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APPLYING A STEM ENGAGEMENT FRAMEWORK TO EXAMINE SHORT-TERM RETENTION OF LATINX AND OTHER UNDERREPRESENTED GROUPS IN AN UNDERGRADUATE STEM SCHOLAR PROGRAM

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ABSTRACT

Studying STEM Intervention Program (SIP) retention, particularly what distinguishes those students who remain in the program from those that leave, may be a key to better understand how to keep students on track towards STEM degree completion. This study focuses on the participation of Latinx and other underrepresented racial/ethnic minoritized (URM) groups in a STEM intervention and support program. Applying London, Rosenthal, Levy, and Lobel's (2011) STEM Engagement Framework on five cohorts of participants in a SIP, this study found that maintaining higher levels of scientific identity was related to program retention. Therefore, intentionally designing programs that address systemic inequities and celebrate and affirm minoritized groups' experiences can facilitate adjustment and success. Moreover, women-identified participants were also more likely to remain in the SIP relative to their men-identified counterparts. For practitioners and institutions alike, these results indicate the need to create and implement support programs for women in STEM that go beyond the traditional components of academic support.

Keywords: STEM, Intervention Program, Latinx, women, retention, higher education, scientific identity, familismo

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The need for a larger and more diverse science, technology, engineering, and mathematics (STEM) workforce has become a pressing issue for the United States (U.S.) (National Academies of Sciences, Engineering, and Medicine, 2017; Noonan, 2017). Only 22% of the bachelor's degrees awarded during 2015 and 2016 were in STEM fields (National Center for Education Statistics, 2023). When studying the academic progress of college students who declared interest in STEM majors as they enrolled in college, researchers have found that approximately half of them persisted in STEM majors through their second year of college, with roughly 40% of those who first showed interest in these fields finally persisting to graduation (Chen, 2009; Chen & Soldner, 2013; Griffith, 2010, Snyder & Dillow, 2015).

Regarding the diversification of STEM graduates, researchers have shown that disparities in STEM student graduation rates vary considerably by race and ethnicity. While underrepresented racial/ethnic minoritized (URM) college students enter college with comparable levels of interest in STEM degrees as their counterparts, they do not graduate at the same rate as their White peers (Chen, 2009; Riegle-Crumb & King, 2010; Xie et al., 2015). Relative to their White peers, URM college students have significantly higher odds of switching out of a STEM major. Likewise, URMs majoring in STEM are significantly more likely to drop out of college compared to their White peers (Riegle-Crumb et al., 2019). These racial disparities in STEM college persistence and graduation rates are also reflected at the graduate school level and persist into the STEM workforce.

Regarding the gender diversification of the STEM fields, researchers have pointed out that the underrepresentation of women in STEM is an ongoing problem. Women comprise only 35% of the STEM workforce in the U.S. (National Science Foundation, 2023), but they make up 51% of the U.S. population. Women's underrepresentation in STEM can initially be observed in high school. Compared to females, higher percentages of males earned credits in physics, engineering, engineering/science technologies, and computer/information science during high school (Astorne-Figari & Speer, 2019; Cunningham et al., 2015). Once in college, gender gaps in college math-intensive STEM majors are substantial (Dickson, 2010), and women are far more likely to leave math-intensive STEM majors than men are (Astorne-Figari & Speer, 2019). Additionally, while, overall, female students received higher percentages of bachelor's degrees than male students in STEM fields, a lower percentage of bachelor's degrees were awarded to women than to men (34% vs. 66%) (National Science Foundation, 2023).

Along with the interest in increasing student retention and diversity in STEM majors to maintain global economic competitiveness, there is a strong social pressure to achieve STEM equity (Gomez et al., 2021). Since certain degrees in the STEM fields have the highest wage premium among all bachelor's degree fields (Carnevale et al., 2015; Funk & Parker, 2018; Hershbein & Kearney, 2014; Melguizo & Wolniak, 2012), achieving STEM equity is strongly related to reducing the economic disadvantages that URM and female populations face. A major difficulty in achieving equity for these populations is the inability of colleges and universities to retain those URM and women who start but do not complete their STEM degrees.

To significantly increase the number of URMs and women in the STEM workforce, colleges and univerisities will need to begin addressing and dismantling systemic barriers that students experience both at the enrollment stage and during their participation in the STEM programs. Among the strategies that a growing number of institutions have adopted to increase recruitment, retention, and completion of URMs and women in STEM are STEM intervention and support programs (SIPs). These programs offer a series of academic and social support services targeted especially to students interested in, or currently enrolled in STEM degree programs (Chang et al., 2014; Maton et al., 2009; Sto Domingo et al., 2019). The employment of SIPs in universities and colleges has been accompanied by strong financial investments. Estimates indicate that there are around 150 federally funded STEM initiatives in the U.S, and that the federal government's investments in STEM education programs have remained stable from 2010 to date: around 3 billion dollars per year (Government Accountability Office, 2018).

For these reasons, there is a growing interest among scholars to better understand how these programs work. Traditionally, researchers have focused on the effects of participating in SIP programs. For instance, scholars have shown that URM students who participate in these types of undergraduate programs are more likely than students with similar academic backgrounds to maintain an interest in STEM, earn better grades in STEM classes, complete STEM degrees, and attend graduate school in STEM fields (Barlow & Villarejo, 2004; Maton & Hrabowski III, 2004; Maton et al., 2000). Despite our knowledge that these programs work for URM student populations, less work has focused on the programs themselves.

Scholars (Clewell & Campbell, 2002; Tsui, 2007), and recently the National Academies of Sciences, Engineering, and Medicine (2017), have called for additional studies addressing SIPs. Accordingly, researchers began to focus on a deeper understanding of these kinds of programs. For instance, scholars have paid attention to the role of STEM program directors (Gomez et al., 2021), STEM interventions funding practices (Rincon & George-Jackson, 2016), and the theoretical discourses driving the design of SIPs (Walker, 2018). However, little is known about program effectiveness indicators, such as program retention. Studying SIP program retention, particularly what distinguishes those students who remain in the program from those that leave, could be a key to better understanding how to keep students on track toward STEM degree completion.

Specifically, and considering the well-documented necessity to increase Latinx participation in STEM, this study focuses on the participation of Latinx and other URM in a STEM intervention and support program. Despite Latinx being the largest and fastest growing URM group in the United States (Colby & Ortman, 2015), and despite the unprecedented advances of this population in postsecondary education participation, Latinxs' representation in STEM remains at proportions that do not correlate with the proportion of Latinxs in the U.S. population (National Science Foundation, 2023). In this sense, Latinx workers were 16% of the total employed population in 2016, but they made up only 6.8% of professionals in STEM occupations (U.S. Bureau of Labor Statistics, 2016).

