methods

This study's data collection included rigorous triangulation of sources to capture the training's holistic experience and its influence on the learning outcomes. The data collection plan combined multiple collection efforts to improve the study's internal validity (Stake, 1995). This study's collection methods included a pre-assessment survey, semi-structured interview protocols, and pluralistic walkthroughs for both mentors and mentees. This triangulation of data collection was imperative to support and confirm the qualitative data credibility and trustworthiness (Savin-Baden & Howell Major, 2013; Stake 1995; Yin, 2017).

Collecting and analyzing multiple data collection efforts supports a multifaceted approach to understanding complex phenomena. Soliciting narratives that detail the training program's experience from various perspectives provided numerous avenues to explore how, if at all, the training program was effective in improving cultural responsiveness in peer mentoring. The development of each survey and interview protocol was deeply rooted in the literature for collecting robust qualitative data that can be used to recognize emerging themes, thus to understand the central phenomenon of cultural responsiveness.

Current literature on the construction of qualitative interview questions can be summarized in three points. First, interview questions should be short and positioned to evoke longer, detailed responses from the interviewee. Often, these are referred to as open-ended questions, which simply means that they cannot be answered with yes or no. Second, questions should prompt the interviewee to recall specific events or instances. Third, the interview guide should include a small number of questions that invite follow-up and are aimed at encouraging the interviewee to share more detailed, in-depth responses to each prompt (deMarrais, 2003). The researcher followed these recommendations for the interview protocol (Appendix E). Table 4 provides justification for each question in the interview protocol. Table 5 articulates the alignment between the research questions and the case study design employed by this research study. Each data collection method is described in the next section.

Table 4*Interview Protocol Justification*

| Interview Prompts | Justification | Literature |
|--|--|--|
| In terms of the user interface, what was your impression of the training's effectiveness? Efficiency? Satisfaction? | The first question of the interview protocol is short but stacked. Here, the intention of this question connects directly to common UX and LXD studies that seek to understand the effectiveness, efficiency, and satisfaction of the training content and its interface. The question is short and open-ended as it's asking for the interviewees detailed account of the experience completing the training. | deMarrais, 2003; Gregg et al., 2020; Savin-Baden & Howell Major, 2012; Tawfik et al., 2020 |
| Before completing this training, were you familiar with the term "culturally responsive"? | The next series of questions in the protocol relate to cultural responsiveness. While question 2 is a yes/no question, it leads directly into question 3, which is positioned in a way to encourage the interview to share more about their definition of CR and if – and to what extent – she considers herself culturally responsive. | deMarrais, 2003; Savin-Baden & Howell Major, 2012 |
| Do you feel comfortable with the term since completing the training? Would you describe yourself as culturally responsive? | | |
| What, if any, instructional design elements within the virtual STEM mentoring training program contributed to your cultural responsiveness? | Here, the questions return to the interface and user experience completing the training to identify specific instances of the training that the interview felt were instructionally effective. This question, paired with the last question in the protocol, introduce the opportunity to provide clarification on what is meant by "instructional design elements" and presents the opportunity to engage in dialogue about specific instances of the training that were memorable and impactful. | deMarrais, 2003; Gregg et al., 2020; Savin-Baden & Howell Major, 2012; Tawfik et al., 2020 |
| What, if any, instructional design elements within the virtual STEM mentoring training program hindered the development of your cultural responsiveness? | The interview protocol concludes by asking for any negatively slanted takeaways from the user experience completing the training. | deMarrais, 2003; Gregg et al., 2020; Savin-Baden & Howell Major, 2012; Tawfik et al., 2020 |

Table 5*Alignment of Research Questions and Design*

| Research Questions | Data Collection Method | Data Collection Procedure |
|---|---|--|
| How, if at all, did the racially minoritized women mentor and mentees' experience with the virtual STEM peer mentoring training program influence their cultural responsiveness? | Virtual training modules, virtual Slack community | One-on-one interviews, Pre-assessment survey |
| What, if any, instructional design elements within the virtual STEM peer mentoring training program did racially minoritized women perceive as efficient and satisfying? | Virtual training modules, virtual Slack community | One-on-one interviews, pluralistic walkthrough |
| What, if any, instructional design elements within the virtual STEM peer mentoring training program contribute to racially minoritized women's cultural responsiveness development? | Virtual training modules, survey | One-on-one interviews, pluralistic walkthrough |
| What, if any, instructional design elements within the virtual STEM peer mentoring training program hindered racially minoritized women's cultural responsiveness development? | Virtual training modules, virtual Slack community, survey | One-on-one interviews, pluralistic walkthrough |

Data Collection Procedures

The data collection process for this study followed a rigorous and triangulated, multi-method approach. Once I obtained IRB approval, I began the data collection process by introducing myself and my research virtually to the participants via an introductory email. I solicited participants for the study by distributing an invitation and including an electronic informed consent form. In the direction of past studies, I also offered to host an informal question-and-answer session via Zoom web conferencing technology to give potential participants the opportunity to ask questions about the study and clarify their role and obligations as study subjects (Sharpe, 2019). The participants did not indicate any interest in this web conference, and, as such, I canceled the event.

I also communicated my availability for one-on-one telephone or web conference conversations. Students interested in participating in the study were asked to electronically sign and return the informed consent document or complete the electronic informed consent form before I provided access to the training environment (Appendix D). Upon receiving the signed informed consent documentation, I provided electronic verification of my role as the researcher for the study and distributed the finalized, signed copies of the informed consent form to all study participants. This study included only those mentoring students who completed and submitted the informed consent documentation.

Pre-Assessment Survey

The virtual STEM peer mentoring training opened with an invitation to complete a pre-assessment that collected demographic information and asked participants to gauge their perception of their cultural responsiveness (Appendices A and B). Additional data on STEM

efficacy, STEM identity, and persistence mechanisms was also collected but not used in the study. Only those survey prompts directly related to cultural responsiveness were analyzed.

The cultural responsiveness section of the pre-assessment allowed respondents to self-report qualities pertaining to cultural agility. For these purposes, the survey included the Cross-Cultural Mentoring Inventory (Suffrin et al., 2016). The survey used a six-point Likert-type scale that prompted respondents to rate their perceived cross-cultural awareness within a mentoring relationship (Appendix B). Higher scores on each item indicated higher levels of self-reported multicultural competence. The scale used for this study was a revised edition of the Cross-Cultural Counseling Inventory (Hernandez & LaFromboise, 1983; revision by LaFromboise et al., 1991). In its original version, the CCCI sought to measure cross-cultural counseling competencies. The revised version of this scale included several keyword changes (e.g., counselor changed to mentor) but still resulted in a respectable reliability of .89 in validity testing (Suffrin, 2014).

One-on-One Interviews

The one-on-one interviews followed a semi-structured protocol, collecting personal narratives from participants that described their experiences with and reflections on the training's design. This data informed the study's attempt to understand the experience of mentoring training related to cultural responsiveness. I hoped that these interviews provided a safe space for participants to share their personal experiences confidentially. Participants were asked to turn on their web cameras during the interviews and each session was recorded, transcribed, and saved to both cloud-based and device-based locations. Each one-on-one session began with a pluralistic walkthrough to gather feedback on the design and development of the training. This practice is a common usability and learning experience design procedure.

Usability studies incorporate a multifaceted, interdisciplinary approach to measuring the effectiveness and efficiency of and satisfaction with a platform or experience. Built on a framework of human-computer interaction principles, user experience (UX) studies tend to analyze the role of interaction or aesthetics (Sutcliffe & Hart, 2017). One such method of collecting usability experiences is through pluralistic walkthroughs (Bias, 1994; Nielsen, 1994; Riihiahho, 2002).

Traditionally, pluralistic walkthroughs include a video-recorded, narrated user experience in which the system administrator, product designer, and user gather to discuss and reflect on a user experience or interface components. I used a similar approach with this study. The participant and I met via Zoom web conferencing to walk through the mentoring training program's various modules. I prompted the participant to describe her experiences using the training platform. The walkthrough focused primarily on what the researcher considered culturally responsive components, including imagery, case studies, and other elements. Using culturally responsive learning experience design as a guide, the researcher prompted the participant for reactions based on the user experience regarding practices, ontology, representation, and tasks to see if the participant felt the user experience was, in fact, culturally responsive and authentic.

The purpose of this walkthrough was to collect end-user insight into the experience of completing a virtual STEM peer mentoring training program while also establishing trust between the researcher and the participants. After the walkthrough, the interview shifted to a more traditional approach that included questions that prompted participants to reflect on their experience with the training and how those experiences informed or influenced their cultural responsibility. See Appendix E for the one-on-one interview protocol.

Access and Integrity

The integrity of the data collected for this study was a primary concern. Because the study involved interactions with an underrepresented population, I wanted to reassure all participants that their anonymity was a top priority. While the research stands to benefit them and their successful pursuit of a STEM degree, I wanted to foster an environment of trust and respect, so I employed the following privacy protocols. I created a secure, cloud-based repository using Google Drive to store data and maintained an offline copy of this repository for disaster recovery management. To maintain privacy, I assigned pseudonyms to all participants and settings involved in the study (Stake, 1995).

Data Analysis

Because the data collection procedures included qualitative and quantitative measures, which is common in a case study design and learning design experience study, a diversification of data analysis was needed. While this case study design followed a qualitative methodology, quantitative analysis pieces were used to interpret the pre-assessment survey data. Descriptive statistics, including mean and standard deviations for each survey item, are included in Chapter 4. These survey results should not create projections or assumptions. Instead, they support and extend the data collected through qualitative methods.

The timing of this study aligned with a significant social justice movement happening across the United States. As such, my role as a researcher and observer was already being shaped and informed by these events and my purposeful encounters with the literature surrounding racially minoritized women exploring STEM degree programs and fields. To help maintain my objectivity and recognize both my privilege and my position as the researcher, I kept a research journal where I followed bracketing procedures to identify and isolate the subjectivities and

biases that I brought into the data analysis procedures. A more in-depth account of these subjectivities is provided in my research position statement found within the Biases and Subjectivities section of this chapter.

I recorded entries in this research journal throughout the project to track the evolution of the project and to trace my growth as a culturally responsive scholar. Relationship building is an integral part of establishing trust between the researcher and participants and my use of this journal helped me collect personal details about my participants to forge meaningful relationships with them. Through these observations, I identified emerging themes that arose. Identifying emerging themes and appropriately categorizing them extended the impact of this research.

Interview transcripts are an integral piece of qualitative data collection and were analyzed holistically and with technological assistance. With the transcripts, I first ensured their accuracy by listening to the audio recordings and verifying what was transcribed. I then printed and organized all transcripts in a three-ring binder and kept a digital copy within the secure Google Drive. I worked from the paper copies to identify, via highlighting and coding procedures, emerging themes and references directly related to this study's objectives. I meticulously combed through the transcripts looking for and highlighting keywords, terms, references, or other mentions applicable to the study. Aggregating these ideas and using coding frameworks (Auerbach & Silverstein, 2003; Creswell, 2007), I formulated a series of codes and related them to central themes. I collated and categorized the data to create a visual representation of the coding results and relationships.

Once coding and categorizing were complete, I combined this information with my research field notes to analyze it holistically. This holistic approach (Stake 1995; Yin, 2017) to

data analysis illustrated the narrative experience of completing the mentoring training program, helping me to better understand the training experience as it related to growth in cultural responsiveness from the participants. To further solidify the emerging themes, I imported all interview transcripts into the Nvivo coding software. From there, I highlighted and coded the passages I identified in the hard copies of the transcripts to receive a data visualization of the themes recognized by the software program. Combining these coding efforts was essential in identifying and supporting the emerging themes. See Appendices H, I, and J for coding reports and data visualization.

An integral part of successful data analysis is articulating alignment between the research questions and the analysis performed on the collected data. Table 6 illustrates this alignment between the research questions and the data analysis procedures. Also featured in this table are the data collection mechanisms employed for each item.

Table 6*Alignment of Research Questions and Data Analysis*

| Research Questions | Data Sources | Analysis |
|---|--|--|
| How, if at all, did the racially minoritized women mentor and mentees' experience with the virtual STEM peer mentoring training program influence their cultural responsiveness? | One-on-one interviews, pre-assessment Survey | Coding (Yin, 2017; Creswell, 2007; Auerbach & Silverstein, 2003) Journaling (Creswell, 2007; Creswell & Creswell, 2017) |
| What, if any, instructional design elements within the virtual STEM peer mentoring training program did racially minoritized women perceive as efficient and satisfying? | One-on-one interviews | Coding (Yin, 2017; Creswell, 2007; Auerbach & Silverstein, 2003) Journaling (Creswell, 2007; Creswell & Creswell, 2017) Memoing (Creswell, 2013; Stake 1995) |
| What, if any, instructional design elements within the virtual STEM peer mentoring training program contribute to racially minoritized women's cultural responsiveness development? | One-on-one interviews, pluralistic walkthrough | Coding (Yin, 2017; Creswell, 2007; Auerbach & Silverstein, 2003) Journaling (Creswell, 2007; Creswell & Creswell, 2017) |
| What, if any, instructional design elements within the virtual STEM peer mentoring training program hindered racially minoritized women's cultural responsiveness development? | One-on-one interviews, pluralistic walkthrough | Coding (Yin, 2017; Creswell, 2007; Auerbach & Silverstein, 2003) Journaling (Creswell, 2007; Creswell & Creswell, 2017) |

Trustworthiness

Qualitative research respects and follows a particular methodology and design.

According to Denzin and Lincoln (2018), qualitative research has an entirely different aim and purpose from quantitative studies and because of these inherent differences, a different measure of credibility and trustworthiness must be used, with its own terminology (Creswell, 2007; Denzin & Lincoln, 2018; Savin-Baden & Howell Major, 2013). Trustworthiness describes a qualitative researcher's ability to establish credibility, dependability, and transferability of the research findings (Guba & Lincoln, 1985; Norwell et al., 2017; Sharpe, 2019). This section will discuss some of these terms and explain how concerns about trustworthiness within the study were addressed.

To begin, recognizing research bias is the cornerstone of establishing and supporting credibility. Qualitative studies demand that researchers continuously reflect on their biases and acknowledge these biases through reflective practice (Creswell, 2007; Savin-Baden & Howell Major, 2013). This study's credibility was upheld by bracketing my own experiences and biases. Bracketing is the process of suspending bias and preconceptions to maintain research integrity (Savin-Baden & Howell Major, 2013). I used my research journal to collect my reactions and prejudices, hoping to isolate them from the data analysis process.

Further, I worked closely with my dissertation chair and advisor, Dr. Rockinson-Szapkiw, and my dissertation committee to ensure that my experiences and biases did not jeopardize the study's credibility. To further establish and support trustworthiness and credibility, I provided appropriate member checking (Creswell, 2007) and welcomed the study's participants to review and clarify portions of the study to support transparency and build trust. These

interactions were facilitated via Zoom web conferencing as well as within the virtual Slack community.

The design of this study placed emphasis on the triangulation of data collection procedures. I employed multiple means of data collection which supports data triangulation. Information, perceptions, and reflections were received and recorded to ensure meaning and credibility (Creswell, 2007; Savin-Baden & Howell Major, 2013). The use of surveys and one-on-one interviews allowed me to pair the quantitative and qualitative data to better understand the mentors' and mentees' experiences. To ensure the interview transcripts' validity, provide opportunities for clarification, and empower the participants, I engaged in member-checking. I distributed copies of the interview transcripts and coding to the interview participants to give each an opportunity to credential the information I collected and ensure its authenticity (Mero-Jaffe, 2011). It was imperative that the participants involved in this study felt confident in my data collection and how it was characterized and coded.

