STEM Summer Bridge Programs: Implications for College Counseling and Social Justice in Higher Education

by

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Abstract

Ethical counselors promote social justice (American Counseling Association, 2014). Based on counselors' specialty and site of practice, promoting social justice involves different goals and methods. One way for college counselors to promote social justice is to support students from groups historically excluded from higher education at their institution. Based on multiple personal identities, higher education is not representative of the overall US population (National Center for Education Statistics, 2023). The greatest driver of the underrepresentation of students from historically excluded groups is retention (Shaw et al., 2021). The Culturally Engaging Campus Environments model of student retention (CECE; Museus, 2014) asserts that institutions and their agents, e.g., college counselors, should engage their diverse student population's cultural selves to support student retention. One program which was designed to be congruent with the CECE model is the Auburn University STEM Summer Bridge program (SSB; Gonzales et al., 2022). The present study used a quantitative, repeated measures design to investigate if participation in an SSB improved participants' academic self-efficacy (ASE) confidence and stress, sense of belonging to the STEM fields generally, and sense of inclusion within their college. Participants (N = 156) were primarily 18 years of age (n = 147, 94.6%) and most identified as Black/African American (n = 105, 67.3%). Results indicated a significant change in participants' ASE confidence and sense of belonging to STEM before and after completing SSB. Possible explanations of nonsignificant ASE stress and sense of inclusion findings and implications to inform college counselors' praxis are also discussed.

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Table of Contents

List of Tables

List of Abbreviations

ASE: Academic Self-Efficacy

CECE: Culturally Engaging Campus Environment

COSAM: College of Sciences and Mathematics

HES: Historically excluded students

OIED: Office of Inclusion, Equity and Diversity

SSB: STEM Summer Bridge

Chapter 1

Introduction and Background of the Problem

Ethical counselors promote social justice (American Counseling Association, 2014). Called the fifth force in counseling (Ratts, 2009), the term social justice has been operationalized across multiple disciplines, including philosophy, religion (Thrift & Sugarman, 2019), critical studies (Combahee River Collective, 1977), and counseling (Dollarhide et al., 2016). Broadly, the overall goal of social justice is to create a world where everyone can experience equity, justice, and liberation (Nassar & Singh, 2020). However, the literature varies in describing the ways in which a society can achieve this goal based on discipline. Recent counseling literature suggests a multiplistic definition of and approach to enacting social justice, which adopts an interdisciplinary perspective to inform how a counselor can work to promote social justice (Peters & Luke, 2021). This multiplistic approach proposes four groups of facets which comprise social justice and can be used to bridge the gap between the definitions often used in counseling and interdisciplinary social justice literature. Specifically, counseling definitions of social justice tend to highlight the role of recipients and agents of justice in the process of enacting social change, whereas interdisciplinary definitions of social of justice tend to highlight complexity, nuance, contextual factors, and pluralistic perspectives and ways of understanding (Peters & Luke, 2021).

The four groups of facets which comprise a multiplistic definition of social justice are as follows (Peters & Luke, 2021): First, Cultural, distributive, and associational justice relate to equitable access to and control over the direction of social justice work. Next, retributive, restorative, and procedural justice relate to addressing specific concerns of justice and value a flexible implementation of social justice action to meet the needs of those wronged by society.

Then, emancipatory, and intergenerational justice relate to the liberation of all people oppressed in society and striving for a better future for subsequent generations. Finally, transformative and transitional justice relate to grassroots and top-down sources of change respectively, indicating that change can, but does not need to, come from larger entities like government or non-governmental organizations. Taken together, these facets of social justice highlight collaboration, flexibility, and equity at all levels of engagement in social justice work (Peters & Luke, 2021).

A useful model to inform engaging in social justice is the Multicultural and Social Justice Counseling Competencies (MSJCC; Ratts et al., 2016). This model focuses on praxis, i.e., using theory, knowledge, and personal experience to inform action to diminish systemic oppressive forces (Freire, 1968/1970). This model also considers the development of the counselor's competence in attitudes, beliefs, knowledge, skills, and action, and the interaction between personal identities of the counselor and the person or group with whom the counselor is working (Ratts et al., 2016). Using the MSJCC and holding a multiplistic perspective on social justice (Peters & Luke, 2021), counselors can engage in social justice work in many ways (Nassar & Singh, 2020). The American College Counseling Association (ACCA) also provides the following diversity statement to direct college counselors' praxis (ACCA, 2000):

> The members of the American College Counseling Association (ACCA) provide programs and services that adhere to the mission of ACCA and that enhance the learning experience for students through the promotion of social justice, community development, civility, and stewardship. ACCA recognizes that multidimensional diversity enriches the campus community and enhances opportunities for human understanding, both of which contribute to the collegiate experience for all. Therefore, we pledge to provide college

> counseling services that nurture environments where similarities and differences among people are recognized, respected, and honored. (ACCA, 2000)

Taken together, a multiplistic perspective on social justice (Peters & Luke, 2021), the MSJCC (Ratts et al., 2016), and the ACCA Diversity Statement (2000) direct college counselors to work to diminish systemic barriers to college students' success and wellbeing. Moreover, they suggest that a critical component is the diversity of the student and faculty members within programs. As mentioned prior, there are many ways a college counselor can accomplish the goal of establishing the program and institutional factors that support social justice (Nassar & Singh, 2020). One way is to increase the representation of historically excluded students (HES) at their higher education institution. The term HES is preferable to terms such as traditionally underrepresented minority (e.g., Miller & Orsillo, 2020) because it highlights the systemic oppressions which causes the underrepresentation of HES in higher education (Armstrong, n.d.). On the other hand, underrepresentation is solely the description of a disparity between the representation of people who identify with a specific demographic factor in an overall population, e.g., people living in the US, and within a specific group, e.g., people enrolled in a higher education institution.

Representation of HES in Higher Education

The rate of student representation is inequitable between higher education institutions and general population levels in the United States based on multiple demographic variables. According to the National Center for Education Statistics (2023), approximately 12.3% of the 15.4 million undergraduate students in the US who were enrolled in fall of 2021 identified as Black, whereas approximately 13.6% of the US population identified as Black (United States Census Bureau, 2022). This means that Black students are underrepresented in the US

undergraduate student population by approximately 200,000 students, because the 1.9 million Black students would need to be increased to about 2.1 million students to equal 13.6% of the total 15.4 million student population. Another example of underrepresentation which emerges in higher education representation are students from a lower socioeconomic status (SES; Tompsett and Knoester, 2023). For example, about 74% of high school graduates from the highest SES quintile attend a four-year university within 18 months of graduating high school (Reber & Smith, 2023). On the other hand, only about 23% of high school graduates from the lowest SES quintile attend a four-year university in that same time period. In addition, some disparities in undergraduate student representation are trending toward poorer representation, e.g., Native American and Black student enrollment decreased by 40% and 27% respectively between 2010 and 2021, whereas some disparities in student representation are trending toward greater representation, e.g., students of two or more races and Hispanic/Latinə student enrollment increased by 127% and 30% in this time frame, respectively (National Center for Education Statistics, 2023). Taken together, these representation rates and trends of representation show a complex national picture of student representation, and college counselors should understand their specific institutions' strengths, needs, and opportunities to best serve their campus community (Brunner et al., 2014).

Because the underrepresentation of students is a systemic issue in higher education, it is valuable for college counselors to consider how they can engage in advocacy which benefits student representation at their higher education institution at multiple levels, from university-wide benefits to individual student benefits (e.g., Kim et al., 2019). From the position of higher education institutions themselves, Hansen (2022) asserts inequitable student representation presents three problems. The first problem is that many higher education institutions are rooted

in a White, middle-to-upper class sociocultural context, and by the year 2044, more than half of people living in the US will hold an ethnic identity which is not solely White and not Hispanic. This is important because the sociocultural context of higher education institutions in the US already do not match many of their students' sociocultural context of home (Museus, 2014), and with this national demographic shift, this cultural mismatch will become even more pronounced. Next, Hansen (2021) also highlights that declined birth rates in the US are leading to fewer students pursuing enrollment in higher education institutions. Much university funding comes from tuition payments, and thus, higher education institutions need to be more competitive for diverse students to retain funding and keep current faculty and staff employed. Finally, the third issue inequitable representation presents for higher education institutions is that students receive better preparation for life and work from more diverse institutions than less diverse institutions. This final point by Hansen (2022) could be seen to center the experience of students at primarily White institutions, or PWIs, and does not consider the important roles of Historically Black Colleges and Universities (HBCUs; Williams et al., 2021) or Hispanic-Serving Institutions (HSIs; Garcia et al., 2021) for providing culturally engaging experiences to their students, for example. A more complete understanding can be garnered by centering the experiences of HES.

When a college counselor centers the experiences of HES in their understanding of how to best support the representation of HES at their institution, it is valuable to consider multiple aspects of student experience and campus environment (Collins-Warfield, 2023; Museus, 2014). Collins-Warfield and colleagues (2023) identified three themes related to HES perceptions of struggle and success and seven themes related to HES perceptions of supportive instructors. The authors included first-generation students, students from low SES backgrounds, and students of color in their investigation. Most important for a college counselor who is seeking to address

HES underrepresentation at their institution is that instilling a growth mindset and the personal integration of knowledge beyond the classroom is part of creating a supportive academic environment for HES. In addition, college counselors can intentionally foster a supportive relationship with HES by creating a humanized campus environment and valuing the irreducibility of each student (Collins-Warfield et al., 2023). Another important factor to consider is HES sense of belonging at their institution (Hussain & Jones, 2021). Hussain & Jones (2021) found that students of color who were attending a PWI felt a greater sense of belonging at their institution if they tended to interact with fellow students of color during their college career and if they perceived that their institution was committed to student diversity. These findings can guide a college counselor to implement and support interventions and events which foster HES interaction in a university-affiliated context, such as seminar series or training workshops.

Taken together, college counselors should be informed by their institution's unique strengths and opportunities for improvement (Brunner et al., 2014) to engage in praxis (Ratts et al., 2016) to promote social justice at their institution (ACCA, 2000). One way to promote social justice is to engage in work to reduce the underrepresentation of HES at their institution. College counselors are uniquely positioned to do so because the greatest contributor to HES underrepresentation is the disparity in retention between HES and students not from historically excluded groups (Shaw et al., 2021). Whereas recruitment and initial enrollment of HES is important, the primary driver of HES underrepresentation is greater levels of attrition, i.e., leaving college before attaining one's intended degree, than students who do not come from a historically excluded group (Costello et al., 2023; Shaw et al., 2021). For example, students who identify as men are about 30% more likely to finish their degree than are students who identify as women; students who do not identify with a historically excluded racial or ethnic identity are

about 30% more likely to finish their degree than students who do; and continuing generation students are about 15% more likely to finish their degree than first generation students (Costello et al., 2023). By giving focus to retention efforts, college counselors can collaborate with various groups at their institution to implement programming which is informed by the experiences of HES (e.g., Collins-Warfield et al., 2023). In addition to being informed by empirical literature which investigates the experiences of HES and understanding the importance of focusing on retention efforts, a college counselor should also integrate theories of student retention to guide their praxis with theoretical consistency.

Theories of Student Retention

Tinto's Theory

The theory of student retention which is most often cited in student retention literature is Tinto's (1993) model of student departure (Ashley et al., 2017; Guiffrida, 2006; Museus, 2014). This model asserts that students begin their education with unique pre-college attributes, e.g., family background, prior schooling, and individual academic ability (Tinto, 1993). Subsequently, these unique pre-college attributes affect the personal goals and expectations students set for their academic and social experience in higher education. Additionally, these pre-college attributes have an impact on the level of commitment students show to achieving their goals. Once students arrive at their higher education institution, students' goals and commitment to their goals are filtered through students' experience of integrating into the culture of their institution. In particular, this model proposes that students who are more integrated into the culture of their institution will tend to be more committed to their goals and their institution itself. When students are better integrated into their institutional system and thus, feel more

committed to accomplishing their academic and social goals, they are more likely to be retained at their institution (Caballero, 2020).

There are two ways in which students can integrate into their institution's academic and social systems, resulting in four means of integration (Tinto, 1993). In particular, students can pursue institutional integration through formal and informal modes of engaging in academic and social systems (Rasco et al., 2020). Considering academic institutional systems, formal integration is related to engaging in activities which accomplish required academic tasks, e.g., participating in class discussions, completing assignments, or researching a topic (Chrysikos et al., 2017). On the other hand, informal integration is related to personal interactions with faculty or staff, e.g., chatting in between classes or at a conference. In a similar vein, formal social integration is related to participating in extracurricular activities sponsored by a higher education institution, e.g., attending a campus event or joining a campus organization. Informal social integration is characterized by personal interactions with peers outside of discrete institutional events, e.g., spending free time with peers. In summary, formal integration strategies involve completing institution-related activities, e.g., attending a symposium, and informal integration strategies involve interacting with the people who engage in these activities, e.g., chatting with someone who attended that symposium.

Taken together, Tinto's (1993) model of student departure asserts that student retention is predicted by how well students are able to separate from their pre-college sociocultural environment and integrate into their new sociocultural environment, i.e., the academic and social systems of their higher education institution. With greater separation and integration, students tend to be more committed to the personal goals they set and the institution they attend

(Caballero, 2020). Subsequently, a better integrated, and thus more committed student is more likely to be retained at their institution.

Critiques of Tinto's Theory

Despite its historical near ubiquity in student retention literature (Ashley et al., 2017) and the fact it is still used to inform modern student retention efforts (e.g., Hovdhaugen et al., 2023), Tinto's (1993) model of student departure has been critiqued for its inapplicability to the experience of HES (Guiffrida, 2006; Museus, 2014; Tierney, 1999). Tierney (1999) argues that separation from a pre-college sociocultural context which was culturally affirming for HES and integrating into a sociocultural context which erases their own is not a desired outcome for HES. Tinto's (1993) theory is an adaptation of the stages of cultural transition (Van Gennep, 1960), modified to explain transitioning from the sociocultural context of home to the sociocultural context of a higher education institution. If these two contexts are congruent, this model can be valuable to explore the progression of a student within their culture (e.g., Chrysikos et al., 2017; Hovdhaugen et al., 2023). However, HES oftentimes experience a change when engaging with a PWI's culture. Tierney (1999) describes this transition process as cultural suicide, i.e., abandoning one's previous sociocultural context to assimilate into a new one rather than progressing within one's culture. This transition process is problematic for HES because it implies that isolating oneself from one's social support systems and cultural identity is desirable to integrate into a PWI's sociocultural context, and thus to be more likely to be retained at their institution (Guiffrida, 2006).

In a similar vein, Guiffrida (2006) highlights that Tinto's (1993) model of student departure too narrowly considers cultural identity when defining the process of students' social integration. In particular, Guiffrida (2006) asserts the Eurocentric paradigm which lies at the

heart of Tinto's theory does not consider enough nuance in integrating into a new culture, and moreover, ignores bi- and multi-cultural student identities. Guiffrida also echoes Tierney's (1999) concern of abandoning one's culture in the pursuit of embodying a different, White culture instead, which can be seen to imply the superiority of the White culture (Fanon, 1952).

Cultural Advancement of Tinto's Theory

On the other hand, Guiffrida (2006) agreed with certain parts of Tinto's (1993) model of student departure, e.g., HES must still obtain both social and academic tools to be successful at their institution and be retained. As such, Guiffrida (2006) sought to create a theory of student retention which remedies the problematic, culturally-limited aspects of Tinto's (1993) theory yet honors the aspects of Tinto's theory which assert student motivation is an important factor in student retention. Specifically, Guiffrida's (2006) theory of student retention incorporates self-determination theory (SDT; Deci & Ryan, 2002) and job involvement theory (JIT; Kanungo, 1982) to create a model which describes how motivation and culture affect HES retention.

