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Is Seeing Believing? Leveraging Modality and Similarity in a Belonging Intervention

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IS SEEING BELIEVING? LEVERAGING MODALITY AND SIMILARITY
IN A BELONGING INTERVENTION

THESIS

A thesis submitted in partial fulfillment of the requirements
for the degree of Master of Science in Education in the College of Education
at the University of Kentucky

By

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Lexington, Kentucky

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2020

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ABSTRACT OF THESIS

IS SEEING BELIEVING? LEVERAGING MODALITY AND SIMILARITY IN A BELONGING INTERVENTION

Students who feel a greater sense of belonging in college often experience more positive academic outcomes. Social-psychological interventions have been shown to improve students' sense of belonging. However, few studies have examined the social cognitive mechanisms through which interventions work. The purpose of this study was to investigate the influence of two such mechanisms—delivery modality and students' perceived similarity to peer models—on the efficacy of a narrative-based, social belonging intervention. First-year students ($N = 1,329$) from a public, land-grant university in the southeastern U.S. were randomly assigned to a social belonging intervention (i.e., a video- or written-based narrative from peers normalizing the adjustment to college) or a control group. The written belonging intervention reduced achievement gaps between first-generation and continuing-generation students. Both intervention conditions reduced achievement gaps between first-generation, racial minority students and their continuing-generation, White peers. Delivery modality predicted students' perceived similarity, such that students in the written belonging condition felt more similar to peers in intervention materials. Perceived similarity to peer narrators in intervention material did not mediate the relationship between the intervention and student outcomes. Understanding intervention mechanisms could help educational researchers develop more effective interventions to support students' transition to and performance in college.

KEYWORDS: Social-Psychological Interventions, Belonging, Delivery Modality, Perceived Similarity, First-Year College Students

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05/03/2020

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Is Seeing Believing? Leveraging Modality and Similarity in a Belonging Intervention

Chapter One: Introduction

Students who feel a greater sense of belonging in college often experience more positive academic outcomes (Yeager et al., 2016). Although a strong sense of belonging has been a known predictor of student achievement and success in college (Walton & Brady, 2017), students who are the first in their family to attend college (i.e., first-generation college students) and underrepresented racial minority (URM) students face disproportionately greater risk of perceiving that they do not fit in (Hurtado & Alvarado, 2015; Stephens et al., 2012). Concerns about belonging are perhaps a precursor to the achievement gaps between historically underrepresented students and their continuing-generation, White peers. For example, first-generation (FG) college students are at a much higher risk of premature college dropout. Only 27% of FG students earn their degree within four years compared to 41% of their continuing-generation peers (DeAngelo et al., 2011). Likewise, the six-year college completion rates of Black and Hispanic students (41.0% and 49.6%) are much lower than completion rates of White (67.1%) students in the United States (Shapiro et al., 2018).

Although many structural barriers can undermine underrepresented students' success in college, researchers have suggested that achievement gaps may be explained by a weaker sense of belonging experienced by FG and URM students once they arrive at college (Stephens et al., 2014). First-year college students, and those from underrepresented racial minority backgrounds, are especially at risk of low sense of

belonging, which can in turn affect their motivation and persistence in college (Strayhorn, 2018).

Social-psychological belonging interventions have been shown to promote positive academic outcomes during the transition from high school to college, and particularly for students from historically underrepresented backgrounds (i.e., FG and URM students; Broda et al., 2018; Yeager et al., 2016). Narrative-based belonging interventions reframe students' beliefs about belonging by normalizing initial worries about belonging (i.e., fitting in at the university) and characterizing them as temporary stressors. Narratives in such interventions are assumed to convince students to push through initial worries about not belonging in college.

Despite the growing body of research testing belonging interventions in higher education, few studies have examined the social cognitive mechanisms through which the interventions affect outcomes (Harackiewicz & Priniski, 2018). Some research on social-psychological belonging interventions suggest that intervention effects are mediated by students' academic engagement (Yeager et al., 2016). However, Harackiewicz and Priniski (2018) noted that "there are inconsistencies in the mediators between studies" (p. 429). Walton and Brady (2017) urged researchers interested in social-psychological belonging interventions to test the conditions under which they work best.

This thesis addresses these questions by testing two mechanisms of a social-psychological, narrative-based belonging intervention designed to support students' sense of social belonging during their first year of college. Specifically, this thesis examines whether the effects of a social belonging intervention vary according to (a) delivery of the intervention in either a video or written narrative format and (b) the degree to which

students feel similar to the peer models depicted in intervention narratives. Although any number of social and cognitive processes could mediate the effects of interventions on students' psychological and academic outcomes, I based my selection of these two mechanisms on the tenets of social cognitive theory and information processing theory, which are described below. Understanding the social and cognitive mechanisms through which intervention effects are mediated could help researchers and educators more effectively use social-psychological interventions to improve students' transition to and performance in college.

Social Cognitive Theory

Bandura's (1986) social cognitive theory emphasizes that humans have the innate ability to exert influence on their own actions, behaviors, and thinking (i.e., human agency). This extends beyond the predominant theory of behaviorism, which positioned humans as passive recipients of the environment (Ormrod, 2010). By contrast, humans are also guided by internal cognitive processes (e.g., selection, attention) as they make sense of the world. That is, rather than solely focusing on how the environment shapes human behavior, social cognitive theorists also consider internal aspects of human functioning.

According to social cognitive theory, human functioning occurs through interactions between environmental, personal, and behavioral factors in a process of triadic reciprocation. Environmental influences, such as a social psychological intervention, can shape how individuals perceive themselves (personal) and how they adjust during their transitions to college (behavioral). These dynamic relationships might also explain how an intervention differentially influences students from various

backgrounds (e.g., first-generation and/or underrepresented racial minority college students).

Another hallmark of social cognitive theory is that people learn vicariously through their exposure to social models. Information from the social environment helps to inform individuals' perceptions about themselves. That is, by watching others in the social environment, individuals make comparisons to evaluate their own life circumstances.

Sense of Belonging

One key personal factor that may affect students' beliefs and behavior is the degree to which they feel socially connected to others. Sense of belonging has been characterized as a sense of fit or feeling of connectedness to others (Strayhorn, 2018). Baumeister and Leary (1995) described individuals to have the innate desire to maintain strong, interpersonal relationships and to feel socially connected to others. A need to belong socially has also been characterized as one key determinant of intrinsic motivation and psychological well-being (Ryan & Deci, 2017). Therefore, it is no surprise that belonging is important for college students' success.

Feelings of belonging have been associated with many positive outcomes for college students, including their self-efficacy, intrinsic motivation, and task values (Freeman et al., 2007). A sense of belonging is especially important as students transition to college (Hoffman et al., 2002). Within the first six weeks of college, students are particularly susceptible to feeling marginalized and wanting to drop out of college (Tinto, 1988). Students from historically underrepresented social backgrounds (e.g., FG and/or URM students) face disproportionately greater risks of feeling like they do not belong in

college (Ostrave & Long, 2007). Subsequently, worries about belonging can affect their performance in college. This is because students who feel socially isolated often split their attention between focusing on whether they belong and focusing on learning (Romero, 2015; Steele, 1997). Implicit messages about whether one belongs come from various sources in the college environment, and feelings of belonging can change depending on what students experience (Pittman & Richmond, 2008). Researchers are attempting to better understand how institutions can more positively portray a sense of belonging through targeted social-psychological interventions (Romero, 2015; Walton & Brady, 2017).

Information From the Environment

The ways in which individuals are exposed to information partly influences how they interpret it. For example, people might interpret information differently according to the modality in which information is presented to them (Moreno & Mayer, 1999). The *modality principle* suggests that people process information better when information is presented through both visual and auditory channels (as opposed to just one or the other).

Researchers have hypothesized that information delivery modality affects memory (i.e., retention and recall), yet few have considered how modality might affect the development of individuals' motivational or affective judgments (e.g., sense of belonging). According to social cognitive theory, individuals alter their personal beliefs and cognition as they attend to and process information in the environment. These processes could also be affected by how environmental inputs are presented (e.g., social messages through video or written material). Therefore, the modality by which a social-

psychological intervention is presented to students might differentially affect their sense of belonging.

Perceived Similarity to Social Models

Social cognitive theory also contends that people learn vicariously from others in their social environment. What people learn vicariously can alter their beliefs about their own life circumstances. For example, students often learn from their more experienced peers about how to behave under different circumstances.

Social learning is also theorized to be enhanced when observers feel similar to the people they observe (Bandura, 1997). The *model similarity hypothesis* suggests that social models wield more influence on observers' beliefs/behaviors when observers feel a sense of similarity to them (Bandura, 1997). When individuals observe social others to develop their beliefs, "using the performances of similar peers is likely to yield more accurate self-appraisal than using the accomplishments of dissimilar peers" (Bandura, 1986, p. 421). In other words, watching someone with whom one shares a sense of likeness may be a fundamentally different experience than watching someone with whom one shares no feelings of similarity. Indeed, feelings of similarity with others might shape how people perceive and interpret information from the environment. The constant interaction between individual perceptions and the environment may then affect how individuals develop other beliefs, such as a sense of belonging.

Goldstein and Cialdini's (2007) vicarious self-perception theory similarly suggests that people can infer their own attributes by observing the behavior of others with whom they feel a sense of similarity. People come to understand themselves by examining the actions and behaviors of others like them. For example, if an individual

feels a sense of like-ness with another peer, the individual may then come to believe that their own experience may also resemble their peer's experience.

Chapter Two: Literature Review

Although social-psychological interventions can have powerful effects on students' educational outcomes, few studies have examined the social cognitive mechanisms that might affect intervention efficacy (Yeager & Walton, 2011). In this section, I provide a brief overview of social-psychological interventions that have been implemented to address students' sense of belonging. Then, I review relevant literature concerning two mechanisms—delivery modality and feelings of similarity—that might moderate or mediate the effect of interventions on target outcomes.

Social-Psychological Belonging Interventions

Many social-psychological interventions have been developed to mitigate specific educational problems such as achievement gaps between historically underrepresented students and their more privileged peers. Such interventions target specific psychological processes (e.g., students' thoughts, feelings, and/or beliefs) that are known predictors of educational problems (Harackiewicz & Priniski, 2018). For example, research evidence has shown that students, particularly those from historically underrepresented social backgrounds, who feel a greater sense of belonging experience more positive academic outcomes in college (Yeager et al., 2016). Therefore, social-psychological belonging interventions have been developed to target students' worries about fitting in at college.

These belonging interventions were initially designed to reduce academic achievement gaps between Black and Hispanic Americans and their White and Asian American peers (Walton & Cohen, 2007). During the transition to college anyone may

wonder about fitting in during their transition to college; however, students who are members of historically underrepresented groups and who face negative stereotypes are especially at risk of not feeling included or valued in a new academic environment (Yeager & Walton, 2011).

Belonging interventions typically involve social messages intended to normalize students' initial worries about belonging by emphasizing that many students (i.e., not just students with underrepresented backgrounds) often worry about not belonging in college. These intervention messages about belonging have often been portrayed through student narratives in which ostensible peers describe their initial worries about belonging in college that later subsided (Walton & Brady, 2017). After exposure to these narratives, students are then asked to write reflections to help reinforce their own beliefs about belonging (i.e., that initial worries about belonging are shared and short-lived).

Walton and Cohen (2007) were among the first to test a social belonging intervention with first-year college students. They implemented the intervention in a series of laboratory sessions with undergraduate students who were part of a psychology subject pool. After being shown ostensible survey results about common experiences with belonging, participants wrote short essays and delivered testimonials through video to express their own beliefs that initial worries about belonging are normal and bound to change over time. The intervention resulted in “roughly a 90% reduction in the racial achievement gap” between Black and White students' grade point averages (Walton & Cohen, 2007, p. 94).

Replications of these social-psychological belonging interventions across diverse samples have resulted in similar findings (Harackiewicz & Priniski, 2018). In a direct

replication of the belonging intervention at a selective college, Walton and Cohen (2011) found the intervention to improve not only academic outcomes for first-year African American students but also students' self-reported health and well-being.

Persistent achievement gaps between historically underrepresented students and their more advantaged peers have also led researchers to adapt the interventions for different audiences. For example, Yeager et al. (2016) tested an online version of the intervention with exiting high school seniors. High school students who received the social belonging intervention were later more likely to be enrolled full time throughout the first year of college, use academic support services, join an extracurricular activity in college, and live on campus. The authors concluded that students who received the belonging intervention were more socially and academically engaged.

Marksteiner et al. (2019) were among the first to test a social-psychological belonging intervention on first-year college students outside of North America. Researchers found that the intervention positively influenced German students' sense of belonging. Students with migration backgrounds and students who were first in their families to attend college especially benefitted from the belonging intervention. Likewise, students who received the belonging intervention experienced less fluctuation in and lower levels of depression.