Aside from credibility and trustworthiness, case study research must recognize its limitations. The essence of case study research is to study a phenomenon in its real-world setting. This characteristic is one of the defining mechanisms that sets case study research apart from other designs. This case or site-specific attribute is also one of its most significant limitations. Generalizability and transferability are concerns with case study research. This research study aimed to combat this limitation and, instead, leveraged this attribute as a strength. The study population of racially minoritized women described a specific demographic identified by certain racial and ethnic features. This work's transferability is advantageous because it may inform future research centered on minoritized or underserved populations.

Biases and Subjectivities

This study's qualitative nature and the case study design it employs demanded researcher subjectivity (Yin, 2017). While it was impossible to remove all traces of research bias from the data analysis procedures, I find it imperative that I comment on my position as the researcher and how this position may have influenced the results of the study. I would like to provide some personal background information about myself and describe my research approach and related scholarly activities, because they are related to and may have influenced the study design.

Before I embarked on this doctoral journey, I was woefully unaware of how I constructed knowledge, but I was vividly aware of my resilience and drive. I studied Appalachian literature and culture and was moved by the scholarly pursuits of those who shared similar cultural experiences. Growing up in central Appalachia was a privilege; I was exposed to grit disguised as a resilience mechanism, an impressive work ethic, and a seemingly unapologetic celebration of cultural heritage. My low-income, conservative, and somewhat sheltered upbringing created a haven where I felt safe to explore and unearth my identity and interests. My family encouraged this exploration and celebrated me as one of the first in my extended family to obtain a bachelor's degree. It wasn't until I continued into my graduate career that I realized that the persistence devices I embodied were not standard, but quite the opposite. I was one of the few who refused to quit, primarily where academics were concerned. I could not understand this disparity and I worked throughout my master's program to better understand the culture that I had lovingly clung to during my adolescence.

Initially, I set out to understand the influence culture has on Appalachian students in online courses. My advisor reached out to me with concerns regarding my study's feasibility and the impact of a global pandemic. As an alternative, she recommended the topic of cultural

responsivity and its effects on racially minoritized women in STEM mentoring programs. After reflecting on this change, I jumped on board and never looked back. I've identified numerous parallels between my interest in Appalachian culture as a resilience and persistence mechanism and how culture can also be leveraged to advance underrepresented minoritized populations.

My concerns surrounding this project are related to my unfamiliarity with racially minoritized women's lived experiences. I am a white woman who has benefitted from the privilege my race has afforded me. While my life has been far from easy, my race and ethnicity have not posed barriers to my growth and success. I have shared my concerns about my racial and ethnic identity with my advisor and it was essential to have racially minoritized women on my dissertation committee. I may not be able to relate to some of the experiences my research participants may have, yet I look forward to using my platform as a white woman to help amplify underserved women's voices pursuing the STEM degrees they desire and deserve.

CHAPTER FOUR: RESULTS

This study aims to advance knowledge in peer mentorship training, especially for STEM mentoring training programs (Gandhi & Johnson, 2016; Pfund et al., 2014). The following questions guided this research:

Central Research Question: How, if at all, did the racially minoritized women mentors' and mentees' experience with the virtual STEM peer mentoring training program influence their cultural responsiveness?

- What, if any, instructional design elements within the virtual STEM peer mentoring training program did racially minoritized women perceive as efficient and satisfying?
- What, if any, instructional design elements within the virtual STEM peer mentoring training program contributed to racially minoritized women's cultural responsiveness development?
- What, if any, instructional design elements within the virtual STEM peer mentoring training program hindered racially minoritized women's cultural responsiveness development?

Chapter Two provided an overview of pertinent research literature and traced the evolution of mentoring across modalities. That chapter also described how to implement culturally responsive measures within a peer mentoring relationship, noting that the most successful mentoring relationships embody culturally responsive attributes (Byars-Winston & Dahlberg, 2019). The methodology explained in Chapter Three described the study's design, participants, setting, data collection and analysis, the subjectivity of the research, and the bias statement. Chapter Four extrapolates the results of the data collection to provide a thorough analysis of emerging themes. To better understand the contextual underpinning of these themes,

this chapter also provides relevant statistics pulled from the pre-assessment to inform generalizations that support the conclusions, limitations, and recommendations found in Chapter Five.

Results

Case: One Training and Two Sites

Site One

Site One was situated within a historically Black college or university (HBCU) located in the southeastern United States. Approximately 20 racially minoritized women pursuing STEM degrees at the institution participated in the virtual STEM peer mentoring training. The faculty facilitator for this training was Dr. Jackson, who identifies as an African American woman and serves as an Assistant Professor within the STEM Education department at the HBCU. Her research focuses on K-12 STEM teaching and racially minoritized women in STEM. I never communicated with Dr. Jackson, nor was she mentioned by my interview participants. Four women (out of the 20), two mentors and two mentees, participated in this study. Cassie, Dana, Amy, and Janelle all agreed to complete the mentoring training program and, in turn, participate in an interview to describe their interaction with the training that enhanced their culturally responsive related competencies.

As described in Chapter Three, the peer mentoring training included eight interactive, virtual modules for the mentors and eight for the mentees. The training required participants to engage between 10 and 15 hours in self-paced, formalized instruction. The eight modules were designed using the Rise 360® interface and included several animated video tools (e.g., Vyond, Doodly) and were hosted on a website using a WordPress theme. Each module was intentionally designed to have three main components: 1) case study, 2) content, and 3) questions for

reflection and discussion. Each module began with a digital case video featuring a woman who performed a culturally responsive peer mentoring relationship function related to the module focus. Following the case study, content was provided via didactic instruction using text, audio, video, and graphic format, and numerous interactive functions native to the Rise 360® interface. Within each module, participants were able to navigate freely through the content. They could move linearly by scrolling down through each section or they could skip around to different sections using a navigation bar. At the end of each module, a series of reflection prompts were provided for both a journaling assignment and an asynchronous virtual discussion assignment. The primary module used during the interviews, Module Seven for this study was chosen because it focused on culturally responsive mentoring.

A recommended schedule for completing the modules across a six-week time period was provided to encourage the participants to engage in the modules in a cohort-style community. All participants described the training as easy to navigate and understand. They were complimentary about the presentation and diversification of the content and they expressed enjoyment with the interactive components. Additionally, the Site One participants expressed their satisfaction with the training, noting that it was worth the time investment.

The modules were complemented with a social and community building element, an asynchronous discussion forum located in the Slack® communication platform. The virtual community was available to mentors and mentees who were actively completing the mentoring training and was facilitated by Dr. Jackson. Dr. Jackson's approach to facilitation was to monitor the discussion that occurred and respond to questions directly asked of her. Throughout the interviews, several training participants mentioned their dissatisfaction with the Slack® communication platform and the lack of participation from both faculty and peers in the virtual

community. In her one-on-one interview, Janelle captured the salient feelings toward the virtual community hosted in Slack®,

Well, I do have a little bit of problems with the Slack channel. I mean, I guess you would call them problems. But I saw on the Slack® channel that I was one of the very few people that were answering the discussion questions. It seemed like it was just me. And towards the beginning, there was a couple of people that were introducing themselves. But gradually, as it got shorter and shorter off into the lessons and everything, it was just me answering them, and no one was replying back. So, I figured maybe am I supposed to be answering them? Where is everybody? Am I alone in here? I'm kind of the only one answering the questions, and I rarely get feedback. So, you know, I was kind of confused about that.

As Janelle's comments alluded to, participation in this community was sparse and did not seem to fulfill its original mission in site one.

Site Two

To better diversify the perspectives and experiences of completing the virtual STEM peer mentoring training program, a second site was included in this study. This institution was a PWI with a student body of approximately 60% women and a little over 50% non-white students (IPEDS, 2019). This institution is also located in the southeastern United States, and the faculty and administration were engaged in ongoing initiatives to promote diversity and equity in STEM, including implementation of a grant project funded by the National Science Foundation ADVANCE: Organizational Change for Gender Equity in STEM Academic Professions program.

As such, I felt that students from this institution could provide valuable insight on their perceptions and experiences of being a Black woman pursuing a STEM-related degree at a predominately white institution. Arguably, this site's women may experience more intersectional, institutionalized barriers than those from the HBCU. I served as the facilitator of the virtual Slack community and training liaison for this site. Four racially minoritized women pursuing STEM degrees at the institution participated in the virtual STEM peer mentoring training, which was four weeks long, instead of six.

The interface for the training was the same that was used for case one and included eight interactive, virtual modules for the mentors and eight for the mentees. A recommended schedule was provided for completing the modules across a four-week period to encourage the participants to engage in the modules in a cohort-style community. As the facilitator, I emailed the participants weekly with encouraging reminders to complete the training. Similar to case one, all participants in case two described the training as easy to navigate, although unbeknownst to me, while the participants engaged with the content, the case scenario videos featured in the modules were unavailable for several days due to technical issues. As a result, these participants were unable to experience the training modules in their entirety.

The modules were complemented with an asynchronous, virtual discussion forum in Slack® communication platform to promote community among participants. Given the four-week time frame for the training, participants were asked to reflect on four of the prompts provided across the eight modules. The intention of these discussion prompts was to encourage participants to dig deeper into their learning to grapple with complex concepts and the prompts were intended to reduce the workload. Unfortunately, only two participants successfully created

a Slack® account and joined the discussion forums. Of those two participants, neither commented nor interacted with the platform at all.

This lack of participation was related to the concerns shared by case one's participants. As the facilitator, I intended to monitor the Slack discussion and would have responded and interacted with participants. Of the women who completed the virtual training at this site, four participated in the online assessments but only one woman, Mary, participated in interviews. There were fewer potential participants at this site (twelve) and in her interview, Mary shared that incentivizing participation in a STEM peer mentoring program may be critical in future implementations,

Well, I do like gifts and prizes and food. I know that before COVID, food would be a great thing, but just being able, I think now just being able to get some feeling like I'm getting something from it... like credit or a certificate that [we] finished the program.

Case two included four students, Katherine, Lilly, Mary, and Octavia, and represented different STEM-related degree programs in engineering and earth sciences. I have listed all four participants in Table 2 because the assessment descriptive statistics and open-ended survey responses may explain their attrition in this study. Moreover, Nielsen and Loranger (2006) identified a minimum of five participants to uncover 80% of usability issues in lab or field-based usability studies, so I aimed to obtain five to ten participants to interview and was able to interview five women across the two cases.

Pre-Assessment Survey

The pre-assessment survey administered in this study sought to measure the participants' self-reported cultural responsiveness related to participation in the virtual STEM peer mentoring training (Appendices A and B). Using the Cross-Cultural Mentoring Inventory (CCMI) this

survey identified areas of strength and weakness in one’s cultural agility within a mentoring relationship. The inventory contained 19 items based on Bronfenbrenner’s (1979) ecological theory. Figure 8 provides the variable and mean while Figure 9 illustrates the variable and standard deviation of responses. This data demonstrates that most participants ($N = 8$) self-reported their ecological attributes highly, which aligned with how they described their cultural responsibility in the one-on-one interviews.

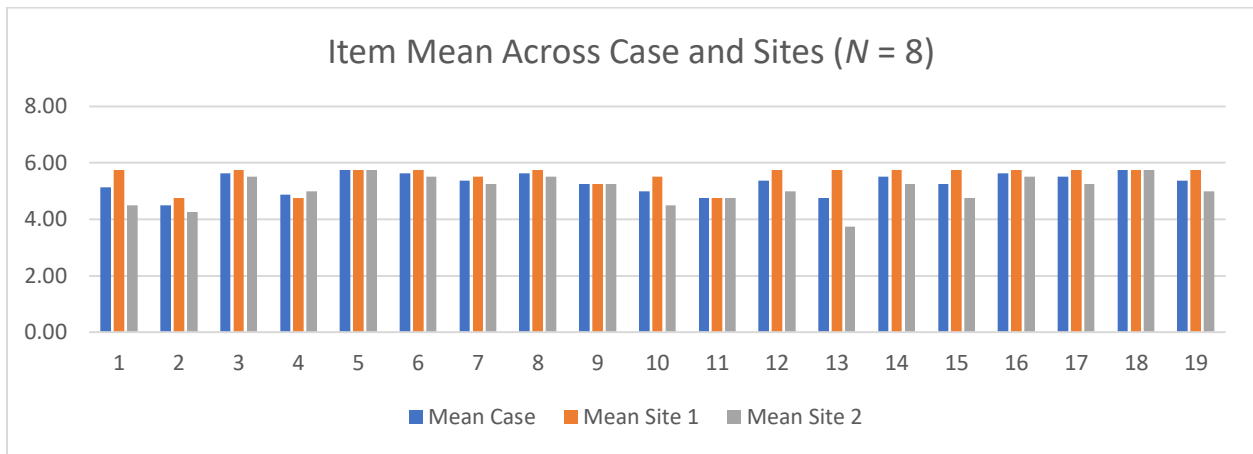


Figure 8

Item Mean Across Case and Sites (N = 8)

An analysis of these descriptive statistics lays the foundation for the themes presented in the next section. Most notably, the participants self-reported the lowest confidence for prompt two, “I can suggest institutional intervention skills that favor the mentee.” Here, one may postulate that the discomfort, apprehension, and lack of confidence result from a “chilly” climate. But this chilly climate is merely a symptom of the intersectional issues of institutionalized racism and sexism found within the educational pipeline. It is plausible that women of color may not feel confident suggesting institutional interventions to other racially minoritized women because of the negative interactions they may have experienced with similar

interventions. Another explanation may stem from the unavailability of these institutional interventions.

Conversely, participants reported the highest confidence for item five, “I am aware of my own cultural heritage.” Here again, the self-reporting aligned with the experiences shared in the one-on-one interviews. As detailed in the following section, each participant shared lively experiences related to Module 7, Culturally Responsive Mentoring. In this module, participants delved into the foundational underpinnings of CRM, prompting participants to take an introspective look into their cultural heritage and values. In these personal explorations, the salient and emerging themes helped reconstruct the experience of racially minoritized women exploring STEM degrees and how the virtual training environments helped position them to be culturally responsive mentors and mentees.

