UNIVERSITY OF CALIFORNIA
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**LAPA WRAP OR LAB COAT?
IDENTITY, SELF-EFFICACY, AND ACADEMIC PERSISTENCE IN EMERGING ADULTS IN STEM**

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in

PSYCHOLOGY

by

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Abstract

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Identity, Self-Efficacy, and Academic Persistence in Emerging Adults in STEM

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This study investigated whether social identity (i.e., ethnic, science, or a combination of ethnic and science identities) and self-efficacy (i.e., general academic and science) predict academic persistence in STEM (i.e., graduating with a baccalaureate degree in a STEM or STEM-related discipline). The study drew on social cognitive theory (SCT, Bandura, 1986) and social identity theory (SIT, Tajfel & Turner, 1986) to test three hypotheses. Hypothesis 1 was that science identity would be a stronger predictor of academic persistence than ethnic identity. Hypothesis 2 was that science self-efficacy would mediate the ability of social identity to predict academic persistence. Hypothesis 3 was that the college context (community college or four-year-university) would moderate the abilities of identity and self-efficacy to predict academic persistence.

One hundred ethnically diverse emerging adults (n = 38 female) comprised of 25 European American, 33 underrepresented minorities (URM), and 42 Asians from a four-year university (n = 50) and a community college (n = 50) contexts participated. They completed an online survey examining the associations between strength of social identity and types of academic self-efficacy. Persistence was operationalized as graduating with a baccalaureate degree in a STEM or STEM-related field.

Results supported both SCT and SIT. Binary logistic regression analyses supported the first two hypotheses: (1) Models with science identity as a predictor variable correctly identified more cases of graduation status than models using ethnic identity as a predictor variable. (2) Science self-efficacy fully mediated the ability of science identity to predict academic persistence. Consistent with SCT and SIT, both the college context and science self-efficacy remained separate, significant predictors of STEM graduation status (i.e., hypothesis three was not supported). Attending a four-year university, having a higher GPA, and having a strong science self-efficacy greatly increased the odds of graduating with a baccalaureate degree in a STEM or STEM-related discipline. However, gender, socioeconomic status, and ethnicity did not.

Keywords: social identity, self-efficacy, academic persistence, college context

Acknowledgements and Dedication

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Lapa wrap or lab coat?

Identity, Self-Efficacy, and Academic Persistence in Emerging Adults in STEM

In the U.S., emerging adults are encouraged to go to college; middle- and upper-class students assume they will attend college, and poor and working-class students often see college as a key pathway to social mobility (Cooper, 2011). College is a context for transition, exploration, and development. Most college students are *emerging adults* who fall between the ages of 18 to 25 (Arnett, 2000). The academic and social contexts of college are full of novel opportunities and diverse experiences. Thus, college not only makes different facets of emerging adults' identities salient, but it is also conducive to the exploration of academic and career trajectories (Hartman & Anderson, 2018; Montgomery & Côté, 2003).

STEM (i.e., science, technology, engineering, and math) and STEM-related careers play a key role in individual social mobility and the United States' ability to compete globally (National Science Foundation, *Science and Engineering Indicators*, 2017; US Congress Joint Economic Committee, 2012). In this study, I investigated the roles of identity and self-efficacy in the academic persistence of college-going emerging adults in a STEM academic context. Specifically, I examined whether college-going emerging adults' strength (i.e., the sense of belonging one acquires through being connected to a larger group/community) and domain (i.e., science and ethnicity) of social identity and self-efficacy are associated with STEM academic persistence operationalized as graduating with a baccalaureate degree in a STEM or a STEM-related discipline.

Previous studies have highlighted the roles of identity and self-efficacy in STEM academic persistence (Chemers et al., 2011; MacPhee et al., 2013; Perez et al., 2014; Rigali-Oiler & Kurpius, 2013;; Sawtelle et al., 2012). To my knowledge, this is the first study that has examined more than one identity domain (science and ethnicity), more than one domain of self-efficacy (academic and science), and their associations with emerging adults' graduation with a baccalaureate degree in a STEM or STEM-related discipline in the same study. Moreover, most research focuses on only one college context. In this study, I collected data from emerging adults in a community college and a four-year university because ethnic minority students are more likely than ethnic majority students to begin their STEM studies in a community college than a four-year university (National Student Clearinghouse (NSC), 2019).

The STEM pathways of community college students have been understudied (Hoffman et al., 2010). It is important to understand the experiences of community college students because of the critical role community colleges play in the academic pipeline (Malcom & Feder, 2016). Due to their open-door policy and affordability, students who are the first in their families to go to college, ethnic minorities, and low-income students are especially likely to enter higher education through community colleges (Schneider & Yin, 2012),. However, these students are also more likely than other community college students to not complete their degrees or to transfer to four-year universities (Castillo et al., 2006; Chen, 2018; Chen et al., 2019; Goldrick-Rab, 2010; Malcom & Feder, 2016; Mau, 2016; NSC, 2019). Identifying factors that contribute to degree completion can help create academic support programs for both ethnic majority and underrepresented minority (URM) students to stay on the path to graduation and upward economic mobility. The present study addresses this gap in the literature by assessing the roles of identity and academic self-efficacy in community college and four-year university students' graduation from STEM and STEM-related disciplines. Focusing on completion of STEM degrees is also a contribution to a literature which has mostly focused on URMs entry into and migration out of STEM (Allen-Ramdial & Campbell, 2014).

The remainder of the introduction is organized as follows: first, I review theory and research on academic self-efficacy and identity development. I focus on research assessing ethnic minority emerging adults' persistence in STEM career pathways because they experience more complex challenges in completing a STEM education that ethnic majority students (Allen-Ramdial & Campbell, 2014; Espinosa, 2011; Malcom & Feder, 2016; Mau, 2016). Second, I review research contrasting URM students STEM persistence in community colleges and four-year universities. Finally, I summarize the goals and hypotheses of the study.

Self-efficacy

Self-efficacy entails one's perceptions of one's own ability to effectively perform a series of actions in a context that has unknown or unpredictable elements (Bandura & Schunk, 1981). It is a key evaluative component of *social cognitive theory* (SCT, Bandura, 1986) and its role in academic persistence and performance has much empirical support (for an overview of self-efficacy and academic motivation, see Pajares, 1996). In a meta-analysis of psychological constructs and academic achievement, Richardson et al. (2012) found that students' sense of academic self-efficacy had a stronger association with their university GPA than their high-school GPA (Richardson et al., 2012). While the importance of self-efficacy to academic persistence is not disputed, in the present study I sought to gain a deeper understanding of the type of self-efficacy that plays the strongest role in STEM academic persistence.

Self-efficacy has been conceptualized in a variety of ways (e.g., Deci & Ryan, 2000; Eccles et al., 1998; Harter, 1982; Lent & Hackett, 1987). In the present study I used Bandura's (1977) definition of self-efficacy, which posits that individuals self-evaluate their capability in particular contexts and tasks. Interestingly, the majority of research on self-efficacy on academic contexts has assessed general academic self-efficacy. In the present study, I assessed I included measures general academic self-efficacy (Chemers, et al., 2001) and science self-efficacy (Chemers et al., 2011) to test Bandura's (1977) proposal that self-efficacy is domain specific.

Academic self-efficacy. *Academic self-efficacy* is the belief that one has the capability to organize and execute courses of action that will result in the attainment of educational goals (Chemers et al., 2001). It can increase over time as individuals master skills and tasks in new environments, e.g., college. Academic self-efficacy is a powerful predictor of academic achievement, academic persistence, and the ability to cope with academic pressures (Chemers at al., 2001; Gore, 2006; Lent, et al., 1984; Wigfield & Eccles, 2000; see Multon et al., 1991 for a meta-analysis). Importantly, the strong association between academic self-efficacy and academic performance has been found in studies that statistically controlled for gender (Rigali-Oiler & Kurpius, 2013) and in URM ethnic groups including Black, Asian, Latinx, and Native American (Gloria et al., 2005; Gloria & Ho, 2003; Gloria & Robinson Kurpius, 2001; MacPhee & Canetto, 2013; Majer, 2009; Torres & Solberg, 2001). Therefore, the empirical evidence has consistently underscored the importance of academic self-efficacy for academic performance across gender and ethnicity/race. However, because the competencies needed to be successful in different academic subjects can vary greatly, general academic self-efficacy may not predict persistence in a specific subject such as science. To address this possibility, the present study assessed both general academic and domain-specific science self-efficacy.

Science self-efficacy. *Science self-efficacy* involves perceptions of competence in science-specific tasks (Chemers et al., 2011). It has numerous important correlates, such as strong associations with developing positive attitudes towards science and commitment to science academic and career goals (Byars-Winston et al., 2010; Lent et al., 1991; Sahin et al., 2017), and STEM academic persistence and achievement (Jungert et al., 2018; Larson et al., 2015; Sawtelle, et al., 2012). This research has shown that the factors that have made general academic self-efficacy a powerful predictor of overall academic achievement and persistence (i.e., high expectations and confidence through past experience and social support) also hold true for science self-efficacy.

The present study builds on past research by examining the relative contributions of general academic and science self-efficacy to students' graduation from STEM and STEM-related majors. In **Hypothesis 1**, domain-specific science self-efficacy was expected to be a stronger predictor of STEM academic persistence than general academic self-efficacy because the measure of general academic self-efficacy does not assess competency beliefs for science-related abilities. One can feel efficacious in a general academic way but not for abilities required for success in the science domain. Indeed, low academic performance and low science self-efficacy are reasons undergraduate students migrate from STEM to non-STEM majors (Litzer, et al., 2014). The importance of science self-efficacy for STEM academic persistence is captured in **Hypothesis 2,** that science self-efficacy will mediate the ability of social identity to predict academic persistence.