Self-determination theory. SDT asserts that individuals experience motivation from two sources, which are internal and external (Deci & Ryan, 2002). Within a higher education context, these motivation sources are applied to the learning process. Intrinsic motivation, in this context, is described as interest in the content that one is learning. On the other hand, extrinsic motivation is described as learning as a means to a separate end, such as engaging in the learning process to earn a high grade in a class. According to SDT, optimal motivation for learning is intrinsic because intrinsic needs are more closely tied to personal growth than are extrinsic needs (Guiffrida, 2006). In addition, SDT also asserts that autonomy within the learning process, a sense of competency over the course content, and a desire for relatedness with peers are important aspects of internal motivation (Reeve et al., 2004). However, people from more

collectivist cultural backgrounds tend to value autonomy within the learning process less than do people from more individualist cultures (Guiffrida, 2006). It is important to note that collectivist cultures are not a monolith, nor are the individuals within them; thus, Guiffrida's theory of student retention asserts collectivist and individualist culture should not be understood categorically, but rather that each term lies at the end of a spectrum. In addition, individuals oftentimes hold both collectivist and individualist cultural values simultaneously, further adding nuance to understanding the role culture plays in student retention.

Job involvement theory. JIT was also considered in Guiffrida (2006) to account for students' differing cultural norms as it relates to academic and social motivation, though JIT was originally envisioned with a work environment in mind (Kanungo, 1982). Both JIT and SDT (Deci & Ryan, 2002) agree that humans experience internal and external motivation for behavior. Within the context of student retention, this motivation relates to social and academic engagement with one's campus community. However, JIT (Kanungo, 1982) uniquely contributes that it is not necessarily one's intrinsic needs being met which drives that individual's identification with a work role, and thus motivation. Instead, it is the satisfaction of a worker's most salient needs which drives motivation most strongly. For example, if a worker is intrinsically motivated to be good at their job but is also short on rent for the month, the more salient need to emerge may be getting enough money to cover housing expenses. As such, the primary motivating factor may be the extrinsic need for housing expenses in this situation, and the intrinsic motivating factor may become primary once the most salient need, housing, is satisfied.

Individuals' needs-saliency patterns are related to previous socialization experiences, which include one's internalized collectivist/individualist cultural orientation, and also one's

perspective on their present job conditions (Kanungo, 1982). In other words, both past and present sociocultural context and workplace experiences should be considered when attempting to understand why certain needs become most salient at specific times. Whereas JIT had not yet been applied within a higher education context before Guiffrida (2006), Kanungo (1982) stated this theory has the potential to be applied to many different contexts. As such, Guiffrida (2006) adapted JIT to inform understanding HES' cultural backgrounds as they relate to the patterns of their most salient needs.

Integration. In summary, Guiffrida (2006) proposes a model of student retention which adapts Tinto's (1993) theory to be more considerate of the cultural identities of HES. Specifically, Guiffrida's (2006) theory remains consistent with Tinto's (1993) in that they both highlight the necessity for students to experience academic and social development to be successful in higher education and remain at their institution. However, rather than asserting a student must assimilate into the majority culture of their institution to experience greater motivation, Guiffrida (2006) takes a more inclusive perspective and instead incorporates SDT (Deci & Ryan, 2002) to better understand motivation while avoiding cultural abandonment and JIT (Kanungo, 1982) to consider the shifting needs salience of HES.

Museus' Theory: Culturally Engaging Campus Environments

Some scholars have questioned whether theories of student retention which seek to be applicable to HES should have their foundation in Tinto's (1993) theory. In creating a student retention model which is separate from Tinto's and applicable to the experience of HES, Museus (2014) outlines four categories of critical perspectives on Tinto's theory which have emerged in the literature. The first is the *cultural foundations* critique, echoing Guiffrida (2006), which asserts that the cultural integration aspect of Tinto's theory is biased against students of color,

whose cultural identity may not match the cultural environment of their institution. Museus (2014) then describes the *self-determination* critique, which elucidates problematic aspects of the theory's emphasis on self-determination, i.e., that a student is responsible for their own success in higher education systems. As such, the role of institutional agents, e.g., college counselors, in fostering students' success is diminished. The third critique identified is the *integration viability* critique, which questions the validity of academic and social integration in predicting the success of college students (Museus, 2014). The final critique mentioned is the *psychological dimension* critique, which asserts that much of the research investigating Tinto's (1993) theory is rooted in a quantitative perspective, observing objective behaviors of academic and social integration. As such, this quantitative investigation tends to ignore the qualitative and subjective variables which may influence student retention, such as a student's sense of connection to their institution.

Addressing these four categories of critiques of Tinto's (1993) theory is the first of three steps in developing a culturally-sensitive model of college student retention which is applicable to HES (Museus, 2014). The second step asserts that a new model must be developed from research which centers experiences and voices of diverse student populations, and the third step of developing a new model of student retention states this model should be quantifiable and testable for empirical validation purposes. Museus (2014) proposes the Culturally Engaging Campus Environments model, i.e., the CECE model, which meets the previous three criteria.

The CECE model considers the external influences which affect both individual influences, i.e., sense of belonging, academic dispositions, and academic outcomes, which impacts student retention (Museus, 2014). Specifically, this model asserts that students with more positive individual influences are more likely to be retained at their institution than students with fewer positive individual influences. As students enter a higher education institution, they

arrive with pre-college inputs, such as a sociocultural identity or their level of academic preparedness, which are related to individual influences and academic outcomes. However, the CECE model asserts that the relationship between environmental factors of a campus environment and a student's individual influences on college success is most important. In particular, this model argues that culturally engaging campus environments, i.e., campus environments characterized by respecting and valuing diverse student cultures, are related to more positive individual influences and thus, greater higher education success outcomes. The CECE model, and specifically the fact that the CECE model prioritizes the creation of CECEs, is useful to college counselors because as institutional agents, college counselors can intentionally help create or offer consultation (Sharkin, 2012) on creating a campus environment which is culturally engaging for HES.

Museus (2014) defined external influences and pre-college inputs as contextual factors, though they are important to consider because they can affect student academic outcomes and can be considered when conducting statistical analysis of the CECE model. External influences include financial factors, such as having the resources to pay for one's education or having to pursue grants, loans and scholarships; employment status, which includes whether a student needs to work in addition to school, if so, the number of hours the student is required to work during their education; and family influences, which includes support from one's family of origin. Perhaps unsurprisingly, HES success is positively related to having the financial resources to pay for one's education (Choy, 2000), being financially supported by needs-based grants if one meets the qualifications (Modena et al., 2020), and receiving support from one's family of origin (Foltz et al., 2014; Palmer et al., 2011). Pre-college inputs include demographic factors, e.g.,

gender, age, religious identity, or ethnic identity; initial academic dispositions, i.e., one's level of academic motivation; and one's academic preparation before attending college (Museus, 2014).

As mentioned prior, students' external influences and pre-college inputs are important to consider as contextual factors, however the main focus of Museus' (2014) theory is on the creation of culturally engaging campus environments, or CECEs, to foster more positive individual influences for HES and support HES retention. The process of creating a CECE involves considering how an institution can engage their students' diverse cultural identities and meet the needs which are most salient to these students. In particular, Museus (2014) offers nine distinct characteristics of a CECE, called CECE indicators, which can be used to guide programming which engages students' diverse cultural selves. These indicators, summarized in Gonzales et al. (2022 pp. 116-118), are as follows:

CECE Indicator #1: Cultural Familiarity. The amount that students interact with and are exposed to faculty, staff and peers who share their cultural background on campus is related to a greater likelihood of success.

CECE Indicator #2: Culturally Relevant Knowledge. Students sustaining and increasing knowledge about their culture and community of origin can positively impact their experience and success in college. Specifically, when students can create, maintain and strengthen connections to their community of origin through spaces allowing them to increase their culturally relevant knowledge, they tend to feel a stronger connection to their institution and experience greater success.

CECE Indicator #3: Cultural Community Service. Students being provided tools and opportunities by their institution to improve and give back to their community of origin through spreading awareness about issues important to that community,

community service, service-learning opportunities and other means can positively impact students' experiences and success.

CECE Indicator #4: Opportunities for Meaningful Cross-Cultural Engagement. Students' meaningful and purposeful engagement with individuals from diverse cultural backgrounds can have positive impacts for not only HES but for students from all backgrounds at an institution.

CECE Indicator #5: Collectivist Cultural Orientations. Students who attend an institution that is based in a more collectivist perspective rather than an individualist perspective are more likely to succeed.

CECE Indicator #6: Culturally Validating Environments. Students who are surrounded by educators who validate their students' cultural identities will have more positive experiences and are more likely to succeed. Specifically, cultural validation occurs when institutions and educators show that they value the diverse cultural identities of their student population.

CECE Indicator #7: Humanized Educational Environments. Campus environments that are characterized by institution-affiliated individuals who care about, are committed to and develop meaningful personal relationships with students are considered humanized educational environments. College students who engage with humanized educational environments tend to have more positive experiences and be more successful.

CECE Indicator #8: Proactive Philosophies. When faculty and staff members make extra efforts to bring valuable information and support to students, students are more likely to maximize their success and persist at their institution.

CECE Indicator #9: Availability of Holistic Support. The availability of holistic support depends on students being provided one or more faculty members who can provide them with the information that they seek, offer the help that they require, or be able to connect them with the information or support they need. If students are supported holistically, they are more likely to be successful. (Gonzales et al., 2022, pp. 116-118)

In summary, the CECE indicators (Museus, 2014) provide a theoretical framework which can inform the praxis of college counselors as it relates to actions and programming which can support the retention of HES at their institution. Specifically, the CECE model asserts the importance of campus environments, which are within a college counselor's role to affect (Sharkin, 2012). When a college counselor implements an intervention, designs an outreach event, or creates programming, they can use the CECE indicators to guide specific aspects of the experience to be culturally engaging for HES, and thus, support their institutional persistence while attending a PWI (Museus, 2014). In practice, the CECE model asserts that institutional agents, e.g., college counselors, should strive to create CECEs which are humanized and culturally affirming for HES. By doing so, students' individual influences, i.e., sense of belonging at their institution, academic dispositions such as academic self-efficacy, and academic performance will be supported, and these students are more likely to be retained at their institution. This provides a theoretical foundation for college counselors' praxis in improving HES retention at their institution. However, specific strategies to create CECEs must also be considered for college counselors to engage in praxis which promotes meaningful change.

College counselors should consider implementing strategies which have been investigated in the literature and shown to be beneficial for HES retention when designing

programs or interventions. In addition, it is valuable to consider the specific populations or characteristics of specific populations when attempting to create CECEs for HES (Museus, 2014). This consideration can also help a college counselor make targeted advocacy efforts when attempting to support HES retention at their institution. For example, one field within higher education which is particularly inequitable in its representation is the STEM field (Chen, 2013; Costello et al., 2023; Intemann, 2009). A few examples of this inequity are that women are underrepresented in both STEM higher education programs and in the STEM workforce (Nimmesgern, 2016), as are folks with Black or Latinə ethnic identities (Starr et al., 2022), who are members of the LGBTQ+ community (Cech & Waidzunas, 2021), or come from a low SES background (Harris et al., 2020). Moreover, these inequities are compounded when a person possesses multiple identities which are historically excluded from STEM (Cech, 2021; Nix & Perez-Felkner, 2019).

Taken together, compared with other fields in higher education, the levels of HES underrepresentation tend to be greater in STEM higher education and subsequently, the STEM workforce (Costello et al., 2023; Intemann, 2009). The primary driver of the underrepresentation of HES in STEM is lower HES retention rates (Shaw et al., 2021). To address this disparity, the literature has explored what programs and interventions higher education institutions and their affiliated faculty and staff members, e.g., college counselors, can engage in to support HES pursuing their STEM degree. For example, Costello and colleagues (2023) found that HES pursuing undergraduate STEM degrees enter college with the intent to pursue a STEM degree at greater proportion than students who do not come from historically excluded groups. However, echoing Shaw et al. (2021), they also found that HES depart from their institutions at greater rates than students not from historically excluded backgrounds, which was attributed to

opportunity gaps which emerge at various points in the STEM pathway. For example, one salient opportunity gap which affects HES in the first semester of college is difficulty with "weed out" courses, i.e., very difficult introductory courses which result in many students either leaving the STEM pathway or college altogether (Costello et al., 2023). These "weed out" courses are not inclusive to HES for many reasons, e.g., exclusive cultural environment unwelcoming to HES or being particularly difficult for students who attended a high school which did not adequately prepare them. There have been many calls to implement programming which supports HES retention in the STEM pipeline (e.g., Costello et al., 2023; Intemann, 2009; Salehi et al., 2020), and considering that opportunity gaps can emerge for HES very early in the college journey, interventions should be delivered to support HES retention before their first semester begins. One type of program which meets these criteria and supports this goal is a STEM Summer Bridge program (SSB; Ashley et al., 2017; Bradford et al., 2021; Gonzales et al., 2022).

STEM Summer Bridge Programs

The majority of SSB programs include programming related to community building, academic skill development, engagement with campus culture, professional networking opportunities, site visits or tours, and establishing systems of social support (Ashley et al. 2017; Cooper et al., 2017). Because there are many aspects of the college experience which SSB programs cover, these programs tend to be multiple week-long experiences. As such, they were designed to provide resources, knowledge and skill instruction on the previously mentioned topics and simultaneously help program participants become familiar with living on campus while pursuing a STEM degree (Bradford et al., 2021; Cooper et. al, 2017).

STEM Summer Bridge programs are not identical across institutions (Bradford et al., 2021). One way they can differ is they can be delivered in a virtual, primarily asynchronous

modality (e.g., Eblen-Zayas & Russell, 2019), virtual synchronous modality (e.g., Alexander et al., 2021), or on-campus modality (Barth et al., 2021). In addition, these programs tend to include some, if not all, of fourteen major SSB components identified by Ashley et al. (2017). These individual components are not listed in order of importance, and rather holistically describe different facets of a SSB program experience. The first two primary components of a SSB program relate to providing students with foundational knowledge in the broader STEM domain and within specific STEM disciplines, such as physics or chemistry. Incoming students may experience difficulty with the rigor of college STEM course work, especially if their pre-college inputs (Museus, 2014) include inadequate academic preparation for the level of baseline knowledge expected at their institution (Salehi et al., 2020). As such, some SSB programs offer introductory and abbreviated academic courses to improve students' baseline knowledge (Chen, 2013). In addition, first-year students pursuing a degree in STEM often take a rigorous courseload in their initial year, which can feel overwhelming for many students regardless of previous academic preparation, and the inclusion of academic coursework in a SSB program can help ease the transition between high school and college-level work expectations (Ashley et al., 2017).

The third and fourth primary components of SSB programs relate to increasing students' interest in their selected major and providing opportunities to engage in research (Ashley et al., 2017). One factor affecting the decision for students to leave a STEM major is because they do not feel strongly interested in the discipline (Seymour & Hewitt, 1997). Thus, SSB programs often aim to increase student interest in STEM broadly and STEM research specifically, assuming that increased STEM interest will lead to increased motivation (Museus, 2014) and thus, improved institutional persistence (Ashley et al., 2017).

Components five, six, and seven of SSB programs involve opportunities for students to connect with others. This includes networking with faculty, networking with student peers, and improving students' sense of belonging at their institution (Ashley et al., 2017). Student sense of belonging has been shown to affect both their levels of academic motivation, academic success, and their overall sense of well-being (Anderman & Freeman, 2004; Pedler et al., 2022; Trujillo & Tanner, 2014). With this in mind, SSB programs can facilitate opportunities for students to build a supportive peer community which can support their sense of belonging to their overall institution community. In a slightly different vein, establishing relationships with faculty can be valuable for students because these experiences can work to reduce students' perception of faculty as intimidating (Ashley et al., 2017) and can lead to mentoring relationships.

