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DESIGNING FOR SELF-EFFICACY: E-MENTORING TRAINING FOR WHITE AND BIPOC WOMEN IN STEM

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This design case describes the tensions and resolutions related to the iterative design of a virtual STEM peer mentoring program for White and Black, Indigenous, and People of Color (BIPOC) women in STEM study programs at Historically Black Colleges and Universities (HBCUs) and at Minority Serving Institutions (MSIs). Stakeholder feedback, along with a conceptual framework, including Tinto's Institutional Departure Model and Bandura's Theory of Self-Efficacy, guided the design work. The second iteration featured eight self-paced, eLearning modules designed to be completed as one per week in conjunction with asynchronous and synchronous communications with program peers and faculty facilitators. The design goals focused on the self-paced modules and resolved content presentation, case videos, practice, and reflection issues. The case highlights the intersection of new design elements with Bandura's (1977) four sources of self-efficacy: social persuasion, vicarious experiences, performance accomplishments, and psychological response.

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INTRODUCTION

The University of Memphis, in collaboration with two Historically Black Colleges and Universities (HBCUs), piloted a virtual peer mentoring program for White and Black, Indigenous, and People of Color (BIPOC) women in science, technology, engineering, and mathematics (STEM) studies in the 2018-2019 academic year. The pilot program, supported by a National Science Foundation (NSF) grant, was developed in response to the nationally recognized need to increase representation and improve the persistence of BIPOC women in STEM (National Science Foundation [NSF], 2019). The pilot program consisted of mentor training followed by a year-long peer mentoring experience. In the spring and summer of 2020, we redesigned the mentor training portion based on (a) a program evaluation of the pilot and (b) research and content development completed for a workbook (Rockinson-Szapkiw et al., 2020). The second iteration of the training program is the focus of this design case. As with the pilot training program, the second iteration aimed to increase BIPOC women's mentoring competencies and STEM self-efficacy before engaging in a virtual peer mentoring program across HBCUs and MSIs. Therefore, the population for the second iteration of the training was extended to include both mentees as well as mentors.

CONTEXT

The Design Team

In March 2020, we formed a design team to develop a second iteration of the virtual peer mentor and mentee training. Our team consisted of six members. Jaclyn Gish-Lieberman served as lead designer and Amanda Rockinson-Szapkiw as the project coordinator and lead content developer. The lead designer had assisted the project coordinator on earlier STEM mentoring research and brought learner experience design (LXD) knowledge to the current design challenge. Andrew Tawfik, the director of the university's Instructional Design and Technology (IDT) Studio, provided ongoing consultation about the project design. Two graduate research assistants from the IDT Studio provided additional technical expertise in LXD, supporting multimedia development and internal testing. Finally, Teresa Theiling joined the design team in July 2020 to conduct usability testing and provide quality control support.

The Original Design Problem

The design problem was contextualized in our research and experience focusing on BIPOC women's STEM persistence across various higher education institutions. This specific design problem was situated within minority-serving institutions (MSIs) and HBCUs. Although MSIs and HBCUs are known to provide socio-cultural pillars that help reinforce positive academic identities and self-efficacy for women of color in STEM, many graduates report that the positive and supportive environment of the institution does not prepare them fully for the psychosocial, gendered, and racial-related challenges and barriers they face when they enter a STEM career (Rockinson-Szapkiw, Herring Watson, et al., 2021; Rockinson-Szapkiw & Wendt, 2021; Rockinson-Szapkiw, Wendt, et al., 2021). A consequence is often a lack of matriculation or persistence in a STEM career. Mentoring, however, improves STEM persistence and prepares women for their STEM careers (Hernandez, Bloodhart, et al., 2017; Hernandez, Estrada, et al., 2017), and the most effective mentoring programs include training. Thus, the focus of this design case is on mentoring program training within an accessible, online space.

Unfortunately, only a few studies have examined STEM peer mentoring programs in virtual spaces (Gandhi & Johnson, 2016). Furthermore, studies on virtual mentoring training, especially for the mentee, are virtually non-existent. The existing research focuses primarily on the benefits of online mentoring, such as positive changes in learning environments for girls (Subotnik et al., 2019) and increased self-determination and self-advocacy in college students with disabilities (Gregg et al., 2016, 2017). These outcomes, however, are often dependent on mentees' perception of *quality* mentoring and mentoring relationships, leading researchers like Subotinik et al. (2019) to call for studies on the "training and supervision of mentors" (p. 93). For, "professionals should recognize that effective virtual mentoring is by no means an automatic process but rather requires adequate… training and resources to support the practice" (Gregg et al.,2017, p. 212). This design case attempts to answer this call by providing a rich description of the design decisions made to train mentors and mentees before their mentoring program (Boling, 2010).

First Iteration: Pilot

The virtual peer mentoring training that preceded and informed the current design project was developed in the spring of 2018. It was implemented in the 2018-2019 academic year as part of a peer mentoring program. Pilot participants, serving as mentors for the pilot program, accessed six self-paced modules through a website. At the same time, weekly asynchronous discussions and interactions were held through the now-defunct Google Communities. Module information was provided primarily in text form with some graphics, interactive activities, and multimedia.

The pilot content and training was guided by educational and social science theory (e.g., Bandura, 1977, 2006; Lent, Brown, & Hackett, 1994; Tinto, 1987) and STEM mentoring research (e.g., Dawson et al., 2015; McGee, 2016; Pfund, Byars-Winston, Branchaw, Hurtado, & Eagan, 2016). Case videos were integrated at the beginning of each module. All case videos focused on BIPOC women's STEM experience. The purpose of these case videos and their content was to assist the mentors in becoming socially and academically integrated in the STEM community. The case videos, coupled with the Google Communities discussions, further provided the mentors with the opportunity to interact with others of similar race, gender, ethnicity, and culture in a STEM community. This supported their integration, and ultimately, their persistence (Brainard & Carlin, 2013; Pon-Barry et al., 2017). As Tinto (2017) posited that self-efficacy influences motivation to persist, identifying self-efficacy as a "foundation upon which persistence is built" (Tinto, 2017, p. 257), training content and activities were also designed to promote the four sources Bandura (1977, 2006) identified as influencing self-efficacy:

- Social persuasion—*verbal affirmation that one can succeed in his or her endeavors*
- Vicarious experience—*learning through observation*
- Performance accomplishment—*personal mastery of a task*
- Psychological response—*emotional or psychological response to an experience*

Moreover, researchers have widely used self-efficacy to understand and support participation in STEM fields (Falk et al., 2017), and self-efficacy is defined as one's belief in her ability to accomplish a task or succeed in a situation (Bandura, 1977).

With increased integration and self-efficacy as an aim, the module content used in the pilot training included topics such as: barriers in STEM, models of mentoring, mentoring competencies, goal setting for persistence in STEM career pathways, and using technology to facilitate mentoring relationships. Additionally, each module concluded with a series of questions and prompts for a journaling assignment. These prompts required the mentors to reflect on their learning and emotional responses to the module content (e.g., psychological response). In online discussions, the mentors were prompted to practice various mentoring functions, giving them opportunities for performance accomplishments. Moreover, the peer training facilitators were also trained to offer verbal affirmations in discussions, and mentors engaged with interactive activities, which presented with automated affirmations.