Just as there are different types of self-efficacy, there are different types of identity. Research has demonstrated the importance of identity to academic persistence and career paths (Althschul et al., 2006; Cohen & Garcia, 2008; Eccles, 2009; Guichard et al., 2012; Lu, 2015), but more needs to be known about whether a specific type of identity is conducive to STEM academic persistence. The present study contributed to existing knowledge by investigating both ethnic identity and science identity, which are two important identities to many college-going emerging adults in a STEM context.

Identity Development in Emerging Adulthood

Identity development is a key task of adolescence and emerging adulthood. Feeling supported by meaningful social groups, such as family, community, and society helps youth construct life narratives that integrate their past and present with their future goals (Azmitia et al., 2013; Erikson, 1968; Habermas & Reese, 2012; McAdams, 2012). Individuals' connection to social groups is often referred to, and studied as, *social identity* (Tajfel & Turner, 1986). People tend to affiliate with others whom they perceive as similar, (i.e., the *in-group*). The in-group is also the group from whom they seek support (Hurtado & Silva, 2008; Turner & Reynolds, 2011) and, through social comparison, use to differentiate themselves from others, i.e., the *out-group*. Because individuals belong to multiple social groups, they have multiple social identities (Maalouf, 1998; Roccas & Brewer, 2002) that may not have the same level of importance to them. Moreover, the salience of a particular social identity is context-dependent (Hurtado & Silva, 2008; Tajfel & Turner, 1986), complex, and multi-faceted (Brewer & Pierce, 2005).

Social support and social connections, key affordances of one's in-group, are important components of many theoretical models of student academic motivation, achievement, and persistence such as the expectancy-value theory (Eccles & Wigfield, 2002), social cognitive career theory (Lent et al., 1994), and the student integration model (Tinto, 1975). Social connection and support are especially important factors in URM students and females' decisions to persist or drop out of STEM pathways (Azmitia et al., 2018; Barth et al., 2018; Carpi et al., 2013; Espinosa, 2011; Good, et al., 2012; Graham et al., 2013; Kim et al., 2018; Leaper & Starr, 2019; Lu, 2015). Through social support and validation, social identities can help students feel connected in the STEM context. For example, a student may feel strong connections with their ethnic identity when in an ethnic studies class and yet have a strong science identity in a chemistry class. It may also be that the social groups with whom a student identifies in particular classes make a difference in how successful they are in those contexts because they provide a sense of belonging within the class context. Sense of belonging and peer social support are key components of academic persistence (Oyserman et al., 2006; Rice et al., 2013; Strayhorn, 2018; Walton & Cohen, 2008).

According to SIT (Tajfel & Turner, 1986), in a given context, the social identities of individuals in less dominant positions (e.g., numerical minorities) are more salient than the social identities of those in majority positions. For URM emerging adults, developing a strong STEM identity may be challenging given the rigorous course work and because, if their ethnic/racial identity is central to them, their potential in-group may initially seem small (i.e., they only consider those who match their ethnicity to be their in-group, and few of their peers and the faculty might share their ethnicity/race) (Hausmann et al., 2007; Rodriguez et al., 2019). To address this possibility, I included a measure of ethnic identity as a predictive factor of academic persistence.

Ethnic identity. *Ethnic identity* encompasses one's affiliation with a group that develops as a result of exploration, experience, and an understanding of similar traditions, values, and beliefs (Phinney, 1992). It addresses a person's values and beliefs as well as sense of belonging and connection to the person's ethnic social group(s). The association between ethnic identity and academic persistence is still not clear (Mendoza-Denton et al., 2008; Miller-Cotto & Byrnes, 2016). Some studies have shown that for members of stigmatized ethnic groups (e.g., Black, Latinx, and Native American), ethnic identity is negatively correlated with academic persistence (Castillo et al., 2006; Jaret & Reitzes, 2009; Okagaki et al., 2009). In contrast, other research has shown that ethnic identity offers a protective factor for ethnic minorities' well-being and is associated with positive attitudes towards other ethnic groups (Chee et al., 2019; Juang et al., 2006). A strong ethnic identity may enable URM students in STEM academic contexts to connect with others from similar backgrounds and increase their persistence to graduation (Altschul et al., 2006; Ong et al., 2006; Syed, et al., 2011). Whereas the connection between ethnic identity and academic persistence is unclear, research clearly indicates that a science identity is one key to STEM academic success.

Science identity. A *science identity* addresses how much people think that being a scientist is part of who they are or want to become along with science-related feelings, attitudes, and behaviors (Chemers, et al., 2011). Similar to ethnic identity, it takes time and experience to develop a science identity. The positive association between science identity and STEM academic persistence has been well-documented (Chemers et al., 2011; Merolla & Serpe, 2013; Stets et al., 2017). Research has also shown that there are gender and ethnic group differences in the strength of students' science identity and that science identity predicts persistence in STEM. For example, in their five-year longitudinal study, Robinson and colleagues (2018) found that members of URM groups were more likely than Asian or White students to start with low levels of science identity that continued to decline over the course of the study.

Overall, being male and of Asian or European descent predicted high levels of science identity and subsequent participation in a science career. Additional research has shown that developing a science identity plays an important role in women's (Carlone & Johnson, 2007; Espinosa, 2011; Schuster & Martiny, 2017) and Latinx and Black students' persistence STEM (Johnson, 2016; Rahm & Moore, 2016). Although taken together, these studies highlight the importance of a science identity to STEM academic persistence is clear, less obvious is the interplay between ethnic identity and science identity for URM emerging adults in STEM.

Identity, Self-efficacy, and Academic Persistence.

Although empirical research has demonstrated the importance of social identity and self-efficacy for academic persistence, few studies have incorporated both constructs in the same study. In those that have examined them together, self-efficacy has been found to be a mediator of the ability of identity to predict academic behaviors such as science research participation and STEM career choice (Byars-Winston & Rogers, 2019; Merolla & Serpe, 2013; Robnett, et al. 2015). In one study, Chemers et al. (2011) assessed the associations between commitment to a science career in STEM and a science identity in URM undergraduate and graduate STEM students. Their results indicated that science self-efficacy and a science identity jointly predicted both undergraduate and graduate students' science career commitment.

Although there is general acknowledgement that individuals have more than one social identity, even fewer studies have investigated more than one type of social identity at a time. In one of the few available programs of research on the relation between ethnic and academic identities and persistence in college, Dovidio, Gaertner, Niemann, and Snider (2001) conducted a series of survey and laboratory studies investigating the association between ethnic and academic identities and feelings of comfort and inclusion in predominantly White (PWIs) four-year universities across the U.S. Their studies assessed associations between perceived experiences of discrimination (stigmatization), feeling part of the university community, and institutional commitment in ethnic-minority faculty and students (Black, Asian, and Latinx heritage). They conceptualized *feeling part of the community* (i.e., sense of belonging) and *institutional commitment* items as representing individuals' academic identity. Regression analyses results indicated that feeling part of the university community significantly predicted institutional commitment and reduced the effects of experiences of discrimination to a non-significant factor in institutional commitment (Dovidio et al., 2001). Their research suggested that having an academic identity and a sense of belonging to the academic context contribute to the social adjustment and psychological well-being of ethnic-minority college students and faculty. Moreover, their work highlighted the importance of considering both ethnic and academic identities when investigating the experiences of ethnic-minority individuals. The present study builds on Dovidio et al.'s (2001) research by investigating the relative contributions of both ethnic and science identities to STEM academic persistence but focusing on the outcome of graduation status rather than institutional commitment. Focusing on graduation rates enabled me to address the implications of these identities for diversifying the STEM workforce.

Summary. Taken together, past research has highlighted the importance of examining both general academic and science self-efficacy in conjunction with an academic identity in underrepresented ethnic-minority STEM students' persistence. The present study builds on previous research by concurrently assessing both general academic and science self-efficacy in conjunction with the roles of both ethnic identity and science identities in URM students' persistence in STEM. Moreover, the current study contributes to existing knowledge by including students from both a four-year university and a community college context.

Type of College

Four-year universities are more selective than community colleges in the type of students they admit into their programs, and therefore are more likely than community colleges to have a student body that is well-prepared for a rigorous STEM program. Four-year university professors are also more likely than community college professors to have research lab and mentorship opportunities that have been empirically demonstrated to be important to the development of STEM academic identities in students (Estrada et al., 2018). Because community college students are less likely to be exposed to STEM mentorship and research experiences, they are also less likely to have gained a STEM value orientation than their four-year university counterparts, which may play a role in their persistence to graduation (Mau, 2016).

According to the National Science Foundation, students who enter a two-year community college are less likely to graduate within three years of transferring to a four year university with a bachelor's degree in STEM than students who enrolled directly in a four-year university and who declared an intention to graduate with a degree in the natural sciences and engineering. (NSF *Science and Engineering Indicators*, 2018). These differences in completion rates between the two types of institutions form the basis of **Hypothesis 3,** that the college context will moderate the ability of identity and self-efficacy to predict academic persistence such that students in four-year universities will be more likely to graduate with a STEM degree than students in community colleges.

While students who begin their STEM majors at four-year universities are more likely to complete their degrees, as the cost of four-year university tuition continues to rise, there is a critical need to improve the ability of community colleges to be a viable path to students on their STEM academic journeys. It is also vital to address the difference in STEM graduation rates for those who begin their STEM studies in community college compared to those who begin their STEM studies at a four-year university because of the need to diversify STEM, fill STEM jobs with home-grown talent and because the higher pay in STEM jobs provides a pathway to social mobility. According to the Pew Research Center, since 1990, STEM jobs have grown faster than any other occupation in the U.S. (Graff et al., 2018). A major step in growing a STEM workforce is ensuring that individuals are retained in STEM academic programs. The present study's inclusion of both community college and four-year university students was intended to provide additional insight into factors that play a role in the large number of community college students who do not complete their baccalaureate degrees in STEM (Schneider, & Yin, 2012).

