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Promoting Self-Efficacy, Mentoring Competencies, and Persistence in STEM: A Case Study Evaluating Racial and Ethnic Minority Women's Learning Experiences in a Virtual STEM Peer Mentor Training

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Abstract
Within this article, the researchers present the design, implementation, and evaluation of a pilot of a virtual peer mentoring training program for racial and ethnic minority women peer mentors within STEM programs at two historically black institutions. The design, usefulness, and usability of the training program are explored, and the influence of participation in the training program on mentors' self-efficacy, mentoring competencies, and persistence in STEM. The results demonstrate that racial and ethnic minority women peer mentors participating in the program increased their STEM self-efficacy, and, in turn, their mentoring competencies and intent to graduate from a STEM program. In addition to these results, lessons learned about the program and its design, including usefulness and usability, and implementation are shared.

Keywords Women · STEM · Peer Mentoring · Instructional Design · Virtual · Learning Experience Design · Racial · Ethnic

According to the National Science Foundation (Byars-Winston & Dahlberg, 2019), underrepresented racial and ethnic minority women (UREMW) obtain fewer degrees in science and engineering than White women and men (NSF, 2018). Even fewer UREMW matriculate into science, technology, engineering, and math (STEM) careers (Fouad, 2016). The small number of UREMW in STEM programs and STEM careers is disconcerting, especially since research shows that women's intellectual ability in STEM fields is equal to that of men (Stoeger et al., 2013; Else-Quest et al., 2010).

Hill et al. (2010) suggested that UREMW's lack of self-efficacy, or belief in their abilities to succeed, is one of the primary reasons that UREMW fail to pursue and persist in STEM fields. Increasing the self-efficacy of this population is critical to broadening participation (Cadaret et al., 2017; Dawson et al., 2015; Falk et al., 2017). One intervention that can increase UREMW's self-efficacy and, ultimately, persistence is mentoring (Carlone & Johnson, 2007; Hill et al., 2010). Participation in mentoring relationships, both internal and external to a research laboratory setting, has been cited as important in assisting UREMW to succeed in STEM (Hill et al., 2010; Pon-Berry et al., 2017). Often, the main focus of mentoring relationships in a research laboratory is academic and professional, leaving the psychosocial and personal issues that inhibit UREMWs' persistence unaddressed. Therefore, McGee (2007) argued that peer mentoring external to the laboratory relationship is especially well suited to address psychosocial and personal issues, such as self-efficacy.

Research has demonstrated that effective peer mentoring programs provide mentors training, equipping them with the competencies needed to adequately support their mentees and develop self-efficacy as mentors (Galbraith & Cohen, 1995; Gandhi & Johnson, 2016; Pfund et al., 2014). Therefore, researchers have called for the development and empirical investigation of mentor training (National Institute of Health, 2011; Pon-Berry et al., 2017). This includes understanding the mentors' experiences in training participation and how they interact with the training environment (e.g., learner design experience). The training environment may be face-to-face or virtual, just as mentoring relationships can occur in both formats.

In response to this call for research, two historically black institutions and one public, predominately white institution with a large minority population partnered to develop, implement, and evaluate the pilot of a Virtual STEM Peer

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Mentoring Training inclusive of a virtual STEM peer mentoring training (VSTEM PMT) for graduate student peer mentors. The training aimed to assist UREMW mentors in developing their STEM self-efficacy and mentoring competencies and, thus, improve their intent to persist in STEM.

Recognizing that virtual peer mentoring programs are significantly different from face-to-face programs, particularly in terms of the user experience, an important step in developing effective training is understanding user experience within the learning environment. Thus, we sought to understand the user (i.e., mentor) experience, and specific elements of the training related to the development of self-efficacy, mentoring competencies, and intent to persist in STEM. We conducted a mixed-methods study focusing on the extent to which the users (i.e., mentors) achieved the training's specified goals (Coursaris & Kim, 2006; Hassenzahl & Tractinsky, 2006) as well as their perceptions of usefulness and usability of the training.

Mentoring Training

For the mentoring relationship to be effective, mentors need opportunities to learn and practice various mentorship skills (Packard et al., 2014). One study exploring the Colorado Mentoring Training program, which included, in part, training for mentors to gain mentoring skills (self-knowledge, goal setting, communication, networking), found that the training resulted in mentors' growth in skill acquisition and application (Nearing et al., 2020). The training should be comprehensive of mentors' roles and program goals, engaging to participants, reflective and practical, and connect mentors to a larger community of support (Collier, 2015). While researchers have documented the importance of mentor training to mentor relationships, few mentoring programs have provided this form of training, and few studies have investigated it (Gandhi & Johnson, 2016; Pfund et al., 2014). Therefore, researchers have called for empirical investigation of mentor training (National Institute of Health, 2011; Pon-Berry et al., 2017). This training may be in a face-to-face setting or via a web or mobile-based interface (i.e., electronic mentoring, e-mentoring, or virtual mentoring) just as mentoring programs have been (Bates, 2015). E-mentoring provides opportunities for mentors to receive the benefits of mentor training without ever having to meet face-to-face through the use of technology-mediated communication such as video conferencing, learning management systems, virtual environments, discussions, and social media (Neely et al., 2017; Rowland, 2012). Virtual communication affordances allow mentors to communicate frequently and from various locations (Headlam-Wells et al., 2005). This provides a way for mentors to interact more frequently (DiRenzo et al., 2010) and opens possibilities for mentors to participate regardless of their physical location (Headlam-Wells et al., 2005). Stone and Lukaszewski (2009) acknowledge that e-mentor training may not be as engaging as face-to-face opportunities and that there are limitations to e-mentoring programs. However, mentors benefit in the same areas (organizational and communication skills, networking, intrapersonal reflection, performance, and confidence) regardless of whether they serve as a mentor through e-mentoring or face-to-face settings (Heaton-Shrestha et al., 2009).

In this study, we focus on the virtual training experience and seek to explore the mentor's experience in the learning environment, understanding how their interactions with environmental elements gave rise to specific outcomes identified for the training. Therefore, we draw on learning experience design (LXD) approaches for this study.

Learning Experience Design

While learning experience design has no definitive definition in the literature, researchers agree that it emphasizes creating a learning experience that helps reach learning outcomes (Tawfik et al., 2020). LXD studies often include examining how content (i.e., instructional design (I.D.)) and user experience (UX) supports the achievement of identified outcomes. Therefore, LDX draws upon and shares many characteristics of User Experience Design (UXD). LXD often applies the UX design principles of usefulness, usability, and desirability. Thus, LXD studies are often situated in the Technology Acceptance Model (TAM) (Davis et al., 1989) and the Universal Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) frameworks, which are based on the assumption that several components predict a learners' acceptance of technology or continued engagement in a learning space (e.g., continuing with a training). In the original TAM model, researchers purported that *perceived usefulness* and *perceived ease of use* are determinants of attitude toward and intention to use a technology (Davis et al., 1989). The former refers to how learners view the utility of a technology or learning space.

In contrast, the latter refers to the learner's perception that using the technology or learning space will be effort-free. Perceived ease of use was later described as effort expectancy in UTAUT. It was defined as "the degree of ease associated with the use of the system during interaction with the technology" (Venkatesh et al., 2003, p. 428). These models demonstrate that interactions with the technology or the learning space are vital to the learners' decision whether to use and how to use a technology or learning space. The models provide an impetus for examining the usefulness, usability, and desirability of the training. However, also important to LDX is the learner's focus and ability to achieve learning outcomes. So, LDX places the learner's experience at the center and concentrates on how elements of the learning environment (e.g., the components including the learner, assessments, activities, content, support) are designed to enhance learner's retention and application of specific concepts, with numerous theories and models being applied to guide this element of LDX throughout the literature.