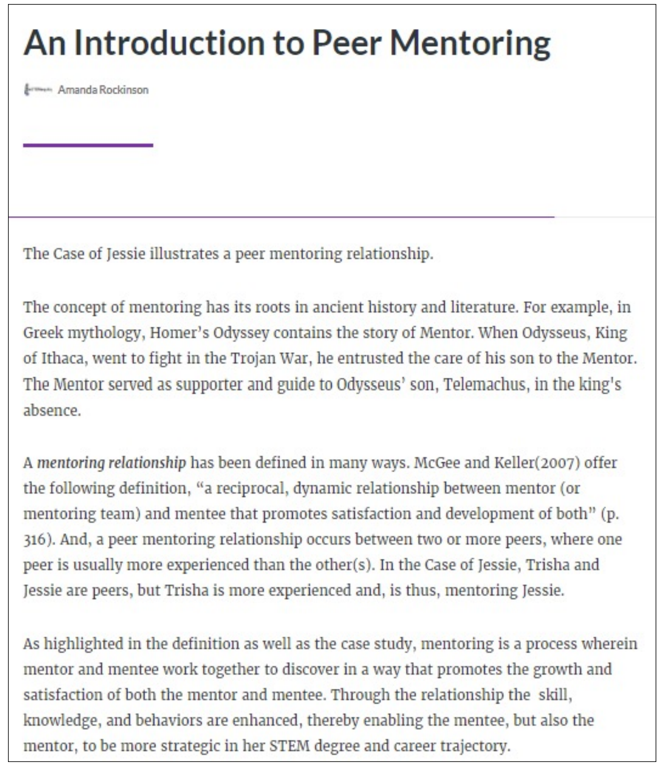
Pilot Feedback

The virtual peer mentoring program pilot was initially implemented at two HBCUs. BIPOC women in graduate STEM programs were invited to apply as mentors. Participants needed to have a cumulative GPA of 3.0 and supply a faculty letter of recommendation upon request. The chosen six participants were all women between the ages of 22 and 31. Five participants identified as Black and one as Hispanic. Two facilitators from the University of Memphis supported the pilot participants through six self-paced modules over eight weeks. The participants completed one module per week. The first week of the training was allotted to enable the mentors to set up appropriate accounts and technology. The final week was used to finalize the training and data collection for evaluation.

The evaluation data collected from the mentors (Rockinson-Szapkiw, Herring Watson, et al., 2021; Rockinson-Szapkiw & Wendt, 2021; Rockinson-Szapkiw, Wendt, et al., 2021) consisted of a series of quantitative assessments implemented before and after the training, including a STEM self-efficacy scale and the Principles of Adult Mentorship Inventory (PAMI; Cohen, 1998). Additionally, qualitative data, including open-ended survey questions, interviews, and focus groups, were collected after the training. These data points illuminated the women's experiences in training. While quantitative data indicated that participants' mentoring skills, self-efficacy, and intention to persist in STEM increased after training, the qualitative data provided insight into how and why the training elements supported these constructs. Qualitative data also provided information about needed areas of improvement. The following five themes arose from the qualitative feedback and served as the design catalyst for the current design project.

1. Additional Topics & Mentee Preparation

Mentors expressed a need to develop additional knowledge about the unique challenges BIPOC and women populations


An Introduction to Peer Mentoring

Amanda Rockinson

The Case of Jessie illustrates a peer mentoring relationship.

The concept of mentoring has its roots in ancient history and literature. For example, in Greek mythology, Homer's Odyssey contains the story of Mentor. When Odysseus, King of Ithaca, went to fight in the Trojan War, he entrusted the care of his son to the Mentor. The Mentor served as supporter and guide to Odysseus' son, Telemachus, in the king's absence.

A *mentoring relationship* has been defined in many ways. McGee and Keller(2007) offer the following definition, "a reciprocal, dynamic relationship between mentor (or mentoring team) and mentee that promotes satisfaction and development of both" (p. 316). And, a peer mentoring relationship occurs between two or more peers, where one peer is usually more experienced than the other(s). In the Case of Jessie, Trisha and Jessie are peers, but Trisha is more experienced and, is thus, mentoring Jessie.

As highlighted in the definition as well as the case study, mentoring is a process wherein mentor and mentee work together to discover in a way that promotes the growth and satisfaction of both the mentor and mentee. Through the relationship the skill, knowledge, and behaviors are enhanced, thereby enabling the mentee, but also the mentor, to be more strategic in her STEM degree and career trajectory.

FIGURE 1. Example of 'wall of text' in pilot module**.**

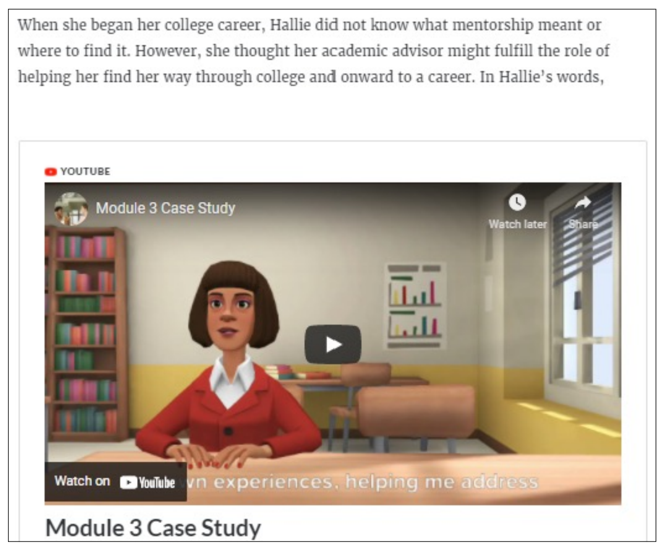


FIGURE 2. Example of the case video in a pilot module. Video avalable at: https://purl.dlib.indiana.edu/iudl/media/f36514vd65

face in STEM (i.e., microaggressions, multiculturalism, and balancing school and family) so they could subsequently address these issues with their mentees. The mentors, however, were not the only ones requesting additional preparation. The mentees involved in the virtual peer mentoring program expressed the desire to have the same training to gain competencies, self-efficacy, and abilities for a more effective mentoring relationship.

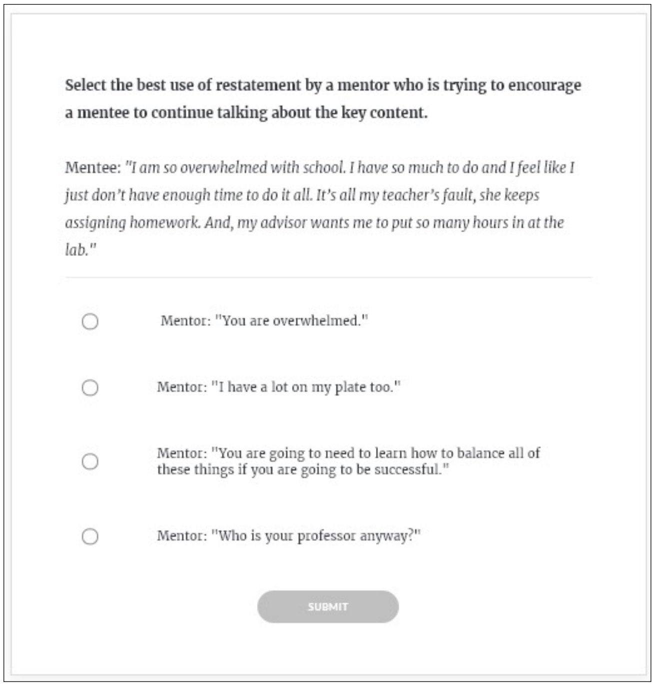


FIGURE 3. Example of practice activity in pilot module.

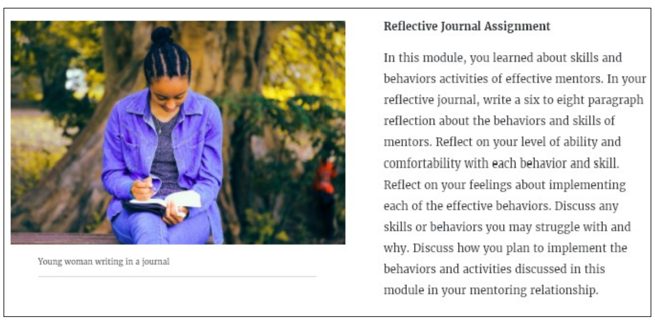


FIGURE 4. Example of reflection activity in pilot module.

PILOT FEEDBACK	CURRENT DESIGN GOALS
1. Additional topics and Mentee Preparation	• Extend six modules • Add parallel mentee modules
2. Content Presentation	• Move from wall of text to more interactive and engaging interactive activities
3. Case Videos	• Enhance and add more case videos
4. Practice	• Add more practice, entitled "Let's Practice" • Add simulations
5. Reflection	• Add more reflection activities entitled "Let's Reflect"

TABLE 1. New design elements based on pilot feedback.