Overview of the Present Study

In sum, this study investigated the roles of self-efficacy and social identity in the STEM academic persistence in college-going emerging adults. I investigated whether there is path to graduating with a baccalaureate degree in a STEM or STEM-related discipline through the strength of a particular social identity (ethnicity or science), or their intersection (ethnicity and science) and to clarify the role of general and science academic self-efficacy in the path to graduating with a baccalaureate degree in a STEM or STEM-related discipline. I also examined whether persistence in STEM differs for community college and four-year-university STEM students. I tested three hypotheses:

Hypothesis 1: Science identity will be a stronger predictor of STEM academic persistence than ethnic identity.

Hypothesis 2: Science self-efficacy will mediate the ability of social identity (science or ethnic) to predict academic persistence.

Hypothesis 3: The college context will moderate the ability of identity and self-efficacy to predict academic persistence such that students in four-year universities will be more likely to graduate with a STEM degree than students in community colleges.

To test these hypotheses, I administered online surveys to undergraduates pursuing STEM majors in both a community college and four-year university context. With each participant's consent, I was granted access to their institution-provided academic transcripts and determined whether they graduated with a degree in STEM or a STEM-related discipline.

Method

Participants

The participants were drawn from a study of 507 emerging adults who participated in a larger study on STEM pathways in a community college and a public university in Northern California. Of the larger group, 90 participants were excluded because of missing data and 111 were excluded because they were not emerging adults (they were at least 30 years-old). Moreover, only participants who were undeclared but were enrolled in a STEM class or were pursuing a STEM or STEM-related major during 2013 and 2014 (as identified by the U.S. Department of Education, see Appendix A for full list) were included in the study. Finally, only participants who completed measures for all the predictor variables of interest (ethnic identity, science identity, academic self-efficacy, and science self-efficacy) met the criteria for inclusion in the study.

The final sample for the study included 100 participants (n = 38 female, M_{age} = 21.82, SD 2.58 ranging from 18 - 27-years-old) comprised of 42 Asian, 25 European American, and 33 underrepresented minorities (URM, i.e., Latinx, African-American, and Native-American) self-identified undergraduate students. Fifty participants were from a community college context and 50 were from a four-year university context (see Table 1 for characteristics based on college context). Twenty-eight participants were undeclared, 69 declared in STEM or STEM-related majors, and three who were initially non-STEM majors eventually graduated in a STEM or STEM-related major.

Parent education and occupation information was used to calculate the participants' socioeconomic status (SES) (Hollingshead, 1957, 2011). Scores ranged from a low score of 8 to a high score of 66, with higher scores indicating a higher socioeconomic position. The participants had socioeconomic levels that indicated socioeconomic diversity (M_{SES} = 35.73, *SD* 13.33).

Recruitment

Participants were recruited during the Fall 2013 through Spring 2014 terms. Community college students at a socioeconomically and ethnically diverse Hispanic-serving institution in Northern California were recruited in Computer Science, Calculus, or Statistics classes in which the instructors offered students extra credit points for completing the online surveys. Participants were not required to be STEM majors, but they had to be enrolled in at least one STEM class. To participate, emerging adults had to be at least 18 years-old.

Concurrent with the community college students, students from a four-year residential public university in Northern California were recruited in one of two ways. First, flyers were posted in several Science and Engineering buildings advertising that STEM students would receive a $10 Amazon gift card for participating in an online survey on their thoughts and experiences as a STEM student. Flyers specifically asked for transfer students who were taking a STEM class, but a few (n = 4 or 10.5%) native (i.e., non-transfer) students also chose to participate in the study. We privileged recruiting transfer students because they typically would have completed their first two years of college at a community college, and this would reduce between group variability between the community college and 4-year university participants. Second, students who had completed at least one course in STEM were recruited through the Psychology department's research pool (n = 28 or 56.2% of four-year university emerging adults). These students earned academic credit in exchange for participating in the study.

Procedure

Potential participants recruited through fliers or community college instructors sent an email expressing their interest in participating to me, and if they met the criteria, I sent them a surveymonkey.com link to the survey. The participants recruited through the Psychology Research Pool were sent the link to the survey through the SONA systems platform. Participants completed the surveys online and sent me an email indicating that they had submitted the survey, after which they were either sent $10 Amazon gift cards electronically or I submitted their names to receive course credit for participating.

All participants answered personal demographic questions (age, gender, and ethnicity) and provided information on their parents' education and occupation. They also self-reported cumulative GPA, type of college attended at the time of participation (community college or four-year university), one-year and five-year post-graduate plans, and completed measures of academic self-efficacy (general and science-specific) and identity (ethnic and science). Although participants self-reported GPA, I only used the institution-provided overall, cumulative GPA for analysis. Participants completed surveys in approximately 90 minutes. Descriptive statistics and scale reliabilities for the measures used are presented in Table 2. Copies of the scales are presented in the appendices.

Persistence was assessed through examination of the participants' official academic transcripts. If the transcript showed that the participant graduated with a STEM or STEM-related major (as classified by the NSF, see Appendix A), he/she was coded as "STEM degree earned." Otherwise, the participant was coded as "STEM degree not earned." In analyzing the data, academic persistence was operationalized and referred to as a dichotomous categorical variable, *graduation status, STEM yes or no*.

Measures

See Table 2 for alpha coefficients of reliability for all the measures.

Ethnic Identity. Emerging adults' sense of ethnic belonging was assessed using the belonging subscale from the *Multigroup Ethnic Identity Measure* (Phinney, 1992) (see Appendix B). This measure has seven questions that assess how much people feel that they belong or have committed to their ethnic identity. Participants recorded their responses on a five-point Likert-type scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Sample items for the commitment scale included "I feel a strong attachment towards my own ethnic group." Strength of ethnic identity is considered low if it is below the mean of 3 and high if the score is 3 and above (Phinney et al., 2007).

Science Identity. The *Identity as a Scientist Scale* (Chemers et al., 2011; see Appendix C) was used to evaluate students' science identity. In this scale, eight items assess how much the participant agrees that s/he is a scientist and is a part of the scientific community (e.g., "Being a scientist is an important part of who I am."). Participants recorded their responses on a five-point Likert-type scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Science self-efficacy. Participants also completed the *Science Self-Efficacy Scale* (Chemers et al., 2011; see Appendix D). It is comprised of 10 questions assessing participant's confidence in being able to perform science-related tasks (e.g., "I am confident that I can generate a research question to answer."). Individuals select their responses from five-point Likert-type scale choices ranging from 1 (Not at all confident) to 5 (Absolutely confident).

Academic self-efficacy. The *Academic Self-Efficacy* scale (Chemers et al., 2001) (see Appendix E) contains eight questions regarding one's feelings of competence in academic tasks (e.g., "I am good at research and writing papers."). Participants recorded responses on a seven-point Likert-type scale ranging from 1 (Very untrue) to 7 (Very true).

Results

Preliminary Analyses and Computations

Academic persistence (graduation in STEM) was the dependent variable of interest and was a dichotomous categorical variable. The other variables were comprised of the type of college attended and participants' scores on academic self-efficacy, science self-efficacy, ethnic identity, science identity, and the ethnic-science identity interaction. Because the Hypothesis 2 required testing for mediation, the self-efficacy components will henceforth be referred to as mediator variables and the type of college attended and identity components will be referred to as predictor variables. Due to the dichotomous categorical nature of the outcome variable (graduating with a baccalaureate degree in a STEM or STEM-related discipline, yes or no), point-biserial correlations were used for assessing all associations with academic persistence and type of college attended. Preliminary bivariate correlation analyses established that graduation status was significantly associated with the predictor variables (type of college attended, ethnic identity, science identity, ethnic-science identity interaction) and the mediator variables (academic self-efficacy, and science self-efficacy). Additionally, type of college attended was significantly associated only with science identity and science self-efficacy. Thus, the criteria to test for meditation were only met for science identity and science self-efficacy. The bivariate correlations between the proposed mediation variables (academic self-efficacy and science self-efficacy) and each identity predictor of interest (ethnic identity, science identity, and ethnic-science interaction) were also all significant (see Table 3). Thus, the criteria for testing mediation were met for identity and self-efficacy variables.

To assess the ethnic-science identity interaction component, a new variable, Ethnic-Science Identity Interaction, was created by multiplying together the ethnic identity and science identity scores for each person. Prior to multiplying the scores, each score was mean-centered (i.e., the mean science identity score was subtracted from all individual emerging adult science identity scores and the mean ethnic identity score was also subtracted from all individual ethnic identity scores) (Cohen, West, & Aiken, 2013).

Chi-square tests for independence (with Yates Continuity Corrections used for 2 x 2 tables) were performed to reduce the potential number of predictor variables. There were no significant differences between gender groups, ethnic groups, or socioeconomic status (see Table 4). Therefore, gender, ethnic group, and socioeconomic status were not included as control or predictor variables for any subsequent analyses. Based on these results, we controlled only for institution-provided GPA. An alpha level of .05 was used for all statistical analyses. Because the outcome of interest, graduation status (i.e., graduated with a baccalaureate degree in a STEM or STEM-related discipline) is a dichotomous categorical item, we used binary logistic regression.

Comparison of ethnic identity to science identity as academic persistence predictors

In order to test Hypothesis 1, that the ability of science identity would be stronger than the ability of ethnic identity to predict STEM academic persistence, two binary logistic regressions were performed. One model, EI (ethnic identity), included the predictor variables ethnic identity and the control variable of GPA. The second model, SI (science identity), included the predictor variables science identity and the control variables of GPA and college type (dummy coded). See Table 5 for the EI and SI regression table.