As there is little agreement about the definition of LDX, little consensus has emerged about how to explore best and measure learner's interaction within and perceptions of a learning environment (Hassenzahl & Tractinsky, 2006; Law et al., 2009). Some studies have explored learner's experience via summative quantitative and qualitative evaluation (e.g., post-surveys, interviews; Hassenzahl, 2004; Shin, 2009), and many studies use experimental procedures to understand how aesthetics (e.g., color, layout, typography) can be manipulated to improve a learner's satisfaction and experience with an interface (Kumar & Garg, 2010; Tuch et al., 2012). Understanding how the learner interacts with the interface to facilitate meaningful learning or specific outcomes via eye-tracking and cognitive think-aloud procedures have also been explored (Elbabour et al., 2017; Jarodzka et al., 2012; Wolff et al., 2016). Moreover, researchers have also set forth metrics for both user and learner experience studies. For example, Coursaris and Kim (2006) identified three,

> Efficiency: the degree to which the product is enabling the tasks to be performed in a quick, effective, and economical manner or is hindering performance; Effectiveness: accuracy and completeness with which specified users achieved specified goals in a particular environment; Satisfaction: the degree to which a product is giving contentment or making the user satisfied. (p. 4).

Drawing from the various LDX approaches, we will use a summative mixed-methods approach to understand the VSTEM PMT's effectiveness in helping mentors reach the specified program outcomes while still considering usability and usefulness.

Conceptual Framework

Given one of the primary aims of the VSTEM PMT was to increase self-efficacy, in addition to LDX, Bandura's (1977) self-efficacy theory and models related to the development of the "whole student" guided the development and will guide the study of the VSTEM PMT (Illeris, 2015; Matteson, 2014). Self-efficacy affects goal choices, effort, and motivation to reach a goal, develop competencies, and persist toward goals when challenges arise (Bandura, 1977). Thus, UREMW with high STEM self-efficacy is more likely to develop mentoring and STEM competencies and persist longer in STEM programs and careers than those with low STEM self-efficacy.

The work of Bandura (2006) on self-efficacy comes out of his social learning theory (SLT), later called social cognitive theory (SCT). Self-efficacy is an individual's belief that she can accomplish a goal given her competencies and the circumstances surrounding the task (Bandura, 1986). Bandura (1977, 2006) proposed that four sources either strengthen or weaken self-efficacy, including performance accomplishments, vicarious experience, social persuasion, and psychological responses. While performance accomplishment is related to the experience one has in performing a specific task, vicarious learning refers to experiences and requires the individual to observe another doing the task. For example, when an individual, especially like oneself, observes another modeling the completion of a task successfully, her belief that she can successfully perform the task improves (Bandura, 1977). Social persuasion refers to receiving affirmation or discouragement about one's ability to succeed (Bandura, 1977). Psychological response refers to how an individual reacts or responds given a specific situation. Researchers have demonstrated that, while mastery experience is most influential in boys' and men's STEM career self-efficacy, the most influential factors for girls' and women's STEM career self-efficacy are vicarious experience and social persuasion (Zeldin & Pajares, 2000). Thus, it is important to have like others to view as a model, serve as an example of success, and provide support and encouragement to develop women's self-efficacy.

Self-efficacy is central to persistence. According to Tinto (2017), persistence is a form of motivation shaped by student perceptions of their experiences. Tinto argues that the outcome interactions among self-efficacy, sense of belonging, and student perceptions of the value of their curriculum are believed to impact students' motivation to persist in their college programs. As outlined above, self-efficacy influences how one approaches a task. Those with strong self-efficacy in a particular area will approach that area with significant effort and motivation to complete the task at hand, even if they experience difficulties along the way (Chemers et al., 2001).

The relationship between self-efficacy and persistence makes self-efficacy the "foundation upon which persistence is built" (Tinto, 2017, p. 257). This relationship is a significant element for institutions to consider when discussing student persistence and developing interventions to influence it. While focusing on students' academic ability is important, there must be a shift toward influencing students' self-efficacy related to students' ability to succeed in general if positive change related to student persistence is to take place. This is particularly true for students from underrepresented groups who face negative stereotypes. Even the reminder of a negative stereotype can result in low-efficacy related to goal attainment—despite those individuals or groups (Steele, 1997; Steele & Aronson, 1995). Providing support programs such as mentoring, which focus not only on improving student academics but also on offering social support, is one of the primary recommendations for fostering the self-efficacy students need to persist (Collier, 2015; Perin, 2014; Tinto, 2017).

Furthermore, a learning environment where self-efficacy and mentoring competencies are developed to consider the "whole student." Matteson (2014, p. 862) purported that the ideal learning experience in which learners build competency and knowledge considers the "whole student," supporting the learner's cognitive, emotional, and social well-being. Similarly, Illeris (2009, 2015), in his *Moving Toward Wholeness: A Comprehensive Model of Learning*, suggested building knowledge and competency interaction with content (i.e., knowledge, competencies, behavior, competencies), the incentive (i.e., emotion and violation that drives learning), and interaction with the environment and others. As such, content in learning environments needs to provoke both emotional and cognitive awareness. Learners need to construct meaning within a community socially, and learning should be designed with a unique focus on learner needs.

The interaction between students' self-efficacy, goals, sense of belonging, and perspectives of the curriculum is critical to the motivation that students will put forth to complete a degree program (Tinto, 2017), as is the development of a quality learner experience. Mentoring can provide opportunities for students to have the support systems recommended in the self-efficacy literature while also creating an environment where students outline and share their goals, create communities of support that improve students' sense of belonging, and provide insight into the various perspectives related to the curriculum being studied that would enhance student persistence overall in the degree and ultimately in a career. The same is true of mentoring training, which has been noted as key to ethical and effective mentoring practices (Rowe-Johnson, 2018).

Purpose and Design

The purpose of this mixed-method study was to explore how the interaction UREMW had with the VSTEM PMT environment did or did not assist them in completing the intended training outcomes of enhanced self-efficacy, perceived mentor competencies, and intention to persist in STEM (e.g., effectiveness; Coursaris & Kim, 2006). Research questions included, (1) How do UREMW perceive the usability and usefulness of the VSTEM PMT? (2) Does UREMWs' participation in a peer mentoring training program contribute to their self-efficacy, mentoring competencies, and intentions to persist? And (3) What elements in the training program environment contribute or hinder changes in STEM self-efficacy, competencies, and behaviors of UREMW? A mixed-methods approach to data collection was used to answer these questions.

The UREMW for this study were students recruited from two mid-size, historically Black colleges and universities (HBCUs) selected to participate in a National Science Foundation (NSF) funded STEM mentoring program. Using a quantitative, within-subjects design, we asked mentors to take a survey exploring their self-efficacy, perceived mentoring competencies, and persistence before and after completing the training. The post-training survey also examined UREMWs' perceptions of the training's usability and usefulness via Likert-type scale questions. A case study approach (Yin, 2014) was then employed to explore what elements of the training influenced the outcomes. Focus groups and one-on-one interviews took place with the mentors to learn more about their interactions and perceptions of the virtual peer mentor training environment. Open-ended post-training survey questions and observations of the training-related online discussion forum were also used. Subsequent studies examined the efficacy of the entire peer mentoring training program for both the mentor and mentees (Rockinson-Szapkiw, et al., 2021a, b, c); this study focuses on the users' experience in the training environment and, as such, focuses not on the mentors' growth in STEM content knowledge, but on changes in mentors' self-efficacy, mentoring competencies, and intentions to persist.