Component eight, which is commonly shared among SSB programs relates to improving objective measures of student success, i.e., students' GPA (Ashley et al., 2017). The facilitators of SSB programs often keep in contact with SSB participants and can keep track of their GPA as students matriculate through their programs if students grant permission. The ninth and tenth components involve objective results of the program, and is one of the primary goals of SSB programs as a whole. Specifically, these components are improving student retention and graduation rates, respectively. Component eleven is related to improving students' internal sense of how prepared they are to complete their selected degree program. Relatedly, the twelfth component is related to improving students' academic self-efficacy, which describes the level of confidence students have in their own ability to successfully matriculate through and complete their selected degree program. This component is similar to the first and second common components of SSB programs (Ashley et al., 2017), except this component focuses on how a student subjectively feels a greater sense of mastery over STEM content rather than examining a

measurable content knowledge increase. Finally, components thirteen and fourteen common among SSB programs are supporting the recruitment of students broadly and enhancing diversity by recruiting HES specifically. Whereas the previous twelve components relate to aspects and participants of the SSB program itself, these final components can be defined as department or college-level goals and can benefit from collaboration between multiple entities within a higher education institution.

The CECE model of student retention (Museus, 2014) maps well onto the common aspects of SSB programs (Ashley et al., 2017). Two aspects of the CECE model (Museus, 2014) are particularly salient in SSB programs. The first is related to supporting students' individual influences, which includes students' sense of belonging, their academic dispositions such as academic self-efficacy, and their academic outcomes, i.e., GPA (Museus, 2014). These individual influences are mentioned specifically in SSB component seven, twelve, and eight, respectively (Ashley et al., 2017). In addition, by nature of being a campus event, it is possible to create a CECE (Museus, 2014) through a SSB program. However, the SSB literature has yet to empirically investigate a SSB program informed by the CECE model of student retention. Moreover, the literature has shown the retention benefits of supporting the academic self-efficacy and sense of belonging of HES generally (Pedler et al., 2022; Travis et al., 2020) and HES pursuing degrees in STEM specifically (Trujillo & Tanner, 2014; Good et al., 2012), but these constructs have not been thoroughly investigated in the context of a SSB program (Louis, 2020; Barth et al., 2021). In sum, this study proposes to examine the development of primarily-HES SSB program participants' individual influences (Museus, 2014) over the course of the program at a PWI, which is a gap in the literature.

The Auburn University STEM Summer Bridge Program

The present research study is focused on the Auburn University STEM Summer Bridge program. The program schedule varies slightly year to year; however the main topics and activities stay relatively stable across years (Gonzales et al., 2022). The following describes the virtual 2021 SSB program at Auburn University, which was conducted virtually to mitigate risk related to the COVID-19 pandemic (Gonzales et al., 2022). Before the program began, participants attended a virtual group orientation session during which accessibility considerations and the program schedule, expectations and goals were discussed. This orientation was also an opportunity for the SSB program facilitators to introduce themselves and other important staff, e.g., graduate student interns, deans, administrative staff, to the participants. In addition, participants and their family members who attended were given the opportunity to ask questions. The primary goal of this orientation session was to begin building community and provide holistic and proactive support and resources.

Each of the four weeks of the SSB program were characterized by a unique theme to organize the SSB experience (Gonzales et al., 2022). The first week's theme related to getting to know oneself and each other by self-exploration, creating relationships and building community. Example activities during this week include a show and tell activity, in which participants shared an item that represents them and described how it was representative of them; completing the StrengthsFinder (Rath, 2007) assessment to identify personal strengths and discussing these strengths; attending and asking questions during a STEM student panel discussion; and an interactive virtual campus tour (Gonzales et al., 2022). The second week's theme was related to students more deeply engaging with, examining, and applying what they learned about themselves and each other in the first week of the SSB program. For example, participants attended a workshop to learn more about their StrengthsFinder (Rath, 2007) results and discuss

them; completed a skills-majors-careers match assessment distributed by the College of Sciences and Mathematics (COSAM) Office of Academic Advising; and attended a workshop focusing on cultural identity, cultural competency, and inclusive student practices led the Auburn University Office of Inclusion and Diversity.

Week three of the SSB program was focused on introducing participants to university faculty and staff who can provide support to them once the semester begins (Gonzales et al., 2022). This included staff members from the Career Center, Office of Academic Support, and University Writing Center, in addition to faculty and staff members who teach introductory STEM courses and college administration. Week four of the SSB program was characterized by the theme of connecting with others, which was accomplished through fostering participant peer connection and relationships between participants and university staff. This week also included providing more information and resources related to university support. This included a presentation on mental health, holistic wellness, and mental health support resources; being introduced to the Office of Student Organizations and which campus organizations exist; and attending panel discussions with SSB alumni.

The in-person Auburn University SSB program covers much of the same content as the online 2021 SSB program (Gonzales et al., 2022), however there are some significant differences which should be acknowledged. The first is, by nature of living together in an on-campus dormitory building, the in-person SSB participants spend time together outside of formal SSB activities which the virtual SSB participants did not. The SSB participants also spent time together walking between activities, such as to and from classes or lunch. In addition, the in-person program also includes STEM-related coursework each morning.

CECE Model of Student Retention in the Present STEM Summer Bridge Program

The SSB schedule described is theoretically congruent with Museus' (2014) CECE model and satisfies each of the nine CECE Indicators. The events and activities of the SSB program which satisfy the CECE Indicators were described in Gonzales and colleagues (2022, pp. 125-127), and are as follows.

CECE Indicator #1: Cultural Familiarity. By nature of targeted recruitment efforts, many of the SSB participants hold historically excluded racial/ethnic identities. Thus, most of the students interacted with peers who share that personal identity. In addition, faculty and staff members who hold historically excluded identities were invited to present to and speak with the students, thus satisfying meaningful exposure to institution-affiliated individuals who may share a similar cultural background with the students.

CECE Indicator #2: Culturally Relevant Knowledge. Of particular import to this CECE Indicator was an Identity Development workshop. This activity not only allowed the students to engage with content regarding the development of various personal identities, but also to engage in discussion with peers and staff members about experiences of prejudice, their own personal biases, and the salience of one's identities based on the space one occupies.

CECE Indicator #3: Cultural Community Service. The Innovative Design Project of the STEM Summer Bridge program satisfied this indicator. Students were asked to identify an issue in their home community. In groups, they then designed a product or service to address this issue. Though not implemented during the program, this project showed the students that their knowledge is and will continue to be beneficial to

their community of origin. In addition, it showed the students that faculty and staff members are interested in serving the students' communities of origin.

CECE Indicator #4: Opportunities for Meaningful Cross-Cultural Engagement. As mentioned in CECE Indicator #1, the STEM Summer Bridge participants themselves were a diverse group of individuals. Additionally, the students engaged with graduate interns, faculty and staff who held diverse cultural identities. Thus, by nature of this engagement, this indicator was satisfied.

CECE Indicator #5: Collectivist Cultural Orientations. Briefly and over-simply stated, collectivist cultural orientation is characterized by valuing the individual as part of a collective and individualist cultural orientation is characterized by valuing the individual independent of groups of which the individual is a member (Triandis, 2018). There are many measures of individualist/collectivist cultural orientations, though reducing a construct such as culture to a numerical index does not provide a holistic and comprehensive perspective (Cozma, 2011). As such, a collectivist orientation was fostered, and thus this indicator was satisfied, through the cultivation of relationships within peer groups, working toward addressing a community-focused issue through the Innovation Design group project, and through modeling (Bandura, 2017) of a collectivist perspective by the program facilitators.

CECE Indicator #6: Culturally Validating Environments. This indicator was satisfied through particular workshops led by institution-affiliated individuals that valued students' cultural identities, e.g. the Identity Development Workshop; the inclusion of briefer culturally-validating interventions, e.g. the Show & Tell exercise; and

supplementary interventions such as having the students submit their favorite song to create a playlist that was played during breaks from content sessions.

CECE Indicator #7: Humanized Educational Environments. The environment of the STEM Summer Bridge program was humanized in many ways. For example, the program facilitators stated from the beginning of the program that the students are valued holistically, explicitly avoiding a reductionistic perspective of a student. Indeed, consistent check-ins and debriefing by the program facilitators, in addition to the previously mentioned playlist, Show & Tell exercise, and other activities evidenced this humanistic perspective.

CECE Indicator #8: Proactive Philosophies. The existence of the STEM Summer Bridge program is itself evidence of a proactive philosophy toward the retention and success of HES. The program offers important information about a multitude of avenues of support, from academic to financial to mental health.

CECE Indicator #9: Availability of Holistic Support. Through the different campus office presentations, students were introduced to staff members who can support them during their college experience. Furthermore, the program facilitators directly stated to the students throughout the program that they are here to support them, and if they cannot directly help them with an issue, they will connect them with someone who can. (Gonzales et al., 2022, pp.125-127)

In summary, the SSB program at Auburn University is theoretically consistent with the CECE model of student retention by satisfying each of the CECE indicators (Museus, 2014). Basing the development of a SSB program in the CECE model is novel to the empirical literature, and it is valuable for college counselors to be able to pull from this evidence base to

inform their program design related to supporting HES retention at their institution. Specifically, college counselors can use the design of the program to inform the development of their praxis (Ratts et al., 2016) to include intentionally creating campus environments which satisfy the CECE indicators (Museus, 2014).

Empirical Support for STEM Summer Bridge Programs

At the present time, there are 16 empirical studies extant in the literature which quantitatively explore the objective impacts of STEM Summer Bridge programs (Bradford et al., 2021). In their meta-analysis, Bradford and colleagues found five dissertations, six conference papers, and five published articles which investigate the efficacy of STEM Summer Bridge programs. The authors operationalized STEM Summer Bridge program efficacy as first-year GPA and first-year retention rates. Compared to control groups of students who did not complete a STEM Summer Bridge program, STEM Summer Bridge participants had a higher first-year GPA and had improved retention rates, indicating that these programs indeed are effective. However, these studies did not consider personal factors such as academic self-efficacy and solely focused on objective measures of program efficacy.

Barth et al. (2021) examined the relationship between in-person SSB participant satisfaction with their SSB experience and two variables, sense of belonging and STEM self-efficacy, across nine institutions' SSB programs in Alabama. At multiple time points, participants' SSB satisfaction was positively correlated with their overall sense of belonging to their institution, the STEM field as a whole, and their STEM self-efficacy. The STEM self-efficacy measure was a brief three-item measure which operationalized this concept as students' academic preparedness and commitment to their major. In addition, Barth et al. (2021) operationalized sense of belonging as a composite variable comprised of three variables. The

first variable was participants' sense of belonging within the SSB program and institution communities. The second was STEM identity, which was operationalized as desiring a successful STEM career, to be recognized for one's contributions to STEM, and to make a positive difference in the world. The third variable was students' perception of faculty supportiveness.

Statement of the Problem/Significance of the Study

The student population attending higher education institutions is not representative of US population numbers based on multiple demographic factors (National Center for Education Statistics, 2023). Some fields within higher education are less representative than others, and STEM-related degree programs in particular are under representative of multiple historically excluded groups, such as women (Nimmesgern, 2016), members of the LGBTQ+ community (Cech & Waidzunas, 2021), and Black or Latina students (Starr et al., 2022). The primary driver of the underrepresentation of HES in STEM-related fields is disparity of retention rates between HES and students not from historically excluded groups (Costello et al., 2023; Shaw et al., 2021). Considering that college counselors promote social justice (American College Counseling Association, 2000; American Counseling Association, 2014), a goal of college counselors' praxis (Ratts et al., 2016) should include supporting the retention of HES at their institution.

There are multiple theories of student retention (e.g., Tinto, 1993) which can guide college counselors' praxis to support HES retention, though Museus' (2014) CECE model of student retention is particularly valuable because it emphasizes the role of institutional agents, e.g., college counselors, in creating campus environments which are characterized by engaging students' diverse cultural selves. There are also multiple interventions college counselors can implement which can support HES retention (Costello et al., 2023), and one which has been shown to be related to higher retention and GPA for HES is a STEM Summer Bridge program

(Barth et al., 2021). STEM Summer Bridge programs can be designed to be theoretically congruent with the CECE model of student retention (Gonzales et al., 2022; Museus, 2014), and college counselors can implement this theory-driven intervention themselves or use its design to inform other programming which creates CECEs and supports the retention of HES at their institution.

Purpose of the Study

There is a dearth of literature which evaluates SSB program efficacy (Barth et al., 2021; Bradford et al., 2021). Within this limited literature base, most studies focus on retention rate and GPA as markers of SSB program efficacy (Bradford et al., 2021), though some also examined student variables which have been shown to predict HES retention, such as STEM major academic self-efficacy or sense of belonging (Barth et al., 2021). However, the SSB literature has not yet explored SSB programs' outcomes on a holistic definition of academic self-efficacy which transcends solely STEM major-related academic self-efficacy. In addition, the literature lacks an investigation into whether the modality of SSB delivery, i.e., virtual or in-person, has a differential outcome on participants' academic self-efficacy and sense of belonging. Finally, the empirical literature lacks the inclusion of the CECE model of student retention (Museus, 2014) to inform SSB program design. This study seeks to fill that gap in the literature by analyzing previously-collected data from four years of the Auburn University SSB program, two of which were conducted virtually and two of which were conducted in person. This addition to the literature is valuable to inform college counselors' praxis to support HES retention at their institution because it provides examples of how to implement an intervention which satisfies all nine CECE indicators (Museus, 2014) and offers additional empirical support for the importance of academic self-efficacy and sense of belonging for HES retention at PWIs.

Research Questions

1: What are participant outcomes of participating in a STEM Summer Bridge program on:

1.a: Participants' academic self-efficacy

1.b: Participants' sense of belonging in STEM, and

1.c: Participants' sense of inclusion at the college level?

2: Does the outcome of participating in a STEM Summer Bridge program differ based on an in-person vs. remote delivery modality on participants' academic self-efficacy, sense of belonging in STEM, and sense of inclusion at the college level?

3: Does a relationship exist between participating in a STEM Summer Bridge program and being retained in a STEM degree program?

Summary

In conclusion, college counselors can embody their ethical value of promoting social justice (American College Counseling Association, 2000; American Counseling Association, 2014) in many ways (Nassar & Singh, 2020). One way to do so is working to support the representation of HES at their institution, and because disparities in retention rates are the largest driver of underrepresentation of HES (Shaw et al., 2021), college counselors should consider interventions which support HES retention. Two important variables which are related to HES retention are their academic self-efficacy and their sense of belonging at their institution (Barth et al., 2021; Museus, 2014). One intervention which is designed to support HES retention in STEM, a higher education field which is particularly misrepresentative (Chen, 2013), in addition

to supporting HES academic self-efficacy, and sense of belonging, is a SSB program (Ashley et al., 2017). STEM Summer Bridge programs can be implemented virtually or in-person (Gonzales et al., 2022), though a majority of the empirical literature related to SSB programs examines in-person programs (Barth et al., 2021) and operationalizes SSB efficacy through GPA and retention rate (Bradford et al., 2021). Research is needed to investigate SSB program outcomes on individual influences (Museus, 2014) which can contribute to HES retention such as academic self-efficacy and sense of belonging. In addition, investigation into the impact of SSB program delivery modality, i.e., virtual or in-person, on participants' individual influences is lacking from the literature.

Chapter 2

Methodology

This study examined previously collected data through a quantitative, pre/post-test survey design to investigate the outcomes of participating in a STEM Summer Bridge program. This study investigated program participants' academic self-efficacy, sense of belonging in a STEM environment, and sense of inclusion at the college level. The literature shows support for the efficacy of STEM Summer Bridge programs for supporting the retention of HES at PWIs (Bradford et al., 2021), and the present program is theoretically congruent with Museus' (2014) CECE model of student retention. As such, the present study contributes to the empirical literature by expanding support for SSB programs in fostering participants' individual influences such as academic self-efficacy and sense of belonging, in addition to investigating the efficacy of a virtual SSB program compared to the efficacy of an in-person SSB program.

Research Questions

1: What are participant outcomes of participating in a STEM Summer Bridge program on:

1.a: Participants' academic self-efficacy

1.b: Participants' sense of belonging in STEM, and

1.c: Participants' sense of inclusion at the college level?

2: Does the outcome of participating in a STEM Summer Bridge program differ based on an in-person vs. remote delivery modality on participants' academic self-efficacy, sense of belonging in STEM, and sense of inclusion at the college level?

3: Does a relationship exist between participating in a STEM Summer Bridge program and being retained in a STEM degree program?