The EI model as a whole explained between 15.1% (Cox and Snell R square) and 21.9% (Nagelkerke R squared) of the variance in graduation status. It was able to correctly predict 78.9% of the graduation cases. The SI model as a whole explained between 28.3% (Cox and Snell R square) and 41.7% (Nagelkerke R squared) of the variance in graduation status. It was able to correctly predict 83.0% of the graduation cases. Based on these results, both ethnic identity and science identity correctly predicted graduation status with a high degree of accuracy. However, science identity explained more variation and was able to accurately predict more cases of graduation status between the two types of social identity, thus supporting Hypothesis 1. We then turned to analysis to test Hypothesis 2, involving the regression model in which both types of identity were considered concurrently to assess which type of identity was most predictive of STEM graduation status, i.e., academic persistence.

Science self-efficacy, social identity, and academic persistence

Hypothesis 2 was that science self-efficacy would mediate the ability of social identity [Science, Ethnic, and the Ethnic-Science Identity Interaction] to predict academic persistence, even when considering control variables and possible interaction effects.

Initially, results from the point-biserial correlations (see Table 3) demonstrated that there were significant associations between science identity and academic persistence (r (97) = .53, $p < .001$) and between science self-efficacy and academic persistence ((r (92) = .55, $p < .001$). There was also a significant association between science identity and science self-efficacy ((r (92) = .69, $p <$

.001). Additionally, there were significant associations between ethnic identity and academic persistence (r (97) = .30, $p < .002$) and between science self-efficacy and ethnic identity ((r (92) = .21, $p = .04$). There were also significant associations between ethnic-science identity interaction and the variables of interest, but they were negative associations: the ethnic-science identity interaction and academic persistence was (r (92) = -.30, $p < .001$); the ethnic-science identity interaction and science self-efficacy, was (r (92) = -.27, $p = .009$). This suggests a more complex relationship among the identity and science self-efficacy variables when considering both science identity and ethnic identity concurrently. Taken together, these preliminary findings indicated that further investigation into the nature of these associations using mediation analysis was warranted.

A series of binary logistic regressions were performed to assess the possible mediation and moderation impact among seven variables: college type, three identity predictor variables (science identity, ethnic identity, and ethnic-science identity interaction), two potential mediating variables (science self-efficacy and academic self-efficacy), and the control variable of GPA.

First, a binary logistic regression was conducted to establish that there was an association between academic persistence and the identity variables. This model assessed the impact of college type, science identity, ethnic identity, and ethnic-science identity interaction and the control variable of GPA on the likelihood that participants graduated with a baccalaureate degree in a STEM or STEM-related discipline. The model as a whole explained between 36.0% (Cox and Snell R square) and 52.8% (Nagelkerke R squared) of the variance in graduation status. See Table 6, section A for the classification table.

Results indicated that science identity recorded an odds ratio of 3.02, $p < .001$, indicating that every unit of science self-efficacy was associated with a 70.1% to 435% increase in the odds of graduating with a baccalaureate degree in a STEM or STEM-related discipline, controlling for other factors in the model. Ethnic identity and the ethnic-science identity interaction were not significant predictors of graduation status and were thus excluded from subsequent analyses (see Table 7, section A for the regression table). However, the control variable of GPA was a significant predictor of graduation status and was thus included in subsequent analyses. These results lend further support to Hypothesis 1, that science identity would be a stronger predictor of STEM academic persistence than ethnic identity.

The second step was to establish that there were significant associations between the possible mediating variables and the identity variables. A hierarchical linear regression was conducted to assess the ability of science identity and GPA to predict science self-efficacy. The control variable of GPA was entered in Step 1, explaining 1.4% of the variance in science self-efficacy. After entering science identity in Step 2, the total variance explained by the model as a whole was 46.7%, F (1, 88) = 78.29, $p < .001$. Thus, the results demonstrated that science identity was significantly associated with science self-efficacy (*beta* = .69, $p < .001$).

A second hierarchical linear regression assessed the ability of science identity and GPA to predict academic self-efficacy. GPA was entered in Step 1, explaining

5.7% of the variance in academic self-efficacy. After entering science identity in Step 2, the total variance explained by the model as a whole was 13.3%, F (1, 91) = 9.08, p = .003. Science identity was significantly associated with academic self-efficacy (*beta* = .30, p = .003). These two hierarchical regressions thus established that science identity and GPA were significantly associated with both types of self-efficacy (science and general academic).

The next step was to conduct a binary logistic regression to establish that there was an association between academic persistence and the potential mediating variables, science self-efficacy and academic self-efficacy. This model assessed the impact of science self-efficacy and the control variable of GPA on the likelihood that participants graduated with a baccalaureate degree in a STEM or STEM-related discipline. The model as a whole explained between 32.9% (Cox and Snell R square) and 49.2% (Nagelkerke R squared) of the variance in graduation status.

Results indicated that science self-efficacy recorded an odds ratio of 5.93, p < .001, indicating that every unit of science self-efficacy was associated with a 134% to 1400% increase in the odds of graduating with a baccalaureate degree in a STEM or STEM-related discipline, controlling for other factors in the model. Academic self-efficacy was not a significant predictor of graduation status, but the control variable of GPA was a significant predictor of graduation status. Thus, between the two types of self-efficacy, only science self-efficacy was established to be significantly associated with graduation status.

The final step for addressing Hypothesis 2 was to conduct a binary logistic regression to assess the impact of science identity, science self-efficacy, and the control variable of GPA on the likelihood that participants graduated with a baccalaureate degree in a STEM or STEM-related discipline. The model as a whole explained between 34.6% (Cox and Snell R square) and 51.7% (Nagelkerke R squared) of the variance in graduation status. See Table 6, section B for the classification table.

Results indicated that science self-efficacy recorded an odds ratio of 3.67, p = .002, indicating that every unit of science self-efficacy was associated with a 59.0% to 748% increase in the odds of graduating with a baccalaureate degree in a STEM or STEM-related discipline, controlling for other factors in the model (see Table 7, section B for the regression table). The control variable of GPA was also a significant predictor of graduation status, but science identity was no longer a significant predictor of graduation status, 1.77, p = .10. Thus, science identity was not included in subsequent analysis.

Summary. In sum, the analyses showed that only science identity and science self-efficacy had a significant association with graduation status. When the predictor variable of science identity and potential mediating variable of science self-efficacy were placed in the same model to predict STEM graduation status, only science self-efficacy remained a significant variable (GPA was also a significant predictor but was a control variable). Taken together, these results support Hypothesis 2, that science self-efficacy would mediate the ability of science identity to predict graduation status. We then turned to Hypothesis 3 to assess whether the college context would moderate the ability of science self-efficacy to predict graduation status.

College context, science self-efficacy, and academic persistence

The initial results from the point-biserial correlations (see Table 3) demonstrated that there were significant associations between science self-efficacy and academic persistence (r (97) = .55, $p < .001$) and between college context and academic persistence (r (100) = .35, $p < .001$). The binary logistic regressions conducted for Hypothesis 2 further established that there was an association between academic persistence and science self-efficacy. Together, these findings indicated that additional investigation into the nature of these associations using mediation analysis was warranted. Thus, a binary logistic regression was performed to assess the possible mediation impact of college context on the ability of science self-efficacy to predict academic persistence while controlling for GPA.

The model as a whole explained between 37.2% (Cox and Snell R square) and 55.5% (Nagelkerke R squared) of the variance in graduation status. See Table 6, section C for the classification table. Among all the different regression analyses conducted thus far (for Hypothesis 1 and Hypothesis 2), this model, which included science self-efficacy, college type, and GPA, was able to correctly predict the most cases of graduation status (84.4%).

Results indicated that science self-efficacy recorded an odds ratio of 4.33, $p <$ .001, indicating that every unit of science self-efficacy was associated with a 93.7% to 8662% increase in the odds of graduating with a baccalaureate degree in a STEM or STEM-related discipline, controlling for other factors in the model (see Table 7, section C for the regression table). College context recorded an odds ratio of 7.09, p = .02, indicating that attending a four-year university was associated with a 32.17% to 3700% increase in the odds of graduating with a baccalaureate degree in a STEM or STEM-related discipline. The control variable of GPA was also a significant predictor of graduation status. Thus, Hypothesis 3 was not supported. College context did not moderate the ability of science self-efficacy to predict graduation status. Instead, science self-efficacy and college context are associated but independent predictors of graduation status.

Summary of Results

Through all these analyses, the control variable of GPA remained a significant predictor of graduation status. With regards to the predictor and potentially mediating variables, regressions demonstrated several important associations among the identity, self-efficacy, and college type variables: a) When the two types of social identities were assessed concurrently, only science identity was a significant predictor of academic persistence. b) When the two types of self-efficacy were assessed concurrently, only science self-efficacy was a significant predictor of academic persistence. c) When assessing associations between the social identities and the types of self-efficacy variables concurrently, only science identity and science self-efficacy were significantly associated. d) When science identity and science self-efficacy were assessed concurrently, only science self-efficacy remained a significant predictor of graduation status. e) Both science self-efficacy and type of college attended were significant independent predictors of graduation status. Taken together, these results suggest that attending a four-year university, having a higher GPA, and having a strong sense of science self-efficacy greatly increased the odds of graduating with a baccalaureate degree in a STEM or STEM-related discipline.

Discussion

The present study drew on social cognitive theory (SCT, Bandura, 1986) and social identity theory (SIT, Tajfel & Turner, 1986) frameworks to investigate whether identity, self-efficacy, and college context play a role in the academic persistence of college-going emerging adults in STEM majors. Specifically, I tested three hypotheses: **Hypothesis 1,** which was supported, was that **s**cience identity would be a stronger predictor of STEM academic persistence than ethnic identity. **Hypothesis 2,** which was also supported, was that science self-efficacy would mediate the ability of social identity to predict academic persistence. **Hypothesis 3**, which was not supported, was that the college context would moderate the ability of identity and self-efficacy to predict academic persistence such that students in four-year universities will be more likely to graduate with a STEM degree than students in community colleges.

The study drew on extant data in which I administered a survey to ethnic minority and majority undergraduates pursuing STEM majors in both a community college and four-year university context. I used their academic transcripts to determine their status for the outcome of interest: graduation with a baccalaureate degree in STEM or a STEM-related discipline.