Methods

Participants and Procedures

During Summer 2018, six graduate students enrolled in STEM programs across the two participating HBCUs were invited and selected as peer mentors for the VSTEM PMT. The peer mentors selected for participation were required to be a UREMW in STEM, be enrolled in a STEM degree program, and have a 3.0 or higher cumulative GPA. Also, peer mentors were expected to serve in a mentoring role instead of a traditional graduate or teaching assistant. Peer mentors were expected to model the correct way to solve problems mentees might encounter, give mentees feedback, sustain mentees' confidence, and correct mentee misunderstandings. In essence, after completing the mentor training, peer mentors would focus on providing support and opportunities for mentee growth (Galbraith & Cohen, 1995). The peer mentors invited to participate in the program were required to complete a virtual, self-paced six-module training program during Summer 2018. Table 1 describes the mentors' demographics and identifies their institution. Pseudonyms were assigned to participants to protect confidentiality. Mentors were enrolled in biology, engineering, psychology, information technology, and speech-language pathology degree programs.

Table 1 Mentor demographics

Pseudonym	Race	Age	Gender	Case
Jerica	Black	26	Female	HBCU 1
Marcia	Black	25	Female	HBCU 2
Catherine	Black	28	Female	HBCU 1
Grace	Black	23	Female	HBCU 2
Penelope	Black	22	Female	HBCU 2
Linda	Latina	31	Female	HBCU 1

Design and Development of the VSTEM PMT

As noted, as part of a larger STEM peer mentoring program funded by the National Science Foundation (Award #1717082), a VSTEM PMT was developed in the Spring of 2018. Six interactive, online modules were developed that provided between 10–15 h of self-paced, formalized instruction. The modules were developed using various authoring tools (e.g., Articulate, Camtasia) and hosted via a WordPress site. Each module ended with an assignment, which required the mentor to engage in reflective journaling activities and participate in an online discussion with other peer mentors and faculty facilitators with expertise in one or more STEM fields. Mentors had eight weeks to complete the training. As the target population for the larger STEM peer mentoring program was UREMW and given that many UREMW has important responsibilities outside of school (e.g., work, family responsibilities), the virtual design was selected to allow flexibility for training completion.

Guided by Galbraith and Cohen's (1995) work and others such as Byars-Winston, Pfund, and Branchaw, the research team and a content expert, selected topics and developed the module content. As Cohen (2003) encouraged a developmental approach to the mentoring relationship, the content focused on building trust and collaborative decision making about mentoring activities and goals. Special consideration was given in the topic selection process to the threefold objectives identified for the training: 1) Peer mentors will develop mentoring competencies to facilitate peer mentor relationships; 2) peer mentors will develop self-efficacy as UREMW in STEM, and 3) peer mentors will solidify their intention to persist in STEM. In alignment with best practices in mentoring program guidelines, mentoring themes were organized around STEM subjects (Building Engineering and Science Talent (BEST), 2004). Content thus included self-reflection on barriers and triumphs of being a minority in STEM, mentoring, relationship building competencies, information-giving; confrontation; goal setting for persistence in STEM career pathways; and using technology to facilitate collaboration in mentoring relationships. Table 2 outlines each module's topic, the corresponding objectives, and the connection with the theoretical frameworks.

Consideration of Bandura's (1977) four sources of self-efficacy, avenues for fostering mentors' persistence (Tinto, 2017), and models related to the development of the "whole student" also guided the module development (Illeris, 2015; Matteson, 2014). Each module was intentionally designed to have three components. First, each module contained a topical discussion section. Within this section, students were provided with didactic instruction related to the identified content for the module. Factual and empirical information was provided in text-based, audio, video, and graphic format. By interacting with content, the mentors developed knowledge about the topic, such as the mentor's functions and responsibilities, the barriers UREMW experience in STEM, and how to use technology to facilitate a mentoring relationship in a virtual environment. They also learned competencies related to facilitating the mentoring relationship. Interactive elements provided the mentors with opportunities to interact with the content, either by thinking or doing. For example, an accordion element enabled the mentors to learn more about specific topics by clicking on keywords and ideas to hear or read more about a topic. Labeled graphics enabled learners to click on different markers on a graphic to hear more about what was seen. Knowledge check questions enabled the mentors to answer questions about the content via selecting an answer to a question, matching, or fill in the black (see Fig. 1). And, a drag and drop sorting interactivity engaged mentors in sorting items into specific categories. Each interactive element provided mentors with immediate feedback on their thought or actions.

Second, each module contained a case study, either a case scenario or vignette, to provide a vicarious learning experience. The mentors could observe a UREMW perform a mentoring function. Cases were presented in video, animated, and audio formats (See Fig. 2). In considering the development of the "whole student," the case studies were also intended to marshal the mentor's motivation and volition by presenting relevant emotional and social scenarios and real-life cases.

Finally, each module required mentors to engage in a personal application through reflective journaling and discussion (see Fig. 3). At the end of each module, a series of questions and prompts were provided, requiring both a journaling assignment and an online discussion assignment. These activities provided mentors with the opportunity to integrate their knowledge and competencies socially. As emotional reactions to tasks (e.g., anxiety, joy) can lead to negative or positive judgments about one's mentoring ability (Bandura, 1977), the prompts and questions purposefully required the mentors to discuss their anxieties about mentoring. They were asked to reflect upon their excitement about mentoring as an attempt to boost confidence in their competencies. The online discussion forum was also a place in which self-efficacy was

Table 2 Module overview

Module topic	Objective(s)	Theoretical connection
Module 1: The Self-Reflective Mentor	(1) reflect on personal experiences (2) apply personal experiences to working with mentees	Persistence: Goal Setting (Tinto, 2017) Self-efficacy: Reflection focused on modeling (Bandura, 1977)
Module 2: The Mentoring Relationship	(1) define the mentoring relationship (2) identify mentor behaviors (3) identify the phases of the mentoring relationship (4) plan the first mentoring meeting (5) develop a mentorship agreement	Persistence: Goal setting (Tinto, 2017) Self-efficacy: Facilitation of vicarious learning experiences through modeling (Bandura, 1977)
Module 3: Essential Mentoring Skills to Begin and Build a Mentoring Relationship	(1) identify skills to build trust and rapport in the mentoring relationship (2) practice skills to build trust and rapport in the mentoring relationship (3) reflect upon current skill level	Persistence: Development of supportive social and academic relationships (Collier, 2015; Perin, 2014; Tinto, 2017) Self-efficacy: Development of social persuasion skills (Bandura, 1977)
Module 4: Essential Mentoring Skills to Inform, Facilitate, Confront, and Help Mentees Reach Their Goals	(1) identify skills to inform, facilitate, confront, and assist your mentee (2) practice skills to inform, facilitate, confront, and assist your mentee (3) reflect upon current skill level	Persistence: Development of supportive social and academic relationships (Collier, 2015; Perin, 2014; Tinto, 2017) Self-efficacy: Development of social persuasion skills & reflection (Bandura, 1977)
Module 5: Essential Skills for Maintaining and Ending an Effective Mentoring Relationship	(1) Understand a general agenda for a mentoring meeting (2) Identify topics to discuss during mentoring meetings (3) Understand the importance of documentation for mentoring meetings (4) Identify how to terminate a mentoring relationship	Persistence: Development of supportive social and academic relationships (Collier, 2015; Perin, 2014; Tinto, 2017) Self-efficacy: Development of social persuasion skills (Bandura, 1977) & reflection
Module 6: Technology for the Mentoring Relationship	(1) Demonstrate understanding of how to create a Google + Account (2) Demonstrate understanding of how to join a Google) Community (3) Demonstrate how to interact with mentors in a Google + Community	Persistence: Opportunities to develop social and academic support network, a sense of belonging, and share perspectives on the training curriculum with other STEM mentors (Collier, 2015; Perin, 2014; Tinto, 2017) Self-efficacy: Opportunities to reflect on personal development & create vicarious experiences with mentors (Bandura, 1977)

encouraged through social persuasion. Mentors received intentional affirmation about their ability to succeed from the faculty facilitators and praise from their peers. The online discussion forum was also designed to create opportunities that foster student persistence by inviting mentors to build an academically and socially supportive network with other participating mentors and faculty facilitators as well as share various perspectives related to the mentor training experience (Tinto, 2017).