2. Content Presentation

Mentors noted that the interactive content helped them better understand their function as mentors, envision their roles, and increase their confidence to be successful mentors. Conversely, they believed that it took too much time to consume when content was presented as a 'wall of text' (see Figure 1). They requested more videos, graphics, and activities to better support their learning.

3. Cases Videos

Mentors reported that case videos (see Figure 2) were salient to their skill development and efficacy building. One participant stated, "I really like the case examples that helped me to see how individuals like me can mentor and solve dilemmas." Another mentioned, "They were important in helping me to practice what I will do with my mentees and seeing I can do this." The pilot participants requested more cases to help them understand additional mentoring functions and competencies.

4. Practice

The mentors requested that more practice activities to develop mentoring skills further and alleviate anxiety about being a successful mentor. The example in Figure 3 below shows one such practice activity in the pilot modules where participants must apply principles of active listening.

5. Required Reflection

Mentors also noted that the reflection activities embedded in the pilot connected them to the content personally, reminding them of their past mentors and what they want to share with their future mentees. Furthermore, the reflection activities increased their self-efficacy, so they suggested more journaling assignments be part of the training. See an example of a reflection activity in Figure 4.

SECOND ITERATION: CURRENT DESIGN OVERVIEW

We started work on a second iteration of the design based on the five themes from the pilot feedback in May 2020 (see Table 1). The redesign process took seven months. All the modules were created using Articulate Rise 360 as they had been in the pilot, and they were placed on a website for the mentors and mentees to access. Similar modus can be viewed via estemequity.com.

In addition to expanding the content modules and adding mentee modules, the design further fortified what pilot participants purported valuing, such as the case videos, practice, and reflection. The modules included more case videos and graphics representative of the BIPOC women, interactive and engaging content delivery, simulated practice, and additional opportunities for reflection. Thus, the new design

	MODULE 1	MODULE 2	MODULE 3	MODULE 4	MODULE 5	MODULE 6	MODULE 7	MODULE 8
Pilot Mentor	The Self-Reflective Mentor	The Mentoring Relationship	Essential Mentoring Skills to Begin and Build a Mentoring Relationship	Essential Mentoring Skills to Inform, Facilitate, Confront, and Help Mentees Reach Goals	Essentials Mentoring Skills for Maintaining and Ending an Effective Mentoring Relationship	Technology for the Mentoring Relationship		
2nd Iteration Mentor & Mentee	An Introduction to the Peer Mentoring Relationship	The Reflective Mentor	Essentials for Building and Maintaining Trust	Essentials for Beginning a Peer Mentoring Relationship	Essentials for Facilitating Develop-ment of the Peer Mentoring Relationship	Essentials for Organizing an Ethical Peer Mentoring Relationship	Essentials for a Culturally Responsive Peer Mentoring Relationship	Essentials for Engaging in an e-Peer Mentoring Relationship

TABLE 2. Comparison of pilot and 2nd iteration modules.

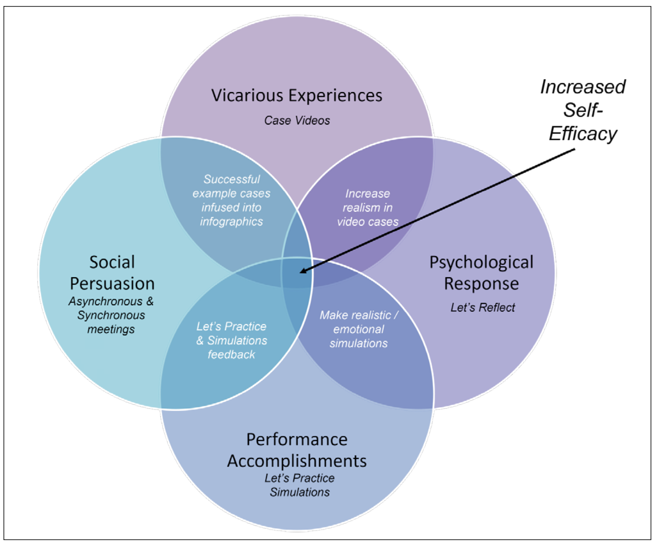


FIGURE 5. Bandura's four sources of self-efficacy intersecting with second iteration design elements.

supported participants' (i.e., mentors and mentees) STEM community and integration, self-efficacy, and competencies as STEM mentors and mentees (Rockinson-Szapkiw, et al., 2021).

Importantly, we wanted these redesign efforts to extend and build upon the self-efficacy gains evident in the pilot version of the learning environment. Research conducted on the pilot (Rockinson-Szapkiw, Herring Watson, et al., 2021; Rockinson-Szapkiw & Wendt, 2021; Rockinson-Szapkiw, Wendt, et al., 2021) reinforced Zeldin and Pajares's (2000) findings that girls and women are more influenced by vicarious experiences and social persuasion than other sources of self-efficacy. However, the pilot participants' suggestion for more interactive, authentic practice and positive response to reflection prompts indicated that Bandura's (1977, 2006) additional sources - performance accomplishment and psychological response - also influenced their self-efficacy. With this in mind, we intentionally identified ways in which our design goals aligned with all four sources of self-efficacy (see Figure 5). Although the second iteration design incorporates social persuasion through positive feedback built into practice activities and case videos, the largest source of social persuasion remained synchronous and asynchronous meetings between mentors and mentees planned during the training. As this design case is focused on the self-paced learning elements of the design, social persuasion is outside the scope of the case and will not be discussed. The intersections of the remaining three sources of self-efficacy with our design elements will be explained in detail in the iteration process section, especially concerning the last three design goals (see Table 1; i.e., case videos, practice, and reflection).

In September 2020, we concluded the second iteration design process by obtaining feedback from participants who were similar to the profile of the training's intended audience (i.e., BIPOC women, women in STEM). We conducted a learning experience design study (LXD) examining participants' interactions with the newly redesigned modules and the ability of these interactions to result in identified learning outcomes. We recruited and interviewed seven women involved in STEM professions or seeking degrees in STEM fields. Of the women, five identified as Black, one as Hispanic, one as White, and one as Asian. While the results of this study will be shared in a forthcoming publication (Rockinson-Szapkiw, et al., 2021 in press), initial results were used as informal feedback to triangulate data and add rigor to our design case (Smith, 2010). Specifically, the feedback provided perspectives from one White woman and BIPOC women that the mostly-White design team could not supply. Those perspectives are reflected in the following sections.

Goal 1: Extending the Content

The first goal was to expand the content. The project coordinator led this effort. During the seven months of design work, we revised the mentor training models expanding the original six modules to eight. Eight new mentee modules were also developed. A comparison of the pilot and second iteration modules can be seen in Table 2. New content on culturally responsive peer mentoring, building trust, and ethics in mentoring was included. These new topics gave mentors and mentees a more authentic look at their mentorship, which would prepare them with the necessary knowledge for an effective relationship. Additionally, a final module on virtual peer mentoring was added to provide ideas and instruction for using online communication tools like Slack and Zoom.

Goal 2: Breaking the Wall of Text

The next design goal was to reimagine the content as interactive and engaging activities. Pilot mentors identified a 'wall-of-text' as a challenge in the pilot training, noting it was too time-consuming to read and sometimes overwhelming. On the other hand, they praised interactive activities and requested additional use of graphics and videos. Therefore, we recognized that the text-heavy content presentation in the pilot needed to be reimagined as interactive and engaging activities. Interactive activities helped segment content into smaller pieces to reduce cognitive load (Huh, Y., 2020; Law & Jacobsen, 2015; Mayer & Moreno, 2003). The following are interactive activities created during the redesign: *Flashcards for Competencies*, *Accordion for Definitions*, *Infographics and Hotspots for Multi-stage Content*, and *Explainer Videos for Complex Concepts*.