Social-psychological belonging interventions have shown evidence of reducing achievement gaps by enhancing academic outcomes for historically underrepresented students during the high school-to-college transition. However, researchers are trying to identify the mechanisms that might moderate or mediate outcomes of the intervention. I next evaluate evidence suggesting that two particular social-cognitive mechanisms—the

modality used to deliver intervention materials and students' feelings of similarity to peer models in intervention material—might influence intervention effects on student outcomes.

Delivery Modality

How individuals perceive, process, and retain information is partly influenced by the way in which the information is presented to them (Mayer, 2017). As noted above, social-psychological belonging interventions often use ostensible peer narratives to reframe student beliefs about belonging (Harackiewicz & Priniski, 2018). For students to reframe their beliefs according to these narratives, they must first attend to and process the messages presented to them. Therefore, how the intervention is presented to students (e.g., through video or written narrative) could affect how successful an intervention is at reframing students' beliefs.

In most social-psychological belonging interventions, students read narratives about belonging presented in writing (e.g., Walton & Cohen, 2007; Yeager et al., 2016). However, providing testimonials through a video delivery format might yield different results. Research on multimedia instruction supports the use of video delivery formats to enhance students' processing of information. Video-based presentations can enhance the dependability of the content portrayed, such that students are more likely to trust the content to be factual and true (Lievens & Sackett, 2006). Videos have also been shown to better support students' interest and comprehension of information compared to a text-only (i.e., written) approach (Hardaway et al., 2018). Researchers have also suggested that multimedia (e.g., video) presentations are more memorable because they enable individuals to process information simultaneously through both visual and auditory

channels (Mayer & Moreno, 2002). Viewers may also engage more when exposed to video portrayals because videos stimulate students' attention by activating a range of sensory modalities (i.e., auditory and visual; Elias & Maher, 1983).

Conversely, irrelevant or distracting material in videos (e.g., video quality, sound quality) might require extraneous processing and weaken the effect of intervention messages (Mayer, 2017). One study examined the cognitive load experienced by undergraduate students during two different class lectures (Homer et al., 2008). Half of students were assigned to a video condition in which they watched a video of a lecturer with slides. Other students were assigned to a no video condition, in which students were only presented slides and audio. Students in the video group experienced significantly greater levels of cognitive load compared to students in the no-video condition.

Although many theorists have described how delivery modality might affect information processing, few researchers have empirically compared a video and text-only narrative. Most of the research regarding delivery modality has focused on how modality affects learning. For example, Lee and List (2018) randomly assigned undergraduate students to reading texts or watching videos and compared their learning outcomes. Participants who read text materials engaged in more frequent, high level annotation strategies compared to those who watched videos; however, students who watched videos reported greater levels of comprehension. The current study investigates how delivery modality might change how individuals respond to and process a social belonging intervention. I examined the differential influence of two intervention delivery modalities (i.e., written and video) on students' sense of belonging and academic grade point averages (GPAs).

Perceived Similarity

Another social cognitive mechanism that might explain intervention effects is how students perceive themselves in relation to peer models presented in an intervention. Does perceiving oneself as similar or dissimilar to the peers portrayed in intervention materials strengthen the effect of the intervention on outcomes? Perceptions of similarity can be based on numerous factors, including cues of phenotypical similarities, relationship closeness, and even perspective taking (Montoya et al., 2008). Goldstein and Cialdini (2007) referred to this construct as a sense of “oneness,” or the extent to which someone feels a sense of shared, merged, or interconnected identities with another person. The terms “perceived similarity,” “feelings of shared characteristics,” and a “sense of like-ness” will be used interchangeably throughout this thesis.

A major gap in the research on perceived similarity is determining how feelings of similarity may serve as a psychological mechanism that undermines or enhances social modeling experiences. Individuals often look to social models as they learn and develop their competency beliefs (Bandura, 2017). When they do, feelings of similarity can be highly impactful (Bandura, 1997). That is, the more similarly individuals feel to a social model, the more meaningful watching the model is to the development of their beliefs, which, in turn, can affect their behavior.

Research on similarity has largely focused on examining the behavioral outcomes of actual similarity to social others in the context of existing relationships (e.g., mentorship dyads, teacher-student relationships). For example, peer homophily (i.e., similarity) has also been shown to predict various social behaviors, including whether individuals sit next to one another (Mackinnon et al., 2011), who adolescents become

friends with (Urberg et al., 1998), and how individuals rate their peers' performances (Strauss et al., 2001).

Although much research has focused on how *actual* similarity affects behavior, less research has focused on how *perceived* similarity might shape individual beliefs. Montoya et al. (2008) differentiated perceived similarity from actual similarity, referring to actual similarity as "an interpersonal situation in which two individuals share attributes" (p. 891). By contrast, perceived similarity refers to one's *beliefs* that another person shares similar characteristics, regardless of whether the other person is actually similar to them. Therefore, perceived similarity does not necessarily depend on actual similarity. Rather, a sense of like-ness may be a response to perspective-taking, cues of genetic relatedness (e.g., phenotypical similarities), shared experience, and relationship closeness. Research has shown that feelings of similarity are also related to individual's behavior. For example, Mitchell et al. (2015) examined perceived similarity among mentor-mentee dyads at a university and found that feelings of similarity were positively associated with greater commitment to mentees' organizations and professions.

Other researchers have experimentally induced feelings of similarity to predict behavior. For example, Goldstein and Cialdini (2007) induced feelings of similarity by prompting students to "take the perspective" of a peer they read about. Those who received the perspective taking prompt were more likely to engage in behaviors similar to the peer they read about. Feelings of similarity have also been shown to predict students' proactive behavior. Gelbach et al. (2016) developed a similarity-inducing intervention that highlighted similarities (e.g., shared beliefs and hobbies) between high school students and their teachers. Students in the intervention condition (who felt more similar

to their teachers) developed closer relationships with their teachers and earned higher course grades, and these effects were stronger for Black and Latinx students.

As noted above, narrative-based social-psychological belonging interventions present students with peer models who share stories about belonging. Feelings of similarity to these peer narrators could influence how belonging testimonials are interpreted and internalized. Some evidence suggests that similarity could even affect individuals' behavior after watching social models. For example, Brown and Inouye (1978) found that time spent on anagram tasks depended on participants' levels of similarity to the social models they viewed. After watching social models fail at anagram tasks, those who felt similar to the models persisted less. In the context of this study, as students are presented with testimonials about belonging in college, feelings of similarity might mediate how these testimonials affect their sense of belonging.

Modality and Perceived Similarity

In the sections above, I have reviewed literature supporting the hypothesis that the effects of a narrative-based social-psychological belonging intervention on student outcomes might depend on how the intervention is delivered or how similarly observers feel to the peer narrators in the intervention. Although these are two distinct mechanisms that may affect intervention outcomes, they may not be independent. It is plausible that the way an intervention is delivered (i.e., in video or in writing) might also affect how similarly observers feel to the peer models delivering the intervention message.

Researchers have not yet examined the differential effectiveness of intervention delivery modalities on individuals' perceived similarity; however, the modality in which the intervention is delivered might also affect how similarly students feel to peer

narrators. For example, students might feel greater similarity when watching a video of a peer talking about their experience than when reading a passage written by a peer (the latter being the modality method used in previous research; Yeager et al., 2016).

Researchers have suggested that videos are better suited to convey the social contexts of a given situation (Harwood & Weissberg, 1987). A video format may offer more social cues and background information (e.g., physical characteristics, mannerisms, accents) with which a viewer can make comparative self-assessments. Students might resonate with or agree more with a peer narrator who shares similar phenotypic characteristics (e.g., racial background, gender). Likewise, students might feel a weaker connection with a person they read about because written narratives offer relatively fewer social cues.

Purpose of the Study

First-generation college students and underrepresented racial minority students face many challenges as they transition from high school to college. Researchers have suggested that achievement gaps between historically underrepresented college students and their White, continuing-generation peers may be in part due to a weaker sense of belonging experienced by many first-generation and/or underrepresented racial minority students once they arrive at college (Stephens et al., 2014). Social-psychological interventions designed to support belonging have been shown to improve outcomes for those historically underrepresented students; however, few studies have examined possible social cognitive factors that might influence their efficacy (Harackiewicz & Priniski, 2018).

The purpose of this study is to test the effects of a social-psychological intervention on first-year college students' sense of belonging and academic GPA and to

investigate whether the intervention reduces social group gaps in belonging or achievement. These social group gaps include gaps between FG and continuing-generation college students and gaps between URM and White students. I also examine the extent to which two social cognitive mechanisms moderate or mediate the relationship between the intervention and student outcomes. Specifically, I investigate differences in the effects of a narrative-based social-psychological belonging intervention as a function of its delivery modality (written or video) and students' perceived similarity on academic outcomes. The following aims and research questions (RQs) were addressed:

Aim 1: To examine the effects of a social belonging intervention on first-year college student outcomes and to determine whether the intervention reduces social group gaps in belonging or achievement

RQ 1a. Does the intervention positively influence first-year college students' sense of belonging or academic GPA?

RQ 1b. Does the intervention reduce belonging gaps between FG and continuing generation students and/or between URM students and White students?

RQ 1c. Does the intervention reduce achievement (i.e., GPA) gaps between FG and continuing generation students and/or URM and White students?

Aim 2: To examine whether the effect of the intervention on student outcomes is moderated by intervention delivery modality (i.e., written or video)

RQ 2a. Is the effect of the intervention on sense of belonging moderated by intervention delivery modality (i.e., written or video)?

RQ 2b. Is the effect of the intervention on first-year GPA moderated by intervention delivery modality (i.e., written or video)?

Aim 3: To examine the social psychological mechanism of perceived similarity as it is related to a social belonging intervention

RQ 3a. Does perceived similarity differ as a function of intervention delivery modality (i.e., written or video)?

RQ 3b. Is perceived similarity enhanced when students share phenotypical characteristics (i.e., gender and/or race) with peer narrators in the video-based intervention version?

RQ 3c. Is the effect of the intervention on sense of belonging or academic GPA mediated by students' perceived similarity to peer narrators?

Chapter Three: Method

Participants

Participants were 1,329 first-year students (62.4% women; 22.2% URM; 29.1% FG students) enrolled in a public, land-grant university in the southeastern United States. This research was conducted at a predominantly White institution (PWI; see Bourke, 2016). Therefore, throughout this thesis, White students were considered to be in the racial majority group. See Table 3.1 for full participant demographics.

Design and Procedure

The research team was involved in the collaborative development of a first-year student survey that was administered by the university's institutional research office. Student surveys were sent via email invitations to all first-year students at three time points: during the first week of the fall semester (August, Time 1), during the final two

weeks of the fall semester (December, Time 3), and during the final month of the spring semester (April, Time 4).

During the third week of class (September 2018; Time 2), the research team recruited first-year students enrolled in introductory writing and academic preparation courses to participate in the intervention by completing a supplemental survey. These courses were selected because they are required of most students during the first year of college. Students in these courses were required to take part in the Time 2 survey for class points; however, only students who consented to share their responses were included in the study. Consent was obtained from students to obtain access to survey responses and their academic records (provided by the university). Over three-quarters (75.3%) of students enrolled in introductory writing and academic preparation courses consented to share their survey data and academic records. A graphical representation of the study design, including a survey timeline, recruitment strategies, and variables of interest is presented in Figure 3.1.

Experimental and Control Conditions

Students were assigned through stratified (by first-generation status and race/ethnicity) random sampling within a Qualtrics survey platform to one of three conditions: a social belonging intervention condition delivered via written narratives ($n = 420$), a social belonging intervention condition delivered via video recorded narratives ($n = 434$), or a passive control condition ($n = 425$). Stratified random sampling was used to ensure equal representation of FG and URM students in each condition.

In both experimental conditions, students were exposed to two ostensibly former students' retrospective accounts of their challenging, yet successful transitions to college

(see Figure 3.2). The intervention narratives normalized worries about belonging and suggested that worries about belonging were likely diminish over time (Yeager et al., 2016). The only distinction in the two conditions was in the mode of delivery.

Students assigned to the *written belonging condition* were presented with two written passages. These passages made no mention of the student narrator's race or gender. Students assigned to the *video belonging condition* were asked to watch two, 2-minute videos that were identically worded to the narratives in the written belonging condition. One video featured an African American female student actor and the other featured a European American male student actor. Video actors were counterbalanced to control for possible ordering effects. That is, participants were equally likely to see the female African American student recount Narrative 1 as they were to see the male European American student recount it (and to see the other actor recount Narrative 2). In this way, all students assigned to the video belonging condition watched two student narratives and were exposed to both student actors.