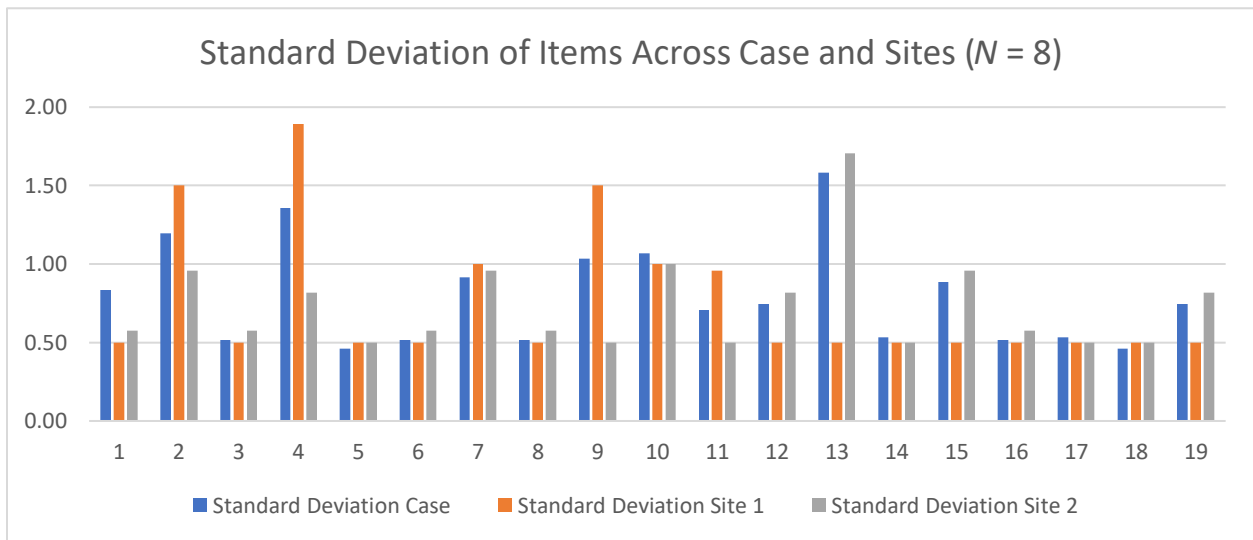


Figure 9

Standard Deviation of Items Across Case and Sites (N = 8)

In terms of variance, the standard deviation was greatest within items two, four, and thirteen. Prompt thirteen, “I present my own values to the mentee” presented significant variance

between sites. Site one participants from the HBCU responded with high confidence while participants from site two, the PWI, responded variably. This prompt relates directly to studies of self-efficacy and STEM-identity that support how racially minoritized women often exhibit lower levels of self-efficacy when pursuing STEM-related degree programs in addition to struggles to comprise a solid STEM-identity (Hill et al., 2010; Olson & Riorda, 2012).

Conversely, the variance reported in prompt four demonstrates a juxtaposition of responses. Prompt four read, “I attempt to perceive problems within the context of the mentee’s cultural experience.” Responses from the HBCU participants demonstrated a higher level of variance than compared to the PWI participants. These results suggest that, although the participants responded with high confidence to the majority of the prompts, indicating a high level of confidence surrounding cross-cultural responsive mentoring, the respondents continue to grapple with the application of culturally responsive tactics within a mentoring relationship.

Themes

The purpose of this field-based, learning experience design study was to explore how, if at all, racially minoritized women mentor and mentees’ experience with the virtual STEM peer mentoring training program influenced the learning outcome of cultural responsiveness. The study’s focus was on collecting and analyzing the mentors’ and mentees’ experiences during the virtual training across the two sites, using data collected from one-on-one interviews, a pluralistic walkthrough, and researcher journaling. Each case was individually and holistically analyzed with manual and software-based coding using Nvivo coding software. The following section details the results of these holistic analyses and coding explorations.

The central research question driving this study assessed how, if at all, racially minoritized women mentors’ and mentees’ experiences with the virtual STEM peer mentoring

training program influenced their cultural responsiveness. One-on-one interviews with five participants across the two sites revealed a consistently high level of satisfaction with the virtual training modules. When asked about their familiarity with cultural responsiveness, each participant shared that she was unfamiliar with the term, but after completing the training they felt comfortable using the term and described themselves as culturally responsive. Further, each participant described a high level of comfort and confidence navigating a peer mentoring relationship where the peer did not share the same racial, ethnic, or cultural attributes.

I then asked participants about specific instructional design components featured throughout the training and how these elements influenced their cultural responsiveness and agility. Information gathered from these pluralistic walkthroughs, combined with the semi-structured one-on-one interviews, yielded the following themes (Figure 10) that attributed to the participants' growth as a culturally responsive mentor or mentee: mentoring as a conduit for giving back and catalyst for belonging, reflective practice to acknowledge differences and promote awareness, interactive elements as a measure of mastery, and culturally responsive curriculum and aesthetics.

-
1. Mentoring as a Conduit for Giving Back and Catalyst for Belonging
 2. Reflective Practice to Acknowledge Differences and Promote Awareness
 3. Interactive Instructional Design Elements as a Measure of Mastery
 - a. Salience of Modality Resulting in Mastery of CR Content
 - b. Impressions of learning element functionality
 4. Culturally Responsive Curriculum and Aesthetics
-

Figure 10

Emerging Themes and Subthemes

Mentoring as a Conduit for Giving Back and Catalyst for Belonging

Consistent with the literature, participants' experiences were consequential of the interaction between their characteristics and characteristics of the training's design (Hassenzahl & Tractinsky, 2006). Participants noted that personal motivations and experiences in STEM informed their internal models they brought to the training and they, in turn, used this to fuel their motivation to interact and complete the training. Participants completing the mentoring training modules frequently shared that the training provided them with an opportunity to give back to other racially minoritized women who may have an interest in pursuing a STEM degree. For these women, helping their fellow peers navigate the often-murky waters of institutionalized racism and sexism was salient.

Several participants made comments about the lack of diversity across their STEM programs. Dana noted in her interview that a lack of representation of persons of color is "why not a lot of people wanna do STEM because they feel like they wouldn't succeed because people of their color or people of their race they don't see too many of those people in there." Mary described her experience as a Black woman in an engineering program as alienating,

For my first two years, I didn't have anybody. I didn't really talk to my professors outside of class. If I had a question, I didn't really feel like I could talk to anyone, even my classmates, because nobody looked like me anymore. So that was very difficult for me.

Both descriptions supported the participants' desire to serve in a mentoring capacity so that those racially minoritized women entering these fields would have guidance and support from someone who shared in their surface-level characteristics. Mary emphasized the importance of having racially minoritized faculty members and classmates,

I didn't know what I was lacking until I experienced it – having a black professor - because I've had black teachers before but being in college and that changing, I didn't realize how easier it was to talk to him than other professors. And I still talk to him to this day, like whenever I see him I'm very happy. I email him frequently. I see him at the games, and it's just like a family type of vibe, and I just don't have that with a lot of my other professors.

In these interview excerpts, the participants explained how important it is for racially minoritized women to identify others who look like them and share in the same cultural value systems. As a result, many participants described the training as a means to fill that void and an avenue to allow them to provide assistance, encouragement, and guidance while also working to perpetuate a sense of belonging. Providing this sense of belonging can originate from within the mentoring relationship. Mary described the training as a blueprint for mentoring. She notes that the training taught her “how to be a better mentor for the next person since I didn't experience what these modules were describing, how I can be a help to someone else so that they don't have to... So that they don't have to experience what I experienced.”

Cassie shared that the training helped her realign her motivations and priorities so that she could be in a position to help her peers, “But now I'm back on the path because I feel like I can help myself with some more rights. And I feel like maybe if I do the right thing, I can help other people. I don't really want to be connected, but I feel like I'm connected.” Here, Cassie described the “pull” she felt during the training that reinforced the importance of having mentors who can pull from their own experiences to help others. Similarly, Janelle shared that the training was a way to “give back in a way, as an alumni, to the students that were there.” In the same vein, Amy described the training as helpful in knowing how to respond in a caring manner

and how the training helped her realize that this notion of care is indeed a cornerstone of success, not only within a mentoring relationship but also within the broader community context,

... that inclusion is very important. And it's not just necessarily, oh there will be glee.

[Younger students] don't know what's going on. But no, it's they might need help, and they just don't know what to ask. So, when you make them feel included, that's how you get to build that group in that bond and keep everyone on the same page.

Dana, one of the only mentees to participate in the study, recognized the importance of training and how this training will benefit both her and her mentor as they embark on the mentoring journey together. For her, the case scenario videos aided in her understanding of how important it is to have someone to motivate and guide you.

And it's always gonna be one person that you can kinda like get with and, like, guide you. And that perspective. Hayley, I think she found someone that was in, like, that field, to like help guide her. Like, yes, you should continue with this. To give her that motivation to continue.

For these participants, the mentoring training aided in their understanding of the impact that culturally responsive mentoring can have on a student's success and persistence, especially racially minoritized women who find themselves in a male-dominated field. Using mentoring to usher women of color through a program while feeling supported and seen can be a critical building block on their path to success.

Reflective Practice to Acknowledge Differences and Promote Awareness

Dynamic interactions with reflection activities engendered acknowledgement of differences and awareness of diversity. Participants' movement toward attaining the learning

outcome was facilitated when they began connecting with authentic and reflective activities that inspired their growth and development. Reflective opportunities were a prominent component of the participants' experience that positively influenced their cultural responsiveness. Each of the eight modules included in the mentoring training concluded with three activities: an application assignment, a reflective discussion, and a module checklist. These activities were positioned to reinforce and apply the materials and information provided in the content modules.

Of these activities, the training participants found the reflective discussion opportunities helpful in promoting their understanding of the materials. The placement of additional reflection prompts dispersed throughout the didactic lecture portions of each module also proved beneficial. The training program encouraged participants to keep a research journal to collect thoughts, reactions, and training reflections. In each of the one-on-one interviews, the participants mentioned the reflection journal's helpfulness. It encouraged them to dive deeper into the materials, surpassing simple understanding and recall of the content.

For Dana, the reflection journals were paramount as "a way for me to, uhm, better understand like, my whys and my hows. Or how I go about me being in the STEM field. Like, why do I want to do this? What is my purpose?" Here, Dana described an integral component of instructional design in that learners look for the materials' purpose. This opportunity to reflect created a space in which she could grapple with the content and her motivation for pursuing the mentoring program. Cassie expressed a similar sentiment as she recalled,

The thing that sticks out the most is the thing I spent the most time on, is the Reflection part. The reflection journal part. And doing the interactions and things like that, but, you know, they tell you to reflect at the beginning, and then you get this whole section to reflect at the end. But yeah, when they tell me straight up, "what is diversity?" and I'm

like... different.... Countries?... I don't know. Then you go, and you read is like, OK now, I can adjust some of these things. So that.

For Cassie, these reflective exercises highlighted the content areas where she may have been weaker, prompting her to revisit the materials. This ability to distinguish areas of weakness that may require more intentional study and attention speaks to the level of self-awareness the mentoring training promotes.

Perhaps one of the most notable influences the reflection activities had on cultural responsiveness was how they reshaped participants' understanding of critical terminology within culturally responsive training and education. Module 7 focused on culturally responsive mentoring and the frameworks that promote cultural responsiveness and agility within the mentoring relationship. This module included four submodules that highlighted cultural responsiveness components: culture, diversity, inclusion, and culturally responsive mentoring. In each interview, the participant described a transformation in her understanding of terms and how these terms situate themselves in mentoring relationships or other heterogeneous groups. Mary shared,

And I've also learned that you know diversity isn't really just about race. Like I learned that in college, that you know, there are a lot of things that make us different because, like I said, even now I'm realizing that, even though I look like someone, we can be completely different people totally different viewpoints or ideas. But I do think that it's important to, just because, like, especially with what's been going on in the world, that they that we have That we have. Obviously, a spotlight that's not the word I'm thinking of. Oh, we have a spotlight in feel like this is talking to me yeah, I feel like there should be. Diversity in all the pictures I'm not even just black or Brown, but even throwing in a

group of girls just having different colored women together and showing them as companions as well and that you can get along with anyone, no matter what your background is or what you look like.

Janelle described a similar transformational understanding of cultural differences through reflective practice.

I think it was interesting, actually. I come from a multicultural family, so growing up in that background, I kind of think a certain way. And that's until you kind of meet other people with different cultural backgrounds, and you get to really understand the way people think. And I think it was interesting that cultural orientation was talked about here because we do tend to think a certain way or feel a certain way or even behave a certain way based on how we grew up. And people come from so many different households and backgrounds. It's unimaginable. So I think I'm learning this is important not just for this mentoring program, but just for life, just dealing with other people. I think this is awesome.

The reflection activities not only stoked the participants' self-awareness but also provided a roadmap for approaching difficult conversations with their mentees and mentors. To this effort, Amy felt that the reflection activities would be a great way to start conversations with her mentor about their cultural contexts as a way to identify intersections and polarities. In her interview, she described how she plans to use the reflection activities to become more culturally agile within her mentoring relationships.

So with the constant insight it'll be very easy for me to compare and contrast with my mentor. When we see how we feel about certain things and if we're on the same page and then kind of build foundations based off of that. So, I liked that.

Mary echoed these sentiments,

I'm just thinking about [the reflection activities], like in a teaching aspect like, if I had a class and we were going through these modules, I would want to have time. Because I do wish them to, I will want to have time for us to talk about what we learned in what we think about certain things.

Dana also described the reflective activities as part of a toolkit to help tear down walls between mentors and mentees. She explained her reactions to the reflection activities in Module 7.

...just because somebody may have a different racial background or their cultural background. But, meeting that person, I feel like you guys are always going to have that one similar point. Even though everything else may be different. There's always going to be that one thing that you and that person are going to have in common, which can easily expand your bond with that person, to get to know their side and they get to know your side.

While the participants all commented on the number of reflection activities and how they felt exhausted by the amount, in each interview the participants realized how transformational the activities were in their own culturally responsive journeys. In my observations, I watched each participant's facial expressions and body language shift into this realization.

Interactive Instructional Design Elements as a Measure of Mastery

For the purposes of this study, the term “interactive instructional design elements” refers to those content presentations that differ from traditional text, audio, and video. The virtual STEM peer mentoring training featured multi-modal content to help diversify the presentation of difficult concepts. This diversification was demonstrated through the thoughtful placement of

short quizzes that measured objective knowledge retention of CR concepts, interactive slider elements to help illustrate ways to approach mentoring relationships where the mentor and mentee may struggle to find commonality, and infographic representations followed by explainer videos that helped expand on the content contained within the graphical representation. Within this overarching theme, two sub-themes emerged:

- Salience of modality used to convey content that resulted in mastering CR content
- Impressions of learning elements functionality

The following section describes the emergence of the two subthemes shared among the participants.

Salience of Modality Resulting in Mastery of CR Content

A salient theme across all participant interviews was how each woman described specific instructional design elements as a positive influence on their knowledge of culturally responsive mentoring. This salience of modality used to convey information resulted in the mastering of CR content. One instructional design attribute featured throughout the mentoring training was the intentional placement of low-stakes knowledge checks, in the form of multiple-choice and multi-select questions, paired with other interactive activities to help learners assess their mastery of the content. Each woman commented on how the content-embedded quizzes helped to ensure they fully understood the material. They also described the immediate feedback provided by the quizzes in a positive manner. Mary shared, “I love the quizzes to kind of solidify that I was learning what I was reading. And then I also like the little check box at the end to like check off what I can explain that I know how to do.” Similarly, Amy noted,

I did like the flashcards. I did like some signs at the end, like a small review almost. And then there'd be like checkpoints. And it's like, so in this module, you learned X, Y, Z,

and you could read over it. OK. I kind of know what that is. I know what that is. And then you would kind of check it off and then proceed.

Dana also expressed great satisfaction with the interactive elements in terms of the placement and diversity of activities.

This is one of the things that I really liked about the training was the interactives. Because it was like something to get you to ‘OK, did you really read? What is it talking about?’ But it was pretty fun because, like, each of the modules had a different setup of interactives. Like, one was like matching, like one was like, drag into the box, one was, like, check which one is right. That’s what I really liked about the training was the interactives.

Instructional design best practices encourage opportunities for the learner to self-assess and receive feedback early and often. Here, the participant reactions endorsed these recommendations, citing that the interactive elements helped with pacing and mastery of content. Pacing was critical for this content. Most of the participants reported high levels of confidence related to cultural responsiveness, as Figure 8 demonstrates. With increased confidence levels surrounding a particular topic, a learner may rush through the content without taking the time necessary to engage with it. These interactive elements slow the completion process and intentionally create spaces for this engagement and reflection to occur. The content’s demand of this pacing and pausing proved helpful to the participants in terms of their understanding and ability to apply culturally responsive tactics to their mentoring relationships.