The first two years of college are pivotal to the retention and recruitment of students in STEM majors (President's Council of Advisors on Science and Technology, 2012), so a better understanding of how STEM interventions and programs work during the first two years of college represent a significant research endeavor and will be the focus of this study. Specifically, we addressed the following research questions: What are the academic, social, or psychosocial dispositions and identities of Latinx, other URM, and non-URM students enrolled in a SIP? How do these factors predict early retention (i.e., within the first two years of study) in a SIP?

This study contributes to the field by examining the process of remaining engaged in a SIP among Latinx students and their peers participating in the SIP, which requires high investment in terms of time, willingness to actively engage in research experiences early in one's career, and willingness to expose oneself to intrusive advising. Also, this research paper presents a distinctive examination of a SIP that is modeled after the success of the University of Maryland, Baltimore County (UMBC) Meyerhoff Scholars Program (MYSP). The MYSP has been one of the leading producers of URM STEM graduates for over thirty years (Maton et al., 2000).

We organize this paper by first providing a description of the SIP under study, and then reviewing relevant literature on STEM-focused SIPs, the participation of Latinx, other URM, and women in SIPs, and variables that are related to STEM engagement, such as interest, self-efficacy, sense of belonging, fewer experiences with discrimination, and STEM identity in relation to gender and racial/ethnic identities. We then introduce the theoretical framework that was used to guide variable selection and the analytic procedures. Finally, the results are presented, along with a discussion of the limitations and significance of this particular study.

The STEM Scholar Program

We incorporated the description of the program using our previous work on SIP retention (see Oseguera et al., 2019; Oseguera et al., 2022). The particular SIP under study in this paper, the STEM scholar program (SSP)[1], is a multi-component program at a large, research-intensive PWI in the mid-Atlantic region of the U.S., aimed at increasing the representation and academic achievement of minoritized students in STEM fields. The program is rooted in three asset-based areas: HBCU culture (i.e., family-like community), Black Greek-lettered organizations (i.e., brotherhood/sisterhood atmosphere), and Black churches (i.e., uplift and inner strength). While the current make-up of students in the SSP are not all Black-identified students, the program utilizes this framing given its success with diverse groups at the institution where the program originated (Maton et al., 2000).

Through participation in the SSP, students are provided with four years of financial, personal, and academic support. To qualify for the SSP, prospective students applying to one of the participating colleges within the university must also complete a program application. The initial pool of finalists are selected among applicants offered admission to the university and are based on a range of criteria including academic success (e.g., high school transcript, math performance on the SAT and ACT), the strength of letters of recommendation, and assessment of required written essays (related to the importance of diversity in STEM). As part of the last step in the selection process, finalists are then invited to participate in an interview weekend on campus where they interact with other SSP cohorts, faculty, and program staff. Following the interview weekend, admission to SSP is extended to a final group of students (usually about 40).

The students who accept admission to SSP are awarded an annual scholarship and are required to participate in a summer bridge program in preparation for their matriculation to the university in the fall. Summer bridge is an intensive, six-week program that takes place during the summer before the first year of college. Students participate in teambuilding activities and attend rigorous math and science foundational courses and seminars, along with introduction to research, study habits, time management, and professional communication skills workshops.

The SSP employs a cohort-based model and is designed to nurture and facilitate community and accountability among students in the program. For instance, previous cohort members are responsible for serving as peer mentors to incoming students in the program. Many of the scholars also offer informal academic tutoring to one another. This is reflective of the SSP’s commitment to nurturing authentic relationships among participants. Indeed, all students are encouraged to work collaboratively, study together, and are expected to engage in community service. Also, as part of the program, students are required to live together on campus for the first three years of college.

Scholars in the program have regular access to academic advisors and faculty mentors. Faculty mentors provide scholars with opportunities to participate in undergraduate research and to work in their laboratories. The advising team provides scholars with contacts to help them obtain summer internships as well as study-abroad opportunities. In their final year, SSP scholars complete a research thesis and are encouraged to share their results at scientific conferences. SSP scholars also participate in GRE/MCAT prep classes and are supported in their graduate school application process. To remain in the program, scholars must participate in program activities and maintain a 3.0-grade point average (Oseguera et al., 2019; Oseguera et al., 2022).

Review of Related Literature

Given the research questions of this study, we reviewed the literature in three important areas. We focus first on the relevant research about SIPs, paying special attention to intervention programs that are STEM-focused. Since one of the foci of this research paper is to better understand SIP retention of Latinx and other URM students and women, we also provide a review of literature that highlights the experience of these populations on SIPs. Then, in the STEM Intervention Program Engagement Factors section, we highlight variables that are related to STEM engagement: interest, self-efficacy, sense of belonging, fewer experiences of discrimination, and STEM identity in relation to gender and race identities. STEM major retention is not equal to SIP retention but given the program's primary purpose of retaining students in STEM majors, including literature around STEM engagement and major retention was justified. We also adapted portions of this literature review given its relevance to our previous work on minoritized student populations (see Oseguera et al., 2019; Oseguera et al., 2022).

STEM-focused Academic and Social Support Programs

The foundational goal of support programs was to facilitate the retention of the new populations and to offer support in leveling the playing field for the ones that were historically excluded from higher education opportunities, by increasing students' preparation for success in college (Kezar, 2004; Perna & Swail, 2001). Originally, support programs focused on increasing access to postsecondary education for White males from less wealthy backgrounds and geographically diverse places (Rudy & Brubacher, 1976), while women (and other underrepresented genders) and URM groups were excluded from these support programs (Arendale, 2011) through discriminatory informal practices and formal discriminatory policies. It was not until the Civil Rights legislation of the 1960s that federally financed programs to provide appropriate services for URM groups and women were created.

During the last forty years, support programs' goals have expanded in response to the growth in the enrollment of historically underserved populations (e.g., women, first-generation, low-income, Black, and Latinx), and the new challenges that have arisen in the diverse fields within the higher education system (Kezar, 2010; Tierney et al., 2005). In this context, in the 1980s, SIPs began to appear in the higher education landscape with diverse goals like increasing the enrollment and/or retention rates of women and historically marginalized racial/ethnic groups, supporting students in their transition to college, and improving undergraduates' experiences and retention within their STEM majors (DePass & Chubin, 2008; George et al. 2019).