Participants in both intervention conditions were required to complete the same "saying-is-believing" reflective assignments by responding to two writing prompts. The prompts asked them to reflect on why they might initially feel as though they do not belong and why these feelings are likely to diminish over time. Participants were also told that their responses "might be shared with future students to improve their transition to college." These "saying-is-believing" reflections allowed students to "personalize generic materials," which promotes internalization of the intervention message (Yeager et al., 2016, p. 7). Students were not limited in response time or length, and they were provided with the intervention messages (either in written text or video) again on the

same page to use as a reference. Students who were randomly assigned to a control condition simply took part in the survey with no additional activity. I refer to this as a passive control condition.

Manipulation Checks

Two comprehension questions followed each intervention condition and served as manipulation checks. First, students were required to report whether they had (a) watched videos of students' experiences, (b) read passages about students' experiences, (c) read passages about reading books or watching videos, or (d) none of the above. The second question asked students to verify whether students in the narratives: (a) often worry at first they don't belong, but over time, come to feel at home; (b) usually find college to be the exact same as their high school experience; (c) come to understand factual information in a more sophisticated way; or (d) none of the above. Students who answered both multiple choice questions correctly were considered to have successfully received the intervention. Students who failed these manipulation checks ($n = 50$) were excluded from analyses.

Measures

Perceived Similarity

Students who were randomly assigned to the social belonging intervention condition were asked to rate how similarly they felt to the peers whose stories they had just read or watched. Directly after their exposure to each narrative, students were prompted to "use the slider below to indicate how similar you feel to this person." Students were presented with a sliding scale that ranged from 1 (*Not at all similar*) to 4 (*Highly similar*) in whole number increments. Students' responses to both similarity

items (i.e., one item per narrative) were summed to reflect a combined, perceived similarity (possible range from 2 to 8). Students in the control condition were not presented with any narratives and were therefore not asked about their feelings of similarity.

Sense of Belonging

A broad measure of sense of belonging adapted from Yeager et al. (2016) was assessed at each time point. Three items assessed students' sense of belonging: "Since you've arrived at [university name], how much do you feel that you . . ." (1) Fit in? (2) Belong? and (3) Feel at home? ($\alpha = .95$). Responses were assessed on a 4-point Likert-type rating scale from (1) *Not at all* to (4) *A lot*.

Demographic and Achievement Variables

Student records were obtained from the institution with students' consent. Data included demographic information (i.e., FG status and racial/ethnic background), measures of academic preparedness (i.e., ACT/SAT scores, high school grade point averages), and academic outcomes described below. First-generation (FG) status was assigned to students who indicated that their parents/guardians had not obtained a four-year postsecondary degree. A dichotomous variable was used to categorize students as first-generation (continuing-generation = 0; FG = 1).

A second dichotomized variable was used to categorize students according to their racial minority status (White = 0; Underrepresented racial minority = 1). Students who identify as African American/Black, Hispanic/Latinx, Asian American, Native Hawaiian/Pacific Islander, American Indian/Alaskan Native, or Multiracial were considered underrepresented racial minority students. Many intervention studies have

previously excluded Asian American students from URM categorization (e.g., Yeager et al., 2016); however, because this research was conducted at a predominantly White institution, Asian American students were considered to be underrepresented racial minority students. This is because URM students, including Asian American students, can be “systematically underrepresented through social structures and the ways in which power is situated among groups” (Bourke, 2016, p. 16).

The academic outcome of interest was students’ cumulative first-year GPA (Time 4). A university-created high school index variable was used in some analyses as a statistical control for students’ academic readiness prior to entering college. The high school index score is calculated by the university’s institutional research team as the weighted linear combination of first-year students’ high school GPA and standardized ACT/SAT score, as follows:

$$(10 \times \text{High school GPA}) + (\text{ACT scores} \div 2)$$

High school index scores ranged from 29.1 to 62.0 ($M = 48.55$, $SD = 6.19$).

Gender and Race Matching to Peer Narrators

Students randomly assigned to the video social belonging condition were categorized according to whether they matched the gender and/or race of the peer narrators they viewed in intervention materials. Peer narrators in the video social belonging condition were counterbalanced to control for possible ordering effects. Students in the video social belonging condition were randomly assigned to watch different actors who recounted Story 1. Participants viewed either an African American female student or European American male student narrator. As noted above, perceptions of similarity can be based on numerous factors, including phenotypical similarities

(Montoya et al., 2008). Therefore, I examined whether phenotypical matching could be used to support students' perceived similarity—and in turn, academic outcomes—by considering the effects of matched characteristics (i.e., gender, race) between participants and peer models in the video belonging intervention. The influence of phenotypical matching on students' perceived similarity was only examined for the first narrator they viewed (i.e., for Story 1). This is because students' perceived similarity to the second narrator may have been confounded by their perceptions of the first person they viewed.

Two dichotomous variables were created to operationalize matched status based on gender and race. Specifically, scenarios in which a female student watched a female peer narrator were considered “matched” on gender and were coded as “1.” Scenarios in which a male student watched a female peer narrator were considered “unmatched” on gender and were coded as “0.” Similar methods were used to match students based on their race. Scenarios in which African American students watched the African American peer narrator were considered “matched” on race and were coded as “1.” Scenarios in which a non-African American student watched the African American peer narrator were considered “unmatched” on race and coded as “0.”

Analyses

A brief description of research questions, variables of interest, and corresponding analyses can be found in Table 3.2. The first research question investigated whether the intervention positively influenced first-year college students' sense of belonging or academic GPA. Two three-way analyses of covariance (ANCOVAs) were used to assess differences between students in the written social belonging, video social belonging, and passive control condition. Specifically, two 3 (Condition) X 2 (FG status) X 2 (URM

status) ANCOVAs were used according to the between-subjects design of the study. The first ANCOVA examined the effects of the intervention on students' sense of belonging at the end of their first semester of college. The second ANCOVA examined the effects of the intervention on students' first-year, cumulative GPA. Both analyses included high school index as a covariate to control for potential effects of college readiness on both belonging and GPA.

Social-psychological interventions have been shown to improve outcomes specifically for FG college students and URM students (Walton & Cohen, 2007). Specifically, interventions have been shown to reduce social group achievement gaps between these FG and continuing generation college students and between URM and White students (e.g., Walton & Cohen, 2011; Yeager et al., 2016). Therefore, I also evaluated whether the intervention had differential effects on outcomes for FG students, URM students, or those students in both groups by including relevant demographic variables in the ANCOVA models described above (RQs 1b and 1c).

A descriptive approach was used to examine the social group gaps in belonging between most and least at-risk students due to the substantial discrepancies in sample sizes for these groups. For example, there were only 12 first-generation, underrepresented racial minority students in the written belonging intervention condition, compared to 91 continuing-generation, White students. Extreme discrepancies in sample size between groups can violate the homogeneity of variance assumption, which in turn affects the robustness of the F test (Blanca et al., 2017). In similar work, researchers have foregone statistical testing to examine gap trends between at-risk students and their peers (e.g., Yeager et al., 2016).

Where appropriate, I further investigated intervention interactions to examine belongingness gaps between FG and continuing generation students and/or URM and White students by condition (RQ 1b). Specifically, I ran three simple effects ANCOVAs to examine the main effects of FG and URM status in each condition. Similar methods were used to examine the effects of the intervention on achievement gaps between student groupings.

My second research question investigated whether the intervention's effects on student outcomes were moderated by delivery modality (i.e., written or video belonging intervention). The three-way between-subjects design allowed me to examine whether delivery modality (i.e., written or video) influenced the intervention's effect on students' sense of belonging (RQ 2a) and first-year, cumulative GPA (RQ 2b).

My final research question investigated the role of perceived similarity in the social-psychological belonging intervention. Only data from students who received the social belonging intervention (either video or written) were examined. I conducted an independent samples *t* test to determine whether students' perceived similarity differed between students in the written- versus video- belonging intervention condition (RQ 3a).

I next investigated whether perceived similarity ratings were higher when students assigned to the video belonging condition shared phenotypical characteristics (i.e., gender and/or race) with peer narrators (RQ 3b). A two-way 2 (Gender match status) X 2 (Racial match status) analysis of variance (ANOVA) was used to examine how race-matching and gender-matching might be related to students' reported feelings of similarity to the first peer narrator.

I then assessed whether perceived similarity mediated the relationship between the experimental condition and student outcomes of belonging and GPA (see Figure 3). Two separate mediation models were used to investigate these relationships using Hayes' PROCESS v3.4 macro for SPSS (Hayes, 2017; RQ 3c). Both models included high school index as a covariate.

To determine whether perceived similarity mediated the relationship between the intervention and students' sense of belonging and/or first-year GPA, I examined the direct effect of the intervention condition on belonging (Written = 0, Video = 1; path c'). Then, I considered the indirect effect of the intervention on sense of belonging through perceived similarity (path ab) by regressing perceived similarity on the intervention condition (path a) and regressing sense of belonging on students' perceived similarity (path b).

Where appropriate, I investigated whether the mechanism of perceived similarity was a partial or full mediation. To do this, I assessed whether the total effect of the intervention condition on sense of belonging (path c) was still significant when considering the indirect effects of perceived similarity. If the total effect of the intervention was statistically significant, this would be considered a partial mediation suggesting that the intervention has both direct and indirect effects on students' sense of belonging. If the total effect of the intervention was not statistically significant, this would be considered a full mediation, suggesting that the intervention only has an effect on belonging due to the indirect effects of perceived similarity. Similar methods were used to determine whether perceived similarity mediated the relationship between belonging intervention condition and students' first-year GPA.

All analyses were performed using the Statistical Package for Social Sciences (SPSS) software v.25 (IBM, 2017). Missing data were handled using listwise deletion because this is the default method for the statistical software package.

Table 3.1*Participant Demographic Information (N = 1,329)*

	<i>n</i>	%
Experimental Condition		
Passive Control	425	33.2
Written Social Belonging	420	32.8
Video Social Belonging	434	33.9
Gender		
Male	471	36.8
Female	808	63.2
Generation Status		
First-Generation	372	29.1
Continuing-Generation	907	70.9
Race/Ethnicity (University definition)		
Caucasian/White	952	74.4
African American/Black (Non-Hispanic)	104	8.1
Hispanic	78	6.1
Asian/Pacific Islander	32	2.5
Multi-Racial	69	5.4
Other or Unknown	44	3.5
Underrepresented Racial Minority Status*		
White	952	74.4
URM	284	22.2

Note. Students reported their own race/ethnicity using categories defined by the university. *Students who identify as African American/Black, Hispanic/Latinx, Asian American, Native Hawaiian/Pacific Islander, American Indian/Alaskan Native, or Multiracial were considered URM students.

Table 3.2

Research Questions, Analyses, and Variables

Research Questions	Analyses	Variables used
AIM 1: To examine the intervention’s effects on first-year college student outcomes and to determine whether the intervention reduced social group gaps in belonging or achievement		
1a. Does the intervention positively influence first-year college students’ sense of belonging or academic GPA?	Two, three-way [3 X 2 X 2] ANCOVAs to examine main effects of experimental condition	IV(s): Experimental condition, FG status, URM status DV(s): Sense of belonging; First-year GPA COV: High school index
1b. Does the intervention reduce belonging gaps between first-generation and continuing generation students and/or underrepresented racial minority and White students?	Simple effects ANCOVAs by experimental condition (where appropriate); Descriptive analyses (where appropriate)	IV(s): FG status, URM status DV(s): Sense of belonging COV: High school index
1c. Does the intervention reduce first-year GPA gaps between first-generation and continuing generation students and/or underrepresented racial minority and White students?	Simple effects ANCOVAs by experimental condition (where appropriate); Descriptive analyses (where appropriate)	IV(s): FG status, URM status DV(s): First-year GPA COV: High school index
AIM 2: To determine whether the effect of the intervention on student outcomes is moderated by intervention delivery modality (i.e., written or video)		
2a. Is the effect of the intervention on sense of belonging moderated by intervention delivery modality (i.e., written or video)?	Three-way [3 X 2 X 2] ANCOVA to examine interactions between experimental condition, FG status, and URM status	IV(s): Experimental condition, FG status, URM status DV(s): Sense of belonging COV: High school index

2b. Is the effect of the intervention on first-year GPA moderated by intervention delivery modality (i.e., written or video)?	Three-way [3 X 2 X 2] ANCOVA to examine interactions between experimental condition, FG status, and URM status	IV(s): Experimental condition, FG status, URM status DV(s): First-year GPA COV: High school index
AIM 3: To explore feelings of similarity and to determine whether the effect of the intervention on student outcomes is mediated by students' perceived similarity to peer narrators		
3a. Does perceived similarity differ as a function of delivery modality?	Independent samples <i>t</i> test	IV(s): Intervention condition (excluding control) DV(s): Perceived similarity (combined sum score)
3b. Is perceived similarity enhanced when respondents share phenotypical characteristics (i.e., group membership of racial minority status and/or gender) with peer narrators?	Two-way ANOVA	IV(s): Gender match, Race match DV(s): Perceived similarity to first peer narrator viewed
3c. Is the effect of the intervention on sense of belonging or academic GPA mediated by students' perceived similarity to peer narrators?	Two mediation models	IV(s): Intervention condition DV(s): Sense of belonging; First-year GPA M: Perceived similarity COV: High school index

Note. Experimental condition (Control = 0, Written intervention = 1, Video intervention = 2); Intervention condition (Written = 0, Video = 1), FG status (FG = 1), URM status (URM = 1). M = Mediator. COV = Covariate.