Participants

The participants in this study were students in the Auburn University SSB program. To participate in SSB, a student must be accepted and enrolled as a first-year Auburn University undergraduate student with a major housed in either the College of Sciences and Mathematics (COSAM) or the Samuel Ginn College of Engineering. To participate in the proposed study, participants also had to be 18 years of age. During the first and fourth week of SSB, participants completed the Academic Self-Efficacy Scale (Zajacova et al., 2005), a slightly modified version of the Math Sense of Belonging Scale (Good et al., 2012), and a slightly modified version of the Engineering Department Inclusion Level Scale (Lee et al., 2014).

A total of 164 individuals completed the surveys. Of the 164 participants, 156 participants were included in analyses. Eight participants' data were not included because they indicated they were 17 years of age. Participants were mostly 18 years of age (n = 147, 94.6%), slightly over half identified as men (n = 82, 52.6%), and primarily identified as Black or African American (n = 105, 67.3%). Full participant demographics can be found in Table 1.

Procedures

This study used a pre/post-test, quantitative approach. Following IRB approval, the participants were recruited during a scheduled meeting during the first week of the program to collect pre-test data. Participants were asked to bring their personal laptops to this meeting and were shown a shortened URL address which linked them to survey materials. Each participant reviewed the information letter at the beginning of the survey and was also provided the

Table 1.
Participant Demographics

	n	*%*
Age		
18	147	94.2%
19	5	3.2%
20	2	1.3%
21	1	.6%
Prefer Not to Answer	1	.6%
Gender Identity		
Woman	69	44.2%
Man	82	52.6%
Non-Binary	2	1.3%
Prefer Not to Answer	3	2.0%
Ethnic Identity		
Black/African American	105	67.3%
Biracial	16	10.3%
White, Not Hispanic	14	9.0%
Asian/Asian American	10	6.4%
Hispanic/Latiné	5	3.2%
Native American	2	1.3%
Pacific Islander	1	.6%
Afro-Hispanic	1	.6%
Filipino African American	1	.6%
Prefer Not to Answer	1	.6%

opportunity to receive a hard copy of the information letter if they desired. By selecting to continue with the survey, the participants indicated their consent. The requirement of documentation of consent was waived because the study shows minimal risk beyond what would be expected in a normal day and consent documentation would be the only identity marker in the survey. This survey contained the following questionnaires: A demographics survey developed by the researcher; the Academic Self-Efficacy Scale (Zajacova et al., 2005); a slightly modified version of the Math Sense of Belonging Scale (Good et al., 2012); and a slightly modified version of the Engineering Department Inclusion Level Scale (Lee et al., 2014). This same procedure was conducted in the fourth week of the STEM Summer Bridge program to collect post-test data.

Instrumentation

Brief Demographic Measure

A demographics measure was developed for this study. The following data were collected: A self-generated participant code to match pre and post-test data; age; gender identity; ethnic identity; mother and father education level; college affiliation (COSAM or Engineering); highest anticipated level of education; intended professional field; and cumulative GPA, if applicable.

Academic Self-Efficacy Scale

The participants' academic self-efficacy was measured via the Academic Self-Efficacy Scale (Zajacova et al., 2005). This scale is comprised of two subscales of 27 items each. Each item relates to a specific college-related task, such as "studying," "making friends at school," "having enough money," and "participating in class discussions." After reading the task, participants rate how stressful they anticipate completing this task will be on a 10-point Likert-style scale, with *1 = not at all stressful* to *10 = extremely stressful*. Respondents will then rate how confident they are they will be able to complete that same task on a 10-point Likert-style scale, with *1 = not at all confident* to *10 = extremely confident*. The overall scale shows high internal validity (Cronbach's $\alpha = .93$), and the stress ($\alpha = .97$) and confidence ($\alpha = .96$) subscales also show high internal validity. The stress and confidence subscales each contain four subscales, which are interactions at school (stress $\alpha = .92$, confidence $\alpha = .91$), academic performance in class (stress $\alpha = .90$, confidence $\alpha = .90$), academic performance out of class (stress $\alpha = .93$, confidence $\alpha = .91$), and managing work, family, and school (stress $\alpha = .79$, confidence $\alpha = .72$). As such, eight total subscales exist. Total stress and confidence scores are calculated by finding

the means of each of the four subscales in stress and confidence respectively. Higher scores in the total stress subscale indicates greater expected stress in completing these tasks, whereas higher scores in the total confidence subscale indicates greater confidence in being able to successfully complete these tasks.

STEM Sense of Belonging Scale

The students' sense of belonging was measured with a slightly modified version of the Math Sense of Belonging Scale (Good et al., 2012). This scale was originally designed to measure students' sense of belonging to the mathematics community at large, and it was adapted to measure students' sense of belonging to the STEM community at large. This was accomplished by replacing all instances of the word "math" with the word "STEM,". This modified scale shows high internal validity (α = .95) and includes 30 items, which all stem from the statement, "When I am in a STEM setting…" Respondents indicate to what extent they agree with the statement made in each item on an 8-point Likert scale, with *1 = strongly disagree* and *8 = strongly agree*. Example items include, "I feel respected," "I feel like an outsider" (reverse coded), and "I have trust that I do not have to constantly prove myself." This scale contains five subscales, which are membership (α = .92), acceptance (α =.91), affect (α =.88), trust (α = .81), and desire to fade (α = .81). Respectively, these subscales examine to what extent respondents feel like a member of the STEM community; how accepted they feel by the STEM community; how their emotions are affected when in a STEM setting; to what extent they trust the STEM community to be fair and supportive; and to what extent they desire to be unnoticed or "fade into the background" when they are in a STEM setting. Subscale scores are calculated by finding the mean of each item within the subscale. Total STEM sense of belonging scores are calculated by

finding the mean of the five subscale scores. Higher scores in this scale indicate feeling a greater sense of belonging to the STEM community.

College Inclusion Level Scale

The students' sense of belonging at the college level was measured by a slightly modified version of the Engineering Department Inclusion Level Scale (Lee et al., 2014). Similar to the adaptation strategy used for the sense of belonging scale (Good et al., 2012), this scale was modified by replacing the word "engineering" with the phrase "COSAM or College of Engineering (COE), whichever you are enrolled in." This scale shows high internal validity (α = .97) and contains 24 items such as, "faculty members in COSAM/COE care about me as a person," "I am comfortable voicing my concerns within COSAM/COE," and "I would rather remain in COSAM/COE than transfer to another college/department." Respondents indicate to what extent they agree with the statement about their college on a six-point Likert scale, with *1 = strongly disagree* to *6 = strongly agree*. This scale includes three subscales, which are caring (α = .96), diversity (α = .87), and pride (α = .90). Respectively, these subscales relate to what extent COSAM/COE shows they care about students holistically, to what extent COSAM/COE shows its commitment to diversity and inclusion, and to what extent students feel proud to be a member of COSAM/COE. The pride subscale included four items and was reduced to a two-item subscale with no impact on alpha levels, and thus the final scale contained 22 items. Subscale scores was calculated by finding the mean of each item in the subscale. Total sense of belonging scores was calculated by finding the mean of the subscale scores.

Data Analysis

This study used a quantitative approach with a pre/post-test survey method and a paired-samples *t*-test design to address research question one. The assumptions of this test include a continuous dependent variable, that the observations are dependent of one another (i.e., participants' pre and post scores are matched), the dependent variable should approximately meet normal distribution, and the dependent variable should not contain outliers (Ross & Shannon, 2011). This design was selected to assess the change in Auburn University's SSB program participants' academic self-efficacy, sense of belonging to the STEM field, and sense of inclusion within their specific college before and after completing the program. These variables were measured by the Academic Self-Efficacy scale, a slightly modified version of the Math Sense of Belonging Scale, and a slightly modified version of the Engineering Department Inclusion Level Scale. Paired-samples *t*-tests were used to determine whether participants' levels of academic self-efficacy, sense of belonging in STEM, and sense of inclusion in their college differed before and after completing the STEM Summer Bridge program (research question 1).

In addition, repeated measures mixed model ANOVA (Murrar & Brauer, 2018) were conducted to examine the differences between the remote delivery and in-person delivery of the STEM Summer Bridge program on participants' academic self-efficacy, sense of belonging in STEM, and sense of inclusion at the college level (research question 2). A repeated measures design was chosen to examine change in participant scores before and after completing the SSB program. The between-subjects variable was modality of SSB program delivery, dichotomously defined as in-person or remote delivery. The within-subjects variables were academic self-efficacy, sense of belonging in STEM, and sense of inclusion at the college level. This design allows for the main effect of SSB completion to be found for the within-subjects variables. It also allows the interaction effect of delivery modality to be found for the within-subjects

variables, which assesses if delivery modality has an impact on the amount of change in the within-subjects variables. The assumptions of a repeated measures mixed model ANOVA with two levels of the within-subjects variable include a normal distribution of both between- and within-subjects residuals and homogeneity of the variance-covariance matrices (Murrar & Brauer, 2018).

A Chi Square test of independence was proposed to explore whether a relationship exists between being retained in a STEM-related major and participating in STEM Summer Bridge (research question 3). The assumptions of this test include a random sample, independent observations, and adequate cell counts (Ross & Shannon, 2011). In this vein, if the df = 1, an *N* between 20 and 40 is suggested (Siegel & Castellan, 1988). Retention is defined as remaining in a STEM-related degree program (Barth et al., 2021). The alpha level for this study was established *a priori* at $\alpha = .05$. Due to the nature of anonymous institutional retention data, SSB participants' retention data cannot be removed from the institutional dataset, and thus the current study's design violates the test assumption of independent observations. As such, this research question was not explored in this study.

Chapter 3

Results

The present study used quantitative methods to explore STEM Summer Bridge (SSB) program participant outcomes related to academic self-efficacy, sense of belonging in the STEM fields, and sense of inclusion at the college level. In addition, this study sought to investigate whether the outcomes of participating in a STEM Summer Bridge program differed on participants' academic self-efficacy, sense of belonging in STEM, and sense of inclusion at the college level based on an in-person vs. remote delivery modality. Finally, this study proposed to investigate whether there was a relationship between completing SSB and being retained in a STEM-related major, but the data available did not allow for this question to be explored. Correlations between main study variables can be found in Table 2.

Table 2.
Correlations of Main Study Variables.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. ASE, Confidence Pre	-									
2. ASE, Confidence Post	.508**	-								
3. ASE, Stress Pre	-.511**	-0.174	-							
4. ASE, Stress Post	-.380**	-0.109	.683**	-						
5. SoB, Pre	.508**	.696**	-.318**	-.218*	-					
6. SoB, Post	.651**	.423**	-.425**	-.402**	.550**	-				
7. Inclusion, Pre	.492**	0.204	-.269**	-0.134	.490**	.423**	-			
8. Inclusion, Post	.328**	.534**	-.246*	-0.087	.344**	.443**	.508**	-		
9. Modality	-0.118	-0.159	-0.027	-0.083	-0.078	-.253**	0.152	-0.062	-	
10. Gender Identity	-0.125	-0.079	.234**	.263**	-0.089	-0.030	0.026	-0.062	0.041	-

*** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the .05 level (2-tailed)*
Note: ASE = Academic Self-Efficacy; SoB = Sense of Belonging in STEM; Inclusion = Sense of Inclusion at College Level

Research Question 1

Paired samples *t*-tests were conducted to investigate Research Questions 1.a, 1.b, and 1.c. Full results for Research Question 1 can be found in Table 3. Regarding Question 1.a, results indicated that there was a significant difference in participants' overall sense of confidence in

being able to accomplish college-related tasks, such that scores before completing SSB (M = 7.99, SD = 1.23) were significantly lower than scores after completing SSB (M = 8.22, SD = 1.31), $t(90) = -1.75$, $p = .042$. Results indicated no significant difference between participants' overall sense of how stressful accomplishing college-related tasks are before completing SSB (M = 5.31, SD = 1.79) and after completing SSB (M = 5.12, SD = 2.00), $t(90) = 1.20$, $p = .117$.

Regarding Question 1.b, results indicated a significant difference in participants' overall sense of belonging in the STEM fields, such that scores before completing SSB (M = 6.47, SD = 1.05) were significantly lower than scores after completing SSB (M = 6.81, SD = .85), $t(92) = -3.50$, $p < .001$.

Regarding Question 1.c, results indicated no significant difference in participants' sense of inclusion at the college level before completing SSB (M = 5.53, SD = .52) and after completing SSB (M = 5.57, SD = .48), $t(84) = -.83$, $p = .204$.

Research Question 2

A repeated measures, mixed model ANOVA was conducted to investigate Research Question 2. Box's M was shown to be significant for this model, $F(36, 22079.85) = 2.23$, $p < .001$, which indicates the assumption of homogeneity of covariance of the data has been violated (Murrar & Brauer, 2018). As such, the results of this analysis cannot be interpreted.

Research Question 3

Research Question 3 was unable to be explored in the present study due to the anonymous nature of institutional retention data preventing independent observations, thus violating an assumption of a Chi square test of independence.

Table 3.
Paired Sample T-Test for Study Variables

	Pre-Test		*Post-Test*				
	M	*SD*	*M*	*SD*	*t*	*p*-value	Cohen's *d*
ASE – Confidence	7.99	1.23	8.22	1.31	-1.75	.042	-.183
ASE – Stress	5.31	1.78	5.12	2.00	1.12	.117	.125
SoB	6.47	1.05	6.81	.85	-3.50	< .001	-.363
Inclusion	5.53	.52	5.58	.48	-.83	.204	-.09

Note: ASE = Academic Self-Efficacy; SoB = Sense of Belonging in STEM; Inclusion = Sense of Inclusion at College Level

Summary

The present study's findings indicated a significant difference in participants' confidence in accomplishing college-related tasks, i.e., ASE confidence, and sense of belonging in STEM scores from before completing SSB to after completing SSB. Specifically, both variables' means were greater after completing SSB than before completing SSB. On the other hand, participants' stress about successfully accomplishing college-related tasks, i.e., ASE stress, and sense of inclusion at the college level scores did not significantly differ from before to after completing SSB. In addition, results indicated that the survey data collected violated the homogeneity of covariance assumption of a repeated measures, mixed model ANOVA, and thus findings from this analysis are not interpretable. Finally, the Chi square test of independence assumption of independent observations was also violated, therefore this analysis was not conducted.

Chapter 4

Discussion

This study sought to explore STEM Summer Bridge (SSB) program participant outcomes related to academic self-efficacy, sense of belonging in the STEM fields, and sense of inclusion at the college level. In addition, this study sought to explore whether modality, i.e., in-person or online delivery of SSB, has an impact on student outcomes. Finally, this study proposed to determine whether there was a relationship between participating in SSB and being retained in one's STEM degree program. The latter two research questions will not be interpreted in the following discussion due to statistical test assumption violations.

Higher education is not representative of the overall US population based on multiple demographic variables, such that students who hold marginalized personal identities tend to be historically excluded from many higher education fields (United States Census Bureau, 2022), and especially from STEM higher education (Costello et al., 2023). The primary driver of the underrepresentation of students from historically excluded groups is a difference in retention rate between students who possess marginalized identities and students who do not (Shaw et al., 2021). Previous models of student retention (e.g., Tinto, 1993) suggest students should assimilate to their institution's culture, though students who possess personal identities which are historically excluded from higher education can experience cultural alienation if they assimilate into an institution whose culture does not match with their own (Guiffrida, 2006; Museus, 2014; Tierney, 1999). STEM Summer Bridge programs were developed to address HES attrition rates by providing a mechanism by which these students can participate in cultural engagement and academic preparation as they enter their college career (Ashley et al., 2017). Through their program activities, SSB programs tend to give focus to building participants' ASE, improving

their sense of belonging within the STEM fields and their institution, and improving their academic preparedness.

Academic Self-Efficacy

As mentioned, an important aspect of SSB programs is building participants' ASE (Ashley et al., 2017; Barth et al., 2021). The present study explored SSB participants' ASE, however somewhat differently than previous SSB literature (Barth et al., 2021). Specifically, the present study considered participant ASE agnostic to specific major, extending beyond solely investigating STEM-related ASE. This is an important perspective for the literature to explore because if SSB programs are consistently shown to support student ASE generally, bridge programs related to non-STEM degree programs could have evidence to support broader implementation and HES pursuing other degrees could receive similar programming.