Impressions of Learning Element Functionality

An additional interactive component that positively impacted the participants’ experience was the interactive slider featured in Module 7. The interactive slider featured several prompts

with the opportunity to “slide” a mechanism across a continuum to denote where the respondent landed in terms of what the prompt was measuring (Figure 11). Ideally, this activity could be used in a mentoring session to raise awareness and identify similarities and differences between the mentor and mentee.

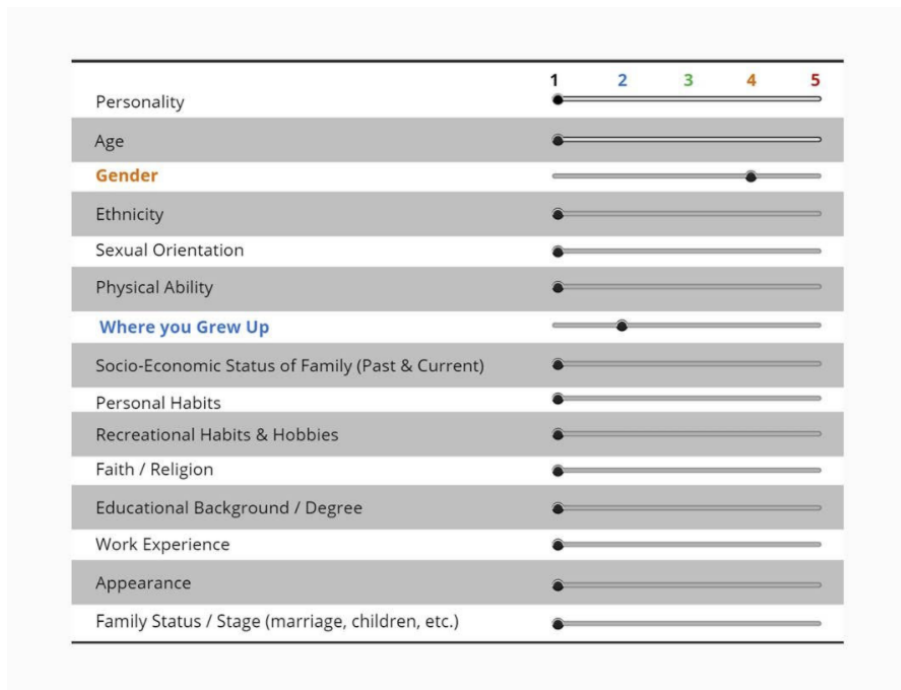


Figure 11

Screenshot of Interactive Slider Activity

Janelle described the activity as a great “icebreaker” when she recalled,

I think this will be like an interesting icebreaker. If you did have like I was in a zoom meeting, for example, with my mentee, I can probably direct them to this module or some way I can get this tool in some way. And I would say, OK, what do you think are the differences? And then, towards the end of the icebreaker, I can kind of show like, oh, no, we have commonalities. We have similarities despite our differences. Like, you may think this, but I’m actually this, and we’re both the same in this category or something of nature. I think it’s interesting, actually. I like this.

Cassie also found relevance with the activity and described it in a similar manner. “Well, I ain’t gonna lie. I know that little slide machine you showed me, when I get a chance to go through it with my mentor, that’s going to help me out. I think it’s a great way to break the ice.” Both participants recognized how the interactive slider could be leveraged to acknowledge similarities and differences between themselves and their mentees. Acknowledging differences and promoting awareness is a foundational element of culturally responsive mentoring. The participants saw clear transferability of skills and practices from this training into their mentoring relationships, which positively impacted their experience and cultural responsiveness.

Culturally Responsive Curriculum and Aesthetics

During the design and development of this virtual training, culturally responsive design was of utmost importance. A final salient theme that emerged through one-on-one interviews with the training participants was an appreciation of this responsive content. Each woman commented on the relatability of various elements featured throughout the modules. Namely, participants mentioned the visual presentation of the content and how they appreciated the presence of racially minoritized women in the images and animated characters used throughout the training. The women shared favorable reactions to the case scenario videos. Cassie acknowledged,

I watched the videos on all of them. Y’all went hardcore with these names. Y’all took down to names. Y’all were, like, very culturally aware with some of these names and some of these images that y’all put in there. I was like, ‘Yeah. Do it right out. See right there, with the braids. Y’all took it there on the braids. I think Jemiah is her name, so y’all went there. I loved it; I loved it. First video, I was ready, and y’all did not disappoint.

Cassie's reaction highlights two key takeaways. First, the liveliness of her reaction prompted by the characters' traditional African-influenced hairstyles suggested that this depiction is not a common one across mentoring (or any) training content that she has been exposed to. Second, her reaction indicated that these purposeful – yet not tokenized – inclusive designs encouraged engagement and excitement. This assumption is further supported by Amy's comments, "Especially because this study is working with a minority group, And the case scenarios really built around minority women and made their views very relatable. And it really, because they were so relatable and made you want to pay more attention and set a nice foundation."

The participants commented on the case scenario video storylines, noting the relatability of the scripts. One tenet of culturally responsive curriculum design is that the content reflects the cultural contexts of the learners. Here, the instructional designers of this training content devoted time and effort to ensure its responsiveness and presentation. The sociocultural context portrayed in the case scenario videos positively impacted their experience and cultural responsiveness. Dana shared that,

... another video about how the girl's parents were like more educated than one of the other girl's parents. I could really relate to the other girl whose parents were not as educated. So, she had to go out to receive more information about how to do things instead of like, the other girl who was going to her mom or dad for questions.

The attention to the sociocultural context beyond the characters' racial and gendered presentation was essential to the participants.

Hindrances

The participants did not mention any element of the learning space or environment that hindered their development of cultural responsiveness, even after directly asking them to identify challenges and hindrances directly. The only negative was that some participants felt the reflections were either repetitive or too frequent, but they almost always immediately followed up with still liking the reflection exercises and thinking they were worthwhile. The most negative feedback surrounded the Slack channel as discussed.

Summary

The central research question for this study asked, “How, if at all, did the racially minoritized women mentors’ and mentees’ experience with the virtual STEM peer mentoring training program influence their cultural responsiveness?” While each of the five participants described a unique experience completing the virtual STEM peer mentoring training modules, their shared experience articulated that overall the training program did contribute to their growth as a culturally responsive mentor or mentee. The five participants across the two sites also complimented the training and described it as thorough, professional, and informative. Some participants even expressed interest in going back through the training with their mentees to enrich their cultural agility.

Collectively the mentoring training participants shared that the training program and its delivery helped motivate them to give back to those who will follow in their footsteps. They described multiple benefits of the reflective practices and prompts placed throughout the training as essential and impactful attributes to their growth as culturally responsive mentors and mentees. The interactive components featured in the training were also well received as each participant listed these features as some of her favorite or most memorable and impactful when

determining the level of mastery of the materials. Finally, the participants appreciated the culturally responsive curriculum and how that curriculum was intentionally produced to better resonate with their own experiences as racially minoritized women in STEM.

CHAPTER FIVE: DISCUSSION AND CONCLUSIONS

The purpose of this learning experience design study that employed a qualitative, case study design was to explore how, if at all, STEM mentors' and mentee's cultural responsiveness were influenced by a virtual training program and what the participants experienced as they completed the training. A total of three mentors and two mentees completed the training and requirements for this study. Participants completed a pre-assessment and eight virtual content modules covering different aspects of virtual peer mentoring in STEM. The pre-assessment data indicated how culturally responsive the participants considered themselves. Following the training, one-on-one interviews were conducted with each participant to explore how, if at all, the training impacted their cultural responsivity. In addition to the walkthrough and interviews with mentors and mentees completing the training curriculum, a research journal held notes, reactions, subjectivities, and reflections. This was used to triangulate the data captured from the pre-assessment and the one-on-one interviews.

Information collected during the participant interviews was thoroughly analyzed using both thematic and categorical aggregations. Interview data was processed both manually and with the Nvivo analytical software program to maximize the thematic output. Chapter Five will begin with a summary and discussion of the results informed by the central research question and sub-questions aligned with current research. The chapter will then offer an overview of the study's implications and limitations before providing recommendations for improving cultural responsivity of both virtual training content and improving one's cultural agility. Chapter Five ends with a summary of the key findings of this study.

Summary and Discussion of Findings

The central research question guiding the study explored how, if at all, did the racially minoritized women mentors' and mentees' experience with the virtual STEM peer mentoring training program influence their cultural responsiveness. The finding provided in the previous chapter supports the claim that the virtual STEM peer mentoring training program did positively impact the participants' cultural responsiveness. While post-assessment data was unavailable due, in part, to a lack of participation, the data collected in the one-on-one interviews and the pre-assessment provided solid justification that positively correlated the completion of the training with increased cultural responsivity. Data extrapolated from the pre-assessment does provide sufficient information to corroborate that participants perceived themselves to be culturally responsive even before completing the training. During the one-on-one interviews, all five participants agreed that they would describe themselves as culturally responsive and felt confident that they could contribute to a culturally responsive mentoring relationship.

Data extrapolated from one-on-one interviews paired with information gathered from the pluralistic walkthrough and the researcher journal triangulated the data and provided justification and theoretical explanations for how the training experience influenced the participants' cultural responsiveness. Four themes emerged through a categorical and thematic analysis that helped situate the training experience and its internal components to affect participants' cultural responsivity. Those four themes were: (a) mentoring as a conduit for giving back and catalyst for belonging, (b) reflective practice to acknowledge differences and promote awareness, (c) interactive instructional design elements as a measure of mastery, and (d) culturally responsive curriculum and aesthetics. In addition to these major themes, two additional subthemes also surfaced: salience of modality used to convey content that resulted mastering CR content and

impressions of learning elements functionality. The conceptual frameworks of culturally responsive mentoring combined with mentoring literature were lenses through which this study explored how the training may have influenced the growth in participant cultural responsiveness related to peer mentoring in STEM.

This study introduced the underrepresentation of racially minoritized women in STEM degree programs and fields and situated culturally responsive mentoring as a channel to promote STEM engagement, matriculation, and persistence for these populations (Byars-Winston & Dahlberg, 2019; Carlone & Johnson, 2007; Hill et al., 2010). As chronicled in Chapter Two, mentoring may assume various modalities, including face-to-face, hybrid, and virtual mentoring (Collier, 2015; Crisp & Cruz, 2009; Cohen & Galbraith, 1995; Lombardo et al., 2017; Neely et al., 2016; Rowland, 2012; Vandal et al., 2018). Mentorship training programs provide training and reflective opportunities to ensure that both mentors and mentees receive the skills needed to participate in the mentoring relationship effectively (Byars-Winston & Dahlberg, 2019; Collier, 2015; Galbraith & Cohen, 1995; Gandhi & Johnson, 2016; Pfund et al., 2014; Pon-Barry et al., 2017).

The most successful mentoring relationships exhibit cultural agility and express and receive culturally responsive information (Byars-Winston & Dahlberg, 2019). Cultural responsiveness is a practiced skill that, while it may come naturally to some, still benefits from training and modeling scenarios. Training in cultural competence presents skills that help mentors and mentees understand how to interact effectively with those from different cultural backgrounds (Sanchez et al., 2014). Cultural competence training broadens and improves one's cultural responsivity, meaning that after cultural competence training the learner should recognize a mentor or mentee's cultural attributes through a strengths-based approach (Sanchez

et al., 2014; Suffrin, 2014). Culturally responsive mentoring relationships can help promote a sense of belonging and, thus, combat some of the systemic environmental issues plaguing racially minoritized women's persistence in STEM.

This study required participants to complete an eight-module virtual mentoring training program that helped participants develop competency in culturally responsive mentoring indicators. This study combined the frameworks described in the Valentine Foundation benchmarks (Lindsay-Dennis et al., 2011), ARCS model (Rockinson-Szapkiw et al., 2020), and the tenets of culturally responsive teaching (Gay, 2018; Gay 2002; Ladson-Billings, 2014; Ladson-Billings, 1994; Rosinski, 2003) and learning design (Eugene et al., 2009) to arrive at a holistic mentoring training experience designed to enhance the learner's cultural responsiveness and that reflects a culturally responsive design. The curriculum's composition and presentation exhibited culturally responsive teaching and pedagogy principles, reinforcing the importance of cultural agility and mentors' and mentees' responsiveness. Each module presented didactic content and then concluded with opportunities to apply concepts and reflect on one's experiences. Chapter Four documented participants' high levels of satisfaction with the training and reinforced, through interview excerpts, that the training positively impacted the participants' cultural responsiveness related to the mentoring relationship.

The findings of this study push the limits of current learning experience design research through the applied incorporation of cultural and socioemotional components. The following section will parse the four emerging themes and their potential contributions to instructional design and technology. First, this section will support an extension of learning experience design to incorporate and account for the cultural perspective of the learner. Next, it will articulate parallels between the findings of this study and the ethos of intentionality in support of what

Glazewski and Ertmer (2020) define as linguistically and culturally diverse (LCD) learners. Then, this section will provide a brief discussion on self-directed learning and how personalized, intentional formative feedback contributes to a sense of belonging for this learner population. Finally, the findings will conclude that case-based instruction can fill a cognitive gap and give a voice and platform to a learner's sociocultural experiences. These findings work to extend the reach of traditional models of instructional design to champion the intentional integration of culturally responsive curriculum into self-directed learning opportunities to cultivate and promote a sense of belonging among minoritized learner populations and instigate emotional responses to multi-modal content.

Emotional Response as a Design Consideration

Perhaps the most significant finding of this study was the empirical data that supports the incorporation of emotional and sociocultural components into instructional design processes. As introduced in Chapter Three, the field of learning experience design (LXD) attempts to combine multiple efforts to provide a more holistic approach to designing content that maximizes both learning (mastery) and experience (usability). What was unique to this study is that the data presented in Chapter Four solidifies the need for additional considerations when designing curriculum, especially self-directed, asynchronous online curriculum for learners who represent minoritized populations.

As the literature supports (Schmidt et al., 2020; Tawfik et al., 2020), defining learning experience design proves to be problematic due, in part, to its newness but also because of its intersectional and interdisciplinary nature. Most often, instructional design scholars approach LDX from a cognitive perspective. The focus of current LDX research and the basis of most definitions centers on successful knowledge transfer and a satisfactory usability experience.

Suppose the learner can master content and meet specific learning objectives while also reporting a helpful, satisfactory experience with the interface. In that case, the learning experience design is thought to be solid and successful. Figure 12 illustrates a high-level visual interpretation of instructional design components through the lens of learning experience design.