Due to the research evidence that continuously shows the prevalence of subtle, indirect, and covert discrimination practices against women and members of other historically marginalized groups within STEM departments (McGee, 2016; Rosenthal et al., 2011a; Rosenthal et al., 2011b; Settles et al., 2009), multiple SIPs aimed at curbing the negative effects of the discriminatory STEM climate that affects these student populations have flourished within the education system.

Based on the needs and characteristics of the diverse college populations, SIPs provide various services, including summer bridge initiatives, undergraduate research opportunities, peer tutoring and mentoring, faculty mentoring, living-learning communities, leadership training, professional development opportunities, and scholarships, to name some of them (George et al., 2019; Oseguera et al., 2019; Rincon & George-Jackson, 2016; Tsui, 2007).

The research around SIPs has been relevant in highlighting the benefits of these interventions, emphasizing how they facilitate retention and academic success in the STEM field, foster graduate degree aspiration, and reduce the attainment gap for URMs and underrepresented genders (UGs). Along with this, researchers have also provided important critiques regarding the deficit ideology used in the design of some of these programs (Bowman in DePass & Chubin, 2015; Linley & George-Jackson, 2013). However, the literature that assesses the effectiveness of SIPs has not provided nor discussed estimates regarding SIP student retention, which is also a relevant effectiveness indicator (Tsui, 2007). Furthermore, Clewell and Campbell (2002) claim that more research is needed not only to understand what works but what works for whom. Thus, to advance STEM support, there is a need to understand what distinguishes those students who stay committed to a SIP from those who depart (Oseguera et al., 2019; Oseguera et al., 2022).

Latinx, Other URM, and Women Participation in SIPs

Research has shown that STEM students who participate in summer bridge programs are significantly more to likely to report higher levels of comfort with faculty (Cooper et al., 2018), increased social integration, and sense of belonging (Tomasko et al., 2016), and higher STEM career aspirations (Kitchen et al, 2018). Also, for URM students, participation in summer bridge programs has been associated with a higher probability of graduation (Murphy et al., 2010).

Research on Latinx college students in SIPs suggests that community-based experiences are critical for the retention of Latinx students in STEM (Herrera & Kovats-Sánchez, 2022). The relevance of community-based experiences for Latinx is related to "*familismo*", which is a deeply rooted cultural value for Latinx populations. *Familismo* refers to a "strong identification to the nuclear and extended 'family' through values that emphasize loyalty, responsibility, solidarity, and reciprocity" (López et al., 2019, p. 88). Hence, the concept of "family" is not restricted to the immediate family, and it might be extended to include far broader networks. In college, then, *familismo* or the lack of it can affect Latinx students' general academic engagement and success (López et al., 2019).

According to the findings of López et al. (2019), Latinx students keenly looked for *familismo* in STEM fields, but unfortunately, students rarely experienced such interactions within their programs of study. According to Hurtado et al.'s (2007) study, in STEM majors, there was often no institutional support for fostering efforts that promote *familismo*, which limited and discouraged Latinx students from engaging in their communities (Hurtado et al., 2007). While it is difficult for Latinxs to find *familismo* in STEM majors, SIPs are the formal spaces in which students can share and enact this cultural value. *Familismo* values might be incorporated in SIPs, for example, through service learning, volunteer opportunities, outreach activities, or community-engaged experiences (Herrera & Kovats-Sánchez, 2022). Research suggests that when Latinx students do not develop *familismo* within their programs' disciplinary boundaries, they actively engage in building informal "family-like" communities outside these disciplinary limits to advance their shared goals (Herrera & Kovats-Sánchez, 2022). Affinity groups, ethnic-based organizations, and student organizations have shown to be relevant for Latinx students' development of an on-campus *familia* (Revelo, 2015; Revelo & Baber, 2018).

Research regarding the participation of women in SIPs suggests that these formal opportunities serve as a significant source of social support and enhance female students' sense of belonging to the STEM fields (Rincon & George-Jackson, 2016; Strayhorn, 2018; Tate & Linn, 2005). Moreover, according to Ong et al.'s (2018) study, women participated in academic and social support programs to seek support to "counter personal attacks, to get emotional support and strategies to counteract isolation" (p. 233).

In this sense, it has been suggested that SIPs work as counterspaces against the gender biases in the STEM academic culture (Ong et al., 2018). As Keels (2019) explains, counterspaces are formal or informal "exclusionary" spaces where those of a similar social identity gather to validate and critique their experiences with the larger institution. As such, SIPs are fundamental for underrepresented students to build a cohesive STEM identity in a culture that does not always reflect or value people who look like them, and to pursue ways to progress academically and professionally that recognize their racial/ethnic and gendered identities (Ong et al., 2018).

STEM Intervention Program Engagement Factors

Engagement is defined as invested time and energy spent on academically purposeful activities that are linked to positive social and academic outcomes such as retention (Kuh, 2001). Considering SIPs usually require participants to devote extra time and effort to activities related to the program, we use an asset-based engagement framing to guide this section of the literature review, and we organize this section according to our guiding theoretical framework (see London et al., 2011).

STEM Interest and Self-Efficacy

Research on students has highlighted the role that cognitive and emotional interests play in facilitating student academic engagement (Mazer, 2013). Given the socioeconomic pressures put on the growth of the number of STEM graduates, there has been a strong development in research that studies the relationship between high school students' STEM interest and engagement in the field. However, as Shin et al. (2016) asserted, such research has focused primarily on school-aged children (e.g., Hong & Lin-Siegler, 2012; Robinson & Kenny, 2003; Wyss et al., 2012). Regarding college students, it has been suggested that students' lack of interest in STEM is a strong predictor of a student's decision to switch from a STEM major to a non-STEM one (Seymour & Hewitt, 1997). Similarly, a large body of literature has also highlighted that student participation in SIPs, such as summer bridge programs (Bruno et al., 2016; Kitchen et al., 2018; Lenaburg et al., 2012; Pritchard et al., 2016; Russomanno et al., 2010; Thompson & Consi, 2007) or undergraduate research programs (Doerschuk et al., 2016; Estrada et al., 2016; Russell et al., 2007), has a positive effect on STEM students, increasing their interest in STEM and their retention in the field.

As interest can influence STEM students' engagement and retention, self-efficacy also affects their academic behaviors, including the effort they put into their academic activities (Elliot et al., 2017). Academic self-efficacy refers to the conviction students have in their own competence to successfully complete academic responsibilities (Bandura, 1986; MacPhee et al., 2013), and it stands to reason that students with higher self-efficacy will be more prone to stay in a SIP.