Results showed participants' confidence related to completing college-related tasks was higher after completing SSB, however results did not show a difference in how stressful participants found completing these college-related tasks. These findings are partially in line with other SSB literature which examines ASE and found that student satisfaction with their SSB experience predicted STEM efficacy across multiple semesters (Barth et al., 2021). Whereas Barth and colleagues (2021) do not delineate between ASE confidence and stress in their analyses, the present study adds additional support for SSB participant outcomes related to increased ASE after completing a SSB program. Additionally, this finding is partially congruent with the CECE model of student retention, in that this model asserts the importance of ASE to support historically excluded student retention (Museus, 2014; Museus et al., 2022). Similar to the previous partial support of the literature, the significant change in participants' ASE

confidence is in line with the CECE model, but the nonsignificant change in participants' ASE stress is not.

At first glance, this finding could be seen to indicate that participating in academic instruction, building community, and receiving holistic support and resources during SSB could be valuable for these participants' confidence in being able to be successful in college, but does not assuage any stress related to college. However, this operationalization of stress within ASE could be missing an important consideration related to student stress appraisal (Travis et al., 2020). Stress can be understood as serving two functions, namely one of motivation, i.e., eustress, and one of hindrance, i.e., distress (Penacoba et al., 2021). This conceptualization of stress has also been explored within ASE (Travis et al., 2020). Indeed, Travis and colleagues (2020) proposed a framework of ASE which conceptualizes the stress factor of ASE with this dual function of stress in mind. This framework asserts the confidence factor of ASE impacts the appraisal students make of their stress. Specifically, if students make an appraisal of their environment and self which is informed by higher ASE confidence, they may be more likely to perceive their academic stress as challenge stress, i.e., motivational, rather than as hindrance stress, i.e., detrimental.

With Travis et al.'s (2020) more nuanced consideration of ASE stress in mind, the present study's findings of significant ASE confidence change and nonsignificant ASE stress change could be viewed in a slightly different light. In particular, the present study's findings may be lacking the ability to tease out a difference in student appraisal of ASE stress, thus missing a change in student appraisal of their stress from hindrance stress into challenge stress. Whereas the present study cannot adequately explore this question, it will inform a future direction for research mentioned later.

Sense of Belonging in STEM

Another primary goal of a SSB program is to build participants' sense of belonging in the STEM fields (Ashley et al., 2017). In line with previous SSB literature (e.g., Barth et al., 2021) and congruent with the CECE model of student retention (Museus, 2014), the present study showed a significant increase in participants' sense of belonging in the STEM fields from before to after completing SSB. This is an important finding because students' sense of belonging in STEM, especially for HES, can help explain the pathway to persistence in one's STEM degree program (Good et al., 2012; Xu & Lastrapes, 2022).

Xu and Lastrapes (2022) explored the relationship between undergraduate students' sense of belonging in STEM, attitudes toward STEM, and career interest through multigroup path analysis, binarily split by gender. It should be noted that attitudes toward STEM is conceptualized similarly to the present study's conceptualization of ASE, such that attitudes toward STEM explored participants' appraisal of their skills related to STEM (i.e., ASE confidence; Zajacova et al., 2005), but differed in that it also explored participants' values related to STEM. They found that, for men, sense of belonging in STEM both directly and indirectly impacted their career interest, such that increased sense of belonging led to both more positive attitudes toward STEM and increased career interest, independently (Xu & Lastrapes, 2022). On the other hand, for women, increased sense of belonging in STEM impacted career interest indirectly, such that sense of belonging impacted attitudes toward STEM, which impacted career interest. However, no direct impact from sense of belonging to career interest was found for students who identified as women. These findings are important to consider in the context of the present study because they could add an additional consideration for supporting HES persistence: Stereotype threat (Good et al., 2012; Spencer et al., 2016).

Stereotype threat describes the phenomenon by which an individual from a marginalized group finds themselves in a situation where a harmful stereotype about them could be seen to explain their behavior. The threat of being judged based on this harmful stereotype can lead to diminished performance and motivation (Spencer et al., 2016). Examining mathematics undergraduate students, Good and colleagues (2012) found that stereotype threat related to women's poorer math performance than men's and the perception that math skills are a fixed trait predicted a lower sense of belonging to the math community for women, but not for men. This lower sense of belonging to the math community for women mediated their math grades and desire to pursue a career in math, such that lower sense of belonging predicted lower grades and career aspirations. However, they also found that instilling the message that math skills can be developed protected against stereotype threat and subsequent diminished sense of belonging, performance, and career aspirations. This finding shows the importance of student appraisals of their situation because if women appraised themselves to be at a fixed math skill level and/or that they were simply worse at math than their counterparts who were men, they performed worse and felt like they did not belong. In addition, this finding is in line with Travis et al.'s (2020) assertion that student appraisals of their academic-related stress in that if students appraise their experience of stress as challenge rather than hindrance stress, they are more likely to be more successful. Similarly, if students who are women appraise their math skills as able to be developed and refute the misogynistic ideal that men are inherently better at math than are women, they are protected from the deleterious effects of stereotype threat (Good et al., 2012).

In summary, the literature agrees that sense of belonging in STEM is important to support student retention in their STEM major (Barth et al., 2021; Good et al., 2012; Xu & Lastrapes, 2022). Importantly, HES tend to feel a lower sense of belonging to their respective field in

general (Hussain & Jones, 2021) and in STEM particularly (Rodriguez & Blaney, 2021), possibly due to underrepresentation or the experiencing the systems which have historically excluded them from these fields. These conclusions are important to consider for the present study because participants were primarily HES across at least one intersection of identity (e.g., ethnic or gender identity) and they tended to feel a greater sense of belonging after completing SSB.

Inclusion at the College Level

In addition to fostering students' sense of belonging to the fields of STEM broadly, a goal of SSB programs is to build a sense of inclusion in their institution for students (Ashley et al., 2017). The CECE model of student retention also highlights the importance of HES feeling included in their institutional culture (Museus, 2014). The results of the present study did not show a change in participants' sense of inclusion at the college level. However, means of pre-test inclusion scores and post-test inclusion scores were high. See Table 3 for details. With this in mind, participants seem to already feel well included in their college as they enter SSB. One explanation for this finding may be that by being recruited for SSB, interacting and corresponding with staff during planning and preparation for SSB, seeing fellow SSB participants during SSB orientation, or other efforts on behalf of the program or institution may have already shown SSB participants that they are included in campus culture. In addition, it is possible that by enrolling in or being made aware of SSB, participants already feel included in their institution.

Despite pre-SSB interaction and engagement as a possible explanation of the nonsignificant sense of inclusion finding, the lack of a significant change in sense of inclusion at the college level after completing a bridge program has been shown elsewhere in the literature

(van Herpen et al., 2020). van Herpen and colleagues found their participants interacted with peers and faculty more effectively after the intervention, though the bridge program in their investigation was a four-day bridge program which emphasized general social and academic preparation for students attending a Dutch university.

Implications for College Counselors

The present study offers multiple implications to inform college counselors' praxis related to promoting social justice and supporting HES at their institution. The findings suggest that SSB participants tended to feel more confident about their ability to accomplish college-related tasks and feel like they belong in the STEM fields to a greater extent after completing SSB. The results did not show significant change in how stressful participants saw accomplishing these college-related tasks or participants' sense of inclusion in their college. One implication for college counselors relates to intervention and program design. In particular, this SSB program was designed to satisfy all nine of Museus' (2014) CECE Indicators (Gonzales et al., 2022). College counselors can collaborate with other organizations or individuals who already support higher education student development (ACCA, 2009) to modify or design and implement programming based on the CECE Indicators (Museus, 2014) to support HES. This could include a SSB program such as the one currently under study, but it could also include other programs, such as a Yoga for stress management program (Milligan, 2006) or a counseling group (Jones & Sam, 2018).

For example, Jones and Sam (2018) describe Cultural Connections, a group counseling modality designed for Black women in college to provide a safe and supportive space to discuss race, gender, and cultural experiences. Based on their description, this group would create a campus environment which satisfied the following CECE Indicators (Museus, 2014): 1, Cultural

Familiarity; 2, Culturally Relevant Knowledge; 3, Cultural Community Service; 5, Collectivist Cultural Orientation; 6, Culturally Validating Environments; and 9, Availability of Holistic Support. Though applying the CECE model to a counseling group extends beyond how Museus originally conceptualized this model, college counselors are institutional agents and this group (Jones & Sam, 2018) is held on campus. As such, it is logical that the CECE model (Museus, 2014) could be applied to a counseling group.

In the design of these programs, it is important for college counselors to consider the process of praxis (Freire, 1968/1970) alongside design implications. This involves considering who their intended HES audience is, what the needs of this audience are, how to meet these needs through intervention, and which CECE Indicators (Museus, 2014) could meet the needs identified. Following the implementation of the intervention, college counselors should also engage in deep self-reflection about their role in the intervention, its successes, its failures, and what they learned about how to disrupt the oppressive systems HES navigate to inform future intervention (Freire, 1968/1970).

In addition to program or intervention design implications, the present study's findings related to ASE can guide college counselors' focus for interventions. In particular, considering Travis et al.'s (2020) conceptualization of ASE stress into hindrance and challenge stress, college counselors could give particular focus to support HES ASE confidence, because students are more likely to appraise their stress as challenge rather than hindrance with higher ASE confidence. Finally, this study also offers a holistic and culturally-relevant view on retention efforts, which can inform college counselors praxis as it relates to supporting HES and promoting social justice in higher education.

Limitations

There are multiple limitations which impact the present study. First, it should be noted that the staff members facilitating the Auburn University SSB program change from year to year. Specifically, each year a new group of eight to 10 interns assist with some student-facing aspects of the program, such as walking with students to various buildings, facilitating community building during downtime, leading select presentations, and performing resident assistant (RA) duties in student dormitories. In addition, a total of five individual program coordinators have assisted with planning and implementation of SSB during the present study's data collection period. The writer and one other member, the supervisor of COSAM OIED, remained involved across all time points of collected data. As such, some differences in participants' SSB experience may be related to differing staff.

In a slightly different vein, a limitation in this study also includes the cross-sectional nature of data collected. Whereas there are data collected from before and after completing SSB, the present study lacks a longitudinal perspective which considers SSB participant outcomes which endure later into their college career. Moreover, to receive a scholarship funded by COSAM OIED, SSB participants are required to complete additional requirements such as completing group study hours and attending a monthly academic success program. These additional co-curricular requirements will be explored in the future research section, as well.

Finally, there are three limitations which relate to the present study's generalizability. First, due to the non-experimental design of the study, causality cannot be determined. Whereas temporal primacy can indicate that changes in participants' academic self-efficacy and sense of belonging in STEM did occur over the time period in which they participated in SSB, the conclusion that these changes were caused by SSB cannot be drawn. Second, the present study examined four iterations of a SSB program at a single, primarily White, public land-grant R1

institution in the South-Eastern US. The cultural experience of attending a SSB program at this University is likely to differ in some ways from other universities, such as HBCUs or small, private PWIs. Third, generalizability of the present findings is limited due to the sample size.

Recommendations for Future Research

Based on the findings of the present study, there are multiple promising avenues for future research. The first is related to the previously-mentioned co-curricular programs and activities provided by COSAM OIED. Specifically, SSB participants often remain involved in additional programs throughout the rest of their academic experience (Barth et al., 2021), yet the majority of SSB literature does not extend to examine student outcomes across their undergraduate career, into their graduate education, or into their career (Bradford et al., 2021). This extension could reveal the presence of enduring outcomes of SSB participation and participant outcomes related to completing these additional co-curricular activities and programs. This avenue of research would not only be beneficial to the SSB literature, which is lacking longitudinal exploration of SSB participants throughout their college career and beyond, but could also be useful for college counselors. Specifically, if SSB outcomes related to academic self-efficacy and sense of belonging are found to be enduring or if results support the benefit of co-curricular activities, college counselors can have evidence supporting the implementation of programming not only at as students enter college, but throughout their college career, as well.

In addition, the SSB program currently under investigation was designed to satisfy all nine of the Culturally Engaging Campus Environments (CECE) Indicators (Gonzales et al., 2022; Museus, 2014). However, the SSB participants' perspectives on to what extent the program satisfied the CECE Indicators was not explored in the present study. Exploring the SSB participants' perspectives on the presence of the CECE Indicators would give a glimpse into

which CECE Indicators contribute most to the variance in participants' academic self-efficacy (Museus et al., 2016), in addition to what extent participants experienced the program to be culturally engaging.

Finally, the present study operationalizes ASE as one's confidence in their ability to accomplish college-related tasks and the extent to which one is stressed about being able to accomplish college-related tasks (Zajacova et al., 2005). However, as mentioned prior, it could be valuable to consider the difference between hindrance stress and challenge stress when operationalizing stress in the context of ASE (Travis et al., 2020). Future research could investigate SSB participant appraisals of stress (i.e., as challenge or hindrance) related to college tasks because challenge stress has been shown to be positively related to student success, whereas hindrance stress has been shown to be negatively related to student success (Travis et al., 2020). The current operationalization of stress in ASE as a singular concept may be missing this important nuance.

Summary

The present research study explored SSB participant outcomes related to ASE, sense of belonging in STEM, and sense of inclusion at the college level. Results showed a significant increase in participants' ASE confidence and sense of belonging in STEM after completing SSB. These findings have implications for college counselors' praxis as it relates to supporting HES at their institution.

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Chapter 5

Manuscript

Introduction

Ethical counselors promote social justice (American Counseling Association, 2014). Called the fifth force in counseling (Ratts, 2009), the overall goal of social justice is to create a world where everyone can experience equity, justice, and liberation (Nassar & Singh, 2020). A useful model to inform engaging in social justice is the Multicultural and Social Justice Counseling Competencies (MSJCC; Ratts et al., 2016). This model focuses on praxis, i.e., using theory, knowledge, and personal experience to inform action to diminish systemic oppressive forces (Freire, 1968/1970). The American College Counseling Association (ACCA) also calls college counselors to promote social justice in their work in their Diversity Statement (ACCA, 2000).

Taken together, the MSJCC (Ratts et al., 2016) and the ACCA Diversity Statement (2000) direct college counselors to work to diminish systemic barriers to college students' success and wellbeing. Moreover, they suggest that a critical component is the diversity of the student and faculty members within programs. There are many ways a college counselor can accomplish the goal of establishing the program and institutional factors that support social justice (Nassar & Singh, 2020). One way is to increase the representation of historically excluded students (HES) at their higher education institution. The term HES is preferable to terms such as traditionally underrepresented minority (e.g., Miller & Orsillo, 2020) because it highlights the systemic oppressions which causes the underrepresentation of HES in higher education (Armstrong, n.d.). On the other hand, underrepresentation is solely the description of a disparity between the representation of people who identify with a specific demographic factor in an overall

population, e.g., people living in the US, and within a specific group, e.g., people enrolled in a higher education institution.

The rate of student representation is inequitable between higher education institutions and general population levels in the United States based on multiple demographic variables. According to the National Center for Education Statistics (2023), students who are Black are underrepresented in the US undergraduate population by approximately 11%, because 12.3% of the 15.4 million undergraduate students in the US who were enrolled in fall of 2021 identified as Black, whereas approximately 13.6% of the US population identified as Black (United States Census Bureau, 2022). Another example of underrepresentation which emerges in higher education representation are students from a lower socioeconomic status (SES; Tompsett and Knoester, 2023). For example, about 74% of high school graduates from the highest SES quintile attend a four-year university within 18 months of graduating high school (Reber & Smith, 2023). On the other hand, only about 23% of high school graduates from the lowest SES quintile attend a four-year university in that same time period.

College counselors are uniquely positioned to engage in work focused on supporting HES because the greatest contributor to HES underrepresentation is the disparity in retention between HES and students not from historically excluded groups (Costello et al., 2023; Shaw et al., 2021). One example of an intervention designed to support HES retention is a STEM Summer Bridge program (SSB; Ashley et al., 2017; Barth et al., 2021).