Flashcards for Competencies

We used interactions to underscore important takeaway information, such as mentor/mentee competencies. In the pilot, this type of information was presented in a single paragraph, and mentors reported skimming over it. To draw attention to important content, interactive activities in the form of flashcard grids were used in the new trainings (e.g., digital cards are arranged in a grid resembling a matching game; see Figure 6). The grid chunked the content highlighting key ideas and scaffolding in a manner that required less mentor and mentee cognitive load (Mayer & Moreno, 2003). The lead designer drew black line figures for the front of the cards to illustrate the concepts written on the opposite side. These hand-drawn figures took time to develop but provided a consistent look across modules. Unfortunately, this additional time may have come at sacrificing other important design elements.

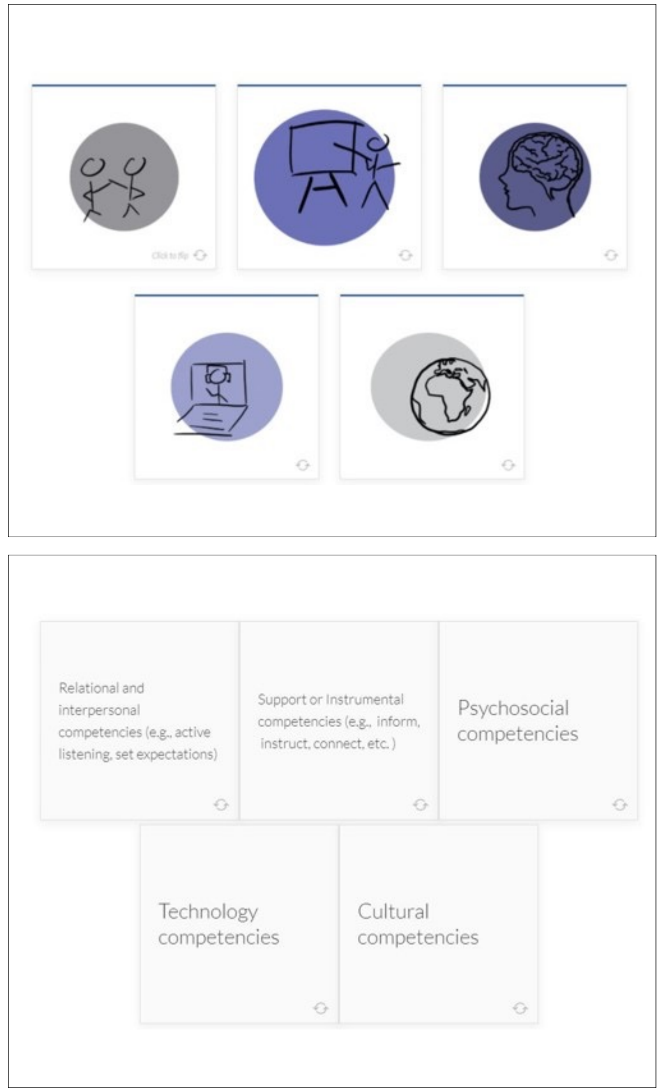


FIGURE 6. Flashcards grid interaction fronts (top) and backs (bottom).

Following the design, an LXD study was completed. According to LXD study participants, the time used to draw images may have been futile. Participant responses were mixed. Some participants responded positively to the illustrations, finding them "cute", while others felt they did not match the concepts. Others remarked that they felt the interaction did not add to their learning experience.

Accordion for Definitions

In addition to engagement, we also wanted to use interactions to draw attention to pertinent definitions. Definitions are an important part of building mentor and mentees' knowledge. Still, they are largely ineffective if buried in paragraphs of text that are skimmed over or skipped altogether. Therefore, an accordion interaction, which allowed mentors and mentees to see the vocabulary terms first and click to expand for a matching definition (see Figure 7), was selected to highlight and call attention to definitions. Flashcards were

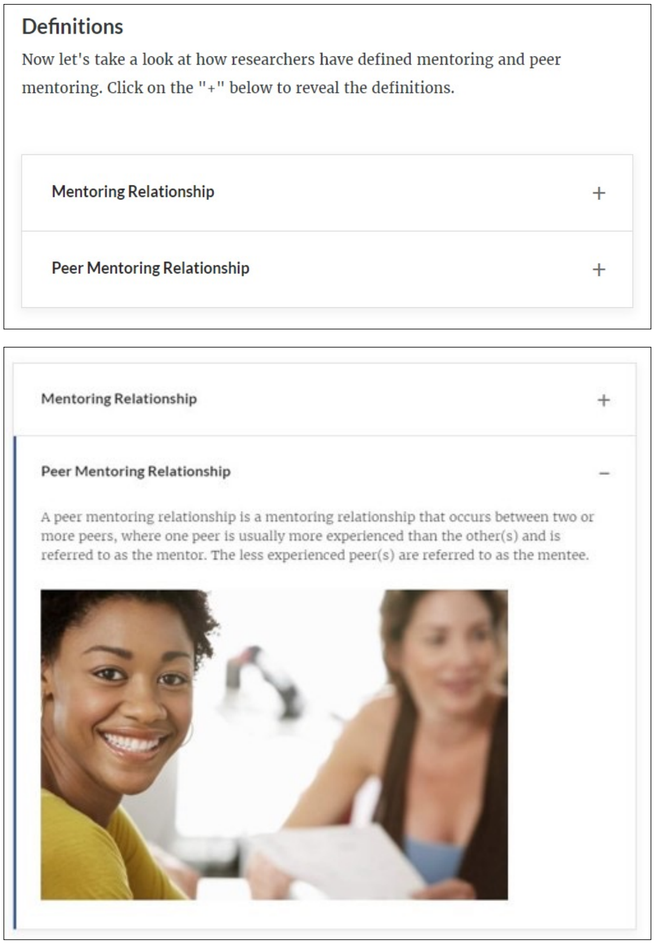


FIGURE 7. Accordion interaction with definitions closed and opened.

not used so that the mentors and mentees could differentiate between competencies (i.e., flashcards) and definitions (i.e., accordion interaction). Additionally, multimedia objects like photos or images added to the text supported the retention of information (Gins, 2006; Mayer & Moreno, 2003).

These features allowed us to segment the content into meaningful chunks (Mayer & Moreno, 2003). Indeed, LXD participants commented that the definitions were easy to find and supported their learning. One participant remarked:

> *"The text is broken up by…you know, some of the grayed-out boxes and definitions where I can go and find things for later because someone who's really trying to study something, they will want to take notes."*

She also noted:

> *"Even though most people will open them and read them, just having all of that text right there open is overwhelming. So, it's nice to be able to open it and say, 'Oh, okay. There's, there's an image.' There's….a definition here to help me understand better.' "*

Infographics and Hotspots for Multi-stage Content

The educational content in the updated modules frequently included complex ideas that required learner engagement. For example, the content might cover processes or stages, such as the four stages of a peer mentoring relationship. We wanted a way to convey multi-step or multi-stage content in a more visual manner to engage mentors and mentees and honor pilot participants' request for more graphics. Infographics created with graphic design tools (i.e.,