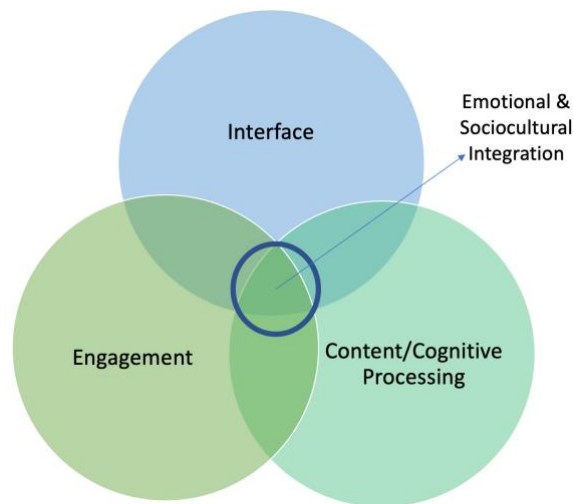


Figure 12

Diagram of Instructional Design Components with Emotional and Sociocultural Integration

First, designers must grapple with modality considerations. In the diagram, the “interface” represents both the modality and platform used to host the learning content. This platform could include a website, learning management system, or other content authoring interface. Next, the diagram identifies the learning content, the cognitive demands presented to the learner. Most instructional design and learning experience design scholarship highlights learning content, including delivering and assessing the content. A third component, engagement, receives considerable attention across instructional design scholarship. Engagement often includes three sources of interaction: student-student, student-instructor, and student-content. These engagement relationships contribute to a student’s overall impression of the content’s transferability and satisfaction. While it’s essential to measure successful knowledge

transfer and learner satisfaction, what is noticeably absent is recognizing how a learner's emotional and sociocultural experiences impact the approach to learning. Here, the image identifies emotional and sociocultural referents at the intersection of interface, content, and engagement.

As evidenced by the emerging themes and supported by the qualitative data presented in Chapter Four, instruction intended for diverse learners, including the self-directed learning content featured in the virtual STEM peer mentoring training, would benefit from intentional emotionally programming and delivery. Each interview participant reacted emotionally to at least one or more components featured throughout the training. Most commonly, this emotional response was due, in part, to the content igniting or calling on a particular memory from the participant's past. One such incident involved Mary and her emotional response to the module on being an empathetic mentor. The content prompted Mary to recall a particular memory where she struggled with a health issue that impacted her persistence. I was able to see how the content ignited this visceral response and Mary's subsequent attention to the module. Her emotional reaction presented physically but also included a cognitive component.

This emotional connection to the materials may result in deeper learning and the recall of module-specific information more easily. Glazewski & Ertmer (2020) described a dearth of understanding surrounding how to engage with culturally diverse learners and offered a way to approach intentional implementation of culturally responsive teaching to tackle complex problem-solving. Coined the ethos of intentionality, this conceptual framework describes the intersection of critical reflection and meaningful action and encourages instructors to integrate deliberate pedagogical interactions that originate from critical reflection and meaningful action.

These two components were present in the current study and provided the empirical data to support this theoretical approach in practice. The virtual STEM peer mentoring training program included both critical reflection and meaningful action as a way to reach racially minoritized women exploring STEM fields. Supported by the interview data, this practice was successful at fostering and growing participants' cultural responsiveness. As such, this practice can be expanded to reach more diverse learners through the implementation of critical reflection and meaningful practice that has deliberate emotional and sociocultural components, as described by eminent CRT scholars (Gay, 2002; Ladson-Billings, 1994).

Formative Feedback and Sense of Belonging

Scholarship on formative feedback in self-directed learning is plentiful. Studies have illustrated how formative feedback influences learning (Goldin et al., 2017), willingness to incorporate feedback (Hao & Tsikerdekis, 2019), and self-regulation mechanisms (Nouri et al., 2019). While the findings from this study support the current literature, it also extends that conversation to include how automated, formative feedback can hinder a sense of belonging.

Often, automatic formative feedback is used to reinforce the material and check for student understanding. Interview participants cited favorable experience with the automated formative feedback received throughout the training, but personalized, organic feedback from an instructor or facilitator was missed. In several interviews, the participants wanted to ensure that they could show evidence of completing assignments, reflections, or other activities. Several women even held their reflection journals within the camera frame so that I could see, in a literal sense, that they had completed the work. These actions link to a longing to have their work recognized by a facilitator or instructors and suggest that the interview participants seek to find a sense of belonging that originates between the learner and the facilitator and cannot be delivered

automatically. Instead, and connected to tenets of CRT, participants described not having a relationship with the facilitator or content creator as disappointing. One may postulate that, given the curriculum and how engrained in care and empathy the content was, organic, facilitator feedback would be a critical component of the experience.

As summarized in Chapter Four, many of the women felt underwhelmed by the participation in the Slack® virtual community and disappointed in the lack of interaction as a whole. This disappointment suggests that, while automated formative feedback may produce positive, measurable results for traditional subject matter, content that involves empathic actions and knowledge, such as cultural responsiveness and cultural agility, may not be suited for similar feedback delivery modalities. Instead, automated formative feedback has the potential to negatively impact a learner's sense of belonging and create a greater separation between the learner and the facilitator. This separation is palpable and further reiterates the alienation that most culturally responsive curriculums try to abolish. Instead, when handling a curriculum that dips into subjects related to CRT, such as organizations exploring cultural sensitivity training and diversity and inclusion training, those programs may need to rethink their approach to assessment and belonging to avoid perpetuating this separation. Instead, having opportunities for more personalized and organic feedback may produce results that extend beyond superficial credentialing and into meaningful organizational change.

Case-Based Learning as a Voice for Culturally Diverse Learners

Case-based learning is often positioned as an opportunity to fill knowledge gaps through vicarious learning opportunities. Instructional designers utilize case studies and other case-based instructional strategies to provide contextual narrative in a way that helps the learner situate herself within a given scenario. Here, the learner does not have to have the personal experience

or exposure for the knowledge transfer. Instead, through vicarious learning opportunities, the learner may have a psycho-emotional response to the content. For diverse student populations, case-based learning strategies can have a dual impact. Interview participants all commented on how the case scenario videos and related content resonated with them. Here, one may project that while the case scenario videos provided the appropriate contextual narrative and set up for the vicarious learning event to occur, it also transcended that purpose to offer a voice and platform for marginalized learner populations.

Chapter Four detailed how participants viewed the mentoring training and program as a way to give back to others who may choose to follow their path. This idea of giving back connects to the sense of belonging which is often absent for women of color in STEM fields. If instructional designers position case-based learning strategies into curriculum for diverse learners, especially racially marginalized women exploring STEM, these cases become a platform of belonging. Students can see how the narrative examples illustrated by case scenario videos provide a voice to historically marginalized groups. This voice and platform help to combat the systemic inequities that currently plague the STEM fields. Cases have an opportunity to illuminate the experience of racially marginalized women in STEM to help bolster support and interest in future generations.

Suggestions for Improvement

While this study's results are not generalizable due to the low number of participants, the work does present opportunities for future studies to explore. Current literature supports that racially minoritized women are woefully underrepresented in STEM (NSF, 2019). These fields are typically male-dominated and are unwelcoming to women, especially women of color (Hall & Sandler, 1982; Janz & Pyke, 2000). To better support racially minoritized women in their

STEM pursuits, the literature promotes the use of mentoring programs to better support underrepresented populations (Carlone & Johnson, 2007; Hill et al., 2010). Previous research (Sharp, 2019) introduced virtual mentoring as an additional channel to support persistence and self-efficacy within minoritized populations. By sharing the experiences of five racially minoritized women across two universities, however, this study emphasized the importance of cultural responsiveness within those mentoring relationships and how mentors and mentees can grow in their cultural agility through a virtual platform.

Racial and gendered disparities exist across many institutionalized, systemically corrupt structures, including all levels of the educational system. The social justice movement has amplified what literature terms the "double bind," which describes the intersectional experience of racially minoritized women as they experience multiple oppressions (i.e., racism and sexism) simultaneously. Crenshaw (1991) defined intersectionality as the overlap of multiple social identities. For racially minoritized women, intersectionality describes the constant juggling of their oppressed social identities as both a woman and as a member of a racially minoritized group. Intersectionality unveils the unyielding power dynamics that continuously suppress minoritized groups through micro and macro structures and interactions (Dortch & Patel, 2017; Sanchez et al., 2019).

Collins (1989, 2002) introduced Black Feminist Thought (BFT) to understand the intersectionality experienced by racially minoritized women. The BFT framework is comprised of six principles: (a) a commitment to social justice to unite black women, (b) a rejection of the singular "Black woman experience," (c) the adoption and adaption of Black feminist consciousness, (d) amplification of voices and success of Black women in arenas both inside and

outside of academia, (e) a recognition of change and the ability to adapt to social shifts, and (f) the construction of alliances to extend Black Feminist movements.

The current study recognizes the role culture and cultural value systems play in social interactions and the construction and prioritization of knowledge but fails to acknowledge how race and racial inequity situate themselves. Critical race theory posits that race continues to be a central root of injustice. This racial inequity is embedded into the very fibers of legal, cultural, and psychological aspects of American life. Through the lens of critical race theory, as it applies to education (Ladson-Billings & Tate, 1995), future studies must situate race, property, and power dynamics as the foundation of institutionalized, systemic inequities. The bounds of this study also failed to account for the intersectional experience of racially minoritized women. To better support racially minoritized women in STEM, STEM degree programs must recognize the tremendous benefits of identity-based mentorship programs that exhibit cultural responsiveness but are also informed by intersectionality and Black Feminist Thought (BFT).

Reimagining mentoring programs and their prerequisite training would first centralize and acknowledge the racialized and gendered disparities in the STEM fields and then create opportunities to showcase the successes of those racially minoritized women who have achieved success in the field. Also, now that virtual mentoring is becoming a more accepted integral component of the college experience, connecting women of color in STEM is easier than ever. Dedicated efforts to pair successful racially minoritized women in STEM fields with those students of color who are embarking on their STEM-related educational journeys could positively impact that experience and improve the likelihood of persistence for that student. An additional suggestion for improved practice is to reexamine mentoring programs and other STEM-related educational support structures to include opportunities to connect outside of the

mentoring programs to support a sense of belonging. This desire to form communal relationships within gendered and racially minoritized groups was salient throughout the participant interviews. These groups can transcend the barrier between students and faculty.

Limitations and Recommendations

Limitations

While this study provided key insights into how thoughtfully placed instructional design elements can enhance the experience of a culturally responsive mentoring training program, the study was also riddled with limitations. Most noticeably, the representation across the two sites was inequitable. The study featured four participants from an HBCU and one participant from a PWI. Understandably, the experience of a Black woman enrolled at an HBCU may differ significantly from a Black woman's experience while registered at a PWI. It is possible that this uneven distribution produced a limited scope of the experience of a Black woman within a mentoring training program.

As noted in Chapter One, HBCUs are renowned for their exceptional support structures that target minoritized populations; this support is part of their mission as a minority-serving institution. As such, students enrolled at HBCUs may have opportunities to receive programming, education, and support that situates race and culture as a central topic or theme. This positionality, by design, works to leverage culture as a resilience mechanism and promotes strengths-based approaches to educational achievement and the potential for success. In comparison, the experience at a PWI is drastically different. While PWIs may host grant-funded initiatives that share a similar mission to HBCUs, these PWIs do not typically situate race as a central issue or concern in programming efforts.

Recommendations

Future studies should expand to include a more diverse array of colleges, universities, and participants. As Black Feminist Thought suggests, the experiences of racially minoritized women are not one-dimensional. Recruiting racially minoritized women across a vast geographic region who represent a diverse group of cultures, ethnicities, and religions would continue to transform our understanding of how culturally responsive mentoring can positively impact the experience of women of color pursuing STEM degrees.

Besides welcoming additional women of color into forthcoming studies, further education and mentoring are also needed for white women. As a white woman studying the experiences of racially minoritized women over the past year, one theme continued to emerge through my reflection and bracketing exercises. Often, I found myself impressed by the ease at which my participants conversed with me during the interviews, yet I found myself disappointed and frustrated by my own discomfort in the same setting. I recall a similar reaction as I was completing the mentoring training modules in preparation for this study. Unlike my participants, I could not connect easily to the storylines or characters featured throughout the curriculum. This discomfort prompted me to take an introspective look into the intergroup anxiety I experienced to understand where it was originating.

This self-study landed on the realization that women of color are already culturally responsive out of necessity. Conversely, and somewhat ironically, I still have considerable work to do on my journey to cultural agility. It is imperative that, as a white woman, I become more culturally responsive so that I may be able to contribute meaningfully to efforts to dismantle the institutionalized and systemic inequities ingrained in our society that continue to perpetuate inequitable power dynamics. Providing training and support to racially minoritized women as

they pursue STEM degrees is warranted and beneficial. Still, these efforts alone will continue to be an inadequate solution to intersectional disparities. To revisit Scott's (2018) astronaut analogy, continued efforts should focus not only on advancing the skills of the astronaut. They should also work to create a more inhabitable environment.

Conclusion

This study's findings are timely and vital as they provide expanded insight into culturally responsive mentoring within a higher education setting. As the literature supports, most mentoring studies concentrate on students at the primary and secondary levels. While it is true that the gendered and racialized disparities begin to surface during these early educational experiences, the detrimental impacts of these inequities persist through higher education institutions. Given the absence of literature surrounding culturally responsive teaching and mentoring at the college and university levels, studies that assess the efficacy of CR-related programming at these levels are needed.

Further, the emerging field of learning experience design related to virtual and hybrid modalities demands increased attention. This study is positioned to help inform future work on the impact of the learning experience and how the presentation and diversification of content impact both the user experience and knowledge transfer success in a digital environment.

The COVID19 global pandemic introduced the world to virtual communication strategies amid a social justice movement. As such, this study was uniquely positioned to offer insight into supporting intersectional minoritized populations in a virtual space. The results of this study support the continued creation and facilitation of engaging, culturally responsive mentoring and training opportunities that foster a sense of belonging among racially minoritized women pursuing STEM degrees.

REFERENCES

- Albritton, T. J. (2012). Educating our own: The historical legacy of HBCUs and their relevance for educating a new generation of leaders. *Urban Review: Issues and Ideas in Public Education*, 44(3), 311–331.
- Alhadreti, O., Elbabour, F., & Mayhew, P. (2017). Eye tracking in retrospective think-aloud usability testing: Is there added value?. *Journal of Usability Studies*, 12(3), 95-110.
- Allen, T. D., Day, R., & Lentz, E. (2005). The role of interpersonal comfort in mentoring relationships. *Journal of Career Development*, 31(3), 155–169.
doi:10.1177/089484530503100301
- Auerbach, C., & Silverstein, L. B. (2003). *Qualitative data: An introduction to coding and analysis*. NYU Press.
- Bardzell, J. (2011). Interaction criticism: An introduction to the practice. *Interacting with Computers*, 23(6), 604–621. <https://doi.org/10.1016/j.intcom.2011.07.001>
- Blake-Beard, S., Bayne, M. L., Crosby, F. J., & Muller, C. B. (2011). Matching by race and gender in mentoring relationships: Keeping our eyes on the prize. *Journal of Social Issues*, 67(3), 622–643. doi:10.1111/j.1540-4560.2011.01717.x
- Brown University. (2020). *Culturally responsive teaching*. Retrieved April 28, 2021 from <https://www.brown.edu/academics/education-alliance/teaching-diverse-learners/strategies-0/culturally-responsive-teaching-0>
- Byars-Winston, A., & Dahlberg, M. L. (Eds.). (2019). *The science of effective mentorship in STEMM*. National Academies Press. doi.org/10.17226/25568
- Byars-Winston, A., Womack, V. Y., Butz, A. R., McGee, R., Quinn, S. C., Utzerath, E., & Thomas, S. B. (2018). Pilot study of an intervention to increase cultural awareness in research mentoring: Implications for diversifying the scientific workforce. *Journal of Clinical and Translational Science*, 2(2), 86–94.
- Carlone, H. & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching*, 44(8), 1187–1218.
- Cimpan, A. (2020, May 3). *How culture impacts UX*. UX Collective. <https://uxdesign.cc/how-culture-impacts-ux-design-6443a80319f3cohen>
- Cohen, N. H., & Galbraith, M. W. (1995). Mentoring in the learning society. *New Directions for Adult and Continuing Education*, 1995(66), 5–14.
- Cole, M. W. (2014). *Turning the STEM tide: An approach for mentoring young women on how to thrive in STEM careers*. Army Research Laboratory.