Scholarly evidence indicates that men in STEM have higher academic self-efficacy than women (Hardin & Longhurst, 2016; Lent et al., 2016; MacPhee et al., 2013; Vogt et al., 2007; Wilson et al., 2015), and that non-URMs from upper SES backgrounds have higher self-efficacy than their peers from other social groups (MacPhee et al., 2013). Since our appraisal of one's own competency in a field is affected by social context cues (MacPhee et al., 2013), men and non-URMs from upper SES backgrounds have higher self-efficacy than their counterparts. Due to the residual effects of racism and gender bias on issues related to educational access and equity, UGs and URMs have fewer role models of successful STEM graduates with the same gender or race/ethnicity, a cue suggesting that people like them do not succeed in the field. Still today, many college-level STEM environments continue to be spaces where White males are the dominant population (Beasley & Fischer, 2012; Bodzin & Gehringer, 2001; Corbett & Hill, 2015). Furthermore, inequities that affect STEM students' chances of self-efficacy development can be also found in the access to research opportunities. According to Robnett et al. (2015), student participation in research opportunities is fundamental for acquiring science self-efficacy, yet, unfortunately, these experiences have been particularly elusive for URM and UG students attending predominantly White institutions (PWIs).

Sense of Belonging, Experiences of Discrimination

In addition to the role that interest and self-efficacy play in relation to STEM engagement, research has shown that students' social experiences, such as their sense of belonging and the experiences of discrimination they have encountered, are fundamental for their engagement and further retention in STEM majors (Estrada et al., 2018; Freeman et al., 2007; Good et al., 2012; Hurtado et al., 2010; Inzlicht & Good, 2006; Strayhorn, 2018; Walton & Cohen, 2011).

Sense of belonging is the experience of integration within a system that a person feels, in which she or he feels that they have a special function in that system (McLaren et al., 2008) and, equally, that the system is important for them (Strayhorn, 2018). Evidence suggests that sense of belonging is especially relevant to those who "perceive themselves as marginal to the mainstream life of college" (Hurtado & Carter, 1997, p. 324). The numerical underrepresentation of URM, women and lesbian, gay, bisexual, transgender, and queer (LGBTQ) students and faculty in STEM works as a cue signaling to these populations that they might not belong in the STEM field (Murphy et al., 2007; Strayhorn, 2009; 2018).

Also, perceiving the campus or academic discipline as hostile or unwelcoming (Estrada et al., 2018), experiencing LGBTQ-biases (Stout & Wright, 2016), racial tension, a hostile racial climate (Hurtado et al., 2010; Locks et al., 2008), or suffering interpersonal discrimination (Dortch & Patel, 2017; Hurtado et al., 1996; Syed, 2010) reduces students' engagement and increases their odds of dropping out from their majors. The racial climate in STEM departments has changed over time, but discrimination has not vanished. While overt discrimination has tended to disappear, more subtle, indirect, and covert discrimination practices are still present in STEM departments (McGee, 2016).

Similarly, despite overt practices of gender discrimination being less prevalent than they were decades ago, covert forms of gender bias and discrimination still exist and occur within the STEM field (Cooper & Brownell, 2016; Wang & Degol, 2017). Research has found that women in STEM math-intensive departments are particularly prone to experience gender bias (Robnett, 2016) and that women experience unequal treatment based on their gender within STEM (Steele et al., 2002). For instance, the same piece of scientific work gets a higher score from undergraduate students when it has a male name attached to it than when it has a female author (Knobloch-Westerwick et al., 2013), and similarly, a curriculum vitae of an undergraduate receives better scoring from faculty when it has a male name attached to it (Moss-Racusin et al., 2012). Likewise, research about LGBTQ students in STEM suggests that, while overt anti-LGBTQ bias is not socially acceptable in the field, subtle anti-LGBTQ bias is still prevalent in STEM classrooms and other academic spaces, such as group project meetings (Cooper & Brownell, 2016), usually in the form of derogatory remarks or jokes and isolation (Cech & Waidzunas, 2011; Patridge et al., 2014).

Gender and Racial/Ethnic Identities in STEM and STEM Identity

Just as the literature has shown that self-efficacy, interest, and sense of belonging are related to student engagement, it has been suggested that the strength and quality of students' academic identification are related to their level of engagement and willingness to be active participants in their learning opportunities, such as participating in SIPs (Estrada et al., 2018, White et al., 2019).

Research about students' identities in STEM has posited that women and URMs are more inclined than other groups to question their STEM identity (Rosenthal et al., 2011a; Rosenthal at al., 2011b; Settles et al., 2009) or experience fragmented academic, science, and personal identities (Beals, 2016; Mahfood, 2014; Tran et al., 2011) because of the perceived stereotypes that STEM is a field for European or American males (Beasley & Fischer, 2012; Bodzin & Gehringer, 2001; Corbett & Hill, 2015), and because of gender and racial imbalance in the field (Settles et al., 2016).

Perceiving that both STEM and other salient psychosocial identities (gender or race identities) are compatible is fundamental for motivation in STEM (London et al., 2011; Rosenthal et al., 2011a). For this reason, the idea that it is important to promote the development of a healthy science identity has become relevant in research (Carlone & Johnson, 2007; Lane, 2016; Ong et al., 2018). UGs and URMs who have successfully navigated the STEM environment frequently develop an identity that is a combination of their STEM and other salient and central identities, such as gender and racial/ethnic identity (McGee, 2016). In this identity development process, URM students redefine what it means to be a scientist and a person of color for them (Herrera et al., 2012; Tran et al., 2011), and UGs develop compatibility between their STEM and gender identities (Cech & Waidzunas, 2011; Rosenthal et al., 2011a). Regarding the role of SIPs during the identity development process, researchers have posited that SIPs offer spaces where URMs and women fulfill their academic selves without being questioned in relation to their other identities (Lane, 2016; Ong et al., 2018).

In this literature review, we have shown how researchers have found a significant relationship between students' engagement in STEM and their interest, self-efficacy, sense of belonging, experiences of discrimination, STEM identity, and well-being. However, what remains constant across this wide array of topics in STEM research is that there is no work that analyzes how these variables influence student retention at the SIP level.