In consideration of cognitive theories to promote usefulness and usability (Mayer, 2009; Moreno & Park, 2010), the text, images, animation, audio, and video content of the modules were designed to minimize cognitive load, so the first person point of view and a conversational tone was used. The content was carefully checked. All narration included relevant imagery while still considering learner accessibility, where students were provided with text for all narration. The modules contained visual and verbal cues to organize content. Finally, mentors were given some control of content as the modules had search and navigation features to enhance user control.

Most of the mentors completed, on average, one module per week, as suggested in the training schedule provided by the faculty facilitators. Mentors participated in an online discussion weekly with the other peer mentors and faculty facilitators across both participating universities. Discussions focused on the content within the modules. The mentors also engaged in reflective journaling activities, which were submitted to a faculty facilitator for review.

Data Collection

This study utilized four data collection methods, both quantitative and qualitative, to address the research questions: a pre–posttest survey, participant observations, an unstructured focus group protocol, and a semi-structured individual interview protocol. The use of multiple data collection

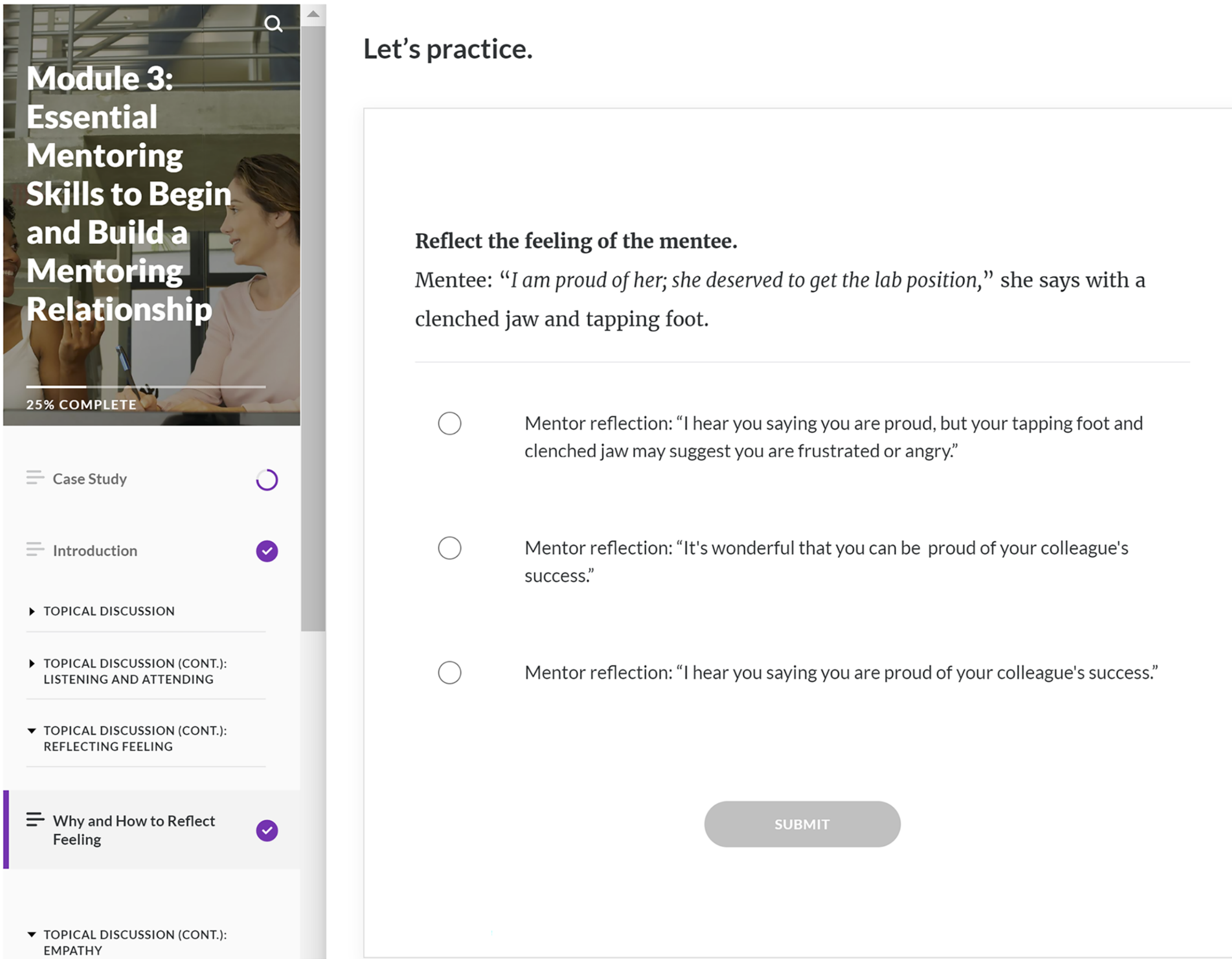


Fig. 1 Example knowledge check question

methods provided a means for triangulating the data to ensure its trustworthiness (Bloomberg & Volpe, 2012).

Quantitative Data Collection

Data were collected from the mentors via a survey in the first and final week of the training. The survey consisted of several components. A researcher-developed Likert-type scale instrument derived from Davis's (1989) TAM and informed by UTAUT developed by Venkatesh et al. (2003) was used to measure how useful the VSTEM PMT was perceived to be as well as the perceived usability (i.e., ease of use) of the training. Davis's (1989) original instrument that assessed usefulness and perceived ease of use contained two subscales and a total of 12 survey items: six survey items related to perceived usefulness and six items related to perceived ease of use. Each statement was responded to using a seven-point Likert-type scale ranging from extremely unlikely (one point) to extremely likely (seven points), resulting in a single subscale range of seven to 42. Higher scores reflected better usefulness and perceived usability. For the current study, we adapted the TAM instrument to create a similar set of questions. We changed the specific technology's name to "VSTEM PMT," adding specific clarifying language unique to the mentors and the training. A few ease of use questions were modified considering UTAUT and usability research. For example, the original perceived usefulness item of "Using [specified technology] in my job would increase my productivity" (Davis, 1989, p. 340) was changed to "Engaging in the VSTEM PMT increased my productivity as a mentor." A three-panel expert review established the instrument's face validity, and Cronbach's alpha for each perceived usefulness and perceived ease of use scale was 0.89 and 0.93, respectively.