- Collier, P. J. (2015). *Developing effective student peer mentoring programs: A practitioner's guide to program design, delivery, evaluation, and training*. Stylus.
- Collins, K. H., Joseph, N. M., & Ford, D. Y. (2020). Missing in action: Gifted black girls in science, technology, engineering, and mathematics. *Gifted Child Today*, 43(1), 55–63. <https://doi.org/10.1177/1076217519880593>
- Collins, P. H. (1989). The social construction of black feminist thought. *Signs: Journal of women in culture and society*, 14(4), 745-773.
- Collins, P. H. (2002). *Black feminist thought: Knowledge, consciousness, and the politics of empowerment*. Routledge.
- Colvin, J. W., & Ashman, M. (2010). Roles, risks, and benefits of peer mentoring relationships in higher education. *Mentoring & Tutoring: Partnership in Learning*, 18(2), 121–134.
- Cree-Green, M., Carreau, A., Davis, S. M., Frohnert, B. I., Kaar, J. L., Ma, N. S., Nokoff, N. J., Reusch, J. E. B., Simon, S. L., Nadeau, K. J. (2020). Peer mentoring for professional and personal growth in academic medicine. *Journal of Investigative Medicine*, 68,1128–1134.
- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Sage.
- Creswell, J.W. (2007). *Qualitative inquiry and research design* (2nd ed.). Sage.
- Creswell, J.W. & Guetterman, T.C. (2019) *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (6th ed.). Pearson Education, Inc.
- Crisp, G., & Cruz, I. (2009). Mentoring college students: A critical review of the literature between 1990 and 2007. *Research in Higher Education*, 50(6), 525–545.
- Davidson, M., & Foster-Johnson, L. (2001). Mentoring in the preparation of graduate researchers of color. *Review of Educational Research*, 71(4), 549–574.
- deMarrais, K. (2003). Qualitative interview studies: Learning through experience. In K. deMarrais & S. Lapan (Eds.). In *Foundations for research: Methods of inquiry in education and the social sciences* (pp. 51-68). Taylor & Francis.
- Denzin, N. K., & Lincoln, Y. S. (2005). Introduction: The discipline and practice of qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative research* (3rd ed.) (pp. 1–32). Sage.
- DiRenzo, M. S., Weer, C. H., & Linnehan, F. (2013). Protégé career aspirations: The influence of formal e-mentor networks and family-based role models. *Journal of Vocational Behavior*, 83(1), 41-50.

- Eddy, S. L., & Brownell, S. E. (2016). Beneath the numbers: A review of gender disparities in undergraduate education across science, technology, engineering, and math disciplines. *Physical Review Physics Education Research*, 12(2), 020106.
- Elliott, C., Mavriplis, C., & Anis, H. (2020). An entrepreneurship education and peer mentoring program for women in STEM: mentors' experiences and perceptions of entrepreneurial self-efficacy and intent. *International Entrepreneurship and Management Journal*, 16(2), 43–67. <https://doi.org/10.1007/s11365-019-00624-2>
- Else-Quest, N. M., Hyde, J., & Linn, C. (2010). Cross-national patterns of gender differences in mathematics: A meta-analysis. *Psychology Bulletin*, 136(1), 103–127. doi:10.1037/a00185053.
- Espino, M. M., & Zambrana, R. E. (2019). “How do you advance here? How do you survive?” An exploration of under-represented minority faculty perceptions of mentoring modalities. *Review of Higher Education*, 42(2), 457–484.
- Eugene, W., Hatley, L., McMullen, K., Brown, Q., Rankin, Y., Lewis, S. (2009). This is who I am and this is what I do: Demystifying the process of designing culturally authentic technology. In N. Aykin (ed.) *IDGD 2009*. LNCS, vol. 5623, (pp. 19–28). Springer.
- Falk, N. A., Rottinghaus, P. J., Casanova, T. N., Borgen, F. H., & Betz, N. E. (2017). Expanding women's participation in STEM: Insights from parallel measures of self-efficacy and interests. *Journal of Career Assessment*, 25(4), 571–584. <https://doi.org/10.1177/1069072716665822>
- Fayer, S., Lacey, A., & Watson, A. (2017). *BLS spotlight on statistics: STEM occupations - past, present, and future*. U.S. Department of Labor, Bureau of Labor Statistics.
- Felder, P. P., & Barker, M. J. (2013). Extending Bell's concept of interest convergence: A framework for understanding the African American doctoral student experience. *International Journal of Doctoral Studies*, 8(1), 1-20.
- Fisher, A. J., Mendoza-Denton, R., Patt, C., Young, I., Eppig, A., Garrell, R. L., Rees, D. C., Nelson, T. W., & Richards, M. A. (2019). Structure and belonging: Pathways to success for underrepresented minority and women PhD students in STEM fields. *PloS One*, 14(1), e0209279.
- Gandhi, M., & Johnson, M. (2016). Creating more effective mentors: Mentoring the mentor. *AIDS and Behavior*, 20(Suppl 2), 294–303. <https://doi.org/10.1007/s10461-016-1364-3>
- Gay, G. (2000). *Culturally responsive teaching: Theory, research, and practice*. Teachers College Press.
- Gay, G. (2001). Educational equality for students of color. In J. A. Banks & C. A. M. Banks (Eds.), *Multicultural education: Issues and perspectives* (4th ed.) (pp. 197–224). Allyn & Bacon.

- Gay, G. (2002). Preparing for Culturally Responsive Teaching. *Journal of Teacher Education*, 53(2), 106–116. <https://doi.org/10.1177/0022487102053002003>
- Gay, G. (2010a). Acting on beliefs in teacher education for cultural diversity. *Journal of Teacher Education*, 61(1-2), 143–152. doi:10.1177/0022487109347320
- Gay, G. (2010b). *Culturally responsive teaching: Theory, research, and practice* (2nd ed.). Teachers College Press.
- Gay, G. (2015). The what, why, and how of culturally responsive teaching: International mandates, challenges, and opportunities. *Multicultural Education Review*, 7(3), 123–139.
- Gay, G. (2018). *Culturally responsive teaching: Theory, research, and practice* (3rd ed.). Teachers College Press.
- Glazewski, K.D., Ertmer, P.A. Fostering complex problem solving for diverse learners: engaging an ethos of intentionality toward equitable access. *Education Tech Research Dev* **68**, 679–702 (2020). <https://doi.org/10.1007/s11423-020-09762-9>
- Goldin, I., Narciss, S., Foltz, P. *et al.* New directions in formative feedback in interactive learning environments. *Int J Artif Intell Educ* 27, 385–392 (2017). <https://doi.org/10.1007/s40593-016-0135-7>
- Gregg, A., Reid, R., Aldemir, T., Gray, J., Frederick, M., & Garbrick, A. (2020). Think-aloud observations to improve online course design: A case example and “how-to” guide. In M. Schmidt, A. A. Tawfik, I. Jahnke, & Y. Earnshaw (Eds.), *Learner and user experience research: An introduction for the field of learning design & technology*. EdTech Books. https://edtechbooks.org/ux/15_think_aloud_obser
- Haggard, D. L., Dougherty, T. W., Turban, D. B., & Wilbanks, J. E. (2011). Who is a mentor? A review of evolving definitions and implications for research. *Journal of Management*, 37(1), 280–304.
- Hall, R. M., & Sandler, B. R. (1982). *The classroom climate: A chilly one for women?* Association of American Colleges.
- Hammond, Z. (2013). *Ready for rigor framework*. Culturally responsive teaching and the brain. https://crtandthebrain.com/wp-content/uploads/READY-FOR-RIGOR_Final1.pdf
- Hammond, Z. (2015). Culturally responsive teaching and the brain: Promoting authentic engagement and rigor among culturally and linguistically diverse students.
- Han, I., & Onchwari, A. J. (2018). Development and implementation of a culturally responsive mentoring program for faculty and staff of color. *Interdisciplinary Journal of Partnership Studies*, 5(2), 3.
- Handelsman, M. M., Briggs, W. L., Sullivan, N., & Towler, A. (2005). A measure of college student course engagement. *Journal of Educational Research*, 98(3), 184–192.

- Hao, Q. & Tsikerdekis, M. (2019). How automated feedback is delivered matters: Formative feedback and knowledge transfer," 2019 IEEE Frontiers in Education Conference (FIE), pp. 1-6, doi: 10.1109/FIE43999.2019.9028686
- Harper, C. (2018, May 14). *HBCUs, Black women, and STEM success*. Higher Education Today. <https://www.higheredtoday.org/2018/05/14/hbcus-black-women-stem-success/>
- Harrison, H., Birks, M., Franklin, R., & Mills, J. (2017). *Case study research: Foundations and methodological orientations*. Forum: Qualitative Social Research. 18(1). <https://doi.org/10.17169/fqs-18.1.2655>
- Hassenzahl, M. (2004). The interplay of beauty, goodness, and usability in interactive products. *Human-Computer Interaction*, 19(4), 319-349.
- Hassenzahl, M., & Tractinsky, N. (2006). User experience-a research agenda. *Behaviour & Information Technology*, 25(2), 91-97.
- Hathaway, R., Nagda, B., & Gregerman, S. (2002). The relationship of undergraduate research participation to graduate and professional education pursuit: An empirical study. *Journal of College Student Development*, 43(5), 614-631.
- Hernandez, P. R., Estrada, M., Woodcock, A., & Schultz, P. W. (2016). Protege perceptions of high mentorship quality depend on shared values more than on demographic match. *Journal of Experimental Education*, 85(3), 450-468. doi:10.1080/00220973.2016.1246405
- Herrington, J., & Oliver, R. (2000). An instructional design framework for authentic learning environments. *Educational Technology Research and Development*, 48(3), 23-48.
- Hill, C. & Corbett, C. & Rose, A. (2010). *Why so few? Women in science, technology, engineering, and mathematics*. American Association of University Women.
- Hollan, J., Hutchins, E., & Kirsh, D. (2000). Distributed cognition: toward a new foundation for human-computer interaction research. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 7(2), 174-196.
- Janz, T. A., & Pyke, S. W. (2000). A scale to assess student perceptions of academic climates. *Canadian Journal of Higher Education*, 30(1), 89-122.
- Jensen, L.E. and Deemer, E.D. (2019). Identity, campus climate, and burnout among undergraduate women in STEM fields. *Career Development Quarterly*, 67(2), 96-109. doi:10.1002/cdq.12174
- Jimenez, M.F., Laverty, T.M., Bombaci, S.P. et al. (2019). Underrepresented faculty play a disproportionate role in advancing diversity and inclusion. *Nature Ecology & Evolution*, 3, 1030-1033 <https://doi.org/10.1038/s41559-019-0911-5>

- Kaptelinin, V. (1996). Activity theory: Implications for human-computer interaction. In B.A. Nardi (Ed.), *Context and consciousness: Activity theory and human-computer interaction*. MIT Press.
- Kaptelinin, V., & Nardi, B. (2018). Activity theory as a framework for human-technology interaction research.
- Kashima, Y. (2010). Culture. In J. M. Levine & M. A. Hogg (Eds.), *Encyclopedia of group processes & intergroup relations* (pp. 177–181). Sage. doi:10.4135/9781412972017
- Kaufman, M. (2017). *E-Mentoring*. National Mentoring Resource Center. http://nationalmentoringresourcecenter.org/images/PDF/E-Mentoring_Model_Review.pdf
- Keyser, D. J., Lakoski, J. M., Lara-Cinisomo, S., Schultz, D. J., Williams, V. L., Zellers, D. F., & Pincus, H. A. (2008). Advancing institutional efforts to support research mentorship: A conceptual framework and self-assessment tool. *Academic Medicine*, 83(3), 21–225.
- Knouse, S. B. (2013). Mentoring for Hispanics. *Review of Business*, 33(2), 80–90.
- Kumar, M., & Garg, N. (2010). Aesthetic principles and cognitive emotion appraisals: How much of the beauty lies in the eye of the beholder?. *Journal of Consumer Psychology*, 20(4), 485-494.
- Lachner, F., Saucken, C., Mueller, F., & Lindemann, U. (2015). Cross-cultural user experience design: Helping product designers to consider cultural differences. In P. Rau (Ed.) *Cross-Cultural Design Methods, Practice and Impact*, (pp. 58–70). Springer. 10.1007/978-3-319-20907-4_6
- Ladson-Billings, G. (1994). *The dreamkeepers*. Jossey-Bass.
- Ladson-Billings, G. (1995a). But that’s just good teaching! The case for culturally relevant pedagogy. *Theory into Practice*, 34(3), 159–165. doi:10.1080/00405849509543675
- Ladson-Billings, G. (1995b). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, 32(3), 465–491. doi:10.2307/1163320
- Ladson-Billings, G. (2014). Culturally relevant pedagogy 2.0: A.k.a. the remix. *Harvard Educational Review*, 84(1), 74–84. doi:10.17763/haer.84.1.p2rj131485484751
- Ladyshevsky, R., & Pettapiece, R. (2015). Exploring adult learners’ usage of information communication technology during a virtual peer coaching experience. *Official Journal of the Online Learning Consortium*, 19(2), 1–15.
- LaFromboise, T. D., Coleman, H. L. K., & Hernandez, A. (1991). Development and factor structure of the Cross-Cultural Counseling Inventory—Revised. *Professional Psychology: Research and Practice*, 22(5), 380–388. <https://doi.org/10.1037/0735-7028.22.5.380>

- Leath, S., & Chavous, T. (2018). Black women's experiences of campus racial climate and stigma at predominantly White institutions: Insights from a comparative and within-group approach for STEM. *Journal of Negro Education*, 87(2), 125–139. <https://www.jstor.org/stable/10.7709/jnegroeducation.87.2.0125>
- Lee, C.D. (2008). *Culture, literacy, and learning taking: Taking bloom in the midst of the whirlwind*. Teachers College Press.
- Leidenfrost, B., Strassnig, B., Schütz, M., Carbon, C. C., & Schabmann, A. (2014). The impact of peer mentoring on mentee academic performance: Is any mentoring style better than no mentoring at all?. *International Journal of Teaching and Learning in Higher Education*, 26(1), 102-111.
- Lindsay-Dennis, L., Cummings, L., & McClendon, S. C. (2011). Mentors' reflections on developing a culturally responsive mentoring initiative for urban African American girls. *Black Women, Gender + Families*, 5(2), 66–92.
- Lombardo, C., Wong, C., Sanzone, L., Filion, F., & Tsimicalis, A. (2017). Exploring mentees' perceptions of an undergraduate nurse peer mentorship program. *Journal of Nursing Education*, 56(4), 227–230.
- Lovitts, B. E. (2001). *Leaving the ivory tower: The causes and consequences of departure from doctoral study*. Rowman and Littlefield.
- Mero-Jaffe, I. (2011). 'Is that what I said?' Interview transcript approval by participants: An aspect of ethics in qualitative research. *International Journal of Qualitative Methods*, 10(3), 231–247. <https://doi.org/10.1177/160940691101000304>
- Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). Jossey-Bass.
- Meschitti, V., & Smith, H. L. (2017). Does mentoring make a difference for women academics? Evidence from the literature and a guide for future research. *Journal of Research in Gender Studies*, 7(1): 166–199.
- Morong, G., & DesBiens, D. (2016). Culturally responsive online design: Learning at intercultural intersections. *Intercultural Education*, 27(5), 474–492. [10.1080/14675986.2016.1240901](https://doi.org/10.1080/14675986.2016.1240901)
- Moschetti, R. V., Plunkett, S. W., Efrat, R., & Yomtov, D. (2018). Peer mentoring as social capital for Latina/o college students at a Hispanic-serving institution. *Journal of Hispanic Higher Education*, 17(4), 375–392. <https://doi.org/10.1177/1538192717702949>
- National Science Foundation, National Center for Science and Engineering Statistics (2017). *Women, minorities, and persons with disabilities in science and engineering: 2017*. Special Report NSF 17-310. www.nsf.gov/statistics/wmpd/