Using the outcome of graduation with a baccalaureate degree in a STEM or STEM-related discipline as the operationalization of STEM academic persistence was a major strength of this study because academic program completion is an important factor in qualifying individuals for entering the STEM workforce (NSF *Science and Engineering Indicators*, 2018). Moreover, whereas GPA is a short-term snapshot that does not reveal the subtleties of a person's academic experiences, graduation status is a long-term assessment of true academic persistence.

By focusing on graduation status but including GPA as a control variable, this research design also helped disentangle mixed results from previous research regarding the associations between GPA, identity, and self-efficacy (Chemers et al. 2011; Lent et al., 1984; Mendoza-Denton et al., 2008; Miller-Cotto & Byrnes, 2016; Wigfield & Eccles, 2000). Contrary to previous studies (Byars-Winston et al., 2010; Chemers et al., 2011; Larson et al., 2015; Lent et al., 2015; Sawtelle et al., 2012), the association between GPA and science self-efficacy was not statistically significant in the present study. However, consistent with previous studies (DeCandia, 2015; Merolla & Serpe, 2013), there were no significant associations between GPA and the strength of social identity.

It may be that the presence of a strong academic identity helps students overcome the disappointment of grades resulting from a challenging curriculum and helps create continued commitment and persistence in pursuing a STEM academic trajectory. Another possibility is that students expect STEM classes to be difficult and do not actually expect to attain high marks. If we had focused on GPA as our assessment of academic persistence or achievement, we would not have been able to discern the roles of identity and self-efficacy in predicting whether a student would graduate with a baccalaureate degree in a STEM or STEM-related discipline.

The Role of Social Identity

In the comparison of predictive power between ethnic identity and science identity, Hypothesis 1 was supported by both preliminary analysis and regression results; the association between science identity and academic persistence was greater in both strength and significance than the association between ethnic identity and academic persistence. Although science identity was a stronger predictor of STEM academic persistence than ethnic identity, it is important to note that analyses evidenced that when assessed individually, both social identities were significant predictors of academic persistence. In terms of a path to academic persistence, it can be argued that the results of this study demonstrated that *both* ethnic and science identities can be a source of support for emerging adults as they navigate their STEM academic journey. Moreover, the results of this study differ from Syed's (2010) finding that only students with a low sense of ethnic identity persisted in a STEM major. This may be because Syed only assessed ethnic identity in his study; perhaps, if science identity were included as a factor, he, too, would have found that both types of identity are predictive of STEM academic persistence.

The Role of Self-efficacy

The present study also sought to clarify the association between identity and self-efficacy in academic persistence. Results revealed that Hypothesis 2 was also supported; science self-efficacy fully mediated the ability of science identity to predict of academic persistence in STEM. In other words, emerging adults did not feel a strong sense of belonging in STEM (that is, they had low science identity) unless they also felt competent in that STEM academic context (as evidenced by level of science self-efficacy). These results are not surprising, as previous work has shown that science self-efficacy has strong associations with selecting science as a career choice, commitment to science academic goals, academic achievement, and STEM academic persistence (Byars-Winston et al., 2010; Chemers et al., 2011; Jungert et al., 2018; Larson et al., 2015; Leaper & Van, 2008; Lent et al., 2015; Muenks, Wigfield, & Eccles, 2018; Sawtelle et al., 2012). Thus, results of this study supported previous research on the importance of science self-efficacy to one's science identity.

The ability of science self-efficacy to mediate the predictive ability of science identity is consistent with the SCT (Bandura, 1986) framework. According to Bandura (1977), feelings of self-efficacy can be gained several ways, including mastery experiences, social learning, and verbal persuasion. Thus, as individuals gain competence in scientific tasks (e.g., through mastery experiences), their sense of self-efficacy will increase. Incorporating more opportunities to develop science self-efficacy, such as by partnering with local STEM companies to provide employee mentors and offer internships or volunteer positions, may also serve to ignite more excitement and interest in emerging adults' STEM education, which in turn, may also increase their GPA and make them more competitive for graduate programs or employment in the lucrative STEM sector.

As students continue to receive positive feedback for their performance in science, their science self-efficacy increases. By using two different types of social identities (ethnic and science) and two types of self-efficacy (general academic and science-specific), this study tested the proposal that the experiences that are conducive to developing an academic identity also entail acquiring a sense of self-efficacy in that particular domain (Carlone & Johnson, 2007). Because community colleges provide an appealing, cost-effective method of meeting lower-division requirements of STEM majors, it was important to investigate the role of college context as well.

The College Context

In addition to the importance of science self-efficacy to STEM academic persistence, another important finding was that college context did not moderate the ability of science self-efficacy to predict graduation status (i.e., Hypothesis 3 was not supported). Instead, the results showed that science self-efficacy and college context are associated, but independent significant predictors of graduation status. This finding has two implications. First, it shows that science self-efficacy plays a powerful role in bolstering STEM academic persistence, regardless of whether one is in a community college or four-year university setting. Second, the finding that attending a four-year university significantly increased graduation in STEM may have obtained because some students attend community college specifically to graduate with an Associate's degree rather than with the intent to transfer to a four-year university. Still, many community college students attend community college with the intention of transferring to a four-year university and pursuing a baccalaureate degree. Along the way, however, some may become aware of STEM career opportunities that require only an Associate's degree, such as being a computer user support specialist (Bureau of Labor Statistics, 2015). Thus, the finding may support the concern that the majority of students attending community colleges are not transferring to four-year universities (Chen et al., 2019; Schneider, & Yin, 2012). However, without further investigation into why these community college students did not transfer, we should not assume that they were not able to pursue a meaningful career in a STEM or STEM-related field after graduation with an Associate's degree.

Generally, community colleges interested in supporting their STEM students in both graduation and transfer to a four-year institution would benefit from investing in opportunities that promote the development of science self-efficacy and a science identity. Four-year universities are more likely than community colleges to have opportunities aimed at developing student's sense of science self-efficacy and building a STEM student community, such as having professors that can offer students experiences through participation in mentoring activities and research labs in which students can learn from other students (Estrada et al., 2018; Flowers & Banda, 2016; Robnett et al., 2015) and internships in the community and with industry leaders. However, due to their open-door policy and affordability (Schneider & Yin, 2012), students who are the first in their families to go to college, ethnic minorities, and low-income students are especially likely to enter higher education through community colleges. Unfortunately, students with these backgrounds are also more likely than other community college students to not complete their degrees or to transfer to four-year universities (Goldrick-Rab, 2010; NSC, 2019). Taken together, the findings of the present study suggest that in order to close this gap in STEM graduation between students who attend community colleges instead of attending four-year-universities directly after high school, community colleges will need to make structural and systemic changes that can provide their students with opportunities vital to developing a sense of science identity and science self-efficacy and promote graduation and/or transfer to a four-year institution.

The results of the present study provided support for the social cognitive theory (SCT, Bandura, 1986) and social identity theory (SIT, Tajfel & Turner, 1986) frameworks and helped clarify the roles of multiple social identities, types of competence beliefs, and college context in emerging adults' STEM academic persistence. However, there are limitations to the present study's approach and findings that must be acknowledged.

Limitations

Two major limitations of this study involve sampling and generalizability of the results. When trying to establish a comparison between two academic contexts such as community college and a four-year institution, reducing variability is important. Instead of stopping at having an equal number of participants in each context, future researchers should plan to collect a large sample size that explicitly targets equal representation of gender, ethnicity, and type of STEM major. The variability in STEM majors included in the study likely also limited the effectiveness of the science-specific measures used because students who are studying in some of the included disciplines may not consider themselves "scientists," such as those studying Business Statistics or a Managerial Science, two fields that are considered STEM-related by the U.S. Department of Education. Thus, they would have scored low on items on the Identity as a Scientist (Chemers et al., 2011) and Science Self-Efficacy Scales (Chemers et al., 2011), which could have affected the predictive ability of science identity on academic persistence. In future studies, I will use measures of science identity and science self-efficacy that would be better able to capture the characteristics and skills of students in STEM majors included in the definition used by the U.S. Department of Education

Because of the extant nature of the data, increasing the sample size or including participants from a California State University context was not possible. Moreover, Silicon Valley is a STEM-centered and ethnically diverse region that is not representative of California or the rest of the United States. Thus, findings may not be generalizable to educational contexts in less diverse, STEM-oriented regions. For follow-up studies, I will broaden the institutions from whom I am collecting the data in order to increase the external validity of the study. Despite these and other limitations, several results from this dissertation provide a foundation for future research on the roles of self-efficacy and identity in STEM academic

Conclusions, Implications, and Future Directions

To answer the question "Lapa wrap or lab coat?" the results suggest that more important than whether one is wearing a lapa wrap or lab coat is the conviction that one is competent and can successfully complete the necessary tasks that a science pathway and career entails. These results support previous research that has shown that developing a strong sense of science self-efficacy is of paramount importance in strengthening emerging adult's persistence in the STEM academic context (Jungert et al., 2018; Larson et al., 2015; Sawtelle et al., 2012). Overall, the results of the present study supported the social cognitive theory (SCT, Bandura, 1986) and social identity theory (SIT, Tajfel & Turner, 1986) frameworks. Moreover, the findings highlighted the importance of studying multiple social identities, types of competence beliefs, and college context concurrently in order to clarifying their roles in emerging adults' STEM academic persistence.

Specifically, the present study's findings demonstrated that science identity requires a strong sense of science self-efficacy in order to play a role in STEM graduation status, and that attending a four-year university greatly increases one's chances of earning a baccalaureate degree in a STEM or STEM-related discipline. These findings are interrelated because four-year universities tend to have STEM programs that enable their students to have opportunities and exposure to more mentoring and lab research than community colleges. Both of these findings underscore that emerging adults need opportunities to acquire that critical sense of science self-efficacy. This, in turn will increase the retention and persistence of those who want to complete a STEM education.