Theoretical Framework

Full investment in the SIP under study requires participants to dedicate time and effort in activities associated with the program. As such, we utilize an engagement framework. Specifically, we drew on London, Rosenthal, Levy, and Lobel's (2011) STEM Engagement Framework, developed using racial and ethnic diverse students and their first-year experiences in college . London et al. (2011) define STEM engagement as "the academic and social variables that are essential not only for retention but also for sustained investment and satisfaction in STEM fields" (London et al., 2011, p. 305). Accoding to London et al. (2011), academic variables include motivation, confidence in STEM abilities, and one's expectation to remain in a STEM major, and they define social variables as the sense of belonging to the major and the educational environment.

The London et al. (2011) framework also incorporates a psychosocial variable that operates as a facilitator of STEM engagement: perceived identity compatibility. They also include identity variables given previous research that demonstrates that embedded stereotypes of STEM academic cultures communicate to certain populations the incompatibility between who they are and who belongs in the STEM field (Carlone & Johnson, 2007; Cheryan et al., 2009; Eccles, 2005; Merolla & Serpe, 2013; Settles, 2004; Steele et al., 2002). According to this framework, if students perceive that their identity is incompatible with the STEM field, they may question their ability to succeed in it, and this may ultimately decrease their engagement within STEM. We included gender and race identity within the framework as the authors recommended that both be included as aspects of identity relevant to STEM engagement. Other research supports this assertion, since having a strong race identity for URMs is related to their positive STEM academic outcomes (Oseguera et al., 2019; White et al., 2019).

Methods[2]

Data Source

Data for this study were collected using confidential web-based surveys administered during the summer of each cohort of the SSP summer bridge program. The surveys elicit information from participants about the academic, social, and psychosocial aspects of their experiences within and outside the SSP. The first three surveys are administered early in the program and primarily collect information about students' prior experiences in high school and expectations for college. The fourth survey, which is administered at the end of the summer bridge program, collects information about participants' experiences during the SSP and includes selected measures asked in earlier surveys.

Sample

The analytic sample (N = 128) for this study was constructed by drawing on data from the first five cohorts (years 2013-2017) of the SSP. Generally, cohort sizes range from 20-40 scholars per year across each cohort. Of these 128 scholars, 72% were identified as a member of a URM group with Latinx students comprising nearly one-third of the overall sample and 59% of the sample identified as women. The race and ethnicity categories were recoded to produce a variable with three mutually exclusive categories. Given the paper's focus on URM students, particularly Latinx students in STEM, we present, whenever possible, separated analyses focusing on Latinx students, other URMs (i.e., Black, Native American, Alaskan Native, Pacific Islander, and multi-racial), and non-URM's. Asian, Asian American, and White identified students are not considered as URMs due to university and program criteria.

Measures

Outcome variable. The main outcome of interest, short-term retention in the first two years of the SSP program, is measured by a binary variable that distinguishes students who do (SSP Retainer = 1) and do not (SSP [non] Retainer = 0) remain in the program during this period.

Independent variables. The selection of independent variables was guided by the STEM Engagement Framework of London et al. (2011), and they were operationalized using SSP summer bridge experience measures (see Table 1 and the Appendix for items, scaling, and alphas). We opted to use measures from the summer bridge surveys as there is a 100% response rate for all SSP participants. Moreover, the SSP leadership described the summer bridge experience as a foundational aspect of the SSP, hence our decision to utilize variables collected during summer bridge.

Academic variables. Two academic scales were included. Scientific Research Excitement is a 5-item scale that captured a respondent's level of excitement about scientific research work and career. Respondents rated the extent to which they agreed with items such as: "I am excited about the idea of scientific research" and "I am firmly committed to pursuing a career in research." This scale has face validity (Slaughter et al., 2015). The second academic scale used was Chemers' (2006) Scientific Self-Efficacy scale, which includes 14 items. Respondents were asked to rate their level of confidence on items such as, "Use technical science skills" and "Figure out what data I should collect." We did not include a measure of academic performance in the model as there was no significant difference between SSP retainers and SSP leavers.

Social variables. Three social variables were used in the analysis. As one of the major focuses of the SSP is to build a strong sense of program community among scholars, we used a 12-item Sense of Community scale. This scale asked respondents to rate their level of agreement with a series of statements about their experiences in the program. Sample items include: "I can trust people in the program," "Being a member of the SSP is a part of my identity," and "When I have a problem, I can talk about it with members of the program." The second social dimension variable used in the analysis was Chemers' (2006) 5-item Scientific Identity Scale, which asks students to rate their level of agreement with statements such as: "I derive great personal satisfaction from working on a team that is doing important research." The third construct among the social variables was Seaton et al.'s (2008) Everyday Discrimination scale, which includes 10 items that ask participants to rate their level of agreement with statements such as "People treat you as if you are not smart" and "You are treated with less respect than other people."

Psychosocial variables. Two psychosocial variables were used in this study. The first construct was a gender-adapted identity scale from MIBI-Teen (Sellers et al., 1998). This is a 6-item construct that includes items such as "Being [my gender] is an important part of my self-image." The second construct was a 3-item MIBI-Teen race centrality scale, it is used to determine whether students view their race as central to their identity, and it includes items such as "I have a strong sense of belonging to others in [my race]."

***Controls*.** We included gender and racial/ethnic group status as controls, given our interest in minoritized groups in STEM. We use Latinx-identified students as the reference and include other URM and non-URM as dichotomous variables in the model.

Table 1

Descriptive Statistics of Variables in the Model

	N	Minimum	Maximum	Mean	Std. Deviation
Retention in the SSP Program	128	0: non-SSP retainer after two academic years	1: SSP retainer	0.9	0.3
Gender	128	1: Man	2: Woman	1.6	0.5
Academic Dimension					
Scientific Research Excitement: SB1	128	2.0	5.0	3.9	0.7
Scientific Research Excitement: SB4	128	1.8	5.0	4.0	0.7
Scientific Self-Efficacy: SB1	128	1.8	5.0	3.9	0.6
Scientific Self-Efficacy: SB4	128	2.5	5.0	4.0	0.6
Social Dimension					
Scientific Identity: SB1	128	2.4	5.0	4.1	0.5
Scientific Identity: SB4	128	2.4	5.0	4.1	0.6
Sense of Program Community: SB4	128	1.7	4.0	3.1	0.5
Less Discrimination Experiences: SB3	128	1.9	6.0	4.7	0.9
Psychosocial Dimension					
Race Centrality: SB2	128	1.0	5.0	3.6	1.0
Gender Salience: SB2	128	1.0	4.7	3.2	0.8

Note. The numbers after summer bridge (SB) represent which survey the particular construct was measured. SB1, 2, and 3 were administered early in the SB and SB4 was administered at the end of the SB experience. See Table 2 for construct scaling.