A researcher-developed scale was also used to assess the mentor's STEM self-efficacy. Bandura's (2006) guidelines for constructing self-efficacy scales were followed

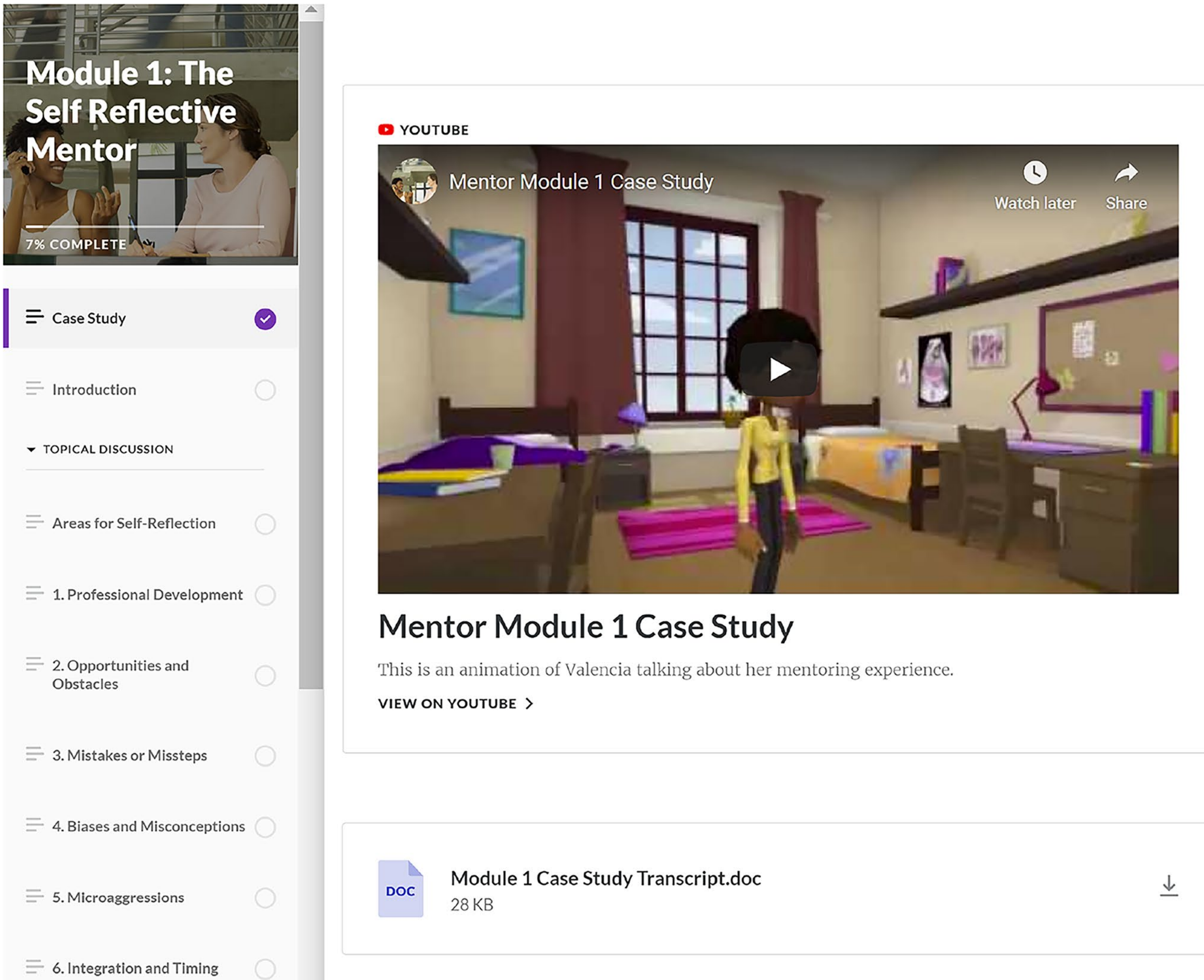
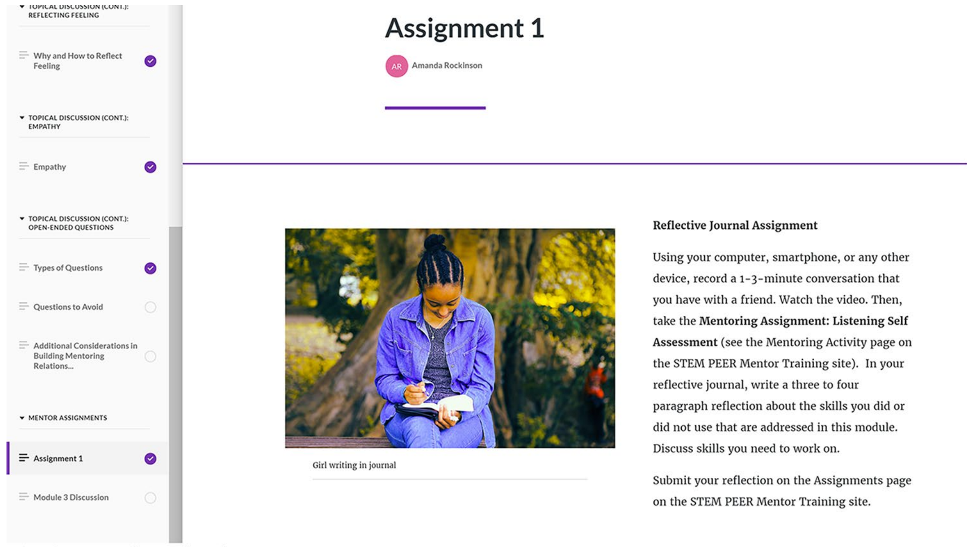


Fig. 2 Example case study

in developing the 54-item scale aimed at measuring mentor's STEM self-efficacy in the areas of achievement self-efficacy, career self-efficacy, and mentorship self-efficacy. The literature on STEM self-efficacy guided the development of each question. The decision to develop an instrument was based on the lack of validated instruments available to measure specific domains of functioning specific to STEM. The researchers were interested in the training. Mentors were asked to rate their level of confidence from 0 to 10 (0 = "Cannot do"; 5 = "Moderately certain I can do," 10 = "Highly certain I can do") on each statement, such as "Persistently work toward my STEM degree even when I get frustrated," and "Have the knowledge to be successful in a STEM job." They were also asked to rate their level of agreement from 0 to 10 (0 = "Strongly disagree," 5 = "Moderately agree," 10 = "Strongly agree") to a series of focused affective statements such as "Enjoy being a STEM mentor" and "Feel excited about getting a STEM job." Higher scores on the overall scale and subscales reflected higher self-efficacy. The instrument's face validity was established by the expert review of two doctoral-degree holding STEM faculty who have published in the area of self-efficacy. Cronbach's alpha for the three subscales on the pre- and posttests ranged from 0.81 to 0.96.

Perceived mentoring competencies were assessed with the Principles of Adult Mentorship Inventory (PAMI; Cohen, 2003). The PAMI is a self-report 55-item inventory that measures six behavioral functions that constitute a mentor's role (i.e., relationship emphasis, information emphasis, facilitative focus, confrontation focus, mentor model, and student vision). Relationship emphasis aligns with trust, including sharing and reflecting on experiences, listening empathetically, and demonstrating understanding and acceptance (Cohen, 2003). Information emphasis is

Fig. 3 Example reflection



the ability to offer advice, including facts regarding career paths and plans for progressing through degree programs. Facilitative focus indicates the ability to explore interests, abilities, ideas, and beliefs, including other views and perspectives, and to use these alternate views to make career and education-related decisions. Confrontation focus aligns with providing respectful insight regarding actions and decisions, including those that are counterproductive to success, and the ability to evaluate the need for a capacity to enact change. A mentoring model can disclose life experiences as a role model to mentees, including taking calculated risks and persisting in the face of challenges. Finally, mentee vision aligns with the ability to initiate change and negotiate transitions while employing critical thinking competencies and an eye toward the future. On the PAMI, respondents are asked to respond to statements about their anticipated or actual mentoring behaviors on a five-point Likert-type scale (e.g., 1 = Never, 2 = Infrequently, 3 = Sometimes, 4 = Frequently, 5 = Always). Higher scores on the overall scale and subscales reflect more effective mentoring competencies. In the initial development process, the PAMI was assessed for content and face validity (Cohen, 2003). A follow-up study provided additional support for its validity and reliability (Cohen, 2008). In the current study, each of the six subscales' reliability using Cronbach's alpha ranged between 0.78 and 0.94. According to Cohen (2008), the PAMI is useful for mentors of any age, and the PAMI has been used to assess university student mentors in STEM (Feldhaus & Bentrem, 2015).