- NCES (2020). *Historically Black colleges and universities*. National Center for Education Statistics.
<https://nces.ed.gov/fastfacts/display.asp?id=667#:~:text=The%20percentage%20of%20female%20enrollment,percent%20attended%20%2Dyear%20institutions>
- Nearing, K. A., Nuechterlein, B. M., Tan, S., Zerzan, J. T., Libby, A. M., & Austin, G. L. (2020). Training mentor–mentee pairs to build a robust culture for mentorship and a pipeline of clinical and translational researchers: The Colorado mentoring training program. *Academic Medicine*, *95*(5), 730–736.
- Neely, A. R., Cotton, J., & Neely, A. D. (2016). E-mentoring: A model and review of the literature. *AIS Transactions on Human-Computer Interaction*, *9*(3), 220–242.
- Nielsen, J. and Landauer, T. (1993). A mathematical model of the finding of usability problems. In *Proceedings of INTERACT '93 and CHI '93 Conference* (pp. 206-213). ACM.
- Nielsen, J. Usability inspection methods. (1994). [Conference presentation handout]. Celebrating Interdependence, Boston. <https://dl.acm.org/doi/pdf/10.1145/259963.260531>
- Nielsen, J., & Loranger, H. (2006). *Prioritizing web usability*. Berkeley, Calif: New Riders.
- Nouri, J., Saqr, M., & Fors, U. (2019). Predicting performance of students in a flipped classroom using machine learning: towards automated data-driven formative feedback. In *10th International Conference on Education, Training and Informatics (ICETI 2019)* (Vol. 17, No. 4, pp. 17-21).
- O'Meara, KerryAnn & Knudsen, Katrina & Jones, Jill. (2013). The role of emotional competencies in faculty-doctoral student relationships. *The Review of Higher Education*, *36*. 315-348. 10.1353/rhe.2013.0021.
- Olson, S., & Riordan, D. G. (2012). Engage to excel: Producing one million additional college graduates with degrees in science, technology, engineering, and mathematics: Report to the president. Executive Office of the President. <https://eric.ed.gov/?id=ED541511>
- Ortiz, J. (2018). *Meeting youth where they are: Why social-emotional skills and cultural responsive mentoring is critical for college and career*. Mentor.
<https://www.mentoring.org/2018/07/meeting-youth-where-they-are-why-social-emotional-skills-and-cultural-responsive-mentoring-is-critical-for-college-and-career-readiness/>
- Perez Medina, J. L., Gonzalez, M., Pilco, H. M., Beatriz Jimenes Vargas, K., Acosta-Vargas, P., Sanchez-Gordon, S., Calle-Jimenez, T., Esparza, D., & Rybarczyk, Y. (2019). Usability study of a web-based platform for home motor rehabilitation. *IEEE Access*, *7*, 7932–7947.
- Petersen, S., Pearson, B. Z., & Moriarty, M. A. (2020). Amplifying voices: Investigating a cross-institutional, mutual mentoring program for URM women in STEM. *Innovative Higher Education*, *45*(4), 317–332.

- Pfund, C., Byars-Winston, A., Branchaw, J., Hurtado, S., & Eagan, K. (2016). Defining attributes and metrics of effective research mentoring relationships. *AIDS and Behavior, 20*(2), 238–248.
- Riihiaho, S. (2002). The pluralistic usability walk-through method. *Ergonomics in Design: The Quarterly of Human Factors Applications, 10*(3), 23–27. 10.1177/106480460201000306
- Rockinson-Szapkiw, A. J., Sechrest-Ehrhardt, L., Dubay, C., & Mizelle, N. D.(2020). Being culturally responsive in a peer mentoring relationship. In A. J. Rockinson-Szapkiw, J. Wendt, & K. Wade-Jaimes (Eds.). *Navigating the peer mentoring relationship: A handbook for women and other underrepresented populations in STEM*. Kendall Hunt.
- Rosinski, P. (2003). *Coaching across cultures: New tools for leveraging national, corporate & professional differences*. Nicholas Brealey.
- Ruane, R., & Koku, E. F. (2014). Social network analysis of undergraduate education student interaction in online peer mentoring settings. *MERLOT Journal of Online Learning and Teaching, 10*(4), 577–589.
- Rubin, J., & Chisnell, D. (2008). How to plan, design, and conduct effective tests. *Handbook of Usability Testing, 17*(2), 348.
- Saffie-Robertson, M. C. (2020). It's not you, it's me: An exploration of mentoring experiences for women in STEM. *Sex Roles, 83*, 566–579. <https://doi.org/10.1007/s11199-020-01129-x>
- Savin-Baden, M., & Howell Major, C. (2013). *Qualitative research: The essential guide to theory and practice*. Routledge.
- Schmidt, M., Earnshaw, Y., Tawfik, A. A., & Jahnke, I. (2020). Methods of user centered design and evaluation for learning designers. In M. Schmidt, A. A. Tawfik, I. Jahnke, & Y. Earnshaw (Eds.), *Learner and user experience research: An introduction for the field of learning design & technology*. EdTech Books.
https://edtechbooks.org/ux/ucd_methods_for_lx
- Shen, F., Roccosalvo, J., Zhang, J., Tian, Y., Yi, Y., Ji, Y., Han, Y., & Kok, A. (2020). Creating culturally responsive Noyce explorers, scholars and teachers. In S. Latifi (Ed.) *17th International Conference on Information Technology-New generations* (pp. 669–672). Springer. 10.1007/978-3-030-43020-7_91
- Shin, D. H. (2017). The role of affordance in the experience of virtual reality learning: Technological and affective affordances in virtual reality. *Telematics and Informatics, 34*(8), 1826-1836.
- Silet, K. A., Asquith, P., & Fleming, M. F. (2010). A national survey of mentoring programs for KL2 scholars. *Clinical and Translational Science, 3*(6), 299-304.

- Smailes, J., & Gannon-Leary, P. (2011). Peer mentoring—Is a virtual form of support a viable alternative? *Research in Learning Technology*, 19(2), 129–142.
- Staats, C. (2016). Understanding implicit bias: What educators should know. *American Educator*, 39(4), 29–33.
- Stake, R. E. (1994). Case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 236–247). Sage.
- Stake, R. E. (1995). *The art of case study research*. Sage.
- Stake, R. E. (2006). *Multiple case study analysis*. Guilford.
- Stoeger, H., Duan, X., Schirner, S., Greindl, T., & Ziegler, A. (2013). The effectiveness of a one-year online mentoring program for girls in STEM. *Computers & Education*, 69, 408–418. doi: 10.1016/j.compedu.2013.07.032.
- Suffrin, R. L. (2014). The role of multicultural competence, privilege, attributions, and team support in predicting positive youth mentor outcomes. [Master' thesis, DePaul University]. https://via.library.depaul.edu/csh_etd/69
- Suffrin, R. L., Todd, N. R., & Sánchez, B. (2016). An ecological perspective of mentor satisfaction with their youth mentoring relationships. *Journal of Community Psychology*, 44(5), 553–568.
- Sutcliffe, A. & Hart, J. (2017). Analyzing the role of interactivity in user experience. *International Journal of Human–Computer Interaction*, 33(3), 229–240, doi: 10.1080/10447318.2016.1239797
- Sweller, J., Van Merriënboer, J. J., & Paas, F. G. (1998). Cognitive architecture and instructional design. *Educational Psychology Review*, 10(3), 251-296.
- Tawfik, A., Gatewood, J., Gish-Lieberman, J., & Hampton, A. (2021). Toward a definition of learning experience design. *Technology, Knowledge and Learning*, 1-26. 10.1007/s10758-020-09482-2
- Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition*. University of Chicago Press.
- Tinto, V. (2015). Through the eyes of students. *Journal of College Student Retention: Research Theory, & Practice*, 19(3), 254–269. doi: 10.1177/1521025115621917
- Tinto, V. (2016, September 26). From retention to persistence. *Inside Higher Ed*. <https://www.insidehighered.com/views/2016/09/26/how-improve-student-persistence-and-completion-essay>
- Tinto, V. (2017). "Reflections on student persistence." *Student Success*, 8(2), 2017.

- Tuch, A. N., Presslauer, E. E., Stöcklin, M., Opwis, K., & Bargas-Avila, J. A. (2012). The role of visual complexity and prototypicality regarding first impression of websites: Working towards understanding aesthetic judgments. *International Journal of Human-Computer Studies*, 70(11), 794-811.
- Turner, C. S. V., & Thompson, J. R. (1993). Socializing women doctoral students: Minority and majority experiences. *Review of Higher Education*, 16(3), 355–370.
- U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS). (2019). Enrollment. Retrieved April 28, 2021 from <https://nces.ed.gov/collegenavigator/?q=university+of+Memphis&s=all&id=220862#general>
- UNCF (2020). *The impact of HBCUs on diversity in STEM fields*. <https://uncf.org/the-latest/the-impact-of-hbcus-on-diversity-in-stem-fields>
- Vaccaro, A., & Camba-Kelsay, M. J. (2018). Cultural competence and inclusivity in mentoring, coaching, and advising. *New Directions for Student Leadership*, 158, 87–97. doi:10.1002/yd.20290
- Vandal, N., Leung, K., Sanzone, L., Filion, F., Tsimicalis, A., & Lang, A. (2018). Exploring the student peer mentor's experience in a nursing peer mentorship program. *Journal of Nursing Education*, 57(7), 422–425.
- Vygotsky, L. (M. Cole, Trans). (1978). *Mind in society*. Harvard University Press.
- Walton, G. M., Logel, C., Peach, J. M., Spencer, S. J., Zanna, M. P. (2015). Two brief interventions to mitigate a “chilly climate” transform women’s experience, relationships, and achievement in engineering. *Journal of Educational Psychology*, 107(2), 468-485. doi:10.1037/a0037461
- Wang, L. (2019). Making invisible work in STEM more visible. *C&EN Global Enterprise*, 97(26) 29–32.
- Wang, M. T., & Degol, J. L. (2017). Gender gap in science, technology, engineering, and mathematics (STEM): Current knowledge, implications for practice, policy, and future directions. *Educational Psychology Review*, 29(1), 119 140. <https://doi.org/10.1007/s10648-015-9355-x>
- Watts, H., Malliris, M., & Billingham, O. (2015). Online peer assisted learning: Reporting on practice. *Journal of Peer Learning*, 8(8), 85-104.
- Wilkins-Yel, K. G., Hyman, J., Zounlome, N. O. (2019). Linking intersectional invisibility and hypervisibility to experiences of microaggressions among graduate women of color in STEM. *Journal of Vocational Behavior*, 113, 51-61. doi:10.1016/j.jvb.2018.10.018

- Williams, S. N., Thakore, B. K., & McGee, R. (2016). Career coaches as a source of vicarious learning for racial and ethnic minoritized PhD students in the biomedical sciences: A qualitative study. *PLoS ONE*, *11*(7), e0160038. <https://doi.org/10.1371/journal.pone.0160038>
- Wolff, C. E., Jarodzka, H., van den Bogert, N., & Boshuizen, H. P. (2016). Teacher vision: expert and novice teachers' perception of problematic classroom management scenes. *Instructional Science*, *44*(3), 243-265.
- Yin, R. K. (2017). *Case study research and applications: Design and methods* (6th ed.). Sage.
- Young, Jemimah & Young, Jamaal & Paufler, Noelle. (2017). Out of school and into STEM: Supporting girls of color through culturally relevant enrichment. *Journal of Interdisciplinary Teacher Leadership*, *1*. <https://doi.org/10.46767/kfp.2016-0010>.
- Zambrana, R. E., Ray, R., Espino, M. M., Castro, C., Douthirt Cohen, B., & Eliason, J. (2015). "Don't leave us behind." The importance of mentoring for underrepresented minority faculty. *American Educational Research Journal*, *52*(1), 4072.
- Zhang, D., & Adipat, B. (2005). Challenges, methodologies, and issues in the usability testing of mobile applications. *International Journal of Human-Computer Interaction* *18*(3), 293–308. doi:10.1207/s15327590ijhc1803_3
- Zozakiewicz, C. (2010). Culturally responsible mentoring: Exploring the impact of an alternative approach for preparing student teachers for diversity. *Teacher Educator*, *45*(2), 137–151.

APPENDIX A

Pre-Assessment Demographics

| No. | Prompt | Question Type |
|-----|--|-----------------|
| 1 | Please Provide your first name. | Short Answer |
| 2 | Please provide your email. | Short Answer |
| 3 | Please describe your interest in the training. | Short Answer |
| 4 | Are you interested in serving as a mentor or mentee? | Multiple Choice |
| 5 | What university are you attending, if any? | Short Answer |
| 6 | What degree are you earning? | Short Answer |
| 7 | What is your degree program? | Short Answer |
| 8 | What is your age? | Short Answer |
| 9 | What is your race/ ethnicity? (Choose all that apply) | Mutli-Select |
| 10 | Which of the following best describes your sexual orientation? | Multiple Choice |
| 11 | What is your martial status? | Multiple Choice |
| 12 | Do you have children? | Multiple Choice |
| 13 | How many dependents (children or aging parents) live with you? | Multiple Choice |
| 14 | Are you currently employed? | Multiple Choice |

APPENDIX B

Cross-Cultural Mentoring Inventory

Cross-Cultural Mentoring Inventory- Revised (Suffrin, Todd, & Sanchez, 2016)

Directions: Please respond to the following statements using the scale provided. Your possible choices range from **Strongly Disagree** to **Strongly Agree**. Please answer honestly, as there are no right or wrong answers.

1 (strongly disagree), 2 (disagree), 3 (slightly disagree), 4 (slightly agree), 5 (agree), 6 (strongly agree)

1. I accurately send and receive a variety of verbal and non-verbal messages.
2. I am able to suggest institutional intervention skills that favor the mentee.
3. I send messages that are appropriate to the communication of the mentee.
4. I attempt to perceive problems within the context of the mentee's cultural experience.
5. I am aware of my own cultural heritage.
6. I value and respect cultural differences.
7. I am aware of how my values might affect this mentee.
8. I am comfortable with differences between me and my mentee.
9. I willing to suggest referral when cultural differences are extensive.
10. I understand the current socio-political system and its impact on the mentee.
11. I demonstrate knowledge about mentee's culture.
12. I am aware of institutional barriers which might affect mentee's circumstances. I elicit a variety of verbal and non-verbal responses from the mentee. values, and/or lifestyle.
13. I present my own values to the mentee.
14. I am at ease talking with this mentee.
15. I recognize those limits determined by the cultural differences between mentee and a mentor.
16. I appreciate the mentee's social status as an ethnic minority.
17. I am aware of the professional and ethical responsibilities of a mentor.
18. I acknowledge and am comfortable with cultural differences.