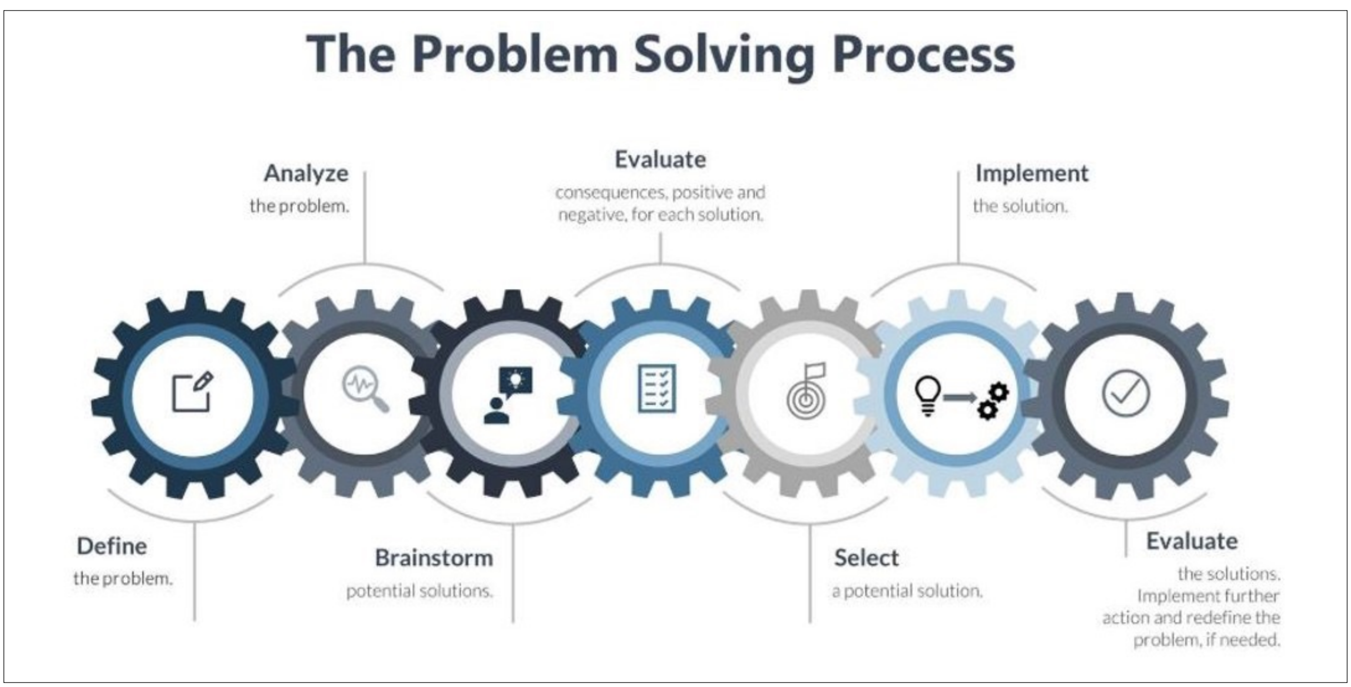


FIGURE 8. Example of a module infographic.

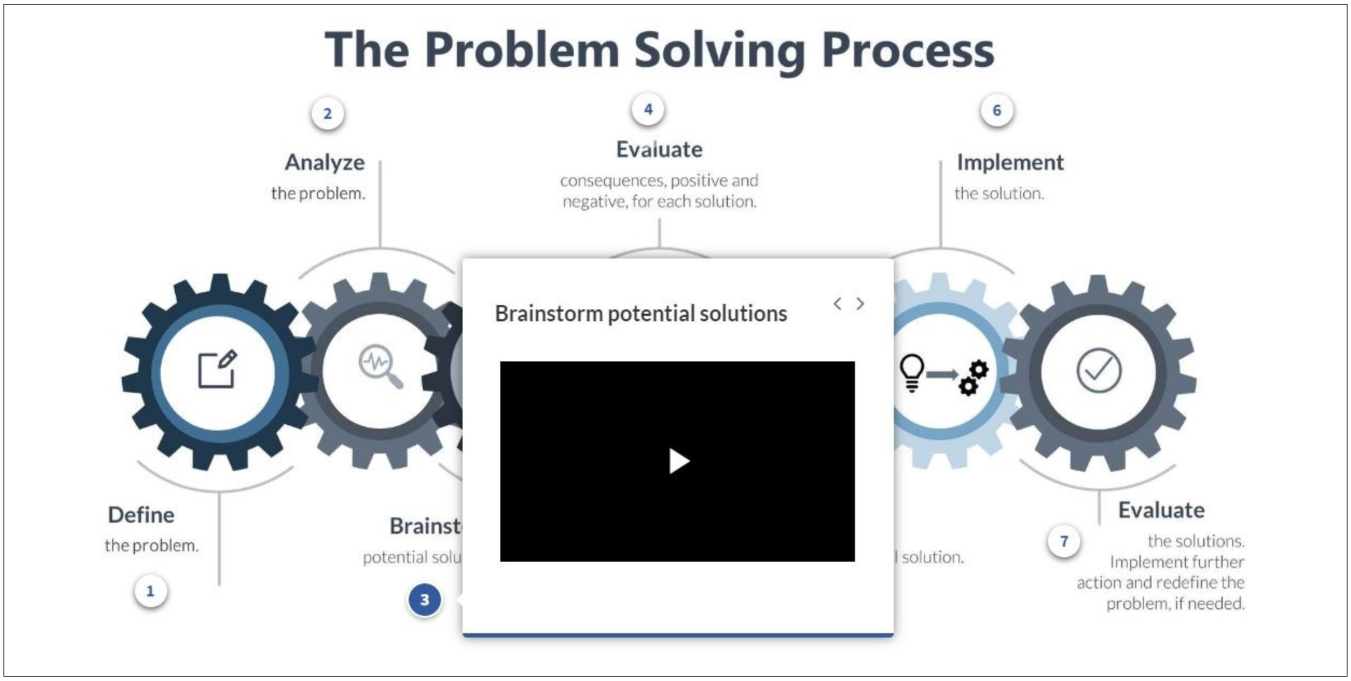


FIGURE 9. Example of an infographic with hotspots.

Adobe Photoshop and Microsoft PowerPoint) allowed us to complete this design goal. For example, the infographic in Figure 8 illustrated the seven-step problem-solving process mentors can use to help mentees resolve issues encountered during their studies (e.g., experiencing difficulty in a lab, losing motivation, etc.). The graphic repeated the colors and circle shapes of the flashcards and the training logo for continuity. Infographics lent learners all the information they needed at a glance, making digestion of complex, interconnected information more efficient.

The infographics clearly showed steps of a process, but we wondered if there was a way to incorporate case videos of mentors and mentees completing the steps to reinforce the concepts. A hotspot interaction enabled us to integrate videos with the infographics. In the example of the problem-solving method, we added a case video to the hotspot featuring each step (see Figure 9).

Explainer Videos for Complex Concepts

Lastly, we desired a better way to explain complex, abstract concepts that mentors and mentees need in order to foster effective relationships. Text-based explanations of such complex concepts in the pilot modules were lengthy and academically dense, presenting challenges to participants' attention and comprehension. This ultimately threatened disengagement with the content. To overcome this design challenge, we discussed the use of explainer videos to support learner engagement of these concepts. We chose a tool that featured animated handwriting and drawing key concepts on a blackboard with narration. For example, the concept of Unconditional Positive Regard, presented by clinical psychologist Carl R. Rogers (1959), is central to building trust in the peer mentoring relationship. Click on Figure 10 to see an example of an informational video about Unconditional Positive Regard (UPR) made for the module. The video scaffolds mentor and mentee's understanding of UPR and increases engagement. It also allowed for a short and focused presentation format that lasted approximately 60 seconds. The decision to vary the video type was also made given feedback from the pilot study. In the pilot study, some participants noted that varying ways to consume information may be preferred for better engagement. They also often requested short videos that narrated key points that were presented in the text.

The short, explainer videos had mixed reviews during the LXD study. Some participants felt they were repetitive with the information presented in text and graphics in the lesson. Others liked having the same information presented in multiple modalities because it accommodated many learning preferences. Many mentioned the video provided helpful summaries of information in the text. One participant noted, "The videos have short summaries, even though the text is very short and, you know, chunked information for each of the items or the modules […] the videos kind of bring it home."

Goal 3: Cases as Vicarious Experiences for Sense of Belonging, Authenticity, and Decision-making

Integration and Belonging

Pilot participants expressed a desire for more cases with women who looked like them and encountered familiar

FIGURE 10. Blackboard animation video example. Video available at: https://purl.dlib.indiana.edu/iudl/media/q47r66qx1v

FIGURE 11. Pilot study video case. Video available at: https://purl.dlib.indiana.edu/iudl/media/g35445jw80

FIGURE 12. Video case characters created with Vyond.

situations and problems (Goal 3). Case examples about BIPOC women in STEM assist mentors and mentees in becoming socially and academically integrated into the STEM community. Tinto (2017) reported that integration impacts motivation directly and affects persistence indirectly. He stated, "A student's sense of not belonging, of being out of place, leads to withdrawal from contact that further undermines motivation to persist" (p. 258).