Two questions also assessed the mentor's intent to persist in STEM degrees and careers, "Do you intend to complete your STEM degree?" and "Do you plan to pursue a career in the area in which you are obtaining a degree?".

Qualitative Data Collection

Qualitative data were collected, including open-ended survey questions, participant observations, an unstructured focus group protocol, and a semi-structured individual interview protocol for mentors. Stake (2003) stresses the importance of gathering the details of what is taking place in and around a case and encourages researchers to situate themselves in their field of study. As such, we logged into the training and discussion forums to review the activity weekly. Within the discussion forum, we noted the mentors' level of participation, the number of response posts, and the content within the initial discussion posts and the responses. These observations provided opportunities for us to learn about the mentors' experiences and why their participation in the training may have influenced their feelings regarding self-efficacy, competencies, and persistence. During observations, we took field notes and used them in the analysis.

Both the open-ended survey questions, which were part of the post-survey, and one-on-one interviews provided an additional opportunity to understand mentors' interactions with the training environment and how their interactions gave rise to the intended outcomes. Open-ended survey questions included, "What has not been beneficial in the mentor training?", "What has been most beneficial in the mentor training in helping you become a mentor?", "What topics would you like to see covered or covered in more depth in your mentor training?" and "What recommendations do you have to improve the mentor training?" The one-on-one interviews allowed participants to share individual experiences and interactions with the training environment and were conducted within 1–2 weeks after the mentors completed the VSTEM PMT. Interviews were conducted via Zoom video conference sessions using a semi-structured interview protocol focused around the study questions; each interview lasted between 45 and 85 min. Interviews were recorded and transcribed for review and analysis.

Finally, focus groups were conducted to "understand the participants' meanings and interpretations" (Liamputtong, 2011, p.3). As unstructured interviews are more conversational and, while the researcher is there to maintain the interview's focus, the flow of ideas and overall conversation is dictated by the focus group participants themselves (Liamputtong, 2011). Two unstructured focus groups were utilized in this study to present preliminary findings and conduct a member check. The focus group sessions were conducted electronically via Zoom video conferencing using an unstructured focus group protocol and were recorded for review and analysis. Notes were taken during the focus group interviews for analysis purposes.

Findings

Quantitative

Descriptive statistics for the pre- and post-survey data were computed to evaluate the training's usefulness and usability and whether the training promoted an increase in the identified outcome of self-efficacy. In turn, the mentors perceived mentoring competency development and STEM persistence. The mentors perceived the VSTEM PMT to be useful or valuable to them in their growth as mentors and students in STEM ($M = 36.50$, $SD = 3.78$); they also found the VSTEM PMT easy to use in terms of layout and navigation ($M = 37.17$, $SD = 3.60$). Participation in the VSTEM PMT also resulted in mentors' improvement, albeit minor, in their STEM self-efficacy, self-efficacy as mentors, and their perceived mentor competencies (see Table 3). Moreover, before the training, only four mentors indicated their intent to persist in their degree and a STEM career. All six mentors indicated their degree and career persistence after the training–a 50% increase in the number of students noting their intent to persist.

Qualitative

To analyze the qualitative data, we employed an analytic approach following guidelines put forth by Stake (1994) and Yin (2014). We printed and read through the focus group notes, observation notes, open-ended survey responses, and interview transcriptions line by line, highlighting salient phrases and words. From the highlighted words and phrases, eleven codes were identified, and data were analyzed using these codes. Focused coding was then utilized, during which we collapsed the original eleven codes, identifying patterns in the codes and building categories within them. This consolidation took place by selecting the codes most frequently found in the data related to how the mentors interacted with the training to influence their self-efficacy, competency, and persistence. This coding process led to identifying patterns and inconsistencies among categories within codes and further solidified (and sometimes challenged) the originally identified codes and three broad themes.

Training Format and Structure: Virtual and Cohort

The virtual format of the training was a salient theme in both the interviews and focus groups. The mentors noted that the online format enabled them to participate in the mentoring training program. As students, daughters, mothers, caretakers of parents, and employees, the mentors appreciated the flexibility and convenience of completing the training at their own pace, "no matter what time," and

Table 3 Descriptive statistics

Scale	Pre-training		Post-training		% of change	Score range
	M	*SD*	*M*	*SD*		
PAMI Relationship	42.33	2.73	44.33	1.21	4.72%	10–50
PAMI Informative	46.83	3.76	48.17	1.33	2.85%	10–50
PAMI Facilitation	27.50	2.51	28.67	1.51	4.24%	6–30
PAMI Confrontation	53.83	5.74	58.00	1.79	7.74%	12–60
PAMI Mentor Model	23.50	1.97	24.83	0.41	5.67%	6–30
PAMI Student Vision	51.00	4.94	53.67	1.51	5.23%	11–55
STEM SE Achievement	111.50	15.24	112.67	15.85	1.05%	10–140
STEM SE Career	110.67	12.69	116.33	4.76	5.12%	10–140
STEM SE Mentorship	213.83	27.94	228.50	12.90	6.86%	26–260

Note. SE = self-efficacy, $N = 6$

from "anyplace." Within the survey, Marcia commented, "the virtual environment enabled me to participate in the program. I am not sure I could have come and gone back and forth to a classroom." She explained that she might not have participated in a residential program because of her familial and job responsibilities. Almost all the mentors made comments in their interviews about the usability of the virtual interface, making statements such as "easy to use," "I liked the overall structure that each module followed," "navigation was simple," and "it was intuitive."

While none of the mentors mentioned the online structure of the training as a challenge, at least two mentors, during their interviews, shared that they would have benefitted from more face-to-face interaction with fellow mentors and faculty facilitators to help clarify assignments and timelines, check-in about training progress, and share ideas about how to engage with mentees. These two mentors also felt the use of a different platform would have allowed for more frequent and less academic interaction with fellow mentors. In the survey, five (83.3%) of the mentors reported that the addition of a one or two-day face-to-face meeting or workshop would have been desirable. All the mentors indicated the importance of and need additional opportunities to connect with mentors, mentees, faculty facilitators, and professionals in the field.

Mentors commented that the virtual nature and structure of the training and the cohort model used enabled them to build community and many connections. Every mentor discussed the importance of their peers' support in their cohort within the online discussions and their day-to-day interactions across campuses. Jerica discussed the importance of her cohort in both the focus group and her one-on-one- interview, "I would say I have a very supportive cohort. I mean we spend a lot of time together, you know…I like I'm pretty sure I'm getting some like lifelong friends…so I think as far as support it comes from my classmates like a hundred percent…" Penelope said the training was "really important um…for women of color especially in a field where there's so little of us…" as it offered "a unique opportunity where we can provide support to each other."