STEM Summer Bridge Programs

The majority of SSB programs include programming related to community building, academic skill development, engagement with campus culture, professional networking opportunities, site visits or tours, and establishing systems of social support (Ashley et al. 2017;

Cooper et al., 2017). Because there are many aspects of the college experience which SSB programs cover, these programs tend to be multiple week-long experiences. They were designed to provide resources, knowledge and skill instruction on the previously mentioned topics and simultaneously help program participants become familiar with living on campus while pursuing a STEM degree (Bradford et al., 2021; Cooper et. al, 2017). These programs can be conducted either in-person or using a remote modality (Barth et al., 2021; Gonzales et al., 2022), which can affect the ways in which SSB participants engage with this content, though SSB programs delivered in both modalities tend to share the same focus. Considering that theoretical understanding is a necessary aspect of praxis (Freire, 1968/1970), it can be valuable to base the design of a SSB program on a theory of student retention (Gonzales et al., 2022).

Culturally Engaging Campus Environments Model of Student Retention

Previous theories of student retention (e.g., Tinto, 1993) have highlighted student integration into their institution's culture as an important aspect of understanding why students are motivated to persist in their degree program. However, Tinto's (1993) theory has been critiqued for its inapplicability to the experience of HES (Guiffrida, 2006; Museus, 2016). In creating a student retention model which is separate from Tinto's and applicable to the experience of HES, Museus (2014) proposes the Culturally Engaging Campus Environments model, i.e., the CECE model. The CECE model considers the external influences which affect both individual influences, i.e., sense of belonging, and academic dispositions, and academic outcomes, which impacts student retention (Museus, 2014). In particular, this model argues that culturally engaging campus environments, i.e., campus environments characterized by respecting and valuing diverse student cultures, are related to more positive individual influences and thus, greater higher education success outcomes. The CECE model, and specifically the fact that the

CECE model prioritizes the creation of CECEs, is useful to college counselors because as institutional agents, college counselors can intentionally help create or offer consultation (Sharkin, 2012) on creating a campus environment which is culturally engaging for HES.

In particular, Museus (2014) offers nine distinct characteristics of a CECE, called CECE Indicators, which can be used to guide programming which engages students' diverse cultural selves. These indicators are as follows: 1, Cultural Familiarity, or students being exposed to faculty, staff and peers who share their cultural background; 2, Culturally Relevant Knowledge, or students sustaining and increasing knowledge about their culture and community of origin; 3, Cultural Community Service, highlights students being provided tools and opportunities by their institution to improve and give back to their community of origin; 4, Opportunities for Meaningful Cross-Cultural Engagement; 5, Collectivist Cultural Orientations of the campus environment; 6, Culturally Validating Environments; 7, Humanized Educational Environments, or that institution-affiliated individuals care about their students as holistic people; 8, Proactive Philosophies, which relates to students receiving resources and support proactively; and 9, the Availability of Holistic Support for students.

In summary, the CECE indicators (Museus, 2014) provide a theoretical framework which can inform the praxis of college counselors as it relates to planning actions and programming which can support the retention of HES at their institution. Specifically, the CECE model asserts the importance of campus environments, which are within a college counselor's role to affect (Sharkin, 2012). When a college counselor implements an intervention, designs an outreach event, or creates programming, they can use the CECE indicators to guide specific aspects of the experience to be culturally engaging for HES, and thus, support their institutional persistence while attending a PWI (Museus, 2014). In practice, the CECE model asserts that institutional

agents, e.g., college counselors, should strive to create CECEs which are humanized and culturally affirming for HES. By doing so, students' individual influences, i.e., sense of belonging at their institution, academic dispositions such as academic self-efficacy, and academic performance will be supported, and these students are more likely to be retained at their institution. This provides a theoretical foundation for college counselors' praxis in improving HES retention at their institution.

Purpose of the Present Study

The purpose of the present study is to provide a theoretical foundation for college counselors to guide their praxis as it relates to supporting HES at their institution. The present study examines a SSB program which was designed to satisfy all nine CECE Indicators (Museus, 2014; see Gonzales et al., 2022 for a more detailed description). In addition, this study seeks to add support for the use of SSB programs to support HES academic self-efficacy, sense of belonging in STEM, and sense of inclusion at the college level.

Method

This study examined previously collected data through a quantitative, pre/post-test survey design to investigate the outcomes of participating in a STEM Summer Bridge program. This study investigated program participants' academic self-efficacy, sense of belonging in a STEM environment, and sense of inclusion at the college level. The literature shows support for the efficacy of STEM Summer Bridge programs for supporting the retention of HES at PWIs (Bradford et al., 2021), and the present program is theoretically congruent with Museus' (2014) CECE model of student retention. In particular, this study seeks to explore participant outcomes of participating in a STEM Summer Bridge program on their academic self-efficacy, sense of belonging in STEM, and sense of inclusion at the college level.

Participants

The participants in this study were participants in the Auburn University SSB program. To participate in SSB, a student must be accepted and enrolled as a first-year Auburn University undergraduate student with a major housed in either the College of Sciences and Mathematics (COSAM) or the Samuel Ginn College of Engineering. To participate in the proposed study, participants must also be 18 years of age. During the first and fourth week of SSB, participants completed the Academic Self-Efficacy Scale (Zajacova et al., 2005), a slightly modified version of the Math Sense of Belonging Scale (Good et al., 2012), and a slightly modified version of the Engineering Department Inclusion Level Scale (Lee et al., 2014).

A total of 164 individuals completed the survey. Of the 164 participants, 156 participants were included in analyses. Eight participants' data were not included because they indicated they were 17 years of age. Participants were mostly 18 years of age (n = 147, 94.6%), slightly over half identified as men (n = 82, 52.6%), and primarily identified as Black or African American (n = 105, 67.3%). Full participant demographics can be found in Table 1.

Procedures

This study used a pre/post-test, quantitative approach. Following IRB approval, the participants were recruited during a scheduled meeting during the first week of the program to collect pre-test data. Participants were asked to bring their personal laptops to this meeting and were shown a shortened URL address which linked them to a Qualtrics survey. Each participant reviewed the information letter at the beginning of the survey and was also provided the opportunity to receive a hard copy of the information letter if they desired. By selecting to continue with the survey, the participants indicated their consent. This survey contained the following questionnaires: A demographics survey developed by the researcher; the Academic

Self-Efficacy Scale (Zajacova et al., 2005); a slightly modified version of the Math Sense of Belonging Scale (Good et al., 2012); and a slightly modified version of the Engineering Department Inclusion Level Scale (Lee et al., 2014). This same procedure was conducted in the fourth week of the STEM Summer Bridge program to collect post-test data.

Instrumentation

Brief Demographic Measure

A demographics measure was developed for this study. The following data were collected: A self-generated participant code to match pre and post-test data; age; gender identity; ethnic identity; and guardian education level.

Academic Self-Efficacy Scale

The participants' academic self-efficacy was measured via the Academic Self-Efficacy Scale (Zajacova et al., 2005). This scale is comprised of two subscales of 27 items each. Each item relates to a specific college-related task, such as "studying," "making friends at school," "having enough money," and "participating in class discussions." After reading the task, participants rate how stressful they anticipate completing this task will be on a 10-point Likert-style scale, with *1 = not at all stressful* to *10 = extremely stressful*. Respondents then rate how confident they are they will be able to complete that same task on a 10-point Likert-style scale, with *1 = not at all confident* to *10 = extremely confident*. The overall scale shows high internal validity (Cronbach's $\alpha = .93$), and the stress ($\alpha = .97$) and confidence ($\alpha = .96$) subscales also show high internal validity. The stress and confidence subscales each contain four subscales, which are interactions at school, academic performance in class, academic performance out of class, and managing work, family, and school. As such, eight total subscales exist, each with acceptable reliability ($\alpha = .72$ - $.92$). Total stress and confidence scores are calculated by finding

the means of each of the four subscales in stress and confidence respectively. Higher scores in the total stress subscale indicates greater expected stress in completing these tasks, whereas higher scores in the total confidence subscale indicates greater confidence in being able to successfully complete these tasks.

STEM Sense of Belonging Scale

The students' sense of belonging was measured with a slightly modified version of the Math Sense of Belonging Scale (Good et al., 2012). This scale was originally designed to measure students' sense of belonging to the mathematics community at large, and it was adapted to measure students' sense of belonging to the STEM community at large. This was accomplished by replacing all instances of the word "math" with the word "STEM,". This modified scale shows high internal validity ($\alpha = .95$) and includes 30 items, which all stem from the statement, "When I am in a STEM setting…" Respondents indicate to what extent they agree with the statement made in each item on an 8-point Likert scale, with *1 = strongly disagree* and *8 = strongly agree*. Example items include, "I feel respected," "I feel like an outsider" (reverse coded), and "I have trust that I do not have to constantly prove myself." This scale contains five subscales, which are membership, acceptance, affect, trust, and desire to fade. All show acceptable reliability ($\alpha = .81$ - $.92$). Respectively, these subscales examine to what extent respondents feel like a member of the STEM community; how accepted they feel by the STEM community; how their emotions are affected when in a STEM setting; to what extent they trust the STEM community to be fair and supportive; and to what extent they desire to be unnoticed when they are in a STEM setting. Subscale scores are calculated by finding the mean of each item within the subscale. Total STEM sense of belonging scores are calculated by finding the

mean of the five subscale scores. Higher scores in this scale indicate feeling a greater sense of belonging to the STEM community.

College Inclusion Level Scale

The students' sense of belonging at the college level was measured by a slightly modified version of the Engineering Department Inclusion Level Scale (Lee et al., 2014). Similar to the adaptation strategy used for the sense of belonging scale (Good et al., 2012), this scale was modified by replacing the word "engineering" with the phrase "COSAM or College of Engineering (COE), whichever you are enrolled in." This scale shows high internal validity (α = .97) and contains 24 items such as, "faculty members in COSAM/COE care about me as a person," "I am comfortable voicing my concerns within COSAM/COE," and "I would rather remain in COSAM/COE than transfer to another college/department." Respondents indicate to what extent they agree with the statement about their college on a six-point Likert scale, with *1 = strongly disagree* to *6 = strongly agree*. This scale includes three subscales, which are caring (α = .96), diversity (α = .87), and pride (α = .90). Respectively, these subscales relate to what extent COSAM/COE shows they care about students holistically, to what extent COSAM/COE shows its commitment to diversity and inclusion, and to what extent students feel proud to be a member of COSAM/COE. The pride subscale included four items and was reduced to a two-item subscale with no impact on alpha levels, and thus the final scale contained 22 items. Subscale scores are calculated by finding the mean of each item in the subscale. Total sense of belonging scores are calculated by finding the mean of the subscale scores.

Data Analysis

This study used a quantitative approach with a pre/post-test survey method and a paired-samples *t*-test design. This design was selected to assess the change in Auburn University's SSB

program participants' academic self-efficacy, sense of belonging to the STEM field, and sense of inclusion within their specific college before and after completing the program. These variables were measured by the Academic Self-Efficacy scale, a slightly modified version of the Math Sense of Belonging Scale, and a slightly modified version of the Engineering Department Inclusion Level Scale.

Results

The present study used quantitative methods to explore STEM Summer Bridge (SSB) program participant outcomes related to academic self-efficacy (ASE), sense of belonging in the STEM fields, and sense of inclusion at the college level. Paired samples *t*-tests were conducted to investigate the research questions. Full results can be found in Table 3. Regarding Question 1, results indicated that there was a significant difference in participants' overall sense of confidence in being able to accomplish college-related tasks, such that scores before completing SSB ($M = 7.99$, $SD = 1.23$) were significantly lower than scores after completing SSB ($M = 8.22$, $SD = 1.31$), $t(90) = -1.75$, $p = .042$. Results indicated no significant difference between participants' overall sense of how stressful accomplishing college-related tasks are before completing SSB ($M = 5.31$, $SD = 1.79$) and after completing SSB ($M = 5.12$, $SD = 2.00$), $t(90) = 1.20$, $p = .117$.

Regarding Question 2, results indicated a significant difference in participants' overall sense of belonging in the STEM fields, such that scores before completing SSB ($M = 6.47$, $SD = 1.05$) were significantly lower than scores after completing SSB ($M = 6.81$, $SD = .85$), $t(92) = -3.50$, $p < .001$.

Regarding Question 3, results indicated no significant difference in participants' sense of inclusion at the college level before completing SSB (M = 5.53, SD = .52) and after completing SSB (M = 5.57, SD = .48), $t(84) = -.83$, $p = .204$.

Summary

The present study's findings indicated a significant difference in participants' confidence in accomplishing college-related tasks, i.e., ASE confidence, and sense of belonging in STEM scores from before completing SSB to after completing SSB. Specifically, both variables' means were greater after completing SSB than before completing SSB. On the other hand, participants' stress about successfully accomplishing college-related tasks, i.e., ASE stress, and sense of inclusion at the college level scores did not significantly differ from before to after completing SSB.

Discussion

This study sought to explore STEM Summer Bridge (SSB) program participant outcomes related to academic self-efficacy, sense of belonging in the STEM fields, and sense of inclusion at the college level. Higher education is not representative of the overall US population based on multiple demographic variables, such that students who hold marginalized personal identities tend to be historically excluded from many higher education fields (United States Census Bureau, 2022), and especially from STEM higher education (Costello et al., 2023). The primary driver of the underrepresentation of students from historically excluded groups is a difference in retention rate between students who possess marginalized identities and students who do not (Shaw et al., 2021). Previous models of student retention (e.g., Tinto, 1993) suggest students should assimilate to their institution's culture, though students who possess personal identities which are historically excluded from higher education can experience cultural alienation if they

assimilate into an institution whose culture does not match with their own (Guiffrida, 2006; Museus, 2014; Tierney, 1999). STEM Summer Bridge programs were developed to address HES attrition rates by providing a mechanism by which these students can participate in cultural engagement and academic preparation as they enter their college career (Ashley et al., 2017). Through their program activities, SSB programs tend to give focus to building participants' ASE, improving their sense of belonging within the STEM fields and their institution, and improving their academic preparedness.

Academic Self-Efficacy

As mentioned, an important aspect of SSB programs is building participants' ASE (Ashley et al., 2017; Barth et al., 2021). The present study explored SSB participants' ASE, however somewhat differently than previous SSB literature (Barth et al., 2021). Specifically, the present study considered participant ASE agnostic to specific major, extending beyond solely investigating STEM-related ASE. This is an important perspective for the literature to explore because if SSB programs are consistently shown to support student ASE generally, bridge programs related to non-STEM degree programs could have evidence to support broader implementation and HES pursuing other degrees could receive similar programming.

Results showed participants' confidence related to completing college-related tasks was higher after completing SSB, however results did not show a difference in how stressful participants found completing these college-related tasks. These findings are partially in line with other SSB literature which examines ASE and found that student satisfaction with their SSB experience predicted STEM efficacy across multiple semesters (Barth et al., 2021). Whereas Barth and colleagues (2021) do not delineate between ASE confidence and stress in their analyses, the present study adds additional support for SSB participant outcomes related to

increased ASE after completing a SSB program. Additionally, this finding is partially congruent with the CECE model of student retention, in that this model asserts the importance of ASE to support historically excluded student retention (Museus, 2014; Museus et al., 2022). Similar to the previous partial support of the literature, the significant change in participants' ASE confidence is in line with the CECE model, but the nonsignificant change in participants' ASE stress is not.

At first glance, this finding could be seen to indicate that participating in academic instruction, building community, and receiving holistic support and resources during SSB could be valuable for these participants' confidence in being able to be successful in college, but does not assuage any stress related to college. However, this operationalization of stress within ASE could be missing an important consideration related to student stress appraisal (Travis et al., 2020). Stress can be understood as serving two functions, namely one of motivation, i.e., eustress, and one of hindrance, i.e., distress (Penacoba et al., 2021). This conceptualization of stress has also been explored within ASE (Travis et al., 2020). Indeed, Travis and colleagues (2020) proposed a framework of ASE which conceptualizes the stress factor of ASE with this dual function of stress in mind. This framework asserts the confidence factor of ASE impacts the appraisal students make of their stress. Specifically, if students make an appraisal of their environment and self which is informed by higher ASE confidence, they may be more likely to perceive their academic stress as challenge stress, i.e., motivational, rather than as hindrance stress, i.e., detrimental.