The pilot training contained short, animated videos as cases with carefully selected characters to represent the

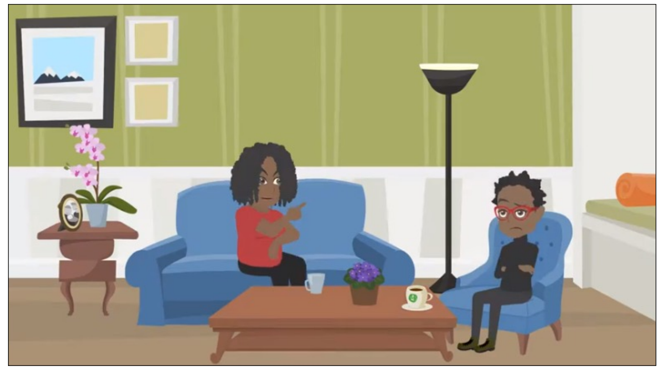


FIGURE 13. Updated case video with a variety of emotions displayed through facial expressions and hand gestures. Video available at: https://purl.dlib.indiana.edu/iudl/media/682x12407d

target population of BIPOC women. The videos featured single, animated characters, usually the mentor thinking aloud through a problem in the mentoring relationship (see Figure 11). However, the updated case scripts for the second iteration called for mentors *and* mentees to interact through dialogue and perform mentoring functions. Therefore, a new cast of characters with more variety was needed, and a software tool was needed to accommodate a larger cast of characters that reflected the BIPOC women population.

There were several high-quality video animation software available, such as Powtoon, Toonly, and Vyond. Vyond provided a robust character creator with options to adjust body size, skin tone, hairstyles, eyewear, accessories, clothing, and even shades of lipstick. Vyond also allowed for within-group customization. For example, the designer could show various skin tones, body types, and hairstyles among Black women. A choice to go with Vyond did come with a cost, however. A subscription was needed to access the character creator and remove the branding logo from each video. Vyond, however, supported the design needs as the representation of BIPOC women was central to the training goals. The character generator allowed for a range of diversity. Figure 12 shows just some of the characters created in Vyond for the expanded case videos.

The LXD testing completed after the design of the modules supported the choice to use Vyond. The LXD participants appreciated the depth of diversity found within the modules and frequently commented on seeing within-group differences (e.g., clothes, hair, etc.) in Latina and Black women. However, one LXD participant voiced that she wished the videos' voice-overs were completed by BIPOC women, noting this would have deepened her sense of connection with the content.

Authenticity

The inclusion of authentic vicarious experiences to increase self-efficacy was also recognized as important in the design and development of the training. Interactions between the mentor and mentee needed to represent contextualized challenges, including potentially emotionally charged and difficult conversations. Bandura (1977), while discussing vicarious experiences, asserted that "seeing others perform threatening activities without adverse consequences can generate expectations in observers that they too will improve if they intensify and persist in their efforts" (p. 197). For example, it was important to include scenarios such as a mentor talking with a mentee who has been upset by a professor's micro-aggression. Observing such a case is likely to bolster the mentor's self-efficacy to handle a similar mentoring situation or a mentee's willingness to discuss such issues with a mentor.

Here again, Vyond enabled the enhancement of the case videos (see Figure 11). The pilot case videos sometimes used computer-generated voiceovers for characters. The video software used did not enable much customization, so characters lacked facial expressions and failed to communicate non-verbally. The flat affect of characters poorly portrayed how mentors use intonation and nonverbal communication to interact with mentees, especially in heightened emotional states. Using Vyond, we used the built-in character gestures feature to add desired emotion, making the cases more realistic. For example, the video in Figure 13 illustrates how the characters express anger, shock, and frustration with facial expressions. Gestures also communicate anger (pointing) and frustration (head in hands), respectively. The more realistic mentor-mentee interactions (verbal and non-verbal) provide a multi-dimension vicarious experience for the mentor and mentees to build self-efficacy and better support the transfer of competencies into real-world mentoring situations. Click on the video in Figure 13 to see an updated case video featuring lip-sync, facial expressions, and gestures all contributing to a realistic vicarious experience for both the mentor and mentee.

Decision-Making

New case videos were developed to introduce each modules' topic. Bandura (1977) asserted that self-efficacy is developed through vicarious experiences. Therefore, the design team wanted to provide mentors and mentees with opportunities to watch mentoring functions be performed. Each case videos had a basic story formula that led the characters from problem to resolution through intentional decision-making, enabling learners to observe the entire process. For example, the case video would first show a mentee upset because she feels her mentee cannot relate to the challenges she is personally facing. The mentor would then be faced with a decision about how to best support the mentee in that situation (e.g., (a) dismiss her mentee as having a bad day or (b) use self-reflection to realize that she hasn't been sharing her own difficult experiences). The team recognized that integrating a multi-step decision-making

FIGURE 14. Mentor demonstrating decision-making by weighing possible choices.

process in the case video was preferred if the goal was to provide a vicarious experience in difficult context (see Figure 14). Enabling learners to watch a case, see the animated mentor make decisions, and then watch the consequence of the decision allows them to more fully experience the mentoring task as well as envision the accompanying consequences.

Goal 4: Practice for Performance Accomplishments

The fourth design goal stemmed from pilot participants' desire to practice applying the mentoring skills presented in the module content. This aligned with Bandura's (1977) belief that performance accomplishments can serve as a source of self-efficacy. We knew from the pilot that participants enjoyed knowledge check questions interspersed through the content. The pilot participants, consistent with the research (Dewey, 1913), also noted that their competency development was facilitated when knowledge was tested or they were asked to apply content. For these reasons, activities like this were included in the second iteration as well. We also knew that these practice opportunities focused on a limited view of a mentoring task, decontextualized from the mentoring relationship. They would not help to alleviate anxiety about implementing lessons learned from the modules. Therefore, we decided on two courses of action to support learner practice. First, we would increase knowledge check opportunities through frequent "Let's Practice" sections. Second, we would create new case simulations using

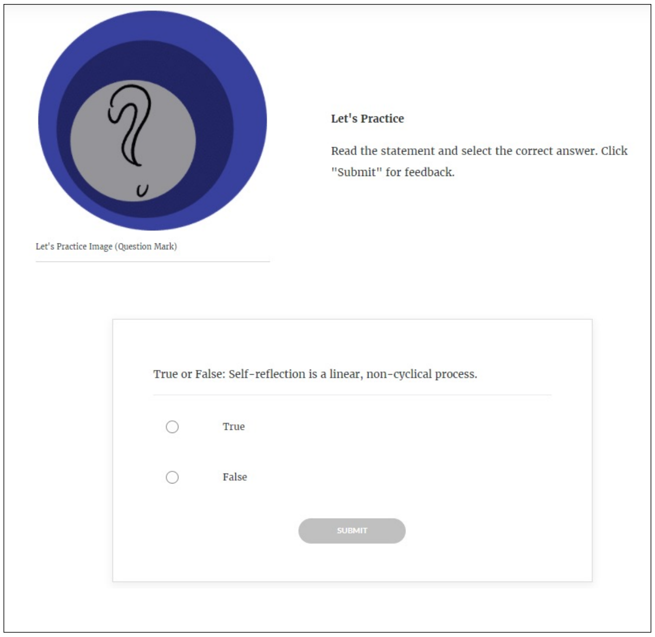


FIGURE 15. The "Let's Practice" icon with instructions and practice question.

interactive branching to immerse learners into more realistic mentoring scenarios where *they* make the decisions. These were integrated throughout the modules and in addition to the introductory case videos that provided only passive decision making.