Table 2

Descriptive Statistics of Variables by Racially Minoritized (URM) Group Status

Variable		Scale	Mean (SD) (N=128)		
			Latinx/Multiracial Latinx (N=41)	*Other URM (N=51)*	*Non-URM (N=36)*
Outcome variable					
Retention in the SSP Program		0: non-SSP retainer after two academic years 1: SSP retainer	0.85 (.4)	0.94 (.2)	0.94 (.2)
Independent variables					
Academic Dimension	Scientific Research Excitement:SB1	From strongly disagree (1) to strongly agree (5)	3.92 (.6)	3.7 (.7)	4.27 (.6)
	Scientific Research Excitement:SB4		3.89 (.7)	3.92 (.7)	4.31 (.5)
	Scientific Self-Efficacy: SB1	From not at all confident (1) to absolutely confident (5)	3.78 (.6)	3.85 (.6)	4.00 (.5)
	Scientific Self-Efficacy: SB4		3.97 (.7)	4.03 (.5)	4.12 (.5)
Social Dimension	Sense of Program Community: SB4	From not at all (1) to completely (4)	3.20 (. 5)	3.08 (.5)	3.16 (.5)
	Scientific Identity: SB1	From strongly disagree (1) to strongly agree (5)	4.16 (.5)	3.91 (.6)	4.21 (.5)
	Scientific Identity: SB4		4.20 (.6)	4.02 (.6)	4.24 (.6)
Psychosocial Dimension	Less Discrimination Experiences: SB3	From almost every day (1) to never (6)	4.91 (.7)	4.39 (1.0)	4.82 (.8)
	Gender Salience: SB2	From strongly disagree (1) to strongly agree (5)	3.13 (.8)	3.31 (. 9)	3.13 (.6)
	Race Centrality: SB2	From strongly disagree (1) to strongly agree (5)	3.63 (1.0)	3.87 (.9)	3.20 (1.0)
Control Variables					
Gender		1: Man, 2: Woman	1.54 (.5)	1.61 (.5)	1.61 (.5)

Note. The numbers after summer bridge (SB) represent which survey the particular construct was measured. SB1, 2, and 3 were administered early in the SB and SB4 was administered at the end of the SB experience.

Analyses

We provided overall means and standard deviations (see Table 1) and means and standard deviations by the three specified racial/ethnic groups (See Table 2). We also employed a one-way ANOVA and Scheffé post-hoc tests for comparing the means of the three racial/ethnic group categorizations to offer a description of the scholars in this sample prior to any higher-order analyses (See Table 3). Since we hypothesized that our STEM engagement model would predict the SSP scholars' decision to remain in the program until the second year, we entered predictors into the analysis based on our theoretical framework as hierarchical multiple regression does (Aron et al., 2013; Cohen, 2013). To better understand the factors that were related to retention in the SSP program, we conducted blocked, logistic regressions. By including independent variables in the regression models from controlling traits to the three dimensions of the conceptual frame in an additive way, we could see the net effect of each set of predictors on program retention. Missing data (less than 5%) were replaced individually with means of the non-missing construct items, as suggested by Shrive et al. (2006).

Limitations

While this work is a relevant contribution to understanding retention in SIPs, it is important to acknowledge some of its limitations. Our sample was drawn from a program at a single university; therefore, the conclusions presented here cannot be generalized. Additionally, the measures we applied were not designed for the conceptual framework, so we do not have a perfect representation of all the variables in the guiding framework.

Also, the small sample size led to lower statistical power and prevented us from producing higher-order statistical analyses, such as the examination of the conditional effects of the components of the STEM engagement model across more specific student subgroups. Additionally, the small sample size did not allow us to examine the intersections of students' scientific, raced, and/or gendered identities as we treated each identity separately in the model. Further, while the survey includes a gender non-binary categorization, fewer than five students selected this option, so per our human subjects review board recommendations we did not report on categories smaller than 5. Finally, this work only examines short-term retention in a SIP program, not offering insights into long-term retention. We expect to replicate these analyses to understand program retention rates across four years of the program and link aspects of programming to both short- and long-term retention. Still, examining short-term program retention is valuable, as attrition from STEM will typically occur within the first two years of study.

Findings

In this section, we present the portrait of the three racial group categories (N = 41 Latinx scholars (32%), N = *51* other URM scholars (40%), and N = 36 non-URM scholars (28%)) and the one-way ANOVA results first. Then, we review the results for the logistic regression analyses with all variables included in the model.

Among the three racial/ethnic group categorizations examined, the results of the ANOVA showed that there were differences in mean scores among the three racial groups in the scientific research excitement variable measured at the beginning of the summer bridge, F (2, 125)=7.65, η^2= .x, p < .001, and at the end of summer bridge, F (2, 125)=4.61, η^2=x, p< .01. There were also the differences of mean scores among the groups for (a) the scientific identity variable measured at the beginning of summer bridge, F (2, 125)=4.19, η^2= x, p< .05; (b) reports of experiencing everyday discrimination variable, F (2, 125)=4.82, η^2= x, p< .01; and (c) the race centrality variable, F (2, 125)=5.14, η^2= x, p< .01.

The Scheffé post-hoc test was conducted to inspect where the differences are located when comparing each pair of racial groupings. The post-hoc test showed that Latinx scholars had a significantly lower scientific research excitement score compared to the non-URM group, a difference that was observed at the beginning and end of the summer bridge. Latinx scholars reported that they experienced discrimination in their daily life less often than their other URM counterparts, and there was not a significant difference in the report of experienced discrimination with the non-URM group. Similarly, the post-hoc test showed that Latinx scholars had a significantly higher scientific identity score compared to the other URM group, but Latinx had not experienced a significant difference in scientific identity score compared to non-URM group.

Table 3

ANOVA test and post-hoc test results

Dependent variable	Group category (I)	Group category (II)	Mean difference (I-J)	SE	*p*
Scientific Research Excitement measured at SB1	*Latinx* student group	Non-URM group	- .36	.15	.06†
	Latinx student group	Other URM group	- .20	.14	.34
Scientific Research Excitement measured at SB4	*Latinx* student group	Non-URM group	- .42	.16	.03*
	Latinx student group	Other URM group	- .03	.14	.97
Scientific identity measured at SB1	*Latinx* student group	Non-URM group	- .06	.12	.90
	Latinx student group	Other URM group	- .25	.11	.09†
Less discrimination at SB3	*Latinx* student group	Non-URM group	- .09	.19	.88
	Latinx student group	Other URM group	- .52	.18	.02*

† < .1; * p < .05; **p< .01; ***p< .001

Note. The ANOVA table is available upon request.