Figure 3.1

Study Design

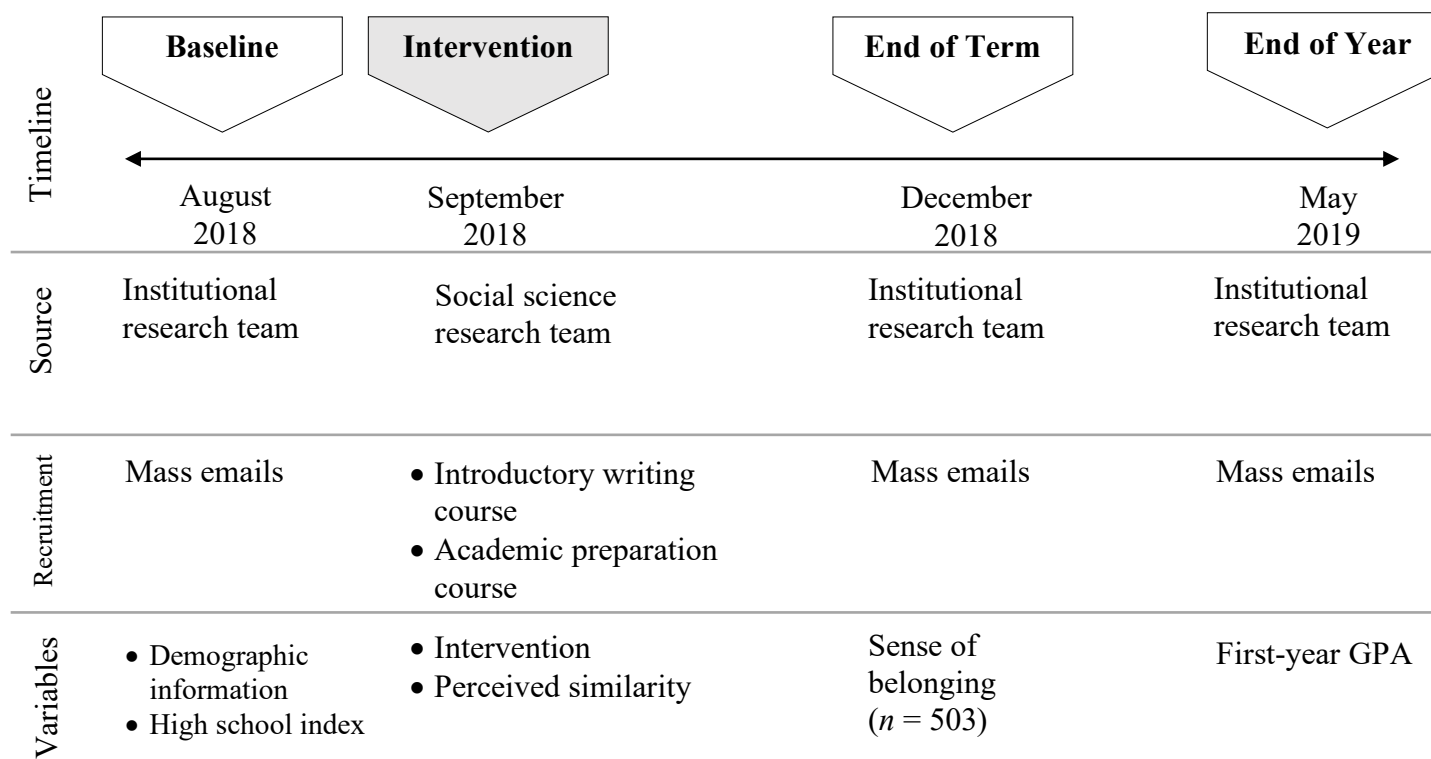


Figure 3.2

Description of Social Belonging Intervention Narratives

Written Social Belonging Condition

Student Story #1

Initially, my transition to [UNIVERSITY NAME] was pretty easy. Hanging out with my friends in my dorm was fun and I met a lot of people early on. After winter break, though, things got harder because I realized that all my really good friends were at home.

However, I decided to just let things fall into place. I got involved in a few campus activities and began to meet people who had similar interests. I realized some of these people were in my classes too, so we became study partners and friends. Once I became more active in [UNIVERSITY NAME] campus life, I found a comfort zone, but it took time before I found my niche. There were definitely times during my first year when I felt pretty lonely.

I would tell future students that feeling lonely is part of adjusting to college. Getting involved in campus groups is really helpful. I can't believe how many different things there are to do around [UNIVERSITY NAME]! There really is something for everyone—whatever your thing is, we probably have a group for it! It can be scary to branch out from the people who you live with, but that's the way I began to feel at home at [UNIVERSITY NAME].

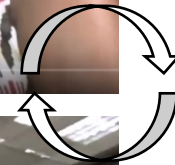
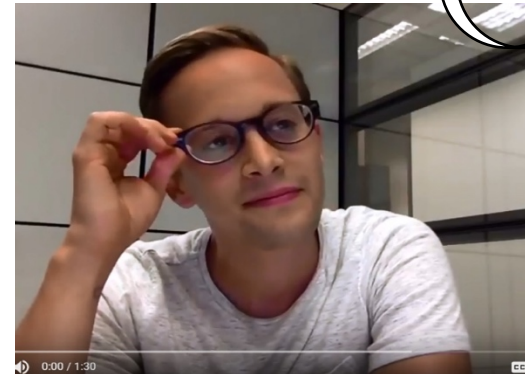
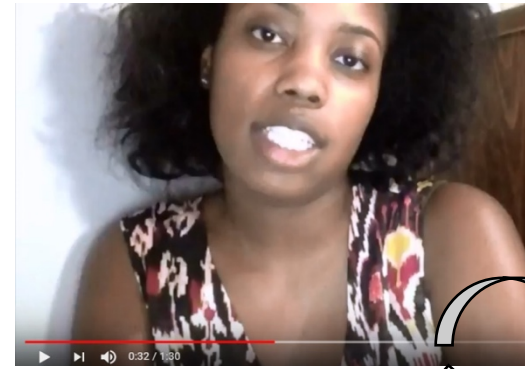
Student Story #1

My first few months at [UNIVERSITY NAME], I didn't really know what I was going. I don't think many people do. When I left class, I just went to a study lab. When I left lab, I just went home and did more work. Even in the car, I was just studying and it wasn't productive. I was just doing the same problems over and over again. I felt stressed, but that's how I thought college just was—lonely and hard.

Eventually, I talked with a few other students in class and we decided to try studying together. It was really helpful—talking about the class, quizzing each other, and going to the TA or professor with questions helped me understand the material better. And we ended up becoming friends too, so I felt less stressed and lonely too. I still hit the books on my own when I need to, but I learned that talking things through with other people helps me get unstuck when class gets tough or I don't understand a problem.

My advice to future students? College is a new experience. It takes time to learn how to do it. But you don't have to pick between doing well in class and making friends of having a good experience. You can do both.

Video Social Belonging Condition*



Note. Intervention narratives were adapted from Yeager et al. (2016). *Video narratives were identical to written narratives and were counterbalanced to control for possible ordering effects.

Chapter Four: Results

The purpose of this thesis study was to test effects of a social-psychological intervention on students' sense of belonging and academic GPA, and to examine the extent to which two social cognitive mechanisms influence intervention outcomes. Specifically, I investigated the effects of a narrative-based social-psychological belonging intervention on academic outcomes as a function of (a) intervention delivery modality (written or video) and (b) students' perceived similarity to peer narrators.

Intervention Outcomes by Modality

The first two research questions examined whether the social-psychological belonging intervention improved two student outcomes: sense of belonging and first-year GPA. I also assessed whether these effects were moderated by delivery modality. Prior to conducting primary analyses, I checked to ensure that students who were experimentally assigned to different conditions did not systematically vary in their sense of belonging or academic readiness. A baseline analysis of variance (ANOVA) revealed no statistically significant differences in students' sense of belonging at the beginning of the semester (Time 1) by condition, $F(2, 1258) = 1.25, p = .29, \eta_p^2 < .001$. A second baseline ANOVA revealed no statistically significant differences in students' academic readiness (i.e., high school index scores) by condition, $F(2, 1274) = 0.27, p = .76, \eta_p^2 < .001$.

Sense of Belonging

First, I examined the effects of the intervention on students' sense belonging and whether results differed depending on the delivery modality of the intervention (RQs 1a and 2a). The 3 (Condition) X 2 (FG status) X 2 (RM status) factorial ANCOVA revealed a main effect of the intervention on students' end of semester sense of belonging that

approached statistical significance, $F(2, 429) = 2.53$, $p = .08$, $\eta_p^2 = .01$ (see Table 4.1). Post hoc analyses revealed that students who received the written social belonging condition ($M = 3.32$, $SD = 0.81$) reported greater levels of belonging than did students who received the video social belonging condition ($M = 3.08$, $SD = 0.84$), when controlling for high school index. Students in the belonging conditions did not differ from those in the control group ($M = 3.10$, $SD = 0.80$).

Next, I investigated whether the effects of the intervention differed specifically for FG and URM students (RQ 1b-c). There was a significant main effect of URM status on students' sense of belonging, $F(1, 429) = 7.34$, $p < .01$, $\eta_p^2 = 0.02$. Regardless of their experimental condition, URM students reported significantly lower levels of belonging ($M = 2.95$, $SD = 0.83$) at the end of the semester compared to their White peers ($M = 3.23$, $SD = 0.81$), controlling for high school index. I also explored possible interactions between the experimental condition, FG status, and URM status. The interactions between experimental condition and FG status or URM status were not statistically significant. In other words, FG students reported similar levels of belonging in the control ($M = 3.12$, $SD = 0.85$), written belonging ($M = 3.23$, $SD = 0.82$), and video belonging conditions ($M = 3.01$, $SD = 0.80$). URM students also reported similar levels of belonging in the control ($M = 2.92$, $SD = 0.89$), written belonging ($M = 3.14$, $SD = 0.77$), and video belonging conditions ($M = 2.81$, $SD = 0.82$). Adjusted means can be found in Table 4.3.

Cumulative First-Year GPA

I next investigated the effects of the belonging intervention on students' cumulative first-year GPA (RQ 1a). I also examined whether the effect of the intervention on students' first-year GPA differed according to the intervention modality

(RQ 2b). The 3 (Condition) X 2 (FG status) X 2 (URM status) factorial ANCOVA revealed no statistically significant main effects of the intervention on students' cumulative first-year GPA, $F(2, 1168) = 1.27, p = .28, \eta_p^2 < .01$ (see Table 4.4). In other words, students randomly assigned to the written belonging intervention ($M = 3.12, SD = 0.77$), the video belonging intervention ($M = 3.08, SD = 0.74$), or the passive control condition ($M = 3.04, SD = 0.76$) had similar first-year GPAs (see Table 4.5). Adjusted means can be found in Table 4.6.

Finally, I examined whether the effects of the social belonging intervention on students' GPA differed for FG and URM students (RQ 1c). The ANCOVA revealed an interaction between the experimental condition and FG-status on students' first-year GPA that approached statistical significance, $F(2, 1168) = 2.57, p = .08, \eta_p^2 < .01$. Therefore, a simple effects ANCOVA was conducted to examine how the intervention might affect FG students specifically. The simple effects ANCOVA revealed that FG students had significantly lower first-year GPAs than did continuing-generation college students in both the control [$F(1, 393) = 23.67, p < .001, \eta_p^2 = 0.06$] and video social belonging conditions [$F(1, 398) = 7.80, p < .01, \eta_p^2 = 0.02$], controlling for high school index. However, there were no significant differences in first-year GPA between FG and continuing-generation students who were assigned to the written belonging intervention condition, $F(1, 375) = 2.09, p = .15, \eta_p^2 = .01$. This suggests that the written belonging intervention removed the achievement gap between FG and continuing-generation students.

When examining the effects of the intervention on URM students' first-year GPA, I found no statistically significant interactions between the experimental condition and

URM status, $F(2, 1168) = 1.86, p = .16$. That is, URM students randomly assigned to the written belonging intervention ($M = 2.87, SD = 0.85$), the video belonging intervention ($M = 2.97, SD = 0.76$), or the passive control condition ($M = 2.85, SD = 0.83$) had similar first-year GPAs.