Let's Practice

The knowledge check questions in the pilot were scattered throughout the modules without a planned pattern. To add consistency and highlight these activities as performance accomplishments (Nielsen, 1994; Tawfik et al., 2021). We decided to rebrand them as "Let's Practice" sections at the end of the module's sub-sections. We developed an icon using a simple, black line drawing of a question mark on circles in the training logo colors. This was set left on the screen opposite the sub-header "Let's Practice" and instructions for whatever question(s) followed. Question formats included true and false, multiple-choice, drag and drop, and matching. We allowed unlimited attempts to get the correct answer and provided helpful hints and encouragement in the feedback once a learner submitted an answer. This feedback served as an additional source of social persuasion by affirming learning gains or helping learners understand the correct answer.

The LXD study performed on the redesign affirmed what we knew from the pilot: participants appreciated the practice to gauge their understanding and hold their attention. However, several LXD participants commented from a usability standpoint that the icon was too big and created too much white space between the instructions and the actual questions, as shown in Figure 15. Some users tried to click the icon as well, thinking that it was an interactive piece of the module.

Case Simulations

Participants from the pilot project desired practice at implementing new knowledge and skills into authentic mentoring scenarios. Increased opportunities for successful mentoring practice in a safe space would decrease anxiety and increase chances for later success. Bandura (1977) posited that "successes raise mastery expectations; repeated failures lower them, particularly if the mishaps occur early in the course of events" (p. 195). In the second iteration, we wanted mentors and mentees to avoid early mishaps in their mentoring experiences, so we accomplished this by simulating opportunities for making decisions about the mentoring relationship without the consequences of failure.

To build a safe space for performance accomplishment, we case simulations. At the start of each module, case videos allowed the learner to be fairly passive, observing how the mentor and mentee used module lessons to make decisions and resolve problems. The goal for the simulations was to move the participants from the role of observer to that of the active decision-maker. Mentors and mentees could then practice making decisions related to their relationship to increase their self-efficacy for mentoring and STEM.

The first step was to decide how to incorporate interactive decision-making into the case videos. Participants needed opportunities to engage with the video to explore choices and gather information before deciding. We opted to combine the animated case videos with Articulate Storyline for its capability to create branching scenarios, which takes participants through a series of problems, decisions, and consequences of those decisions. For example, learners watch an initial scene with a problem presented between the mentor and mentee (e.g., the mentee is frustrated because the mentor is not actively listening to her problem). Following the initial scene, the learners are prompted to use the on-screen buttons to explore two possible responses to resolve the problem at their own pace. On-screen buttons allowed users to navigate through the video-based simulations much like a choose-your-own-adventure book, but initial internal testing of our simulation design by the IDT Studio revealed ambiguity about button labels and instructions. To resolve the ambiguity, we changed the label from "option" to "response" (see Figures 16 and 17) because participants are being asked to choose the best way to respond to the mentor or mentee. Next, aligned with Nielsen's (1994) visibility of system status heuristic, we added visual reminders (i.e., yellow checkmarks) to show that a participant had visited a response button. Confusion persisted with these changes, however. The IDT Studio graduate students and the project director were unclear about what the "Choose an option" button did, so it was renamed "Answer" and removed

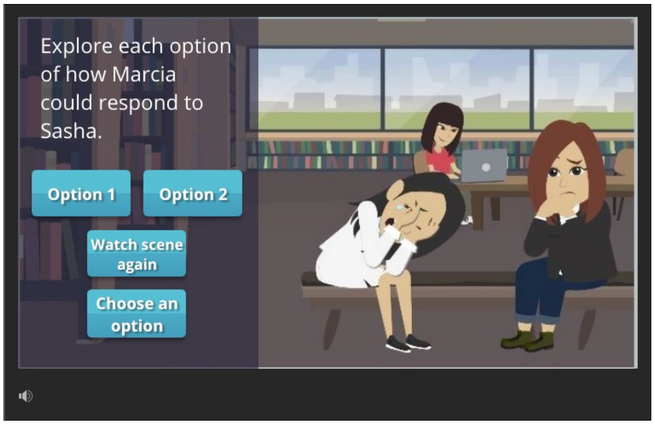


FIGURE 16. Original case simulation design.

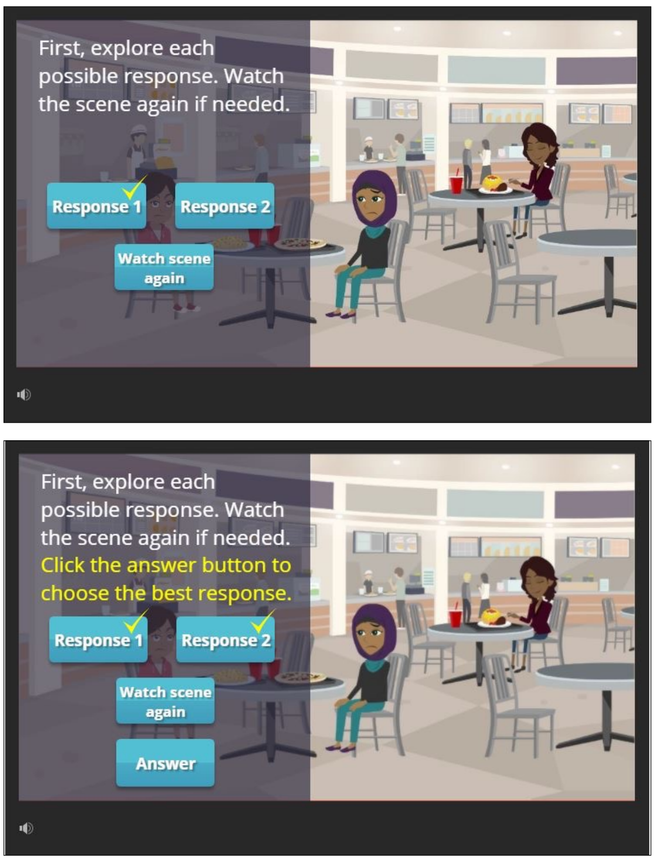


FIGURE 17. Updated case simulation design in two steps.

from view until participants visited both responses. The button appearance was accompanied by both visual and oral instructions (see Figure 17) to support the participants. These small changes clarified what to do and streamlined the process to make a fool-proof experience. Indeed, LXD testing confirmed that participants were able to complete the case simulation without issue.

After viewing both possible responses and clicking the "Answer" button, participants then needed the opportunity to make the decision. Storyline, the software used to create

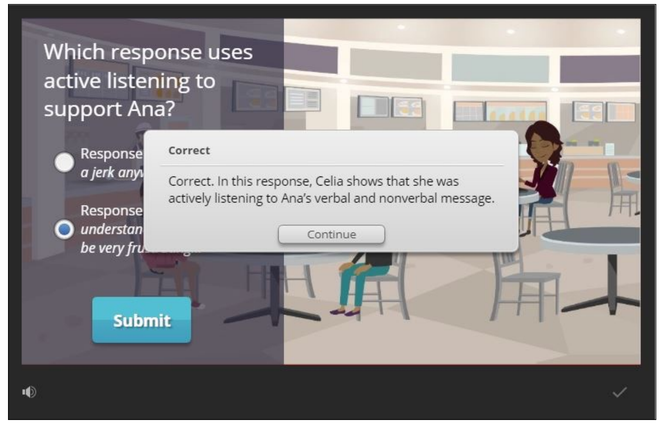


FIGURE 18. Oral and written feedback.

the simulation, has a multiple-choice quiz feature that can be directly built into the simulation allowing for a seamless experience. Learners are presented with each option in multiple-choice format with brief written reminders of each choice. After selecting an option, they are subsequently presented with clear feedback about why the response is appropriate or not (see Figure 18).

While requiring more time to create, integrating the decision-making into the case simulation ultimately strengthened the fidelity of the performance accomplishment for the learners. The case simulations immersed learners into realistic mentoring scenarios that afforded them space to practice decision-making actively and, as a result, gain performance accomplishments to support self-efficacy. LXD participants responded positively to the simulations, stating that they involved them in decision-making and kept them engaged in the modules. One participant stated, "I wasn't just watching the video like I was in the other modules […]. So, I like that it was turned into something more." Unfortunately, we were unable to produce case simulations for each module because of the complex nature of both writing and developing them. We were perhaps over-ambitious to think we could incorporate them into every module, especially given the funding allocated for design. As a team, we discussed how to address this issue and decided to focus on developing case simulations for the later modules where the content is suited for mentor and mentee decision making.