The numbers after summer bridge (SB) represent which survey the particular construct was measured. SB1, 2, and 3 were administered early in the SB and SB4 was administered at the end of the SB experience. See Table 2 for construct scaling.

We now move to the results of the blocked logistic regression results predicting program retention after two years (See Table 4). In model 4, the full model, the *Academic Dimension and Psychosocial Dimension variables* were not significant predictors of short-term program retention, while gender and race/ethnic group were significant in the model. However, the *Social Dimension variables,* scientific identity, and fewer incidents of discrimination turned out to be significant predictors of short-term program retention.

Women were 9.3 times (OR=9.30, p < .05) more likely to remain in the program compared to their men counterparts. Regarding the race/ethnic group variable, the results indicate that compared to other URM scholars, Latinx scholars are less likely to be retained during their first two years, albeit marginally, but there is no retention difference between Latinx students and their non-URM peers. Scholars who had higher scientific identity during the SSP summer bridge program were 9.72 times more likely to remain in the SSP (OR = 9.72, $p < .05$).

Also, scholars who reported fewer incidents of discrimination during SSP summer bridge program were 2.68 times more likely to remain in the SSP (OR = 2.68, $p < .05$). The pseudo-R2 of model 4 was .35, and the chi-square of the Hosmer-Lemeshow indicated that this model had a sound goodness-of-fit.

In summary, the logistic regression analyses indicate that, albeit marginally, compared to other URM scholars, Latinx scholars are less likely to be retained in the program during their first two years. However, Latinx scholars have comparable odds of program retention as non-URM scholars; a promising finding in the given literature that demonstrates Latinx students' lower retention than White and Asian students. These results are conditional on the variables of the model, indicating that these racial group differences are estimated with an assumption that students are compared when they have the same level of predictors in the model. Women, reporting high levels of scientific identity at end of summer bridge (SB4), or reporting fewer incidences of discrimination during summer bridge (SB3) are significant factors for program retention after two years.

Table 4

Results of Logistic Regression Model for SSP Program Retention

Variable	Model 1		Model 2		Model 3		Model 4	
	B	OR	B	OR	B	OR	B	OR
Control Variable								
Gender: Woman (versus Man)	1.41*	4.10*	1.34†	3.84†	2.03*	7.599*	2.23*	9.29*
Non-URM group (Latinx=reference)	1.01	2.74	.67	1.96	1.35	3.84	1.31	3.71
Other URM group (Latinx =reference)	.95	2.58	.96	2.62	-1.57†	-4.78	1.59†	4.94
Independent Variables								
Academic Dimension								
Scientific Research Excitement			.70	2.01	.50	1. 58	.43	1.54
Scientific Self-Efficacy			- .49	.62	-1.27†	.28†	-1.28	.28
Social Dimension								
Scientific Identity					2.33**	10.27**	2.27*	9.72*
Sense of Program Community					-0.31	.74	-2.60	0.77
Less Discrimination					1.02*	2.78*	.98*	2.68*
Psychosocial Dimension								
Gender Salience							- .36	.69
Race Centrality							- .13	.88
Constant	-.23	.80	- .82	.44	-10.94*	.00*	-9.15†	.00†
Model fit	.12		.15		.34		.35	
Pseudo R^2	(p>.10)		(p<.05)		(p<.01)		(p<.05)	
Δ R^2			.04		.19		.01	

† < .1; * p < .05; **p< .01; ***p< .001

Note. See Table 1 for item scaling and the appendix for construct items.

Discussion

Guided by the STEM engagement framework, in this section, we discuss major findings in relation to early program retention in the STEM scholar program (SSP). The results indicate that women scholars are more likely to remain in this program than their men peers. These results suggest that women may be more inclined than men to engage in the extra-curricular and academic activities demanded by the SSP. This finding is consistent with the research that posits that women are more likely to seek out and utilize campus resources and have greater help-seeking skills than their men peers (Morgan & Robinson, 2003; Stevens & Mora, 2017). Along with this, these results suggest that women students consider that the support and opportunities provided by the SSP are adequate for them. As discussed in the literature review, there is a robust research finding indicating that SIPs serve as significant sources of social support for women and serve as spaces where women seek support to counter bias and isolation in a male-dominated field.

The results indicate that, compared to other URM scholars, Latinx scholars are slightly less likely to be retained in the program during their first two years. Given the program's explicit focus on Black culture, it appears that participation in the SSP may serve as a specific engagement factor for the other-URM group. The Black-centered culture of the program likely provides not only a safer and more affirming space, but also a culturally relevant context for Black students in the SSP, who might otherwise feel isolated and marginalized at a PWI campus in general, and within a STEM program in specific. Of importance to emphasize is that there still appears to be a benefit to the Latinx students in that they maintain similar rates as their White and Asian peers in the program. In this sense, our findings suggest that providing a culturally relevant context for Latinx is important and it might enhance Latinx SIPs retention and subsequently STEM major retention.

SIPs are fundamental for underrepresented students to build a STEM environment that does not constantly reflect or value a single dominant culture, but that celebrates the diversity of cultures from its members. Particularly for Latinx students, it might be relevant to incorporate program components associated with the values of "*familismo*" through service learning, volunteer opportunities, outreach activities, or community-engaged experiences (Herrera & Kovats-Sánchez, 2022, Rendón et al., 2020; Rincón et al., 2020). Our work offers paths to better understand this finding related to the slightly higher departure of Latinx from SIP than their other URM peers, it is important to conduct further investigation into this phenomenon, especially given the program's intentionality to create spaces for minoritized groups to thrive in STEM.

Our findings also extend research underscoring the importance of scientific identity to SIP retention in addition to STEM major retention, which has been the focus of past research in this area (e.g., Carlone & Johnson, 2007; Merolla & Serpe, 2013). From an asset-based perspective, this study suggests that students who did not experience or did not succumb to the identity-related threats that they encounter in STEM environments (Lane, 2016) stay engaged in the SIP during the first two years of the program. The findings regarding the importance of scientific identity to SIPs retention are particularly important to students from non-dominant populations, like women and non-binary gender identities and URM who are more prone to encounter identity-related threats in the STEM field (Herrera et al., 2012; Lane, 2016; Tran et al., 2011).