The ANCOVA results revealed a statistically significant three-way interaction for between the experimental condition, FG-status, and URM status, $F(2, 1168) = 3.50, p < .05, \eta_p^2 = 0.01$. Given subgroup sample size restrictions, a descriptive analysis was used to examine achievement gap trends between students in the most and least at-risk groups (see Figure 4.1). This descriptive analysis revealed that both versions of the social belonging intervention reduced achievement gaps between the most (FG, URM) and least (continuing generation, White) at-risk students. First-year GPA gaps between these students in the passive control, written social belonging, and video social belonging conditions were 0.68 points, 0.46 points, and 0.39 points, respectively.

Perceived Similarity

Another primary aim of this thesis was to determine whether participants who felt a greater degree of similarity to peer narrators in the intervention may have benefitted more from the intervention itself (RQs 3a-c). Only data from students who received the social belonging intervention (either written or video) were used to examine the role of perceived similarity. I first assessed whether feelings of similarity differed between students who were assigned to the written belonging intervention and to the video belonging condition. I then investigated whether phenotypical matching influenced how similarly students felt to the peer narrators they viewed. Finally, I investigated whether perceived similarity mediated the effects of the intervention on student outcomes.

Differences by Modality

First, I assessed students' whether perceptions of similarity might differ according to which modality of the intervention students received (RQ 3a). An independent samples t test revealed that students in the written belonging intervention condition ($M = 4.70$, $SD = 1.28$) reported significantly higher levels of perceived similarity to peer narrators than did students in the video belonging intervention condition ($M = 4.50$, $SD = 1.13$), $t(832.3) = 2.37$, $p < .05$, 95% CI [0.03, 0.36] indicating that delivery modality had a small effect on students' feelings of similarity (Cohen's $d = 0.16$).

Matching by Race and Gender

I then examined the effect of phenotypical matching to the first peer narrator's race and/or gender on students' perceived similarity (RQ 3b). Recall that students in the video social belonging condition were categorized by whether or not they matched the race and gender of the first peer narrator they viewed. A 2 (Gender match status) X 2 (Racial match status) ANOVA revealed no statistically significant main effects for gender matching [$F(1, 441) = 0.002$, $p = .96$] or race matching [$F(1, 441) = 1.78$, $p = .18$] on students' perceived similarity scores. That is, there were no statistically significant differences in perceived similarity between students whose gender matched the peer narrator's gender ($M = 2.41$, $SD = 0.74$) and students whose gender did not match the peer narrator's gender ($M = 2.41$, $SD = 0.72$), Cohen's $d = .01$. Likewise, there were no statistically significant differences in perceived similarity between students who were racially matched to the peer narrator ($M = 2.47$, $SD = 0.71$) and students who were not ($M = 2.37$, $SD = 0.74$), Cohen's $d = .07$. However, results showed a statistically significant interaction between gender and racial match status, $F(1, 417) = 7.38$, $p < .01$.

An additional simple effects ANOVA was conducted to further examine the interaction between gender and race matching on students' perceived similarity. Analyses revealed that the main effect of racial matching on perceived similarity was only statistically significant for students who were not matched on gender, $F(1, 200) = 5.78, p < .05$. In other words, racially matched students ($M = 2.55, SD = 0.72$) only reported greater levels of perceived similarity compared to racially non-matched students ($M = 2.32, SD = 0.70$) when students were not also matched on gender, Cohen's $d = .32$ (see Table 4.7). When students matched the gender of the peer narrator, there were no statistically significant differences between students who matched the peer narrator's race ($M = 2.31, SD = 0.63$) and students who did not match the peer narrator's race ($M = 2.49, SD = 0.63, Cohen's d = .27$). Taken together, these results indicate that students who matched the peer narrator on one characteristic (either gender or race) reported greater levels of similarity than students who matched on both characteristics or on neither characteristic (see Figure 4.1).

Perceived Similarity as a Mediator

Two models were tested to determine whether perceived similarity mediated the relationship between intervention condition (written = 0, video = 1) and students' end of semester belonging and first-year GPA (RQ 3c). Students in the passive control condition were excluded from these analyses because they were not exposed to peer narrators and were, therefore, not asked about their perceived similarity. I also controlled for students' academic readiness (i.e., high school index) in each analysis.

The first model tested perceived similarity as a mediator of the relationship between intervention condition and students' sense of belonging (see Figure 4.2). The

intervention condition directly predicted students' sense of belonging, $b = -0.24$, $p < .05$, CI [-.43, -.05] (path c'). Students in the video social belonging condition rated their sense of belonging an average of 0.24 points lower than students in the written social belonging condition.

Results revealed no direct relationship between the intervention condition and the hypothesized mediator, perceived similarity, $b = -0.24$, $p = .09$, CI [-0.52, 0.03] (path a). That is, regardless of their assignment to either the written social belonging intervention or the video social belonging intervention, students did not differ in their ratings of perceived similarity to peer narrators. Additionally, students' reported levels of similarity did not predict their end of semester belonging (path b); thus, the indirect effect of intervention condition on students' sense of belonging through levels of perceived similarity was not statistically significant (controlling for high school index; path ab).

I next examined perceived similarity as a mediator of the relationship between intervention condition and students' first-year GPA (see Figure 4.3). The intervention condition did not significantly predict students' first-year GPA, controlling for students' high school index (path c'). However, the intervention significantly predicted students' perceived similarity, $b = -.18$, $p < .05$, CI [-.34, -.01] (path a). Specifically, students in the video social belonging condition rated their perceived similarity an average of 0.18 points lower than students in the written social belonging condition. Perceived similarity was also found to predict students' first-year GPA, such that students who reported greater levels of similarity had higher GPAs, $b = .05$, $p < .05$, CI [.01, .08] (path b). However, the indirect effect of intervention condition on students' first-year GPA through perceived similarity was not statistically significant (path ab). Overall, these mediation

analyses revealed that perceived similarity did not act as a mediating mechanism for the relationship between intervention condition and student outcomes.

Table 4.1*ANCOVA Results for Students' Sense of Belonging*

Source	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	<i>p</i>	η_p^2
Intercept	37.42	1	37.42	56.67	< .01	.12
High School Index	1.26	1	1.26	1.91	.17	< .01
Experimental Condition	3.34	2	1.67	2.53	.08	.01
FG Status	0.22	1	0.22	0.33	.56	< .01
URM Status*	4.84	1	4.84	7.34	< .01	.02
Experimental Condition X FG Status	0.45	2	0.23	0.34	.71	< .01
Experimental Condition X URM Status	0.05	2	0.03	0.04	.96	< .01
FG Status X URM Status	0.47	1	0.47	0.72	.40	< .01
Experimental Condition X FG Status X URM Status	0.11	2	0.06	0.09	.92	< .01
Error	283.28	429	0.66			

Note. A 3 (Experimental Condition) x 2 (FG Status) x 2 (URM Status) ANCOVA was used to examine differences across groups, with High School Index as a covariate. FG = First-generation college student. URM = Underrepresented racial minority student. Variables were defined as followed: Condition (Control = 0, Written Intervention = 1, Video Intervention = 2), FG Status (FG = 1), URM Status (URM = 1).

**p* < .05.

Table 4.2*Means and Standard Deviations for Students' Sense of Belonging by Condition, FG Status, and URM Status*

	Passive Control			Written Social Belonging			Video Social Belonging		
	<i>n</i>	<i>Mean</i>	<i>SD</i>	<i>n</i>	<i>Mean</i>	<i>SD</i>	<i>n</i>	<i>Mean</i>	<i>SD</i>
Full Sample	143	3.10	0.80	149	3.32	0.81	150	3.08	0.83
FG Status									
FG	46	3.12	0.85	39	3.23	0.82	45	3.01	0.80
Continuing-generation	97	3.09	0.78	110	3.35	0.81	105	3.10	0.85
URM Status									
URM	29	2.92	0.89	31	3.14	0.77	34	2.81	0.82
White	114	3.15	0.77	118	3.37	0.82	116	3.16	0.82
FG X URM Status									
FG, URM	16	2.90	0.94	12	2.97	0.83	11	2.73	0.65
FG, White	30	3.24	0.79	27	3.35	0.81	34	3.11	0.83
Continuing-generation, URM	13	2.95	0.86	19	3.25	0.73	23	2.86	0.91
Continuing-generation, White	84	3.11	0.77	91	3.38	0.83	82	3.17	0.82

Note. FG = First-generation college student. URM = Underrepresented racial minority student.

Table 4.3*Adjusted Means and Standard Errors for Students' Sense of Belonging by Condition, FG Status, and URM Status*

	Passive Control			Written Social Belonging			Video Social Belonging		
	<i>n</i>	<i>Mean</i>	<i>SE</i>	<i>n</i>	<i>Mean</i>	<i>SE</i>	<i>n</i>	<i>Mean</i>	<i>SE</i>
Full Sample	143	3.05	0.09	149	3.24	0.09	150	2.98	0.09
FG Status									
FG	46	3.08	0.13	39	3.18	0.14	45	2.93	0.14
Continuing-generation	97	3.02	0.12	110	3.31	0.10	105	3.03	0.10
URM Status									
URM	29	2.92	0.15	31	3.12	0.15	34	2.82	0.15
White	114	3.18	0.09	118	3.37	0.09	116	3.14	0.15
FG X URM Status									
FG, URM	16	2.91	0.20	12	2.98	0.24	11	2.76	0.25
FG, White	30	3.24	0.15	27	3.37	0.16	34	3.11	0.14
Continuing-generation, URM	13	2.93	0.23	19	3.26	0.19	23	2.89	0.17
Continuing-generation, White	84	3.11	0.09	91	3.37	0.09	82	3.16	0.09

Note. FG = First-generation college student. URM = Underrepresented racial minority student. Adjusted means were calculated using the covariate of high school index.

Table 4.4*ANCOVA Results for Students' First-Year GPA*

Source	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	<i>p</i>	η_p^2
Intercept	0.11	1	0.11	0.26	.61	< .01
High School Index*	155.00	1	155.00	378.61	<.01	0.25
Experimental Condition	1.04	2	0.52	1.27	.28	< .01
FG Status*	11.07	1	11.07	27.04	<.01	.02
URM Status	0.70	1	0.70	1.71	.19	< .01
Experimental Condition X FG Status	2.10	2	1.05	2.57	.08	< .01
Experimental Condition X URM Status	1.52	2	0.76	1.86	.16	< .01
FG Status X URM Status	0.61	1	0.61	1.50	.22	< .01
Experimental Condition X FG Status X URM Status*	2.86	2	1.43	3.50	.03	.01
Error	478.18	1168	0.41			

Note. A 3 (Experimental Condition) x 2 (FG Status) x 2 (URM Status) ANCOVA was used to examine differences across groups, with High School Index as a covariate. FG = First-generation college student. URM = Underrepresented racial minority student. Variables were defined as followed: Condition (Control = 0, Written Intervention = 1, Video Intervention = 2), FG Status (FG = 1), URM Status (URM = 1).

**p* < .05.

Table 4.5*Means and Standard Deviations for Students' First-Year GPA by Condition, FG Status, and URM Status*

	Passive Control			Written Social Belonging			Video Social Belonging		
	<i>n</i>	<i>Mean</i>	<i>SD</i>	<i>n</i>	<i>Mean</i>	<i>SD</i>	<i>n</i>	<i>Mean</i>	<i>SD</i>
Full Sample	398	3.04	0.76	380	3.12	0.77	403	3.08	0.74
FG Status									
FG	115	2.76	0.86	106	2.87	0.85	114	2.89	0.75
Continuing-generation	283	3.16	0.68	274	3.21	0.85	289	3.16	0.72
URM Status									
URM	94	2.85	0.83	82	2.87	0.85	89	2.97	0.76
White	304	3.10	0.72	298	3.18	0.73	314	3.11	0.73
FG X URM Status									
FG, URM	43	2.48	0.90	38	2.80	0.77	36	2.78	0.79
FG, White	72	2.93	0.80	68	2.92	0.85	78	2.95	0.73
Continuing-generation, URM	51	3.17	0.61	44	2.93	0.92	53	3.11	0.71
Continuing-generation, White	232	3.16	0.70	230	3.26	0.68	236	3.17	0.73

Note. FG = First-generation college student. URM = Underrepresented racial minority student. Adjusted means were calculated using the covariate of high school index.