With Travis et al.'s (2020) more nuanced consideration of ASE stress in mind, the present study's findings of significant ASE confidence change and nonsignificant ASE stress change could be viewed in a slightly different light. In particular, the present study's findings may be

lacking the ability to tease out a difference in student appraisal of ASE stress, thus missing a change in student appraisal of their stress from hindrance stress into challenge stress. Whereas the present study cannot adequately explore this question, it will inform a future direction for research mentioned later.

Sense of Belonging in STEM

Another primary goal of a SSB program is to build participants' sense of belonging in the STEM fields (Ashley et al., 2017). In line with previous SSB literature (e.g., Barth et al., 2021) and congruent with the CECE model of student retention (Museus, 2014), the present study showed a significant increase in participants' sense of belonging in the STEM fields from before to after completing SSB. This is an important finding because students' sense of belonging in STEM, especially for HES, can help explain the pathway to persistence in one's STEM degree program (Good et al., 2012; Xu & Lastrapes, 2022).

Xu and Lastrapes (2022) explored the relationship between undergraduate students' sense of belonging in STEM, attitudes toward STEM, and career interest through multigroup path analysis, binarily split by gender. It should be noted that attitudes toward STEM is conceptualized similarly to the present study's conceptualization of ASE, such that attitudes toward STEM explored participants' appraisal of their skills related to STEM (i.e., ASE confidence; Zajacova et al., 2005), but differed in that it also explored participants' values related to STEM. They found that, for men, sense of belonging in STEM both directly and indirectly impacted their career interest, such that increased sense of belonging led to both more positive attitudes toward STEM and increased career interest, independently (Xu & Lastrapes, 2022). On the other hand, for women, increased sense of belonging in STEM impacted career interest indirectly, such that sense of belonging impacted attitudes toward STEM, which impacted career

interest. However, no direct impact from sense of belonging to career interest was found for students who identified as women. These findings are important to consider in the context of the present study because they could add an additional consideration for supporting HES persistence: Stereotype threat (Good et al., 2012; Spencer et al., 2016).

Stereotype threat describes the phenomenon by which an individual from a marginalized group finds themselves in a situation where a harmful stereotype about them could be seen to explain their behavior. The threat of being judged based on this harmful stereotype can lead to diminished performance and motivation (Spencer et al., 2016). Examining mathematics undergraduate students, Good and colleagues (2012) found that stereotype threat related to women's poorer math performance than men's and the perception that math skills are a fixed trait predicted a lower sense of belonging to the math community for women, but not for men. This lower sense of belonging to the math community for women mediated their math grades and desire to pursue a career in math, such that lower sense of belonging predicted lower grades and career aspirations. However, they also found that instilling the message that math skills can be developed protected against stereotype threat and subsequent diminished sense of belonging, performance, and career aspirations. This finding shows the importance of student appraisals of their situation because if women appraised themselves to be at a fixed math skill level and/or that they were simply worse at math than their counterparts who were men, they performed worse and felt like they did not belong. In addition, this finding is in line with Travis et al.'s (2020) assertion that student appraisals of their academic-related stress in that if students appraise their experience of stress as challenge rather than hindrance stress, they are more likely to be more successful. Similarly, if students who are women appraise their math skills as able to be

developed and refute the misogynistic ideal that men are inherently better at math than are women, they are protected from the deleterious effects of stereotype threat (Good et al., 2012).

In summary, the literature agrees that sense of belonging in STEM is important to support student retention in their STEM major (Barth et al., 2021; Good et al., 2012; Xu & Lastrapes, 2022). Importantly, HES tend to feel a lower sense of belonging to their respective field in general (Hussain & Jones, 2021) and in STEM particularly (Rodriguez & Blaney, 2021), possibly due to underrepresentation or the experiencing the systems which have historically excluded them from these fields. These conclusions are important to consider for the present study because participants were primarily HES across at least one intersection of identity (e.g., ethnic or gender identity) and they tended to feel a greater sense of belonging after completing SSB.

Inclusion at the College Level

In addition to fostering students' sense of belonging to the fields of STEM broadly, a goal of SSB programs is to build a sense of inclusion in their institution for students (Ashley et al., 2017). The CECE model of student retention also highlights the importance of HES feeling included in their institutional culture (Museus, 2014). The results of the present study did not show a change in participants' sense of inclusion at the college level. However, means of pre-test inclusion scores and post-test inclusion scores were high. See Table 3 for details. With this in mind, participants seem to already feel well included in their college as they enter SSB. One explanation for this finding may be that by being recruited for SSB, interacting and corresponding with staff during planning and preparation for SSB, seeing fellow SSB participants during SSB orientation, or other efforts on behalf of the program or institution may have already shown SSB participants that they are included in campus culture. In addition, it is

possible that by enrolling in or being made aware of SSB, participants already feel included in their institution.

Despite pre-SSB interaction and engagement as a possible explanation of the nonsignificant sense of inclusion finding, the lack of a significant change in sense of inclusion at the college level after completing a bridge program has been shown elsewhere in the literature (van Herpen et al., 2020). van Herpen and colleagues found their participants interacted with peers and faculty more effectively after the intervention, though the bridge program in their investigation was a four-day bridge program which emphasized general social and academic preparation for students attending a Dutch university.

Implications for College Counselors

The present study offers multiple implications to inform college counselors' praxis related to promoting social justice and supporting HES at their institution. The findings suggest that SSB participants tended to feel more confident about their ability to accomplish college-related tasks and feel like they belong in the STEM fields to a greater extent after completing SSB. The results did not show significant change in how stressful participants saw accomplishing these college-related tasks or participants' sense of inclusion in their college. One implication for college counselors relates to intervention and program design. In particular, this SSB program was designed to satisfy all nine of Museus' (2014) CECE Indicators (Gonzales et al., 2022). College counselors can collaborate with other organizations or individuals who already support higher education student development (ACCA, 2009) to modify or design and implement programming based on the CECE Indicators (Museus, 2014) to support HES. This could include a SSB program such as the one currently under study, but it could also include

other programs, such as a Yoga for stress management program (Milligan, 2006) or a counseling group (Jones & Sam, 2018).

For example, Jones and Sam (2018) describe Cultural Connections, a group counseling modality designed for Black women in college to provide a safe and supportive space to discuss race, gender, and cultural experiences. Based on their description, this group would create a campus environment which satisfied CECE Indicators one, two, three, five, six, and nine (Museus, 2014). Though applying the CECE model to a counseling group extends beyond how Museus originally conceptualized this model, college counselors are institutional agents and this group (Jones & Sam, 2018) is held on campus. As such, it is logical that the CECE model (Museus, 2014) could be applied to a counseling group.

In the design of these programs, it is important for college counselors to consider the process of praxis (Freire, 1968/1970) alongside design implications. This involves considering who their intended HES audience is, what the needs of this audience are, how to meet these needs through intervention, and which CECE Indicators (Museus, 2014) could meet the needs identified. Following the implementation of the intervention, college counselors should also engage in deep self-reflection about their role in the intervention, its successes, its failures, and what they learned about how to disrupt the oppressive systems HES navigate to inform future intervention (Freire, 1968/1970).

In addition to program or intervention design implications, the present study's findings related to ASE can guide college counselors' focus for interventions. In particular, considering Travis et al.'s (2020) conceptualization of ASE stress into hindrance and challenge stress, college counselors could give particular focus to support HES ASE confidence, because students are more likely to appraise their stress as challenge rather than hindrance with higher ASE

confidence. Finally, this study also offers a holistic and culturally-relevant view on retention efforts, which can inform college counselors praxis as it relates to supporting HES and promoting social justice in higher education.

Limitations

There are multiple limitations which impact the present study. First, it should be noted that the staff members facilitating the Auburn University SSB program change from year to year. Specifically, each year a new group of eight to 10 interns assist with some student-facing aspects of the program. In addition, a total of five individual program coordinators have assisted with planning and implementation of SSB during the present study's data collection period. The writer and one other member, one of the supervisors of SSB, remained involved across all time points of collected data. As such, some differences in participants' SSB experience may be related to differing staff.

Finally, there are three limitations which relate to the present study's generalizability. First, due to the non-experimental design of the study, causality cannot be determined. Whereas temporal primacy can indicate that changes in participants' academic self-efficacy and sense of belonging in STEM did occur over the time period in which they participated in SSB, the conclusion that these changes were caused by SSB cannot be drawn. Second, the present study examined four iterations of a SSB program at a single, primarily White, public land-grant R1 institution in the South-Eastern US. The cultural experience of attending a SSB program at this University is likely to differ in some ways from other universities, such as HBCUs or small, private PWIs. Third, generalizability of the present findings is limited due to the sample size.

Recommendations for Future Research

Based on the findings of the present study, there are multiple promising avenues for future research. For example, SSB participants often remain involved in additional programs throughout the rest of their academic experience (Barth et al., 2021), yet the majority of SSB literature does not extend to examine student outcomes across their undergraduate career, into their graduate education, or into their career (Bradford et al., 2021). This extension could reveal the presence of enduring outcomes of SSB participation and participant outcomes related to completing additional experiences.

In addition, the SSB program currently under investigation was designed to satisfy all nine of the CECE Indicators (Gonzales et al., 2022; Museus, 2014). However, the SSB participants' perspectives on to what extent the program satisfied the CECE Indicators was not explored in the present study. Exploring the SSB participants' perspectives on the presence of the CECE Indicators would give a glimpse into which CECE Indicators contribute most to the variance in participants' academic self-efficacy (Museus et al., 2016), in addition to what extent participants experienced the program to be culturally engaging.

Finally, the present study operationalizes ASE as one's confidence in their ability to accomplish college-related tasks and the extent to which one is stressed about being able to accomplish college-related tasks (Zajacova et al., 2005). However, as mentioned prior, it could be valuable to consider the difference between hindrance stress and challenge stress when operationalizing stress in the context of ASE (Travis et al., 2020). Future research could investigate SSB participant appraisals of stress (i.e., as challenge or hindrance) related to college tasks because challenge stress has been shown to be positively related to student success, whereas hindrance stress has been shown to be negatively related to student success (Travis et

al., 2020). The current operationalization of stress in ASE as a singular concept may be missing this important nuance.

Summary

The present research study explored SSB participant outcomes related to ASE, sense of belonging in STEM, and sense of inclusion at the college level. Results showed a significant increase in participants' ASE confidence and sense of belonging in STEM after completing SSB. These findings have implications for college counselors' praxis as it relates to supporting HES at their institution.

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Table 1.
Participant Demographics

	n	*%*
Age		
18	147	94.2%
19	5	3.2%
20	2	1.3%
21	1	.6%
Prefer Not to Answer	1	.6%
Gender Identity		
Woman	69	44.2%
Man	82	52.6%
Non-Binary	2	1.3%
Prefer Not to Answer	3	2.0%
Ethnic Identity		
Black/African American	105	67.3%
Biracial	16	10.3%
White, Not Hispanic	14	9.0%
Asian/Asian American	10	6.4%
Hispanic/Latiné	5	3.2%
Native American	2	1.3%
Pacific Islander	1	.6%
Afro-Hispanic	1	.6%
Filipino African American	1	.6%
Prefer Not to Answer	1	.6%

Table 2.
Correlations of Main Study Variables.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. ASE, Confidence Pre	-									
2. ASE, Confidence Post	.508**	-								
3. ASE, Stress Pre	-.511**	-0.174	-							
4. ASE, Stress Post	-.380**	-0.109	.683**	-						
5. SoB, Pre	.508**	.696**	-.318**	-.218*	-					
6. SoB, Post	.651**	.423**	-.425**	-.402**	.550**	-				
7. Inclusion, Pre	.492**	0.204	-.269**	-0.134	.490**	.423**	-			
8. Inclusion, Post	.328**	.534**	-.246*	-0.087	.344**	.443**	.508**	-		
9. Modality	-0.118	-0.159	-0.027	-0.083	-0.078	-.253**	0.152	-0.062	-	
10. Gender Identity	-0.125	-0.079	.234**	.263**	-0.089	-0.030	0.026	-0.062	0.041	-

*** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the .05 level (2-tailed)*
Note: ASE = Academic Self-Efficacy; SoB = Sense of Belonging in STEM; Inclusion = Sense of Inclusion at College Level

Table 3.
Paired Sample T-Test for Study Variables

	Pre-Test		*Post-Test*				
	M	*SD*	*M*	*SD*	*t*	*p*-value	Cohen's *d*
ASE – Confidence	7.99	1.23	8.22	1.31	-1.75	.042	-.183
ASE – Stress	5.31	1.78	5.12	2.00	1.12	.117	.125
SoB	6.47	1.05	6.81	.85	-3.50	< .001	-.363
Inclusion	5.53	.52	5.58	.48	-.83	.204	-.09

Note: ASE = Academic Self-Efficacy; SoB = Sense of Belonging in STEM; Inclusion = Sense of Inclusion at College Level

Appendix A: IRB Approval

Revised 06/09/2022

AUBURN UNIVERSITY HUMAN RESEARCH PROTECTION PROGRAM (HRPP)

REQUEST for MODIFICATION

For Information or help completing this form, contact: **The Office of Research Compliance (ORC)**
Phone: **334-844-5966** E-Mail: **IRBAdmin@auburn.edu**

- **Federal regulations require IRB approval before implementing proposed changes.**
- **Change means any change, in content or form, to the protocol, consent form, or any supportive materials (such as the investigator's Brochure, questionnaires, surveys, advertisements, etc.). See Item 4 for more examples.**

1. Today's Date	5/8/2023

2. Principal Investigator (PI) Name: Matthew A. Gonzales

PI's Title:	Doctoral Student/Graduate Assistant	**Faculty PI (if PI is a student):**	Kimberly X. Mulligan-Guy, Assc. Dean of Inclusion, Equity and Diversity
Department:	COSAM OIED	**Department:**	COSAM OIED
Phone:	(334) 844-4663	**Phone:**	(334) 844-4642
AU-E-Mail:	Mag0097@auburn.edu	**AU E-Mail:**	Kxm0001@auburn.edu
Contact person who should receive copies of IRB correspondence (Optional):	Click or tap here to enter text.	**Department Head Name:**	Kimberly X. Mulligan-Guy
Phone:	Click or tap here to enter text.	**Phone:**	(334) 844-4642
AU E-Mail:	Click or tap here to enter text.	**AU E-Mail:**	Kxm0001@auburn.edu

3. AU IRB Protocol Identification

3.a. Protocol Number: #19-351 EP 1910

3.b. Protocol Title: COSAM Office of Inclusion, Equity and Diversity Program Evaluation

3. c. Current Status of Protocol – For active studies, check ONE box at left; provide numbers and dates where applicable

☐	**Study has not yet begun; no data has been entered or collected**	
☒	**In progress If YES, number of data/participants entered: 81**	**Current Approval Dates**
☐	**Is this modification request being made in conjunction with/as a result of protocol renewal? ☐ YES ☒ NO**	**From: 4/23/2020**
☐	**Adverse events since last review If YES, describe:** Click or tap here to enter text.	**To: N/A**
☐	**Data analysis only**	
☐	**Funding Agency and Grant Number:** Click or tap here to enter text.	**AU Funding Information:** Click or tap here to enter text.
☐	**List any other institutions and/ or AU approved studies associated with this project:** Click or tap here to enter text.	

The Auburn University Institutional Review Board has approved this Document for use from 04/24/2023 to ----------
Protocol # 19-351 EP 1910

4. Types of Change
Mark all that apply, and describe the changes in item 5

☒ **Change in Key Personnel**
List the name(s) of personnel being added to or removed from the study and attach a copy of the CITI documentation for personnel being added to the study.