The focus on graduation rather that grades may also be the reason that the results from this study yielded no ethnic, gender, nor socioeconomic group differences in graduation status. This finding indicates that URMs, who are usually highlighted as having lower grades and retention rates than their Asian or European American peers (ref), were able to persist in the STEM academic context at a rate that was comparable to these other historically successful ethnic groups (NSF *Science and Engineering Indicators*, 2018). These results support recent studies showing that when predicting academic persistence, the demographic factors of gender, socioeconomic status, and ethnicity/race are of secondary importance to psychosocial factors such as sense of belonging and ability beliefs (Barth et al., 2017; Hall et al., 2017). These findings are encouraging, because psychosocial factors such as self-efficacy are more easily influenced by institutional actions and context than demographic variables and provide direction for future research.

Using Bandura's (1977) foundational ideas for establishing feelings of self-efficacy (i.e., through low-stakes mastery experiences, persuasion, and social learning), researchers and educational practitioners can develop interventions aimed at helping a diverse group of both ethnic-minority and ethnic-majority participants develop science competency beliefs. In four-year universities, there is a well-known practice of having STEM "weeder" courses that "weed out" students from continuing on to upper level classes (Malcom & Feder, 2016). Having supplementary interventions that build self-efficacy may help these beginning students persevere through these difficult classes. It is also important not to neglect the needs of STEM community college students because the high cost of tuition and increasing levels of competition for admission at four-year universities have resulted in community colleges playing a vital role in the educational attainment of low SES, immigrant, and ethnic minority groups in STEM and STEM-related fields (Mooney & Foley, 2011; NSF, 2017). Because science self-efficacy has positive associations with STEM academic persistence independent of science identity, a priority in the future direction for research is to focus on investigating a variety of time-effective and cost-effective approaches for developing science self-efficacy underrepresented ethnic minority STEM students , particularly when these students are early in their academic career (i.e., in their first or second year of post-secondary education).

The results from the present study can be disseminated to educators and institutional administrators at all levels (primary, secondary, and postsecondary) to help them understand the specific factors that can be used to design an academic environment that is conducive to the success of their students in STEM classes and majors. Educators can also identify students who are at risk of dropping out of STEM by having them take domain-specific identity and domain-specific self-efficacy assessments at the beginning of the year and implementing interventions to improve their skills and self-efficacy so that their motivation to persist in that class or major can be increased.

The study's focus on diverse student groups, including both ethnic majority and URM students in STEM fields is timely, as California and, more broadly, the U.S., are increasingly concerned with all students' academic persistence and the availability of a well-trained work force in STEM fields. California is one of the most diverse states in the nation, and thus, understanding the role of identity in STEM pathways will be especially beneficial to the state and its emerging adult residents. The current political climate and attitude towards immigration and foreign workers also calls for a need to increase home-grown STEM talent to fill the continually growing workforce demand in STEM and STEM-related fields. Broadening the types of successful STEM students will also introduce more diverse perspectives to enhance the field in general and provide a pathway to social mobility for URM students. Because STEM fields are associated with better paying jobs, this research will inform basic research and educational policies that benefit underrepresented students both locally and nationally.

Appendix A

STEM-Designated Degree Program List

1 1.0308 Agroecology and Sustainable Agriculture.
1 1.0901 Animal Sciences, General
1 1.0902 Agricultural Animal Breeding
1 1.0903 Animal Health
1 1.0904 Animal Nutrition
1 1.0905 Dairy Science
1 1.0906 Livestock Management
1 1.0907 Poultry Science
1 1.0999 Animal Sciences, Other.
1 1.1001 Food Science
1 1.1002 Food Technology and Processing
1 1.1099 Food Science and Technology, Other.
1 1.1101 Plant Sciences, General
1 1.1102 Agronomy and Crop Science
1 1.1104 Agricultural and Horticultural Plant Breeding
1 1.1105 Plant Protection and Integrated Pest Management
1 1.1106 Range Science and Management
1 1.1199 Plant Sciences, Other.
1 1.1201 Soil Science and Agronomy, General
1 1.1202 Soil Chemistry and Physics
1 1.1203 Soil Microbiology
1 1.1299 Soil Sciences, Other.
3 3.0101 Natural Resources/Conservation, General.
3 3.0103 Environmental Studies.
3 3.0104 Environmental Science
3 3.0199 Natural Resources Conservation and Research, Other.
3 3.0205 Water, Wetlands, and Marine Resources Management.
3 3.0502 Forest Sciences and Biology
3 3.0508 Urban Forestry.
3 3.0509 Wood Science and Wood Products/Pulp and Paper Technology
3 3.0601 Wildlife, Fish and Wildlands Science and Management.
4 4.0902 Architectural and Building Sciences/Technology.
9 9.0702 Digital Communication and Media/Multimedia
10 10.0304 Animation, Interactive Technology, Video Graphics and Special Effects
11 11.0101 Computer and Information Sciences, General
11 11.0102 Artificial Intelligence

11 11.0103 Information Technology
11 11.0104 Informatics
11 11.0199 Computer and Information Sciences, Other.
11 11.0201 Computer Programming/Programmer, General
11 11.0202 Computer Programming, Specific Applications
11 11.0203 Computer Programming, Vendor/Product Certification
11 11.0299 Computer Programming, Other.
11 11.0301 Data Processing and Data Processing Technology/Technician
11 11.0401 Information Science/Studies
11 11.0501 Computer Systems Analysis/Analyst
11 11.0701 Computer Science
11 11.0801 Web Page, Digital/Multimedia and Information Resources Design
11 11.0802 Data Modeling/Warehousing and Database Administration
11 11.0803 Computer Graphics
11 11.0804 Modeling, Virtual Environments and Simulation
11 11.0899 Computer Software and Media Applications, Other.
11 11.0901 Computer Systems Networking and Telecommunications
11 11.1001 Network and System Administration/Administrator
11 11.1002 System, Networking, and LAN/WAN Management/Manager
11 11.1003 Computer and Information Systems Security/Information Assurance
11 11.1004 Web/Multimedia Management and Webmaster
11 11.1005 Information Technology Project Management
11 11.1006 Computer Support Specialist
11 11.1099 Computer/Information Technology Services Administration and Management, Other.
13 13.0501 Educational/Instructional Technology.
13 13.0601 Educational Evaluation and Research.
13 13.0603 Educational Statistics and Research Methods
14 14.0101 Engineering, General
14 14.0102 Pre-Engineering
14 14.0201 Aerospace, Aeronautical and Astronautical/Space Engineering
14 14.0301 Agricultural Engineering
14 14.0401 Architectural Engineering
14 14.0501 Bioengineering and Biomedical Engineering
14 14.0601 Ceramic Sciences and Engineering
14 14.0701 Chemical Engineering
14 14.0702 Chemical and Biomolecular Engineering
14 14.0799 Chemical Engineering, Other.
14 14.0801 Civil Engineering, General
14 14.0802 Geotechnical and Geoenvironmental Engineering
14 14.0803 Structural Engineering

14 14.0804 Transportation and Highway Engineering
14 14.0805 Water Resources Engineering
14 14.0899 Civil Engineering, Other.
14 14.0901 Computer Engineering, General
14 14.0902 Computer Hardware Engineering
14 14.0903 Computer Software Engineering
14 14.0999 Computer Engineering, Other.
14 14.1001 Electrical and Electronics Engineering
14 14.1003 Laser and Optical Engineering
14 14.1004 Telecommunications Engineering
14 14.1099 Electrical, Electronics and Communications Engineering, Other.
14 14.1101 Engineering Mechanics
14 14.1201 Engineering Physics/Applied Physics
14 14.1301 Engineering Science
14 14.1401 Environmental/Environmental Health Engineering
14 14.1801 Materials Engineering
14 14.1901 Mechanical Engineering
14 14.2001 Metallurgical Engineering
14 14.2101 Mining and Mineral Engineering
14 14.2201 Naval Architecture and Marine Engineering
14 14.2301 Nuclear Engineering
14 14.2401 Ocean Engineering
14 14.2501 Petroleum Engineering
14 14.2701 Systems Engineering
14 14.2801 Textile Sciences and Engineering
14 14.3201 Polymer/Plastics Engineering
14 14.3301 Construction Engineering
14 14.3401 Forest Engineering
14 14.3501 Industrial Engineering
14 14.3601 Manufacturing Engineering
14 14.3701 Operations Research
14 14.3801 Surveying Engineering
14 14.3901 Geological/Geophysical Engineering
14 14.4001 Paper Science and Engineering
14 14.4101 Electromechanical Engineering
14 14.4201 Mechatronics, Robotics, and Automation Engineering
14 14.4301 Biochemical Engineering
14 14.4401 Engineering Chemistry
14 14.4501 Biological/Biosystems Engineering
14 14.9999 Engineering, Other.