Table 4.6*Adjusted Means and Standard Errors for Students' First-year GPA by Condition, FG Status, and URM Status*

	Passive Control			Written Social Belonging			Video Social Belonging		
	<i>n</i>	<i>Mean</i>	<i>SE</i>	<i>n</i>	<i>Mean</i>	<i>SE</i>	<i>n</i>	<i>Mean</i>	<i>SE</i>
Full Sample	398	2.98	0.04	380	3.02	0.04	403	3.07	0.04
FG Status									
FG	115	2.79	0.06	106	2.95	0.07	114	2.96	0.07
Continuing-generation	283	3.17	0.05	274	3.08	0.05	289	3.18	0.05
URM Status									
URM	94	2.92	0.07	82	2.96	0.07	89	3.10	0.07
White	304	3.04	0.04	298	3.08	0.04	314	3.04	0.04
FG X URM Status									
FG, URM	43	2.63	0.10	38	2.95	0.10	36	2.94	0.11
FG, White	72	2.95	0.08	68	2.96	0.08	78	2.97	0.07
Continuing-generation, URM	51	3.20	0.09	44	2.96	0.10	53	3.26	0.09
Continuing-generation, White	232	3.14	0.04	230	3.20	0.04	236	3.11	0.04

Note. FG = First-generation college student. URM = Underrepresented racial minority student. Adjusted means were calculated using the covariate of high school index.

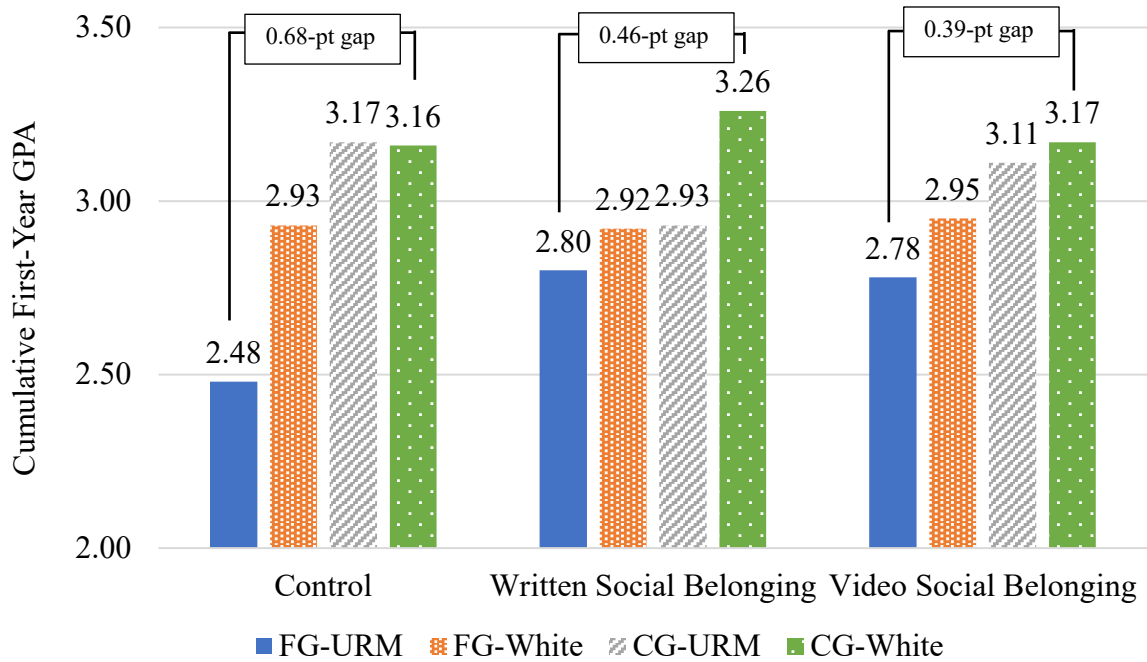
Table 4.7*Perceived Similarity to Peer Narrator by Gender and Race Matching (N = 434)*

	Gender Matched			Gender Non-Matched			Full Sample		
	<i>n</i>	<i>Mean</i>	<i>SD</i>	<i>n</i>	<i>Mean</i>	<i>SD</i>	<i>n</i>	<i>Mean</i>	<i>SD</i>
Full Sample	209	2.44	0.75	225	2.43	0.72	-	-	-
Race Matched	58	2.31	0.63	115	2.55	0.72	173	2.47	0.69
Race Non-Matched	144	2.49	0.72	104	2.32	0.70	248	2.42	0.75

Note. Only data from participants who were assigned to the video belonging condition were examined. Students were considered “gender matched” when they had the same gender as the first peer narrator they viewed (e.g., scenarios in which a female student watched a female peer narrator). Students were considered “race matched” when they had the same race as the first peer narrator they viewed (e.g., scenarios in which a African American student watched the African American peer narrator).

Figure 4.1

Gaps in First-Year GPA Between First-Generation, Underrepresented Racial Minority Students and Continuing-Generation, White Students



Note. FG-URM = First-generation, underrepresented racial minority students. FG-White = First-generation, White students. CG-URM = Continuing-generation, underrepresented racial minority students. CG-White = Continuing-generation, White students. Achievement gaps are based on raw means scores for each student grouping.

Figure 4.2

Perceived Similarity Ratings Based on Gender and Race Match Between Participants and Video Narrators

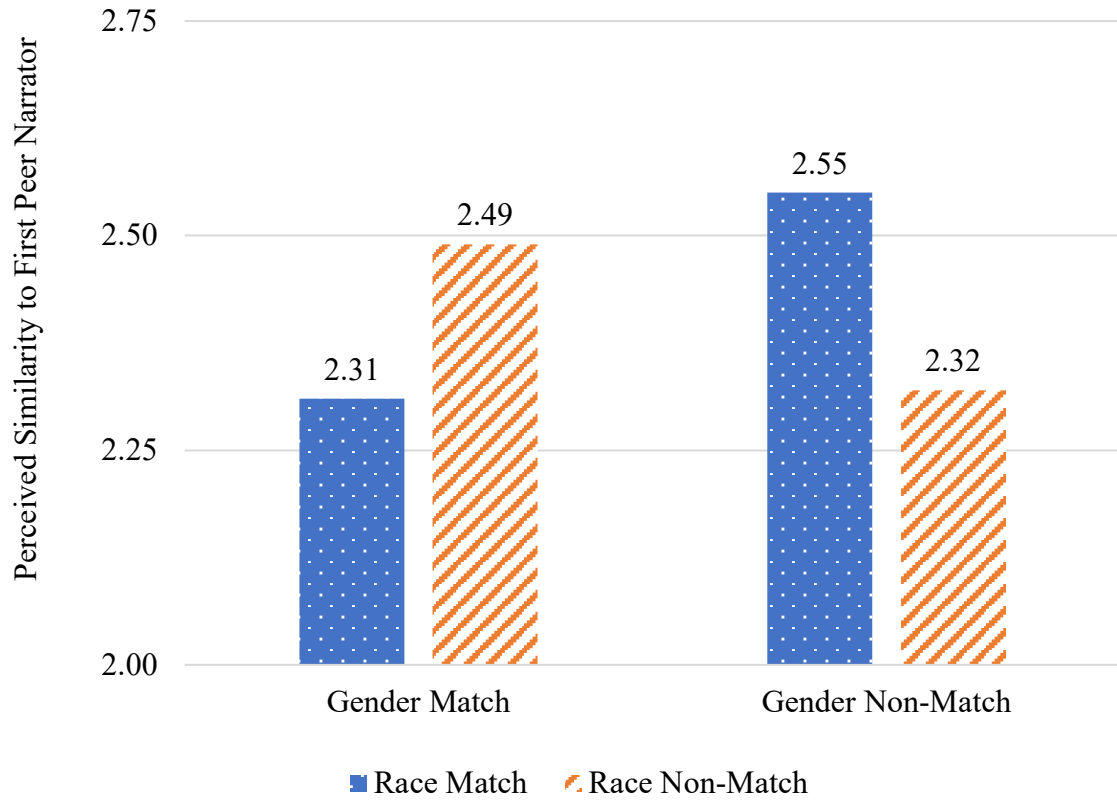
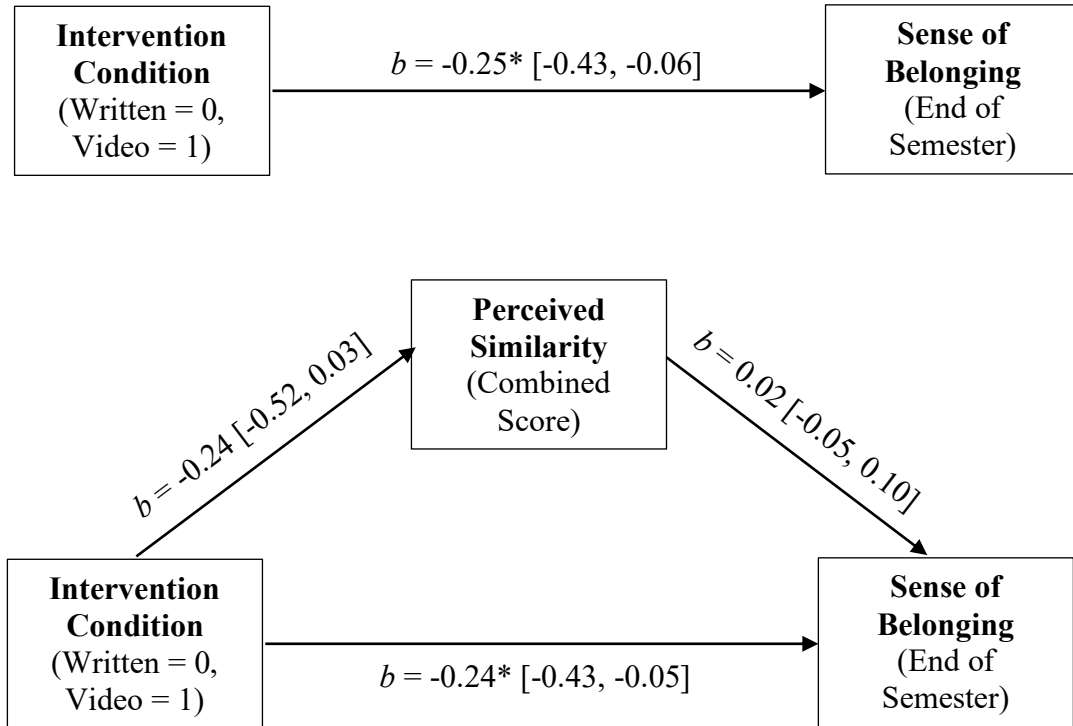


Figure 4.3

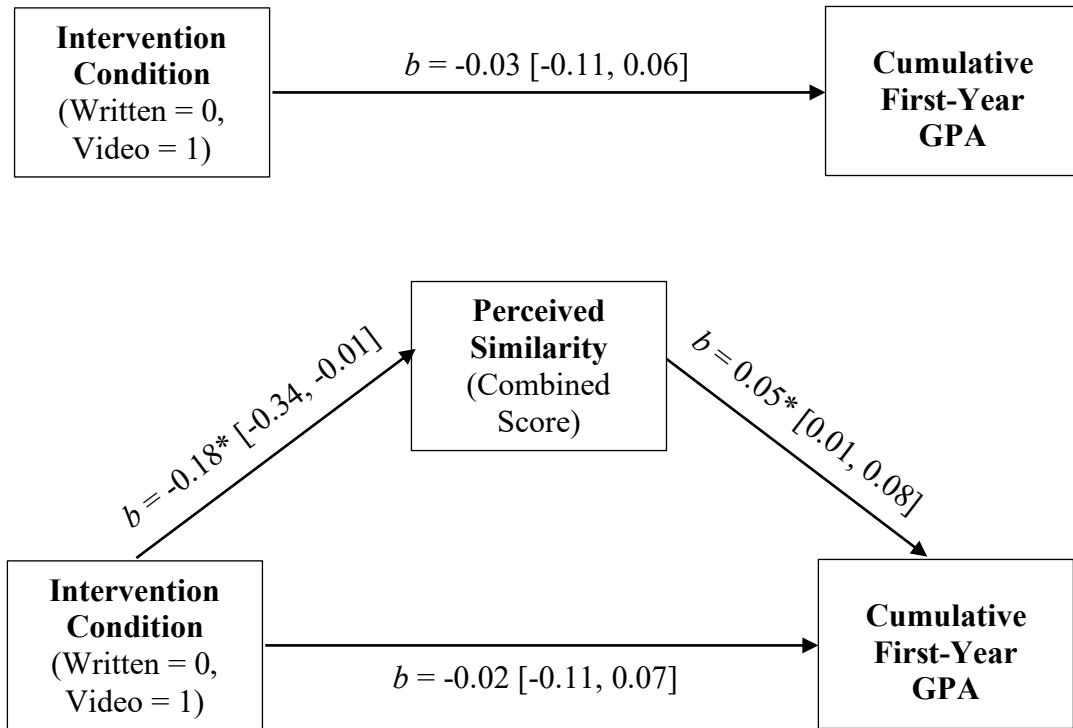
Perceived Similarity as a Mediator Between Intervention Condition and Sense of Belonging



Note. $*p < .05$. Analyses control for high school index.