The connections in the cohort illuminated for the mentors the importance of professional connections also. During the interviews and focus groups, mentors shared that the training helped them prioritize internships and professional connections in the field. Grace shared:

> I thought that I would just continue going through the motions…I've been doing my posters and stuff like that without necessarily searching out for the internship so when this program came it made me sought [seek] out like more opportunities within my within my little department and internships and push so that my survey and my CV are like up to par with like what employers will want even in the spring semester so it actually gave me more… it gave me a lot more to work with while doing the program of like making myself more persistent to getting to my career…

Linda shared similar thoughts about realizing the importance of making connections in her field of study. "I actually wanted to reach out to a bilingual therapist, and I just never did, and it's always in the back of my mind, so now this is like oh my gosh, I need to do this…connecting here made other connections seem important."

Practical and Inclusive Training Content

Mentors frequently described the training's content when discussing how the training led to changes in their self-efficacy, competencies, and intentions to persist in STEM. During the interviews, focus groups, and training discussion forums, participants shared ways in which the training helped them develop skills related to handling various situations they might experience in STEM fields as UREMW (e.g., finding a sponsor for career advancement, microaggressions) as well as preparing for the peer mentoring relationship. The didactic content presented in training was discussed during the interviews and focus groups. Mentors described the information covered in training as "helpful" and "detailed." Penelope likened her interaction with the training content to going to church:

> …it's just like I guess I can use this analogy…like you…like going to church like…you you know I know how to behave and do right but you go kind of go for that that refresher you know what I mean you know for that weekly reboot so I would definitely say that you know like reading…reading all of the modules and stuff like that was definitely like a little boost like for you know just positivity and like positive behaviors to kind of help me…

Marcia shared, in her interview, that the training content helped her feel more empowered. In the same vein, Grace shared how the training content, specifically learning about the lack of women in STEM, increased her motivation to succeed in STEM.

> I knew I was motivated, but now I see I'm like really motivated about like succeeding in STEM because there's a lot of women who kind of like steer away from it once it like gets hard, and I'm just like I know...I know I can finish type thing…so it gives me motivation about myself…more confidence about myself….

She continued sharing that the training "reiterated the importance of staying in the STEM field, especially being a woman," This was important for her, given how easy it is to get discouraged as a double minority (i.e., gender and ethnic/racial minority). She said that interacting with the training content helped her focus on her career moving forward.

The mentors also identified the content as a "resource" or "tool" beneficial to their growth as mentors. In the interviews, the mentors also recalled specific content and ideas that lead to perfecting their time management skills to accommodate better the time they committed to the training program and meeting with their mentees. In the focus group, Grace shared that she had a basic understanding of what mentoring was, but interacting with the training content "helped reiterate like what a good mentor is supposed to do and what not to do…" She went on to say, "I never thought about the fact that I may need to talk about diversity and differences we [her and her mentee] have…that could affect us and our communication."

Moreover, the content presented in the case study format was described as "informative" and "helped me [to know what to] do as a mentor." When asked about the most notable element of the training, Linda commented, "I would say that, you know, like reading … all of the modules and stuff…I really like the case examples that helped me see how individuals like me can mentor and solve dilemmas." Catherine, in a survey response, also summarized this important element of the training by saying, "They [case studies and examples] were important in helping me to practice what I will do with my mentees and seeing I can do this [mentoring]."

Many also commented on the diversity and cultural references within the case studies, making comments such as "I really liked the attention to diversity in the cases…even the names…being Black I recognize stuff like that", and "the cases really talked about stuff you face, and your mentee faces as a minority… that's stuff for real and made me think about how I handle things and can help my mentee handle it too. That's important if we are to keep…keep it going."

While the mentors found the content useful and informative, some mentors noted that the modules were time-consuming in interviews and survey responses given all the content. They recommended that less text, more case studies, and "more visual graphs" would improve content consumption. Valuing the case studies, Catherine, in her survey response, recommended, "I want to see more [case] studies where I can see how to handle things, and you know, be asked how I might respond and then maybe have feedback on what I did that would help."

Dynamic Training Elements

The dynamic elements of the training also engendered the mentors' beliefs, competencies, and intended behaviors. Within the open-ended survey questions, five (83.3%) of the mentors noted that the training's dynamic elements helped them better understand their functions as mentors, increase their confidence, and complete the training successfully. Throughout the interviews and focus groups, mentors noted that the multiple-choice, flip card, and other interactive practice activities helped them learn "how to be a mentor." Marcia commented on her interaction with a multiple-choice activity in a discussion post, "I couldn't believe what I got wrong. But, the feedback helped me think about my answers and why there was a better way of communicating with my mentee."

However, the mentors found the reflective journal and reflective discussions most helpful of all the training elements. Penelope shared, "I really…I like the method…of this training of having to reflect on ourselves." Mentors repeatedly mentioned the opportunity to reflect through all data. The mentor's found the reflective journal activities "very helpful," often discussing the benefits of the reflection elements in terms of their self-awareness, self-efficacy, competence development, and persistence. In her interview, Marcia shared that the training gave her time to think about who was influencing her "in a positive way" and who was not and "really look[ing] at that again…" Grace shared that the journal reflection activities were "very beneficial especially since it teaches me new things about myself everyday…about what this program is doing for me…" Engaging in the reflection activities also led mentors to think about the value of mentoring and the mentor role. For example, Penelope wondered how she might be different if she had a mentor who helped her on her academic journey.

> I wonder how much stronger and more confident I would have been seeing a woman who looks like me in the STEM field pushing me to go further…especially if I was younger… if I had someone when I was 18 you know, in this masters or doctoral program talking to me about like staying in the STEM field, I might have been a physicist you know I would have probably stuck with more of the hard sciences…I didn't have that kind of guidance or mentorship so I felt very individual and alone.

Similarly, Catherine explained how she had previously been at a university where she was not supported as a UREMW in STEM and did not believe she could succeed there. Reflecting on that experience helped her see that "one of the key factors for self-efficacy is mentorship. I don't say that just 'cause of the program. You invest [in the mentoring relationship] and it gives opportunities….and guidance." Catherine continued explaining how the reflection element of the training increased her awareness about her mentor role and the competencies she needed, "I really appreciated the [reflective questions] helping us reflect on past experiences that we've had, and it really helped me think about the past mentors that I've had, what I want to bring into I'm being a mentor in this program…and all the skills and things I need to learn." Marcia concurred, "it [journal entries] really did a good job to get you to think about mentoring and experiences in STEM on a personal level. It started me thinkin' what I can share with my mentee." In the open-ended survey questions, four of the mentors identified the self-reflective journaling and discussion as most salient to their development of confidence as mentors. All the mentors also found great value in posting their reflections to the online discussion forum. All six mentors participated in the opportunity to post their reflections weekly throughout the entire training. During the focus group and individual interviews, mentors frequently commented that the reflective discussions with peers allowed them to see and reflect on others' thoughts about the training content, which solidified their understanding of competencies needed to be an effective mentor. Catherine commented that her interactions in the discussion improved her self-efficacy, "my confidence was boosted when others liked my ideas for the activities and things I planned to do with my mentee. I think I even started seeing myself as a leader–someone who could make a difference in STEM." Penelope wrote in the survey, "I did appreciate … the Google community where we all…could see what our experience, you know different perspectives and thoughts…."