Our findings highlighting that having fewer incidences of discrimination are significant factors for students' program retention after two years, are consistent with the research around major retention, which suggests that suffering interpersonal discrimination reduces students' engagement and increases their odds of dropping out from their majors (Dortch & Patel, 2017; Hurtado et al., 1996; Syed, 2010). Also, we present evidence suggesting that Latinx students were as likely to experience discrimination as non-URMs, and slightly less likely to experience discrimination than other URMs. This is not surprising, given what is known from research about the racialized and discriminatory experiences of Black students at PWIs generally (e.g., Allen, 1992; Johnson, 2013; Mwangi et al., 2018; Solorzano et al., 2000), and in STEM fields specifically (McGee, 2015, 2016).

Another important finding of this work is that departure from the SSP is not likely because of URM students' or women's lack of fit in STEM. Previous literature suggests that students leave STEM majors because of their lack of interest in the field or because of their reduced confidence in their STEM abilities (Adedokun et al., 2013; Espinosa, 2011). Neither scientific research excitement nor scientific self-efficacy measured in the summer prior to their first academic year predicted remaining in the SSP or alternatively leaving the program. Sense of program community was not predictive, but it is likely the point at which it is measured that explains this insignificant finding. At the end of summer bridge, it is likely that participants have yet to develop the strong sense of community that these programs typically engender so we plan to continue to examine how this construct behaves as SSP scholars continue through the SSP.

Additionally, one surprising finding was that race centrality or gender salience did not enter as predictive of remaining in the SSP, suggesting that the SSP provides an environment that affirms varying levels of raced and gendered identities and we will continue to monitor the extent that the SSP provides participants in the program with tools to better navigate and integrate these identity aspects into the program, which is suggestive of the literature on science identity and scientific identity compatibility. In this respect, Herrera et al. (2012) claim that encouraging the link between students' social identities and scientific identities can promote retention so a deeper understanding of how these identities change/develop during the undergraduate years should be followed.

Implications

This study has implications for the understanding of SIPs, particularly SIPs retention, which is an unexplored area, and the findings are relevant for the design and implementation of support programs in STEM. URMs at PWIs tend to experience a more negative racial climate that becomes a barrier to adjusting to colleges and universities (Carter et al., 2013). Therefore, intentionally designing programs that address systemic inequities and celebrate and affirm minoritized groups' experiences can facilitate adjustment and success. In this respect, our work suggests that one way in which support program leaders can orient their efforts is through the incorporation of strategies that center Latinx culture and values, in addition to the strategies that highlight Black culture. Our findings also indicate that helping students in STEM fields to form a solid scientific identity in their early years of college can be critical to later STEM success.

A critical finding of this study is that, in all the models, women had significantly higher odds of remaining in the SSP, suggesting that women take advantage of these types of opportunities. Even though the SSP is a very demanding program, women appear more willing to invest their time and effort when they are provided with a challenging, yet supportive and welcoming environment. It begs the question of whether men enter college with inflated levels of self-efficacy and self-esteem to succeed (Bench et al., 2015; Else-Quest et al., 2010; OECD, 2015; Tellhed et al., 2017; Williams & George-Jackson, 2014) and thus expect to be successful without the assistance of a STEM support program since the majority of college STEM environments continue to be male-dominated spaces that privilege male perspectives (Beasley & Fisher, 2012; Bodzin & Gehringer, 2001; Corbett & Hill, 2015). For practitioners and institutions alike, these results indicate the need to create and implement support programs for women in STEM that go beyond the traditional components of academic support.

Conclusion

This study is one of the first to examine the relationship between STEM engagement and identity dispositions and early retention in a STEM-focused support program. While research using the London et al. (2011) framework has been relevant in the understanding of student retention in STEM majors, our findings suggest that this framework, which focuses on academic, social, and psychosocial dimensions, has some utility for use in predicting who stays in a SIP. The findings of the study highlight the importance of cultivating persistence-facilitating environments that foster student's scientific identity, protect students from experiences of discrimination, and/or provide them with the tools to navigate these discouraging situations.

It is important to mention that these are the early findings studying support program retention. More work in this area is necessary given the impact that SIPs have in retaining minoritized students in STEM. Investigating programs such as the SSP can provide insights into how SIPs moderate long-term success in STEM. Future studies would benefit from including a comparison group of students in STEM majors who are not in a support program, a comparison of academic support programs across STEM fields, a national representation of minoritized students, and comparisons of STEM support programs across different institutional types.

ENDNOTES

[1] For the purposes of this study, we use "SSP" as a pseudonym to protect the identities and privacy of participants in the program.

[2] Portions of this methods section were adapted from a prior manuscript, given similar analytic approaches and the same data source (see Oseguera et al., 2019).

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Appendix

List of Selected Survey Items in each Construct

Construct in the Analysis
Scientific Research Excitement (5-item construct) (Alpha= .80) • I enjoy doing research-related tasks. • I expect that my career will focus on research rather than practice. • I am excited about the idea of scientific research. • I am firmly committed to pursuing a career in research. • I look forward to working in a research lab.
Scientific Self-Efficacy (14-item construct) (Alpha= .91) • Use scientific literature and/or reports to guide research • Develop theories by integrating and coordinating results from multiple studies • Create explanations for the results of the study • Figure out the methods I should use • Figure out what data I should collect
Sense of Community (12-item construct) (Alpha= .89) • I am with the other Science Scholars a lot and enjoy being with them. • When I have a problem, I can talk about it with members of the program. • I can trust people in the program. • If there is a problem in the program, members can get it solved. • Program members and I value the same things.
Scientific Identity (5-item construct) (Alpha= .84) • I feel like I belong in the field of science or engineering. • I have come to think of myself as a 'scientist' or ‘engineer.’ • I have a strong sense of belonging to the community of scientists or engineers. • The daily work of a scientist or engineer is appealing to me. • I derive great personal satisfaction from working on a team that is doing important research.
Everyday Discrimination (10-item construct) (Alpha= .86) • People act as if they are better than you. • You are treated with less courtesy than other people. • You are threatened or harassed. • People act as if they think you are not smart. • You are called names or insulted.
Race Centrality (3-item construct) (Alpha= .82) • I have a strong sense of belonging with [own race/ethnicity] people. • I feel close to other [own race/ethnicity] people. • Being [own race/ethnicity] is an important part of who I am.
Gender Salience (6-item construct) (Alpha= .78) • Being men/women has a lot to do with how I think about myself. • Being men/women is an important part of my self-image. • Being men/women is unimportant to my sense of who I am. [a] • Being men/women has little to do with how I think about myself. [a] • I prefer to watch movies or television programs that have been made to appeal to boys/girls and men/women.

Note. The full list of items are available upon request.

[a] This is a reverse coded item.