APPENDIX C

IRB Documentation



Institutional Review Board
Division of Research and Innovation
Office of Research Compliance
University of Memphis
315 Admin Bldg
Memphis, TN 38152-3370

March 2, 2021

PI Name: Chelsie Dubay
Co-Investigators:
Advisor and/or Co-PI: Amanda Rockinson-Szapkiw
Submission Type: Initial
Title: Building Culturally Responsive STEM Peer Mentoring Relationships Through Virtual Training: A Multi-Site Case Study
IRB ID: #PRO-FY2021-242

Expedited Approval: March 2, 2021

The University of Memphis Institutional Review Board, FWA00006815, has reviewed your submission in accordance with all applicable statuses and regulations as well as ethical principles.

Approval of this project is given with the following obligations:

1. When the project is finished a completion submission is required
2. Any changes to the approved protocol requires board approval prior to implementation
3. When necessary submit an incident/adverse events for board review
4. Human subjects training is required every 2 years and is to be kept current at citiprogram.org.

For additional questions or concerns please contact us at irb@memphis.edu or 901.6783.2705

Thank you,
James P. Whelan, Ph.D.
Institutional Review Board Chair
The University of Memphis.

APPENDIX D

Student Informed Consent

Building Culturally Responsive STEM Peer Mentoring Relationships Through Virtual Training: A Multi-Site Case Study

Dear Student,

This letter serves as an invitation to participate in a research study about your experience as a mentor or mentee in a science, technology, engineering, and math (STEM) virtual STEM peer mentoring training program. You are receiving this invitation to participate because:

- you are a racial or ethnic minority woman
- you are currently pursuing or interested in pursuing a STEM degree program
- you have agreed to participate in the virtual mentoring program during the 2020-2021 academic year.

Please allow me to introduce myself. My name is Chelsie Dubay and I am serving as Lead Investigator (LI) for this research project. I am currently a doctoral candidate at the University of Memphis Department of Instructional Curriculum and Leadership. Dr. Rockinson-Szapkiw serves as the faculty research sponsor and advisor for this study and will guide us through this research. Other persons may also be welcomed onto the research team. If requested, I can provide their contact information.

The purpose of this study is to examine the experience of underrepresented, racially minoritized women who completed a virtual STEM peer mentor training program designed to establish and increase the cultural responsiveness and effectiveness of a peer mentoring relationship to see if completion of the virtual training program impacted their cultural responsiveness. By doing this study, we hope to learn more about how virtual mentoring training

programs may cultivate the mentoring relationship, encourage pursuit of STEM degrees, and improve cultural responsiveness.

Please consider participating in this study. The things required of you involve no more risk or harm than you would experience on an average day outside of this study. If you choose to participate, this participation will include:

- **Non-participant observations** - Chelsie Dubay (LI, UofM) will observe the virtual peer mentor training environment, the private, virtual community, and the virtual mentoring environment.
- **One-on-One Interview** – You will be invited to participate in a one-on-one interview in mid-November so that I can gather your feedback about your individual experience completing the virtual STEM peer mentoring training program. This interview will take place via Zoom web conferencing technology and will be recorded and transcribed. You are not required to use a web cam, but video is encouraged. This one-on-one interview will take approximately 20-30 minutes.

Please know that participation in this research study is voluntary, and you may opt to discontinue your participation at any time. I will make every effort to ensure that any information collected throughout the study be kept confidential within limits afforded by law. You will not be individually identified in any report associated with this study. While this study includes little to no risk, I cannot guarantee that you will get an immediate benefit from participating. Your participation, however, stands to help us better understand how to increase racially minoritized women's cultural responsiveness in peer mentoring relationships, which may directly increase a student's ability to succeed in a STEM degree program.

Please complete and submit this form electronically, indicating whether or not you will participate in this study. If you have any questions about the study, please feel free to contact me directly at (276) 275-9639. If you have any questions regarding your rights as a research subject, please contact Beverly Jacobik, Associate Director of Research Compliance at the University of Memphis at (901) 678 – 2705.

Please note that the University of Memphis does not have any funds budgeted for compensation for injury, damages, or other related expenses.

Please sign this portion of the page and email this portion to cmdubay@memphis.edu. Please contact me directly at (276) 275-9639 with any questions or to make alternate submission arrangements.

I, _____, AGREE • DO NOT AGREE •

(Print YOUR name)

To participate in the research study entitled “XXXX” conducted by Chelsie Dubay at the University of Memphis. I understand the purposes of this study and that participation is voluntary. I understand that refusal to participate will involve no penalty or loss of benefits to which I am otherwise entitled.

Participant’s Signature: _____ Date: _____

Lead Investigator’s Signature: _____ Date: _____

APPENDIX E

One-on-One Interview Protocol

Building Culturally Responsive STEM Peer Mentoring Relationships Through Virtual

Training: A Multi-Site Case Study

Pseudonym:

Date:

Time:

Location:

Introduction: Please tell me a little about yourself and how you became interested in STEM.

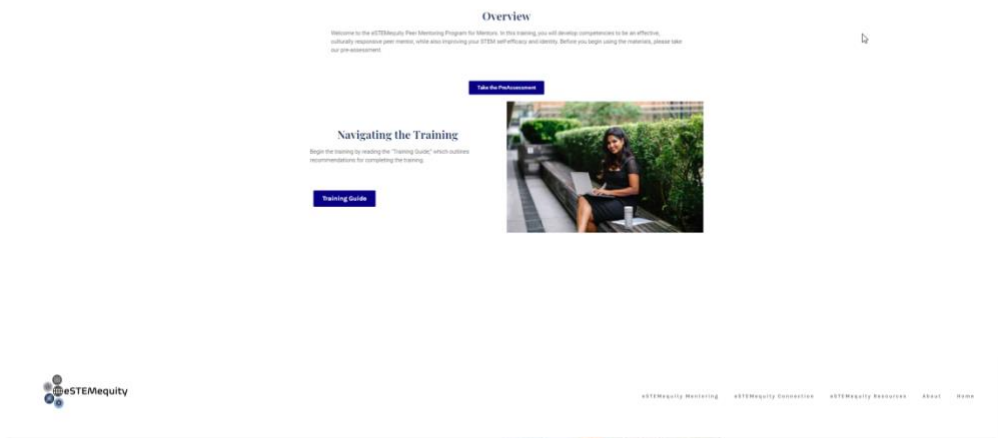
<Introduce Interactive UX Walkthrough>I want to spend a couple of minutes walking through the virtual training environment where you completed your virtual peer mentor training. I will share my screen and move through each module. Please share your impressions and experience using this training platform.

Central Research Question. How, if at all, did the racially minoritized women mentor and mentees' experience with the virtual STEM mentoring training program influence their cultural responsiveness?

1. In terms of the user interface, what was your impression of the training's effectiveness? Efficiency? Satisfaction?
2. Before completing this training, were you familiar with the term "culturally responsive"?
3. Do you feel comfortable with the term since completing the training? Would you describe yourself as culturally responsive?
 - a. What, if any, instructional design elements within the virtual STEM mentoring training program contributed to your cultural responsiveness?
 - b. What, if any, instructional design elements within the virtual STEM mentoring training program hindered the development of your cultural responsiveness?

APPENDIX F

Virtual Peer Mentor Training Environment

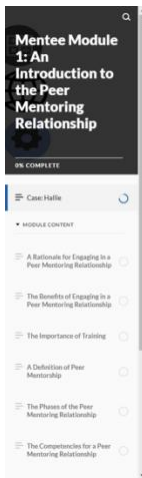




Objectives

In this module, you will:

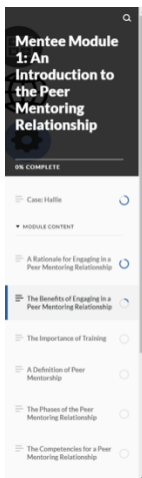
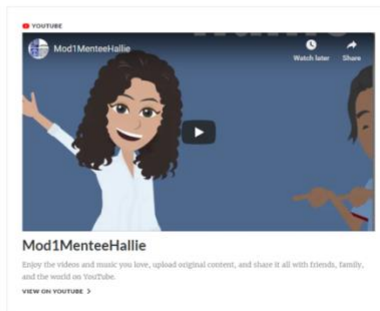
- (1) Identify the benefits of participating in a peer mentoring relationship
- (2) Define peer mentorship
- (3) Identify the phases of a peer mentoring relationship
- (4) Identify the characteristics, roles, responsibilities, and competencies of peer mentors and mentees



Hallie's Choice

Watch the following video about Hallie, an undergraduate student in Physics. What choice does she need to make? What is the best choice and why?

We'll talk more about Hallie's choice in Module 1. Click the video to get started.



The Benefits of Engaging in a Peer Mentoring Relationship



Let's Reflect Image (Book and Pen)

Let's Reflect

Throughout each module, you will be asked to engage in reflection and journal writing. Each module has a module reflection as well as smaller "Let's Reflect" journal writing activities scattered throughout.

This is your first "Let's Reflect" activity.

In your reflection journal, list 3 benefits you want to gain from being a mentee.

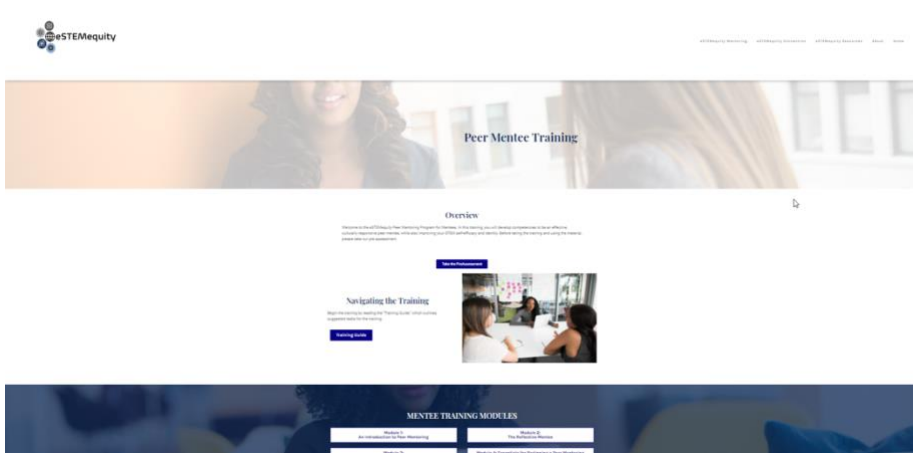
The Benefits of a Peer Mentoring Relationship

There are many benefits you can reap by engaging in a peer mentoring relationship. A STEM peer mentoring relationship supports both your psychosocial, academic, and professional growth and development.

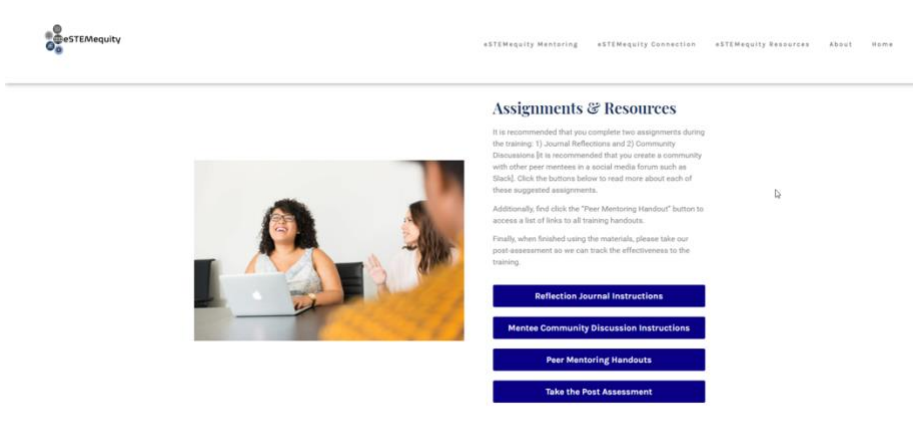
Based on educational and social science theory^{9,10,11,12,13,14} as well as research on STEM

APPENDIX G

Virtual Peer Mentee Training Environment



Assignments & Resources

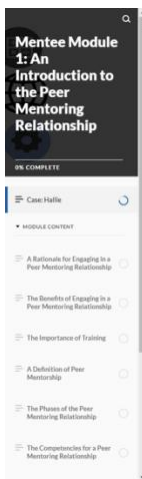




Objectives

In this module, you will:

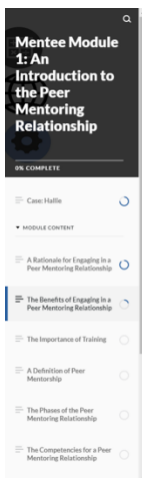
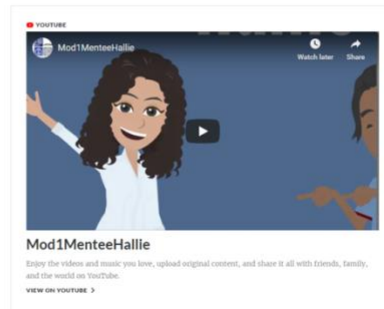
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Based on educational and social science theory^{9,10,11,12,13,14} as well as research on STEM

APPENDIX H

Nvivo Coding Treemap

The diagram below is a representation of the frequency of codes before grouping codes into thematic categories. This graphics was generated using Nvivo 12.



APPENDIX I

Nvivo Coding Summary List

Listed below is the summary output of the codes and their frequency across the five interviews collected for this study. This list was also generated with the Nvivo 12 software.

| Codes | Number of References |
|--|-----------------------------|
| Codes\\sense of belonging | 23 |
| Codes\\culture | 19 |
| Codes\\Culturally Responsive | 16 |
| Codes\\personal experiences | 16 |
| Codes\\application to practice | 14 |
| Codes\\identifying similarities | 13 |
| Codes\\mentoring skills | 12 |
| Codes\\differing viewpoints | 11 |
| Codes\\reflection journal | 11 |
| Codes\\case scenario videos | 10 |
| Codes\\give back | 9 |
| Codes\\interactive component | 9 |
| Codes\\presentation of content | 9 |
| Codes\\experience as a STEM major | 8 |
| Codes\\going through something similar | 7 |
| Codes\\persistence | 7 |
| Codes\\motivation | 6 |

| | |
|------------------------------------|---|
| Codes\\reflect | 6 |
| Codes\\learning styles | 5 |
| Codes\\pacing through the training | 5 |
| Codes\\slack channel | 5 |
| Codes\\accountability | 4 |
| Codes\\appreciate culture | 4 |
| Codes\\career aspirations | 4 |
| Codes\\mentor | 4 |
| Codes\\reason to pursue stem | 4 |
| Codes\\structure | 4 |
| Codes\\feedback | 3 |
| Codes\\module chunking | 3 |
| Codes\\need for community | 3 |
| Codes\\STEM self-efficacy | 3 |
| Codes\\training videos | 3 |
| Codes\\handouts | 2 |
| Codes\\module objectives | 2 |
| Codes\\need for training | 2 |
| Codes\\repetition | 2 |
| Codes\\being involved | 1 |
| Codes\\getting start guide | 1 |
| Codes\\preassessment | 1 |
| Codes\\tracking progress | 1 |

APPENDIX J

Manual Nested Coding