Goal 5: Reflection to Support Psychological Response

For the final design goal, the design team wanted to leverage the positive response to the existing reflection journal component in the previous design by infusing reflection opportunities throughout the modules, not just at the end. By presenting more reflection points, we hoped to build stronger connections to mentors' and mentees' psychological responses to mentoring experiences. The hope was that exposing learners to repeated emotional arousal in practice would help them to eventually lower anxiety and increase

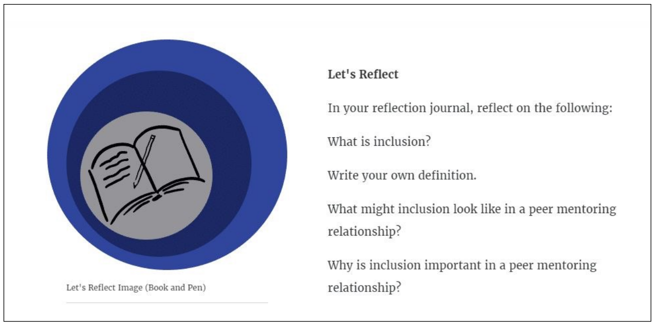


FIGURE 19. Let's Reflect exercise for knowledge activation.

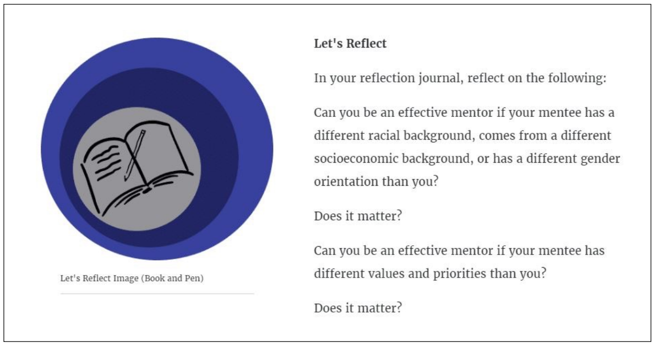


FIGURE 20. Let's Reflect exercise for self-reflection on potentially stressful situations.

self-efficacy surrounding their real mentoring experiences. Psychological response, originally called emotional arousal, is the fourth source of self-efficacy derived from coping with difficult situations. Bandura (1977) reasoned that "high arousal usually debilitates performance" (p. 198); therefore, the training aimed at increasing self-efficacy should promote behaviors that lessen or eliminate fear and anxiety tied to performance accomplishments. Those who participated in the pilot recognized that these opportunities helped to bridge their past mentoring experiences with their future mentoring capabilities. Connecting to learners' past experiences helped them to reduce anxiety and feel more confident about future mentoring activities.

These new reflection points were labeled "Let's Reflect" to be consistent with the "Let's Practice" pattern. The lead designer again drew a new icon of a journal and pencil much like the "Let's Practice" icon to help distinguish them from other module content (see Figure 19). The "Let's Reflect" sections appear both before new educational content to activate learners' previous knowledge of a topic and after a case to encourage self-reflection on feelings and responses to potentially stressful or threatening situations (see Figure 20).

Once the design team decided the goal of the "Let's Reflect" sections, the next step was to consider how to provide the best learner interaction. Mindful of keeping mentors and mentees in the flow state, or the mental state of being "fully involved in the present moment" (Nakamura & Csikszentmihalyi, 2002, p. 89), we considered using the authoring tool's native short answer option that would allow participants to type their reflections directly into the module rather than using a physical journal. We rejected this option, however, when internal testing from the learner's point of view revealed that there was no option to turn off the feedback. With no single correct answer, learners would receive incorrect feedback with every entry. To mitigate this issue, we turned to Storyline's data entry input feature. This option would allow learners to type their responses into a similar textbox without the complication of providing feedback. We eventually abandoned this route as well, though, because we lacked the time and expertise to figure out how to aggregate all of the reflections into one document for participants to download and review, rendering all reflections lost to the system. After consulting with the project director, we decided to maintain the original pilot design, which required mentors and mentees to use an offline, physical journal to complete "Let's Reflect" activities. This low-tech option appeared to best serve our learners. Indeed, participants involved in the LXD testing seemed to like the idea of the reflection points and journaling. One believed that the physical journal would help the mentor and mentee's focus better by providing a concrete task. Another responded the journaling would help mentors and mentees sort out their motivations for mentoring. Several people, however, pointed out that the journal requirement needed to be highlighted early in the training so that participants are prepared. This would prevent disruption of their flow state while completing the modules.

DESIGN REFLECTION

We believe this case emphasized the importance of making design decisions based on relevant research, theory, and participants' authentic voices brought in through LXD testing. Research on BIPOC populations and women in STEM programs helped us to recognize the importance of integration and self-efficacy among both the mentors and mentees. Tinto's (1987) Institutional Departure Model and Bandura's (1977, 2006) Theory of Self-Efficacy worked in concert to guide our design decisions.

While working within the theoretical framework provided initial guidance, internal testing by design team members with LXD experience was essential to developing an intuitive user experience. Team members with LXD experience were invaluable as the first layer of internal testing. They brought a much-needed refining eye to the simulations. Their input molded the design into a feature that users can intuitively operate, enabling them to focus on the content and lesson rather than worry about completing the learning task. This iterative testing was imperative to helping catch problems with the case simulations activities that could disrupt learning. Case simulation activities were an important piece of the design because they supported the goal of creating more authentic practice as a way to increase self-efficacy in learners. Their complexity warranted several additional sets of eyes to smooth out the learner experience. Having a project team with LXD expertise was very helpful to the redesign process.

The final step of the iteration process involved bringing in seven White and BIPOC women to test the modules using an LXD protocol. The participants closely resembled our target learners, bringing in new perspectives that could not be replicated by the lead designer or other design team members. This LXD testing affirmed areas where we were on the right track, such as the representation of BIPOC populations and women through animated characters. Their perspectives also helped stretch our efforts to think more deeply about representation within groups through contextual decisions about hairstyles, clothing, body sizes, and voice. Additionally, they helped us to see that the hand-drawn icons for the flashcards and the "Let's Practice" and "Let's Reflect" icons did not add to their learning as we had hoped. As it was, our LXD testing came so close to the second launch date that we were unable to accommodate many of the users' changes or suggestions.

Working with these women made us rethink when to incorporate learner voices into the design process. From this experience, we can see that testing earlier in the design process would clarify seemingly implicit design decisions and ultimately help us prioritize the design elements that impacted their learning.

Most of our design hours went toward resolving design tensions related to incorporating representation and empathic responses to underrepresented populations. We wanted BIPOC and women learners to gain insight into the complexities facing BIPOC populations and women in STEM, so videos featured heavily in the modules as opening cases, as simulations, and even as examples to reinforce the infographics. The videos had to be authentic enough to draw learners into meaningful experiences, while also allowing interactions that afforded them to iterate their problem-solving and build self-efficacy within the environment. We were able to harness animation video technology to showcase women representative of our learner population in authentic situations navigating a range of complex emotions.

Despite focusing time on the video projects, we were still limited by time and resources to build them to their full potential. As a team, we would have liked to make enough case simulations for each module and to hire voice talent to match the BIPOC population. As one of our test participants pointed out, having the lead designer's voice as a White woman was inauthentic and distracting. Future iterations would greatly benefit from the addition of voice actors who better represent the BIPOC female population.

Arguably the largest design tension we faced as a design team was a focus on how to build a sense of belonging and self-efficacy for underrepresented populations in an online training module. We believe our work to resolve issues presented by the pilot was successful in many regards and added to the design knowledge base. The design decisions discussed here provided vicarious experiences through increased quantity and quality of case videos. We also added performance accomplishments through "Let's Practice" and case simulations. And, finally, we guided learners in psychological responses through "Let's Reflect" journal activities.

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