15 15.0000 Engineering Technology, General
15 15.0101 Architectural Engineering Technology/Technician
15 15.0201 Civil Engineering Technology/Technician
15 15.0303 Electrical, Electronic and Communications Engineering Technology/Technician
15 15.0304 Laser and Optical Technology/Technician
15 15.0305 Telecommunications Technology/Technician
15 15.0306 Integrated Circuit Design
15 15.0399 Electrical and Electronic Engineering Technologies/Technicians, Other.
15 15.0401 Biomedical Technology/Technician
15 15.0403 Electromechanical Technology/Electromechanical Engineering Technology
15 15.0404 Instrumentation Technology/Technician
15 15.0405 Robotics Technology/Technician
15 15.0406 Automation Engineer Technology/Technician
15 15.0499 Electromechanical and Instrumentation and Maintenance Technologies/Technicians, Other.
15 15.0501 Heating, Ventilation, Air Conditioning and Refrigeration Engineering Technology/Technician
15 15.0503 Energy Management and Systems Technology/Technician
15 15.0505 Solar Energy Technology/Technician.
15 15.0506 Water Quality and Wastewater Treatment Management and Recycling Technology/Technician
15 15.0507 Environmental Engineering Technology/Environmental Technology
15 15.0508 Hazardous Materials Management and Waste Technology/Technician
15 15.0599 Environmental Control Technologies/Technicians, Other.
15 15.0607 Plastics and Polymer Engineering Technology/Technician
15 15.0611 Metallurgical Technology/Technician
15 15.0612 Industrial Technology/Technician
15 15.0613 Manufacturing Engineering Technology/Technician
15 15.0614 Welding Engineering Technology/Technician
15 15.0615 Chemical Engineering Technology/Technician
15 15.0616 Semiconductor Manufacturing Technology
15 15.0699 Industrial Production Technologies/Technicians, Other.
15 15.0701 Occupational Safety and Health Technology/Technician
15 15.0702 Quality Control Technology/Technician
15 15.0703 Industrial Safety Technology/Technician
15 15.0704 Hazardous Materials Information Systems Technology/Technician
15 15.0799 Quality Control and Safety Technologies/Technicians, Other.
15 15.0801 Aeronautical/Aerospace Engineering Technology/Technician

15 15.0803 Automotive Engineering Technology/Technician
15 15.0805 Mechanical Engineering/Mechanical Technology/Technician
15 15.0899 Mechanical Engineering Related Technologies/Technicians, Other.
15 15.0901 Mining Technology/Technician
15 15.0903 Petroleum Technology/Technician
15 15.0999 Mining and Petroleum Technologies/Technicians, Other.
15 15.1001 Construction Engineering Technology/Technician
15 15.1102 Surveying Technology/Surveying
15 15.1103 Hydraulics and Fluid Power Technology/Technician
15 15.1199 Engineering-Related Technologies, Other.
15 15.1201 Computer Engineering Technology/Technician
15 15.1202 Computer Technology/Computer Systems Technology
15 15.1203 Computer Hardware Technology/Technician
15 15.1204 Computer Software Technology/Technician
15 15.1299 Computer Engineering Technologies/Technicians, Other.
15 15.1301 Drafting and Design Technology/Technician, General
15 15.1302 CAD/CADD Drafting and/or Design Technology/Technician
15 15.1303 Architectural Drafting and Architectural CAD/CADD
15 15.1304 Civil Drafting and Civil Engineering CAD/CADD
15 15.1305 Electrical/Electronics Drafting and Electrical/Electronics CAD/CADD
15 15.1306 Mechanical Drafting and Mechanical Drafting CAD/CADD
15 15.1399 Drafting/Design Engineering Technologies/Technicians, Other.
15 15.1401 Nuclear Engineering Technology/Technician
15 15.1501 Engineering/Industrial Management
15 15.1502 Engineering Design
15 15.1503 Packaging Science
15 15.1599 Engineering-Related Fields, Other.
15 15.1601 Nanotechnology
15 15.9999 Engineering Technologies and Engineering-Related Fields, Other.
26 26.0101 Biology/Biological Sciences, General
26 26.0102 Biomedical Sciences, General
26 26.0202 Biochemistry
26 26.0203 Biophysics
26 26.0204 Molecular Biology
26 26.0205 Molecular Biochemistry
26 26.0206 Molecular Biophysics
26 26.0207 Structural Biology
26 26.0208 Photobiology
26 26.0209 Radiation Biology/Radiobiology
26 26.0210 Biochemistry and Molecular Biology

26 26.0299 Biochemistry, Biophysics and Molecular Biology, Other.
26 26.0301 Botany/Plant Biology
26 26.0305 Plant Pathology/Phytopathology
26 26.0307 Plant Physiology
26 26.0308 Plant Molecular Biology
26 26.0399 Botany/Plant Biology, Other.
26 26.0401 Cell/Cellular Biology and Histology
26 26.0403 Anatomy
26 26.0404 Developmental Biology and Embryology
26 26.0406 Cell/Cellular and Molecular Biology
26 26.0407 Cell Biology and Anatomy
26 26.0499 Cell/Cellular Biology and Anatomical Sciences, Other.
26 26.0502 Microbiology, General
26 26.0503 Medical Microbiology and Bacteriology
26 26.0504 Virology
26 26.0505 Parasitology
26 26.0506 Mycology
26 26.0507 Immunology
26 26.0508 Microbiology and Immunology
26 26.0599 Microbiological Sciences and Immunology, Other.
26 26.0701 Zoology/Animal Biology
26 26.0702 Entomology
26 26.0707 Animal Physiology
26 26.0708 Animal Behavior and Ethology
26 26.0709 Wildlife Biology
26 26.0799 Zoology/Animal Biology, Other.
26 26.0801 Genetics, General
26 26.0802 Molecular Genetics
26 26.0803 Microbial and Eukaryotic Genetics
26 26.0804 Animal Genetics
26 26.0805 Plant Genetics
26 26.0806 Human/Medical Genetics
26 26.0807 Genome Sciences/Genomics
26 26.0899 Genetics, Other.
26 26.0901 Physiology, General
26 26.0902 Molecular Physiology
26 26.0903 Cell Physiology
26 26.0904 Endocrinology
26 26.0905 Reproductive Biology
26 26.0907 Cardiovascular Science

26 26.0908 Exercise Physiology
26 26.0909 Vision Science/Physiological Optics
26 26.0910 Pathology/Experimental Pathology
26 26.0911 Oncology and Cancer Biology
26 26.0912 Aerospace Physiology and Medicine
26 26.0999 Physiology, Pathology, and Related Sciences, Other.
26 26.1001 Pharmacology
26 26.1002 Molecular Pharmacology
26 26.1003 Neuropharmacology
26 26.1004 Toxicology
26 26.1005 Molecular Toxicology
26 26.1006 Environmental Toxicology
26 26.1007 Pharmacology and Toxicology
26 26.1099 Pharmacology and Toxicology, Other.
26 26.1101 Biometry/Biometrics
26 26.1102 Biostatistics
26 26.1103 Bioinformatics
26 26.1104 Computational Biology
26 26.1199 Biomathematics, Bioinformatics, and Computational Biology, Other.
26 26.1201 Biotechnology
26 26.1301 Ecology
26 26.1302 Marine Biology and Biological Oceanography
26 26.1303 Evolutionary Biology
26 26.1304 Aquatic Biology/Limnology
26 26.1305 Environmental Biology
26 26.1306 Population Biology
26 26.1307 Conservation Biology
26 26.1308 Systematic Biology/Biological Systematics
26 26.1309 Epidemiology
26 26.1310 Ecology and Evolutionary Biology
26 26.1399 Ecology, Evolution, Systematics and Population Biology, Other.
26 26.1401 Molecular Medicine
26 26.1501 Neuroscience
26 26.1502 Neuroanatomy
26 26.1503 Neurobiology and Anatomy
26 26.1504 Neurobiology and Behavior
26 26.1599 Neurobiology and Neurosciences, Other.
26 26.9999 Biological and Biomedical Sciences, Other.
27 27.0101 Mathematics, General
27 27.0102 Algebra and Number Theory

27 27.0103 Analysis and Functional Analysis
27 27.0104 Geometry/Geometric Analysis
27 27.0105 Topology and Foundations
27 27.0199 Mathematics, Other.
27 27.0301 Applied Mathematics, General
27 27.0303 Computational Mathematics
27 27.0304 Computational and Applied Mathematics
27 27.0305 Financial Mathematics
27 27.0306 Mathematical Biology
27 27.0399 Applied Mathematics, Other.
27 27.0501 Statistics, General
27 27.0502 Mathematical Statistics and Probability
27 27.0503 Mathematics and Statistics
27 27.0599 Statistics, Other.
27 27.9999 Mathematics and Statistics, Other.
28 28.0501 Air Science/Airpower Studies.
28 28.0502 Air and Space Operational Art and Science.
28 28.0505 Naval Science and Operational Studies.
29 29.0201 Intelligence, General
29 29.0202 Strategic Intelligence
29 29.0203 Signal/Geospatial Intelligence
29 29.0204 Command & Control (C3, C4I) Systems and Operations
29 29.0205 Information Operations/Joint Information Operations
29 29.0206 Information/Psychological Warfare and Military Media Relations
29 29.0207 Cyber/Electronic Operations and Warfare
29 29.0299 Intelligence, Command Control and Information Operations, Other.
29 29.0301 Combat Systems Engineering
29 29.0302 Directed Energy Systems
29 29.0303 Engineering Acoustics
29 29.0304 Low-Observables and Stealth Technology
29 29.0305 Space Systems Operations
29 29.0306 Operational Oceanography
29 29.0307 Undersea Warfare
29 29.0399 Military Applied Sciences, Other.
29 29.0401 Aerospace Ground Equipment Technology
29 29.0402 Air and Space Operations Technology
29 29.0403 Aircraft Armament Systems Technology
29 29.0404 Explosive Ordinance/Bomb Disposal
29 29.0405 Joint Command/Task Force (C3, C4I) Systems
29 29.0406 Military Information Systems Technology