Figure 4.4

Perceived Similarity as a Mediator Between Intervention Condition and First-Year GPA



Note. $*p < .05$. Analyses control for high school index.

Chapter Five: Discussion

The purpose of this thesis was to investigate the effects of a narrative-based social belonging intervention and to consider its efficacy based on students' sociodemographic characteristics (i.e., race, generation status). I also examined two possible mechanisms (i.e., delivery modality and perceived similarity) related to intervention efficacy.

Overall Effects of the Intervention

My first aim was to investigate the effects of a brief, social-psychological belonging intervention on student outcomes. The social belonging intervention did not appear to affect students' sense of belonging for the full sample (RQ 1a). Students in the social belonging conditions reported similar levels of belonging to those in the passive control condition. This somewhat surprising finding could be due to attrition at the end of the semester. Only 53.8% (503 of 1,329) students took part in end-of-semester surveys. This attrition may have been non-random and related to students' sense of belonging. For example, students who did not feel like they belonged may have been less likely to engage with survey materials sent by the institution at the end of the semester. Conversely, students with higher levels of belonging may have been more compliant with a university-sent survey. This may have reduced the variability in belonging scores, which could have been a source of bias.

I next examined the intervention's effects on students' first-year GPA for which data were available and did not depend on self-report. Social belonging interventions have been shown to positively influence students' GPA during the first year of college (e.g., Patterson et al., 2017). In this case, however, the social belonging intervention, on average, did not affect first-year students' cumulative first-year GPA. Nevertheless, brief

or “light-touch” social-psychological interventions rarely have meaningful effects for all first-year students. As described previously, social psychological interventions target specific problems (Harackiewicz & Priniski, 2018). Social belonging interventions were developed to target social group achievement gaps and mitigate negative feelings of stereotype threat among historically underrepresented students (Yeager & Walton, 2011). As Yeager and Walton (2011) explained, social-psychological interventions “are powerful tools rooted in theory, but they are context dependent and reliant on the nature of the educational environment” (p. 268). In this study, most students had parents who attended college and most students were White. The setting of the study was a predominantly White institution. Continuing-generation and White students face fewer negative stereotypes and have higher social class standing relative to others at their institution (Shapiro et al., 2018; Stephens et al., 2012; Walton & Cohen, 2007). Therefore, only small, if any, intervention effects were expected for the full sample.

Reducing Social Group Gaps

A major objective of this thesis was to investigate whether the belonging intervention might reduce belonging and achievement gaps between historically underrepresented students (i.e., FG and/or URM) and their continuing-generation and/or White peers. Past research has shown belonging interventions to reduce achievement gaps between FG and continuing-generation students (Marskeiner et al., 2019; Yeager et al, 2016), as well as achievement gaps between URM and White students (Walton & Cohen, 2007, 2011). Therefore, I examined interactions between experimental condition, FG-status, and/or URM-status.

Sense of Belonging

I first examined whether the intervention had differential effects on FG and/or URM students' sense of belonging (RQ 1b). FG and URM students are at especial risk of not feeling like they belong in college (Stephens et al., 2014; Walton & Cohen, 2007). To my surprise, the results of this study provided no evidence that the social belonging intervention had differential effects on FG and/or URM students' sense of belonging. Regardless of experimental condition, URM students reported feeling less like they belonged than did White students.

Researchers have found social belonging interventions to be particularly beneficial for historically underrepresented students' sense of belonging. For example, Marksteiner et al. (2019) found a belonging intervention to increase sense of belonging among German college students with non-German migration backgrounds (who are racially underrepresented in German schools). Likewise, the authors found the belonging intervention to support first-generation college students' sense of belonging. Marksteiner et al.'s (2019) study may have been more effective at increasing students' sense of belonging because their belonging intervention required students to write daily diary entries about their experiences and belonging. The practice of writing diary entries may have better supported the internalization of the intervention.

As noted above, the findings may be due to attrition and self-selection in our sample. Roughly 60% of the sample did not report their end of semester belonging in surveys sent by the institutional research team. This attrition may be non-random and related to students' sense of belonging. Students who feel less like they belong may have been less likely to engage with survey materials sent by the institution. Additionally, FG

and/or URM students face disproportionately greater risks of college dropout and are more likely to have dropped out of the study. This could have reduced the number of FG and/or URM students in our sample, potentially biasing results and conclusions. Another limitation was that this study used listwise deletion in all analyses. Other statistical techniques to handle missing data might produce more reliable results.

Cumulative First-Year GPA

Social-psychological interventions often help students who are most at risk of college dropout (Stephens et al., 2014). When examining this possibility among URM and White students (RQ 1c), however, I found no evidence to suggest that the belonging intervention used in this study reduced achievement gaps. Indeed, regardless of their experimental condition, there were no differences in URM and White students' first-year GPAs when controlling for students' academic readiness. It bears noting that the URM definition used for this study was broad. Asian students were categorized in the URM group, even though they typically perform at similar rates to White students (DeAngelo et al., 2011). Findings may have been different had I examined group differences by each ethnicity or race. For example, other researchers have found social belonging interventions to improve the academic performance of Black and Hispanic students, specifically (Walton & Cohen, 2007, 2011; Yeager et al., 2016).

Although there were minimal effects of the belonging intervention on URM students' GPA, the intervention was found to reduce achievement gaps between FG and continuing-generation college students. Among student randomly assigned to the written intervention condition, FG students performed just as well as continuing-generation college students. That is, the written belonging intervention removed achievement gaps

between FG and continuing-generation college students. Additionally, although there were still significant GPA gaps between FG and continuing-generation college students assigned to the video belonging condition, this gap was descriptively smaller than that between these groups who were assigned to the control group. This provides more evidence to suggest that belonging interventions can be used to specifically support first-generation college students' achievement. For example, Yeager et al. (2016) not only found a social-psychological belonging intervention to raise FG college students' first-year GPA, but the intervention also reduced the percentage of students in the bottom quintile of their class rankings. Continuing-generation students neither benefitted nor were harmed from the intervention.

Students first in their families to pursue a college degree often face negative stereotypes about their abilities and are generally numerically underrepresented in college (Stephens et al., 2012). Like underrepresented racial minority students, FG students can face a cultural mismatch during the transition to college (Covarrubias et al., 2019). For example, first-generation college students have been shown to have more interdependent motives for attending college (such as supporting their families) compared to continuing-generation college students. The independent cultural norms (e.g., independent expectations of self-expression and individual freedom) of U.S. universities can interfere with FG students' common interdependent norms (Stephens et al., 2012). This cultural mismatch can then lead FG students to question their fit with the university, which can also undermine their performance. Therefore, it comes as no surprise that the belonging intervention might have been especially beneficial for supporting FG students' achievement.

Modality Differences

A second objective of this study was to examine whether delivery modality of the intervention moderated its effect on students' sense of belonging and first-year cumulative GPA. Students randomly assigned to the written social belonging condition reported significantly greater levels belonging at end of semester than did those assigned to the video social belonging condition. That is, the written version of the intervention appears to have been more effective at supporting students' beliefs about belonging. The written version of the intervention also appeared to be more effective at closing social group achievement gaps. As noted above, FG students who were randomly assigned to read passages related to belonging performed equally as well as continuing-generation college students. This was not the case for FG students assigned to the video belonging intervention. These results did not support my original hypothesis that a video version of the intervention may be more effective at positively influencing student outcomes. However, there are a number of reasons why the video version of the intervention may have been less effective at reducing social group achievement gaps.

Researchers have suggested that complex multi-media presentations, such as videos, may require more mental effort from students to process material and store it in long-term memory (Mayer et al., 2001). The video condition may have burdened students' with irrelevant or distracting material that required extraneous information processing (Mayer, 2017). Students who worry about belonging already have to split their attention between worrying about whether they belong and focusing on their learning. These split-attention effects are more prominent for FG and URM students who might face feelings of cultural mismatch (Stephens et al., 2012; Steele, 1997). Therefore, these

students may experience greater cognitive load when watching video materials about belonging, which may have hindered its effect at reducing social group achievement gaps.

Another possible explanation for why the video intervention was less effective at reducing social group achievement gaps may be that students perceived the video narratives to be less authentic. Video narratives were portrayed by student actors who read scripted narratives developed by the research team. This may have affected how authentic these messages seemed to students and, subsequently, how the materials affected targeted outcomes. Researchers interested in testing similar methods should consider filming actual student stories to relay to students.

Researchers could also consider learner preference when delivering social-psychological interventions with written or video narratives. The effects of multimedia presentations on cognitive load have been shown to vary from individual to individual based on their learning preferences. Homer et al. (2008) found that students with high preference for visually-presented information experienced less cognitive load when watching videos and experienced more cognitive load when given information through audio. This study did not assign students' to social belonging interventions based on their learning preference; however, further research could examine whether allowing students to choose between videos or text might help them process intervention material.

Leveraging Feelings of Similarity

In addition to examining how modality influences the efficacy of a social-belonging intervention, this thesis also explored how feelings of similarity to peer

narrators might change the intervention's effectiveness. Only data from students who received the belonging intervention were used to examine feelings of similarity.

Differences by Modality

I first examined how delivery modality of the intervention (i.e., written or video) might affect how similarly students feel to peer narrators. Students randomly assigned to the written belonging intervention condition reported greater levels of similarity to peer narrators than did students assigned to the video belonging intervention. This was surprising, because the written intervention narrative provided no personal information (e.g., racial background, gender) about the peer narrator. I hypothesized that this lack of personal background information would make it more difficult for students to identify with and perceive themselves as similar to peer narrators in the written intervention condition.

However, students assigned to the written belonging condition may have had more freedom to imagine a peer more like themselves when reading narratives. In contrast, students who watched the video interventions were given more information about the peer narrator, which may have limited their perceived similarity. Seeing the peer narrator's race and gender may have actually led students to feel greater dissimilarity to the peer. For example, an Asian American female student might immediately feel dissimilarly to the European American male peer narrator. Had the same student received the written version of the intervention, she may have felt more similarly to the peer narrator given her freedom to imagine a peer who seemed relatable. The current study design did not allow me to make within-student comparisons between the written and video versions of the belonging intervention; however, a within-subjects

design could provide more evidence on how delivery modality might affect students' perceived similarity. Specifically, a within-subjects design would allow me to compare whether individual students' feelings of similarity differ according to the modality of the intervention.

Gender and Race Matching to Peer Narrators

Another goal of this thesis was to explore whether seeing someone who appears to belong to one's own social groups (i.e., gender, race) might enhance feelings of similarity. This analysis focused only on participants assigned to the video condition, because this was the only condition in which students could see the peer narrator (i.e., their gender and race).

To explore how gender and race matching might affect students' feelings of similarity, I compared students who matched the peer narrator's gender and/or race to those who did not. Students who matched the peer narrator's gender (e.g., female students who watched the female narrator) reported similar levels of perceived similarity compared to students who did not match the peer narrator's gender. Likewise, students who matched the peer narrator's race (e.g., African American students who watched the African American narrator) reported similar levels of perceived similarity compared to students who did not match the peer narrator's race. Other researchers have found positive effects of gender and race matching to pedagogical agents (e.g., animated or virtual social models in learning materials) on students' motivation (e.g., John et al., 2014, Rosenberg-Kima et al., 2013). However, these studies have only assessed motivational outcomes such as self-efficacy, interest, and engagement (Baylor, 2011). This study instead focused on how gender and/or race matching to social models might

influence students' judgments of similarity to peer narrators. Additionally, rather than examining matching gender and race to virtual agents, this study examined the effects of matching to human agents.

One interesting but unexpected pattern emerged when examining possible interactional matching of race and gender. Racial matching to peer narrators only predicted students' feelings of similarity when students were not matched to the narrator's gender. In other words, when students did not match the peer narrator's gender, those who matched the peer narrator's race reported greater levels of similarity than did those who did not match the peer narrator's race. However, when students matched the peer narrator's gender, there were no differences in perceived similarity between those who matched on race and those who did not. These findings show the complexity of social comparative appraisals and suggest that students weigh multiple types of information when they consider how similarly they feel to peer narrators. Matching students on one or two characteristics, such as gender or race, does not always guarantee that they will feel similarly to peer models. Researchers interested in enhancing feelings of similarity could consider how other characteristics might predict how similarly individuals feel to their peers, beyond phenotypical characteristics of gender and race. For example, McCroskey et al.'s (1975) perceived homophily scale measures how similarly individuals feel to others based on similar attitudes and background.