Similarly, in her interview, Penelope described how hearing her peers' different perspectives about mentoring improved her understanding of the mentor role and competencies needed,

> …having a mentor who...really cares and is prepared and has expectations of you and pushes you a little bit but still is willing to hear you is very important. Through this process I've kind of realized just like how much goes into that mentor relationship because you know we have a little more power and the direction and the focus and the responsibilities of progressing this forward… helped me see like you know like I said before that everybody else kind of like shares the same pain but experienced it differently and things like that…it was great to like respond to everybody else and do the journals and know that they were kind of just like you…"

Discussion

While this study using a mixed-methods data collection approach only served a small sample of UREMW graduate students in STEM, the study results begin to provide insights into designing and developing a VSTEM PMT with UREMW, especially in the HBCU context. Participants believed that participation in the training helped them improve their STEM self-efficacy, perceived mentoring competencies, and intentions to persist in STEM degrees and careers. These findings align with the previous study of the impact of peer mentor training in STEM content areas about the development of confidence, leadership competencies, and persistence (Nearing et al., 2020; Streitwieser & Light, 2010; Tien et al., 2004). However, a previous study has not yet examined the impact of peer mentor training on self-efficacy or among UREMW populations at HBCUs specifically. When comparing the number of HBCUs to the number of primary White institutions and minority-serving institutions (non-HBCUs), HBCUs produce a larger percentage of UREMW with STEM degrees than non-HBCU institutions (Owens et al., 2012). Capitalizing on HBCUs' contributions to broadening participation in STEM, particularly among UREMW, and exploring methods for further enhancing the participation of UREMW in STEM, is both timely and necessary. Given the literature that supports the relationship between self-efficacy, motivation, and persistence in STEM fields (Cadaret et al., 2017; Dawson et al., 2015; Falk et al., 2017; Hill et al., 2010), creating opportunities to enhance self-efficacy outcomes, confidence, perceptions of competency, and persistence can yield beneficial outcomes. Thus, the current study's findings are important in laying the groundwork for investigating STEM self-efficacy beliefs among UREMW. As the literature suggests, with mentoring being cited as a key component to UREMWs' success (Owens et al., 2012; Remaker et al., 2019), there is a persisting need for mentoring UREMW, inclusive of effective mentor training.

When considering the mentor training's design and development, the qualitative findings of this study illuminate salient design elements for virtual training aimed at promoting self-efficacy, perceived mentor competencies, and intention to persist in STEM. The virtual structure, cohort model, mentoring competency content, case studies and vignettes, attention to culture and diversity (including various names and models), interactive elements, and reflection elements were noted as especially appreciated and important. Overall, the findings demonstrate positive outcomes as a result of the structure and design of the training. In particular, mentors noted that the program's virtual and flexible nature allowed them to participate when, otherwise, they may not have had the time or opportunity to do so. The inclusion of various components within the training, such as case studies and vignettes, provided mentors with a model to reflect and learn competencies, such as confrontation, negotiation, and problem-solving, responding to vicarious experience (Bandura, 1977). The reflective components allowed mentors to engage in self-reflection, resulting in opportunities to consider varied perspectives and viewpoints and to engage in critical thought and analysis of experience, pre-conceived notions, and reconciliation of new ideas and strategies, responding to psychological response (Bandura, 1977).

While the mentors reported positive experiences and outcomes from the program overall, suggested improvements included a face-to-face component. Thus, a blended or hybrid model of VSTEM PMT should be explored. Additional opportunities to practice were suggested, which could be addressed by branching in case of studies and additional vignettes. Increased use of names and culturally-situated context could further support mentors' level of comfort with engaging with various mentoring training components.

Quantitative findings of the current study support that engagement in the peer mentor training influenced mentor's self-efficacy in mentorship (6.86% change) and career self-efficacy (5.12% change) from pre- to post-training. However, only modest change was shown in achievement self-efficacy (1.05% change), indicating that achievement self-efficacy could be better supported and is an area that could be enhanced in future iterations of the training. This could be accomplished, for instance, by providing additional case studies, as also evidenced by mentors' open-ended survey and focus group data, that present instances of challenge, persistence, and achievement or perhaps through enhanced interaction with faculty facilitators to support the achievement of self-efficacy of mentors.

The current study also shows that the mentor training influenced mentors' confrontation focus (7.74% change), mentor model competencies (5.67% change), student vision competencies (5.23% change), relationship emphasis (4.72% change), and facilitative focus (4.24% change). However, only a modest change was shown in information emphasis (2.85% change). Information emphasis, which includes offering advice and possessing the ability to offer facts and tailored information regarding career paths, training, and education to mentees (Cohen, 2003), could be further supported by providing mentors with additional resources on specific degree pathways at each respective university, career opportunities, networking opportunities, and professional development opportunities to provide to mentees. While the faculty facilitators did provide information to mentors regarding resources on each respective campus, including sharing opportunities for networking and field-based engagement through the faculty's networks, enhancing the availability of such resources could further support mentors. Future studies might include gathering data on which specific resources are needed and how best to disseminate the mentors' resources for sharing with mentees. Thus, a more systematic way of sharing resources to enhance informative competencies could be of benefit. Additionally, mentors noted that the addition of other topics to the training modules could be of benefit. These additional topics could include case studies that model instances in which the mentee requires guidance on her degree program, career path, or opportunities for professional development and how the mentor can effectively tailor and provide resources to meet mentee needs best.

Participants identified the importance of interacting with a community during the training, consistent with the communal values and community identity that both the Black and Hispanic communities uphold (Miville et al., 2000; Owens-Sabir, 2007). The expressed desire for more direct leadership from the faculty facilitators provided an important implication for practice and aligned with what has been written about online communities. Communities of practice require active leadership to be effective (Wenger et al., 2002). The primary leader in an asynchronous learning environment at a university is often the faculty (Palloff & Pratt, 1999). Designing training that promotes and facilitates community may not be sufficient; faculty facilitators guiding initiatives may need to be more actively involved to facilitate the online community. It may be necessary for faculty facilitators to do regular check-ins, hold face-to-face meetings, complete face-to-face workshops, or enhance their presence online to facilitate community. Thus, the faculty facilitators should have a more direct leadership role in building community and facilitating online discussions as these activities may be essential to the success of the training. As has been seen successful in mentor training for research experiences (Pfund et al., 2014), a one- or two-day workshop to solve case examples and practice competencies may improve the current peer mentor training.

Conclusion

This study supports that engagement in a VSTEM PMT can yield positive benefits to mentors, including the development of self-efficacy, perceived mentoring competencies, and persistence. Specifically, the findings demonstrate that mentors' relationship competencies, facilitation competencies, confrontation competencies, mentor model competencies, and informative competencies are enhanced through participation in the program. The findings further demonstrate that mentors' career self-efficacy and mentoring self-efficacy are enhanced after engagement in training, with very modest improvement in achievement self-efficacy. Mentors found the program's design to be both useful and easy to use, noting specific benefits that they derived from the various design components (e.g., virtual design to enable participation at any time, case studies for viewing models of communication). Further, mentors found that participation in the program encouraged them to persist, with several noting feelings of belonging (e.g., not being alone in their experiences and struggles) and a renewed motivation to succeed. Some suggestions for improvement were offered, but enhancements to the current program.

The findings of this study are important as they provide much-needed insight regarding the design, development, and influence of the VSTEM PMT on UREMW mentors engaged in STEM degree programs at HBCUs. Given ongoing initiatives to support equitable participation of UREMW in STEM, and given the literature that supports the positive benefits of peer mentoring relationships in general, understanding how to design and develop mentor training is needed. This study serves as a foundation for developing and implementing an effective VSTEM PMT model at two HBCUs. While continued research is needed, the findings are promising in supporting UREMW mentors' STEM self-efficacy and mentoring competencies. Future research should further refine the existing model and examine the impact of the mentoring relationship post-mentor training on UREMW mentors and mentees.

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Declarations

Conflict of Interest Amanda J. Rockinson-Szapkiw declares that he/she has no conflict of interest. Jillian Wendt declares that he/she has no conflict of interest.

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