29 29.0407 Missile and Space Systems Technology
29 29.0408 Munitions Systems/Ordinance Technology
29 29.0409 Radar Communications and Systems Technology
29 29.0499 Military Systems and Maintenance Technology, Other.
29 29.9999 Military Technologies and Applied Sciences, Other.
30 30.0101 Biological and Physical Sciences
30 30.0601 Systems Science and Theory
30 30.0801 Mathematics and Computer Science
30 30.1001 Biopsychology
30 30.1701 Behavioral Sciences.
30 30.1801 Natural Sciences
30 30.1901 Nutrition Sciences
30 30.2501 Cognitive Science
30 30.2701 Human Biology.
30 30.3001 Computational Science.
30 30.3101 Human Computer Interaction.
30 30.3201 Marine Sciences
30 30.3301 Sustainability Studies.
40 40.0101 Physical Sciences
40 40.0201 Astronomy
40 40.0202 Astrophysics
40 40.0203 Planetary Astronomy and Science
40 40.0299 Astronomy and Astrophysics, Other.
40 40.0401 Atmospheric Sciences and Meteorology, General
40 40.0402 Atmospheric Chemistry and Climatology
40 40.0403 Atmospheric Physics and Dynamics
40 40.0404 Meteorology
40 40.0499 Atmospheric Sciences and Meteorology, Other.
40 40.0501 Chemistry, General
40 40.0502 Analytical Chemistry
40 40.0503 Inorganic Chemistry
40 40.0504 Organic Chemistry
40 40.0506 Physical Chemistry
40 40.0507 Polymer Chemistry
40 40.0508 Chemical Physics
40 40.0509 Environmental Chemistry
40 40.0510 Forensic Chemistry
40 40.0511 Theoretical Chemistry
40 40.0599 Chemistry, Other.
40 40.0601 Geology/Earth Science, General

40 40.0602 Geochemistry
40 40.0603 Geophysics and Seismology
40 40.0604 Paleontology
40 40.0605 Hydrology and Water Resources Science
40 40.0606 Geochemistry and Petrology
40 40.0607 Oceanography, Chemical and Physical
40 40.0699 Geological and Earth Sciences/Geosciences, Other.
40 40.0801 Physics, General
40 40.0802 Atomic/Molecular Physics
40 40.0804 Elementary Particle Physics
40 40.0805 Plasma and High-Temperature Physics
40 40.0806 Nuclear Physics
40 40.0807 Optics/Optical Sciences
40 40.0808 Condensed Matter and Materials Physics
40 40.0809 Acoustics
40 40.0810 Theoretical and Mathematical Physics
40 40.0899 Physics, Other.
40 40.1001 Materials Science
40 40.1002 Materials Chemistry
40 40.1099 Materials Sciences, Other.
40 40.9999 Physical Sciences, Other.
41 41.0000 Science Technologies/Technicians, General
41 41.0101 Biology Technician/Biotechnology Laboratory Technician
41 41.0204 Industrial Radiologic Technology/Technician
41 41.0205 Nuclear/Nuclear Power Technology/Technician
41 41.0299 Nuclear and Industrial Radiologic Technologies/Technicians, Other.
41 41.0301 Chemical Technology/Technician
41 41.0303 Chemical Process Technology
41 41.0399 Physical Science Technologies/Technicians, Other.
41 41.9999 Science Technologies/Technicians, Other.
42 42.2701 Cognitive Psychology and Psycholinguistics
42 42.2702 Comparative Psychology
42 42.2703 Developmental and Child Psychology
42 42.2704 Experimental Psychology
42 42.2705 Personality Psychology
42 42.2706 Physiological Psychology/Psychobiology
42 42.2707 Social Psychology
42 42.2708 Psychometrics and Quantitative Psychology
42 42.2709 Psychopharmacology
42 42.2799 Research and Experimental Psychology, Other.

43 43.0106 Forensic Science and Technology
43 43.0116 Cyber/Computer Forensics and Counterterrorism.
45 45.0301 Archeology.
45 45.0603 Econometrics and Quantitative Economics.
45 45.0702 Geographic Information Science and Cartography
49 49.0101 Aeronautics/Aviation/Aerospace Science and Technology, General.
51 51.1002 Cytotechnology/Cytotechnologist.
51 51.1005 Clinical Laboratory Science/Medical Technology/Technologist.
51 51.1401 Medical Scientist
51 51.2003 Pharmaceutics and Drug Design
51 51.2004 Medicinal and Pharmaceutical Chemistry
51 51.2005 Natural Products Chemistry and Pharmacognosy
51 51.2006 Clinical and Industrial Drug Development.

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Table 1

*Emerging adult sample characteristics**

	All (*n* = 100)		**Community College (*n* = 100)**		**Four-year University (*n* = 100)**	
Variable	***M***	***(SD)***	***M***	***(SD)***	***M***	***(SD)***
Age	21.82	(2.58)	21.28	2.48	22.36	2.67
Self-reported GPA	3.18	(.53)	3.16	.54	3.20	.52
Institution-provided GPA	3.08	(.54)	3.02	.53	3.16	.55
Socio-economic Status	35.73	(13.33)	34.59	11.00	36.95	15.51
Academic self-efficacy	5.14	(.82)	5.09	(.75)	5.18	(.89)
Science self-efficacy	3.47	(1.12)	2.99	(1.07)	3.95	(.97)
Ethnic identity	3.13	(.70)	3.13	(.66)	3.13	(.75)
Science identity	3.11	(1.27)	2.59	(1.21)	3.36	(1.10)
Gender	*n*					
Female	38		20		18	
Male	62		30		32	
Ethnic Group						
Asian	42		31		11	
European American	25		5		20	
URM	33		14		19	
First-generation	30		18		12	
Major						
STEM or STEM-related	69		31		38	
Undeclared	28		16		12	
Non-STEM	3		3		0	
Graduation Status						
STEM degree	70		27		43	
No STEM degree	30		23		7	

*Percentages may not add up to 100 because of missing data

Table 2

Means, (Standard Deviations), and Reliabilities for Included Measures

Measure	*M*	*SD*
Academic Self-Efficacy (Chemers et al.,1991) Cronbach's α .79	5.14	(.82)
Multigroup Ethnic Identity Measure - *Belonging Subscale (*Phinney, 1992) Cronbach's α .87	3.13	(.70)
Identity as a Scientist Scale (Chemers et al., 2010) Cronbach's α .87	3.11	(1.23)
Science Self-Efficacy Scale (Chemers et al., 2010) Cronbach's α .94	3.47	(1.13)
Researcher-created Variables		
Ethnic-STEM Interactional Identity	-.1773	(.656)

Table 3

Bivariate Correlations for the Variables of Interest

	College Type	**GPA**	**Academic Self-Efficacy**	**Science Self-Efficacy**	**Science Identity**	**Ethnic Identity**	**Ethnic-Science Identity Interaction**
Persistence	.35** .00	.31** .00	.37** .00	.55** .00	.53** .00	.30** .002	-.36** .00
College Type		.13 .22	.05 .61	.43** .00	.42** .00	-.001 1.0	.00 1.0
GPA			.26* .01	.12 .26	.18 .09	.04 .73	.007 .95
Academic Self-Efficacy				.42** .00	.33** .001	.21* .04	-.24* .02
Science Self-Efficacy					.69** .00	.24* .02	-.27** .009
Science Identity						.22* .04	-.28** .006
Ethnic Identity							-.86** .00

* $p < 0.05$; ** $p < 0.01$

Table 4

Chi-square Preliminary Results

Gender	χ^2 (1, n = 100) = .02, p = .90, *phi* = -.04
Ethnic Group	χ^2 (1, n = 100) = 1.78, p = .41, *phi* = .13
Socioeconomic Status	χ^2 (1, n = 62) = 0.95, p = .62, *phi* = .12
College Type	χ^2 (1, n = 100) = 11.97, p < .001, *phi* = .37

Table 5

Regressions Table for Ethnic Identity (EI) and Science Identity (SI) Models

							95% C.C. for EXP (B)	
EI model	**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp (B)**	**Lower**	**Upper**
GPA	1.55	.52	8.85	1	.003	4.70	1.70	13.03
Ethnic Identity	.98	.40	5.91	1	.02	2.67	1.20	5.88
Constant	-6.66	2.19	9.28	1	.002	.000		

							95% C.C. for EXP (B)	
SI model	**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp (B)**	**Lower**	**Upper**
GPA	1.46	.60	5.99	1	.01	4.30	1.34	13.84
Science Identity	1.46	.28	16.99	1	<.001	3.15	1.82	5.43
Constant	-6.49	2.07	9.81	1	.002	.002		

Table 6

Classification Table for Regression Models

Model Factors	Predicted No STEM degree	STEM degree	Graduation Status No STEM degree	STEM degree	Overall %
A. Science identity, ethnic identity, ethnic-science identity interaction, college type, GPA	13	11	8	60	79.3
B. Science identity, science self-efficacy, GPA	12	10	6	63	82.4
C. Science self-efficacy, college type, GPA	12	10	4	64	84.4

Table 7

Regressions Table for Different Mediator and Predictor Variable Models

A. Science identity, ethnic identity, ethnic-science identity interaction ESII), college type, GPA							**95% C.C. for EXP (B)**	
	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp (B)**	**Lower**	**Upper**
GPA	1.64	.65	6.45	1	**.011**	5.18	1.45	18.41
Science Identity	1.10	.29	14.41	1	<.001	3.02	1.71	5.35
Ethnic Identity	.83	1.16	.51	1	.47	2.29	.24	21.97
Ethnic-Science II	-.02	.42	.003	1	.96	.98	.43	2.23
Constant	-9.50	4.75	4.00	1	.05	.000		

B. Science identity, science self-efficacy (Science SE), GPA, and graduation status							**95% C.C. for EXP (B)**	
	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp (B)**	**Lower**	**Upper**
GPA	1.77	.71	6.33	1	.011	5.89	1.48	23.45
Science Identity	.57	.34	2.77	1	.10	1.77	.90	3.45
Science SE	1.30	.43	9.27	1	.002	3.67	1.59	8.48
Constant	-9.78	2.85	11.73	1	.001	.000		

C. Science self-efficacy (Science SE), college type, GPA							**95% C.C. for EXP (B)**	
	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp (B)**	**Lower**	**Upper**
GPA	1.90	.75	6.50	1	.011	6.68	1.55	28.76
Science SE	1.47	.41	12.77	1	<.001	4.33	1.94	9.66
College Type	1.96	.86	5.22	1	.022	7.09	1.32	38.00
Constant	-9.66	2.89	11.19	1	.001	.000		