☐ **Additional Sites or Change in Sites, including AU classrooms, etc.**
Attach permission forms for new sites.

☒ **Change in methods for data storage/ protection or location of data/ consent documents**

☒ **Change in project purpose or project questions**

☒ **Change in population or recruitment**
Attach new or revised recruitment materials as needed; both highlighted version & clean copy for IRB approval stamp

☒ **Change in study procedure(s)**
Attach new or revised consent documents as needed; both highlighted revised copy & clean copy for IRB approval stamp

☒ **Change in data collection instruments/forms (surveys, data collection forms)**
Attach new forms as needed; both highlighted version & clean copy for IRB approval stamp

☐ **Other**
(BUAs, DUAs, etc.) Indicate the type of change in the space below, and provide details in the Item 5.c. or 5.d. as applicable. Include a copy of all affected documents, with revisions highlighted as applicable.
Click or tap here to enter text.

5. Description and Rationale

5.a. For each item marked in Question #4 describe the requested change(s) to your research protocol, and the rationale for each.

This protocol modification seeks to add two members to key personnel and qualitative data collection through focus group and individual interviews. Edward Wiggins, M.Ed. will be added to key personnel to assist with data collection, which can involve obtaining informed consent from participants. Jamie Carney, Ph.D., will be added to key personnel to assist with qualitative analyses and dissertation feedback.

The change in data and consent document storage method includes storing audio recorded interview data on a recording device before the data are transferred to a secure folder to which only the PI has access. The data will then be deleted off the recording device's memory. The rationale behind this change is to ensure accurate transcription, and thus later coding, of participant data, and this method is secure. The transcription of the audio data will also be saved in a secure folder. In addition, in-person interview participants will receive a paper consent document before participating in a focus group. After participants sign the informed consent document and complete the focus group, the PI will scan each informed consent document, save it in a secure folder to which only the PI has access, and shred the paper copies. The rationale behind this change is to ensure that each participant present gives informed consent, and being that everyone will be present in the same space, doing so physically can ensure each participant can ask any questions they may have. By shredding physical copies and only retaining digitally secure copies, another level of security is added. Because STEM Summer Bridge is OIED's longest running program and began in 1997, many earlier participants no longer live in the local area making an in-person interview infeasible. Participants who live too far geographically to participate in an in-person interview will be invited to participate in a virtual interview. This informed consent document will be housed in Qualtrics, shared with the participant at the start of the virtual meeting, and the interview will begin upon the researcher confirming the submission of the informed consent document in Qualtrics. The researcher will also receive verbal confirmation that the informed consent document has been read in its entirety and completed. The data collected from virtual interviews will be saved in a secure folder.

A change in project purpose includes adding that the results for this study will be used to satisfy dissertation requirements.

A change in population being sampled includes extending the sample frame to include previous STEM Summer Bridge/other OIED program participants who are no longer enrolled in an undergraduate program at Auburn University. By including previous participants, this study can explore the long-term impact of STEM Summer Bridge beyond participants' undergraduate experience.

Regarding recruitment procedures, the changes would include adding a sentence to the recruitment script for current STEM Summer Bridge participants which would introduce them to the option to participate in a focus group after submitting their post-test. In addition, upon submission of the pre and post quantitative

Qualtrics surveys, participants will be shown a thank you message with a link to another Qualtrics survey to enter their Auburn email address to be contacted to participate in focus groups. The rationale behind these changes is that by mentioning the option to participate in focus groups multiple times, participants may be more likely to volunteer. In addition, the quantitative survey primarily focuses on the experiences of being a student, and as such, potential study participants who previously completed STEM Summer Bridge and are still enrolled as a student (e.g., in graduate or professional school) will receive a recruitment email inviting them to complete the quantitative and qualitative data collection procedures. Potential participants who are no longer enrolled as a student will receive a recruitment email inviting them to complete the qualitative data collection procedures. A purposive sampling method will be used to sample this population because this study focuses on the experiences of people who have completed STEM Summer Bridge.

A change in study procedures is also necessary to add qualitative data collection to this project. Current STEM Summer Bridge participants will be invited to participate in focus groups which will be conducted after they submit their post-tests during the final week of the STEM Summer Bridge program. In addition, previous STEM Summer Bridge participants will be invited via email to participate in individual interviews. The interview protocol focuses on exploring the concepts the quantitative survey does with greater depth and richness, in addition to exploring the long-term impact of STEM Summer Bridge. Validity procedures for these interviews will include triangulation between current and past STEM Summer Bridge participants; member checking, by creating a summary of themes from interview data, sharing with participants, and soliciting feedback; establishing the researchers' positionality, to attempt to clarify researcher bias; and spending prolonged time in the field, as key personnel are also staff of the STEM Summer Bridge program. Reliability procedures for these interviews will include assessing intercoder agreement between researchers and the creation and consistent checking of a qualitative codebook to ensure consistent coding definitions. Finally, one item will be added to the quantitative survey, asking in what year participants completed STEM Summer Bridge.

5.b. Briefly list (numbered or bulleted) **the activities that have occurred up to this point, particularly those that involved participants.**

- Three time points of pre/post quantitative data (2020, 2021, 2022) have been collected
- First time point of data analyzed; second time point data is cleaned

5.c. Does the requested change affect participants, such as procedures, risks, costs, benefits, etc.

Yes, the requested change does affect participants through changes in procedure and risk. Specifically, the procedures change involve the addition of qualitative data collection through focus group and individual interviews. The change in risk is related to interview data collection being confidential rather than anonymous. The lack of anonymity may impact participants, specifically current STEM Summer Bridge participants, such that some may feel coerced to participate because the researchers are staff in the STEM Summer Bridge program. The participants will be informed that their decision to participate is voluntary and will not impact their relation to any staff or the University in any way, and that their identities will be masked in any presentation or publication. In addition, there is a risk of breach of confidentiality because the qualitative data collection procedures are not anonymous. This risk will be minimized by engaging in the secure data storage procedures described previously, i.e., saving the data and other study-related materials in a secure folder and shredding paper consent documents.

5.d. Attach a copy of all "IRB stamped" documents currently used. (Information letters, consent forms, flyers, etc.)

Click or tap here to enter text.

5.e. List all revised documents and attach two copies of the revised documents – one copy which highlights the revisions and one clean copy of the revised documents for the IRB approval stamp.

Information Letter
Informed Consent – In Person Interview
Informed Consent – Virtual Interview
Recruitment Script – In Person
Recruitment Email -Current Student
Recruitment Email – Past Student
Demographics Survey
Interview Protocol - Current Students
Interview Protocol – Past Students, In Person
Interview Protocol – Past Students, Virtual

6. Signatures

Principal Investigator: Matthew A. Gonzales

Faculty Advisor PI, if applicable: Kimberly Mulligan-Guy

Version Date: 5/8/2023

Appendix B: Information Letter

AUBURN UNIVERSITY | COLLEGE OF SCIENCES AND MATHEMATICS
Office of Inclusion, Equity, and Diversity

DO NOT AGREE TO PARTICIPATE UNLESS AN IRB APPROVAL STAMP WITH CURRENT DATES HAS BEEN APPLIED TO THIS DOCUMENT.

INFORMATION LETTER

For a Research Study entitled

"COSAM OIED Program Evaluation"

General Information	You are being asked to take part in a research study. This research study is voluntary, meaning you do not have to take part in it. The procedures, risks, and benefits are fully described further in the consent form.
Purpose	The purpose of this study is to find out how effective the OIED's programs are, and in what ways they are helpful.
Duration	The survey takes about 15 minutes to complete, and you will complete it two times.
Overview of Procedures	You will be asked to complete a survey with questions about your academic experiences and expectations, once now and once again at the end of the program(s) you are in. You will then be invited to participate in a voluntary interview to share more in-depth answers.
Risks	The risks involved include coercion to participate and potential loss of confidentiality.
Benefits	There are no direct benefits to you for participating in this study. The findings may benefit future OIED programs and similar programs.
Alternatives	The alternative is to not participate in this study.

You are invited to participate in a research study to investigate the efficacy of the OIED's programs. This study is being conducted by Matthew Gonzales, Graduate Assistant, under the direction of Dr. Kimberly Mulligan, Associate Dean of Inclusion, Equity and Diversity in the Auburn University College of Sciences and Mathematics Office of Inclusion, Equity and Diversity. You were selected as a possible participant because you are a participant in the OIED's programs and are age 18 or older.

What will be involved if you participate? If you decide to participate in this research study, you will be asked to complete two surveys, one in the beginning of the year and one at the end of the year. Your total time commitment will be approximately 15 minutes per survey. Upon completion of the survey, you will be invited to participate in an interview at a later date. This study will also use anonymous institutional retention data.

Are there any risks or discomforts? The risks associated with this study are coercion to participate and breach of confidentiality. To minimize these risks, please know that your survey responses or decision to participate will not affect your relationship to Auburn University, the OIED, or anyone affiliated with Auburn University or the OIED. In addition, the survey data is anonymous, meaning your name will not be able to be connected to the survey you complete. If you decide to participate in an interview, you will be able to choose a pseudonym to mask your identity.

There are no direct benefits for participating in this study.

There is no compensation offered for participating in this study.

There are no costs associated with participating in this study.

If you change your mind about participating, you can withdraw at any time during the study. Your participation is completely voluntary. Your decision about whether or not to participate or to stop participating will not jeopardize your future relations with Auburn University, the College of Sciences and Mathematics Office of Inclusion, Equity and Diversity or any faculty, staff or other University-affiliated individuals.

Your privacy will be protected. Survey data obtained in connection with this study will remain anonymous. If you decide to participate in an interview, you will be able to choose a pseudonym to mask your identity which will be used in any published materials. Information obtained through your participation may be used to improve future iterations of the OIED programs and for satisfying dissertation requirements, publication and presentation at a professional conference.

If you have any questions about this study, *please ask them now* or contact Matthew Gonzales at mag0097@auburn.edu. A copy of this document will be given to you to keep.

If you have questions about your rights as a research participant, you may contact the Auburn University Office of Research Compliance or the Institutional Review Board by phone (334)-844-5966 or e-mail at IRBadmin@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH TO PARTICIPATE IN THIS RESEARCH STUDY. IF YOU DECIDE TO PARTICIPATE, THE DATA YOU PROVIDE WILL SERVE AS YOUR AGREEMENT TO DO SO.

_____

Investigator's Signature Date

_____

Printed Name

Appendix C: Demographics Measure

Demographics Survey

Participant Code: Your first initial, the first two letters of your mother's first name, the day you were born, and the last digit of your cell phone number. (E.g., CKA026 if your name is Charlotte, your mother's name is Katherine, you were born on the 2nd day of the month, and your cell phone number ends in 6.)

_____

Age: _____

In what year did you complete STEM Summer Bridge? _____

For the following questions below, please check only the most appropriate answer.

Gender Identity:

_____ Male
_____ Female
_____ Non-Binary
_____ Prefer not to specify

Ethnic Identity:

_____ Asian or Asian America, including Chinese, Japanese and others
_____ Black or African American
_____ Hispanic or Latino, including Mexican American, Central American, and others
_____ White, Caucasian, Anglo, European American; not Hispanic
_____ Native American/American Indian
_____ Alaska Native
_____ Native Hawaiian
_____ Pacific Islander
_____ Biracial/More than one race
_____ Prefer not to specify
_____ Other (please specify): _____

Please indicate the year that you are currently in during your studies.

_____ First
_____ Second
_____ Third
_____ Fourth
_____ Fifth or Later

Please circle the highest educational level attained by your parents.

M = Mother, F = Father; If unknown, do not indicate.

M | F No schooling completed
M | F Elementary school to 8th grade
M | F Some high school, no diploma
M | F High school graduate, diploma or equivalent (for example: GED)
M | F Some college, no degree
M | F Trade/technical/vocational training
M | F Associate degree
M | F Bachelor's degree
M | F Master's degree
M | F Professional degree
M | F Doctorate degree

Appendix D: Academic Self-Efficacy Scale

Directions: On the first scale, please answer how stressful these tasks are for you, **from 0 = not at all stressful to 10 = extremely stressful.** On the second scale, please answer how confident you are that you can successfully complete the tasks, **from 0 = not at all confident to 10 = extremely confident.**

Task	Not stressful										Very stressful		Not confident										Extremely confident
	0	1	2	3	4	5	6	7	8	9	10		0	1	2	3	4	5	6	7	8	9	10
Studying																							
Asking questions in class																							
Keeping up with the required readings																							
Understanding my professors																							
Writing term papers																							
My parents' expectations of my grades																							
Making friends at school																							
Doing well on exams																							
Getting papers done on time																							
Having more tests in the same week																							
Taking good class notes																							
Managing both school and work																							
Preparing for exams																							
Managing time efficiently																							
Getting along with family members																							
Improving my reading & writing skills																							
Researching term papers																							
Getting the grades I want																							
Having enough money																							
Talking to my professors																							
Gelling help and information at school																							
Doing well in my toughest class																							
Talking to college staff																							
Finding time to study																							
Understanding my textbooks																							
Participating in class discussions																							
Understanding college regulations																							

Appendix E: STEM Sense of Belonging Scale

Today we have some questions we would like you to answer about your experience with STEM courses and in the STEM academic community. When we mention the STEM academic community, we are referring to the broad group of people involved in that field, including the students in a STEM course.

We would like you to consider your membership in the STEM community. By virtue of having taken many STEM courses, both in high school and/or at Auburn, you could consider yourself a member of the STEM community. Given this broad definition of belonging to the STEM community, please respond to the following statements based on how you feel about that group and your membership in it.

There are no right or wrong answers to any of these statements; we are interested in your honest reactions and opinions. Please read each statement carefully, and indicate the number that reflects your degree of agreement.

Strongly Disagree **Strongly Agree**

1 2 3 4 5 6 7 8

When I am in a STEM setting,

1. ___ I feel that I belong to the STEM community.
2. ___ I consider myself a member of the STEM world.
3. ___ I feel like I am part of the STEM community.
4. ___ I feel a connection with the STEM community.
5. ___ I feel like an outsider.
6. ___ I feel accepted.
7. ___ I feel respected.
8. ___ I feel disregarded.
9. ___ I feel valued.
10. ___ I feel neglected.

Strongly Disagree Strongly Agree

1 2 3 4 5 6 7 8

11. ___ I feel appreciated.

12. ___ I feel excluded.

13. ___ I feel like I fit in.

14. ___ I feel insignificant.

15. ___ I feel at ease.

16. ___ I feel anxious.

17. ___ I feel comfortable.

18. ___ I feel tense.

19. ___ I feel nervous.

20. ___ I feel content.

21. ___ I feel calm.

22. ___ I feel inadequate.

23. ___ I wish I could fade into the background and not be noticed.

24. ___ I try to say as little as possible.

25. ___ I enjoy being an active participant.

26. ___ I wish I were invisible.

27. ___ I trust the testing materials to be unbiased.

28. ___ I have trust that I do not have to constantly prove myself.

29. ___ I trust my instructors to be committed to helping me learn.

30. ___ Even when I do poorly, I trust my instructors to have faith in my potential.

Appendix F: College Sense of Inclusion Scale

Directions: Please indicate the extent to which you agree or disagree with the following statements about **COSAM.**

Example:

Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

1. Faculty in COSAM respect me

2. I am treated like a person (not a number) in COSAM

3. I am respected by other students in COSAM

4. Faculty in COSAM respect all students

5. I feel welcome in COSAM

6. I belong in COSAM

7. I take pride in the fact that I am a student in COSAM

8. All students feel welcome in COSAM

9. I am comfortable voicing my concerns within COSAM

10. Faculty members in COSAM care about me as a person

11. There is a faculty member in COSAM that I can count on

12. COSAM really cares about its students

13. I feel wanted in COSAM

14. I feel needed in COSAM

15. I am valued by COSAM

16. COSAM really values the student

17. COSAM is very inclusive

18. COSAM is very diverse

19. Females are treated fairly in COSAM

20. Ethnic minorities are treated fairly in COSAM

21. I like being a student in COSAM

22. I would rather remain in COSAM than transfer to another college/department