These findings are also interesting in light of how feelings of similarity have been conceptualized. I hypothesized that students who matched on more characteristics would report greater feelings of similarity towards the peer narrators; however, this was not the case. It appears that students who matched on only one characteristic (either gender or

race) report greater levels of similarity compared to those who match on both characteristics. Little research has focused on the number of characteristics that optimize students' perceived similarity to social models (Montoya et al., 2008). As Montoya et al. (2008) suggested, actual similarity is not required for individuals to perceived themselves as similar. Perhaps the relationship between number of matching characteristics and perceived similarity is more complex and warrants further consideration. Some researchers have suggested that belonging is not only dependent on how well students fit in, but also on how they differentiate themselves from others. Gray's (2017) *standing out while fitting in* framework suggests that humans also desire to be distinctive. It might be optimal for students to not only be similar to peer narrators, but also different from them. Matching on too many (e.g., gender and race) characteristics may therefore (paradoxically) weaken how similarly they feel to social models.

Perceived Similarity as a Mediator

I next explored whether perceived similarity mediated the relationships between the social belonging intervention and student outcomes. Bandura (1997) described that social models wield more influence on observers' beliefs/behaviors when observers feel a sense of similarity to them. Therefore, the degree to which students felt similar to peer narrators in the intervention may mediate the effect of the belonging intervention on students' belonging or GPA. Specifically, I hypothesized that students' perceived similarity to peer narrators in intervention materials would differ depending on the version (i.e., written or video) of the intervention they received. Greater feelings of similarity to peer narrators would then predict better outcomes, such that students who

felt more similarly to peer narrators would feel more like they belong and/or perform better academically.

As described previously, the belonging intervention condition predicted students' sense of belonging, such that students in the written belonging condition reported greater levels of belonging than did those in the video belonging condition, controlling for students' academic preparedness. However, there were no indirect effects of the intervention condition on students' sense of belonging through perceived similarity. That is, perceived similarity did not act as a mediating mechanism for this relationship.

Similar results were found when examining whether perceived similarity mediated the relationship between the intervention condition and students' first-year GPA. The intervention condition did not significantly predict students' first-year GPAs. In other words, students' achievement did not differ according to the version of the intervention they received. Although the intervention condition predicted students' perceived similarity, feelings of similarity only marginally predicted students' first-year GPA after controlling for students' academic readiness. Therefore, perceived similarity did not mediate the relationship between the intervention and students' first-year GPA.

These findings suggest that the degree to which students feel similar to peer narrators in intervention materials does not seem to change how effective the intervention is at changing students' sense of belonging or improving their academic achievement. Perceived similarity to peer narrators is a complex phenomenon, as students weigh multiple types (e.g., gender or race) of information when they make judgments about how similarly they feel. Although these feelings of similarity vary across students, this study

does not provide enough evidence to suggest that perceived similarity is a key component of social belonging interventions.

However, these findings should be considered in light of several psychometric limitations. Perceived similarity to peer narrators was measured using single items. Single-item measures are often subject to low reliability, especially when used to measure complex psychological constructs like feelings of similarity (Wanous & Reichers, 1996). A multi-item measure may reduce chances of measurement error and may also be more valid (Diamantopoulos et al., 2012). For example, the perceived homophily scale measures similarity based on several characteristics, such as attitude and background (McCroskey et al., 1975). There were also limitations in how sense of belonging was measured. Three broad items asked students' about their sense of belonging and feelings of fit with the university. However, researchers have suggested that there are several levels of belonging for college students (Freeman et al., 2007). Considering the multifaceted nature of belonging in college (e.g., campus-level belonging, classroom-level belonging, social-belonging, academic-belonging) may have yielded different results.

Conclusion

In this thesis, I explored how two aspects of a social-psychological belonging intervention might influence its efficacy at reducing social group gaps in belonging and achievement. Findings from this thesis provided further evidence that social-psychological belonging interventions can reduce social group achievement gaps, even at a large, public land grant institution. However, this thesis also highlights several factors

that educational researchers might consider before implementing and testing social belonging interventions.

Social-psychological interventions involve complex social cognitive mechanisms. Results supported the notion that the modality in which an intervention is delivered (i.e., through written or video narrative) can affect the efficacy of a narrative-based belonging intervention. Evidence pointed to no clear advantage of delivering a social belonging intervention via video instead of written passages. Due to the nature and limited design of the video belonging intervention, however, more evidence would be required before making substantial claims about whether a written or video belonging intervention might be more effective at changing students' beliefs and subsequent outcomes.

This thesis also explored how feelings of similarity to peer narrators in intervention materials might influence intervention outcomes. Findings suggest that perceived similarity to peer narrators can be altered by the delivery modality of narrative presentations and the type of characteristics shared (e.g., gender, race). It appears that providing more personal background information can actually limit how similarly students feel to social models. Likewise, students weigh multiple types of information when they consider how similarly they feel to social models. Matching students by one or two characteristics, such as gender or race, may not always guarantee that they will feel similar to peer models. Researchers interested in supporting students' feelings of similarity might consider using more ambiguous social models in their materials or allowing students to select their own social models.

This study takes a preliminary step in understanding the mechanisms that support a social-psychological belonging intervention. Researchers have described the challenge

of determining circumstances in which social-psychological interventions work as the “black box” problem (Harachi, 1999; Yeager & Walton, 2011). Findings underscore the importance of understanding how aspects of intervention design and delivery can be used to increase intervention efficacy. This thesis provides further information for researchers and educators to consider when developing and testing related social-psychological interventions. This thesis can also inform educational programs and socially-mediated instructional tools to support students’ sense of belonging in ways that better serve historically underrepresented students as they transition from high school to college.

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Excellence in Internship/Service Learning Award 2018
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Department of Psychology, University of Kentucky

Undergraduate Scholar 2018
Society for Research on Adolescence (SRA)
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PUBLICATIONS AND MANUSCRIPTS

Usher, E. L., **Chen, X.-Y.**, Roeder, M. L., Johnson, A. A., & Mamaril, N. A. (In preparation). *A qualitative analysis of the sources of engineering self-efficacy.*

Ford, C. J., Usher, E. L., Scott, V. L., & **Chen, X.-Y.** (In preparation). *The “perfect” lens: Effects of perfectionism on early adolescents’ math self-efficacy development.*

McKee, S., Brown-Iannuzzi, J., Usher, E. L., **Chen, X.-Y.**, & Brown, C. S. (In preparation). *Perceived socio-economic status and academic outcomes for first year undergraduate students.*

Chen, X.-Y. (2019, September). Identity, power, and equity in education [Editorial]. *Kentucky Kernel*, Fall 2019, 10-11.

SCHOLARLY PRESENTATIONS

* indicates undergraduate student mentee

INTERNATIONAL AND NATIONAL PRESENTATIONS

Han, J., **Chen, X.-Y.**, Usher, E. L., & Brown, C. S. (2020, April 17-21). *Trajectories and outcomes of first-year college students’ self-regulation.* Poster accepted for presentation at the annual meeting of the American Educational Research Association, San Francisco, CA.

Chen, X.-Y., Usher, E. L., Brown, C. S., & Ford, C. J. (2019, August 12-16). *Is seeing believing? Comparing perceived similarity in a dual-modality belonging intervention* [Poster presentation]. European Association for Research on Learning and Instruction Biennial Meeting, Aachen, Germany.

Ford, C. J., Usher, E. L., Scott, V. L., & **Chen, X.-Y.** (2019, August 12-16). *The “perfect” lens: Effects of perfectionism on early adolescents’ math self-efficacy development* [Paper presentation]. European Association for Research on Learning and Instruction Biennial Meeting, Aachen, Germany.

Han, J., Usher, E. L., Li, C. R., Ford, C. J., **Chen, X.-Y.**, Corcoran, K. A., Worick, C. E., & Brown, C. S. (2019, August 12-16). *Quantitative self-efficacy across the first year of college: Trajectories by gender and STEM major* [Poster presentation]. European

Association for Research on Learning and Instruction Biennial Meeting, Aachen, Germany.

Toland, M. D., Lingat, J. M., Qiu, C., Li, C., Ford, C. J., **Chen, X.-Y.**, Han, J., Clement, T., Blevin, J., Shen, L. (2019, August 8-11). *Measuring resident advisor self-efficacy: A differential item functioning study* [Poster presentation]. Annual Meeting of the American Psychological Association, Chicago, IL.

*Scott, V. L., Ford, C. J., Usher, E. L., & **Chen, X.-Y.** (2019, April 11-13). *Gender, perfectionism, and math self-efficacy in elementary and middle school students* [Poster presentation]. National Conference for Undergraduate Research, Kennesaw, GA.

Chen, X.-Y., Usher, E. L., Brown, C. S., & Ford, C. J. (2019, April 5-9). Brief social belonging intervention for first-year students at a land grant university: Does modality matter? In E. A. Canning & M. C. Murphy (Chairs), *Challenges and opportunities: Exploring first-generation college students' lived experiences and interventions to support their success* [Symposium]. Annual Meeting of the American Educational Research Association. Toronto, Canada.

Chen, X.-Y., Roeder, M. L., Johnson, A. A., Mamaril, N. A., & Usher, E. L. (2018, August 9-12). *Sources of engineering self-efficacy in undergraduate engineering: An analysis of open-ended responses* [Paper presentation]. Annual Meeting of the American Psychological Association, San Francisco, CA.

Nelson, A. A., Ford, C. J., **Chen, X.-Y.**, Usher, E. L., & Brown, C. S. (2018, April 12-14). *Evidence from a social-belonging intervention to improve retention of underrepresented college students* [Poster presentation]. Society for Research on Adolescence Biennial Meeting, Minneapolis, MN.

Ford, C. J., Nelson, A. A., **Chen, X.-Y.**, Usher, E. L., & Brown, C. S. (2018, April 13-17). *Preliminary evaluation of a living-learning program (LLP) for first-generation college students: A quasi-experimental approach*. [Paper presentation]. Annual Meeting of the American Educational Research Association. New York, NY

Li, C. R., Usher, E. L., Mamaril, N. A., **Chen, X.-Y.**, Roeder, M. L., Bohac, S. W., Chenot, S. B., & Kennedy, M. S. (2016, August 4-7). *Sources of self-efficacy in engineering students* [Poster presentation]. Annual Meeting of the American Psychological Association, Denver, CO.

Love, A. M. A., Toland, M. D., McCrea, B. L., **Chen, X.-Y.**, Findley, J. A., & Usher, E. L. (2016, August 4-7). *Preliminary scale development of a teacher self-efficacy scale for students with autism* [Poster presentation]. Annual Meeting of the American Psychological Association, Denver, CO.

REGIONAL AND LOCAL PRESENTATIONS

- *Stevens, K. E., *Mitsos, J. E., **Chen, X.-Y.**, Usher, E. L., & Brown, C. S. (2019, April 24). *Brief social belonging intervention for first-year students at a land grant university: Does modality matter?* [Poster presentation]. University of Kentucky Undergraduate Research Showcase, Lexington, KY.
- Chen, X.-Y.**, *Stevens, K. E., *Mitsos, J. E., Ford, C. J., Usher, E. L., & Brown, C. S. (2019, March 2). *Brief social belonging intervention for first-year students at a land grant university: Does modality matter?* [Paper presentation]. Spring Research Conference, Lexington, KY.
- Han, J., Corcoran, K. A., Li, C. R., Ford, C. J., **Chen, X.-Y.**, Worick, C. E., Usher, E. L., & Brown, C. S. (2019, March 2). *First-year college students' STEM-related self-efficacy: Longitudinal measurement invariance and trajectories by gender* [Paper presentation]. Spring Research Conference, Lexington, KY.
- *Scott, V. L., Ford, C. J., Usher, E. L., & **Chen, X.-Y.** (2019, March 2). *Gender, perfectionism, and math self-efficacy in elementary and middle school students* [Poster presentation]. Spring Research Conference, Lexington, Kentucky.
- Chen, X.-Y.**, & Usher, E. L. (2018, April 25). *The social foundations of engineering self-efficacy* [Poster presentation]. University of Kentucky Undergraduate Research Showcase and Psychology Honors Day. Lexington, KY.
- Chen, X.-Y.**, *Hayes, I. M., *Fautsch, N. M., & Usher, E. L. (2018, March 24). *Academic mindset in first-year undergraduate students* [Poster presentation]. Spring Research Conference. Shelbyville, KY.
- Chen, X.-Y.**, Roeder, M. L., Johnson, A. R., & Usher, E. L. (2017, April 1). *The roots of self-efficacy in undergraduate engineering* [Poster presentation]. Spring Research Conference, Cincinnati, OH and at the University of Kentucky Undergraduate Research Showcase, Lexington, KY.
- Chen, X.-Y.**, Li, C., & Usher, E. L. (2016, March 26). *Social models and engineering self-efficacy: What engineers do you know?* [Paper presentation]. Spring Research Conference. Lexington, KY.
- Jones, R. S., Kim, N. A., Li, C. L., **Chen, X.-Y.**, Neeley, R. M., Usher, E. L., & Danner, F. (2015, March 28). *At-risk adolescents' autonomy, relatedness, and stigma: A story of interaction* [Paper presentation]. Spring Research Conference. Louisville, KY.