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Sociocultural and contextual determinants of science career goal at a community college and baccalaureate-granting institution

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Abstract

Guided by social cognitive career theory (SCCT; Lent et al. in J Vocat Behav 45(1):79–122, 1994), we assessed sociocultural (e.g., home-school cultural value mismatch) and contextual barriers (e.g., institutional climate) in science education and career development at both a baccalaureate-granting institution (BGI) and community college (CC) among 263 students (72.4% female; M_{age} = 22.96, SD = 5.70) in the USA. For BGI students, path analyses suggest proximal factors such as in-class prejudice negatively predicted science self-efficacy and prejudice from faculty and staff predicted lower career outcome expectations. For CC students, home-school cultural value mismatch directly predicted science career goals. Implications for future research, intervention and policy are discussed.

Résumé

Déterminants socioculturels et contextuels dans l'objectif de poursuivre une carrière scientifique dans un collège communautaire et un établissement délivrant le baccalauréat

Guidés par la théorie sociale cognitive de la carrière (SCCT; Lent et al., 1994), nous avons évalué les barrières socioculturelles (p. ex. le décalage entre les valeurs culturelles de l'école et de la famille) et contextuelles (par exemple, le climat institutionnel) dans l'enseignement des sciences et le développement de carrière dans un établissement conférant le baccalauréat (BGI) et un collège communautaire (CC) parmi 263 étudiant·e·s (72,4% femmes; M_{age} = 22,96, SD = 5,70) aux États-Unis. Pour les étudiant·e·s de BGI, les analyses suggèrent que les facteurs proximaux tels que les préjugés dans la classe prédisent négativement l'auto-efficacité scientifique et que

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Conflict of interest The authors declare that they have no competing interests.

Ethics approval All procedures were reviewed and approved by the Committee for Protection of Human Subjects at the baccalaureate-granting institution. Informed consent was obtained from all participants.

Consent to participate All participants provided their informed consent to participate in this study.

Consent for publication All authors provided their consent for publication.

les préjugés du corps enseignant et du personnel prédisent des attentes plus faibles en matière de carrière. Pour les étudiants CC, le décalage des valeurs culturelles entre la famille et l'école prédit directement les buts de carrière scientifique. Les implications pour les recherches futures, les interventions et les politiques sont discutées.

Zusammenfassung

Soziokulturelle und kontextuelle Faktoren, die das Laufbahnziel bezogen auf die Wissenschaften an einem Community College und einer Maturitätsschule bestimmen Geleitet von der sozial-kognitiven Laufbahntheorie (SCCT; Lent et al., 1994) haben wir soziokulturelle (z.B. kulturelle und wertebezogene Unterschiede zwischen Elternhaus und Schule) und kontextuelle Barrieren (z.B. institutionelles Klima) in der wissenschaftlichen Ausbildung und Laufbahnentwicklung sowohl an einer Maturitätsschule (BGI) als auch an einem Community College (CC) unter 263 Studierenden (72,4% weiblich; $M = 22_{age}$,96, $SD = 5$,70) in den Vereinigten Staaten untersucht. Bei den BGI-Studierenden deuten Pfadanalysen darauf hin, dass proximale Faktoren wie Vorurteile in der Klasse die wissenschaftliche Selbstwirksamkeit negativ beeinflussen und dass Vorurteile seitens der Lehrkräfte und des Personals zu geringeren Erwartungen an die berufliche Entwicklung führen. Bei den CC-Schülern war die Diskrepanz zwischen den kulturellen Werten im Elternhaus und in der Schule ein direkter Einflussfaktor für wissenschaftliche Laufbahnziele. Es werden Implikationen für zukünftige Forschung, Intervention und Politik diskutiert.

Resumen

Determinantes socioculturales y contextuales de las metas en carreras científicas en un colegio comunitario e instituciones que otorgan grados en bachillerato (103R1) Guiados por la teoría social cognitiva de la carrera (SCCT; Lent et al., 1994), evaluamos las barreras socioculturales (p. ej., el desajuste cultural entre el hogar y la escuela) y las barreras contextuales (p. ej., el clima institucional) en la educación científica y el desarrollo profesional tanto en un bachillerato como en una institución otorgante (BGI) y colegio comunitario (CC) entre 263 estudiantes (72.4% mujeres; Edad = 22.96, SD = 5.70) en los Estados Unidos. Para los estudiantes de BGI, los análisis de ruta sugieren factores proximales como el prejuicio en la clase que predijo negativamente la autoeficacia científica y el prejuicio de la facultad y el personal predijeron expectativas de resultados profesionales más bajas. Para los estudiantes de CC, el desajuste de los valores culturales entre el hogar y la escuela predijo directamente las metas de la carrera científica. Se discuten las implicaciones para futuras investigaciones, intervenciones y políticas.

Keywords

Social cognitive career theory; Science self-efficacy; Science career development

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Introduction

Although careers in science, technology, engineering, math (STEM), and healthcare are some of the fastest growing (Fayer et al., 2017; Torpey, 2014), nearly 48% of bachelor's degree students and 69% of associate's degree students who enter a STEM field will leave it within 3 years (Chen et al., 2013). This attrition in STEM education has created impediments to advancing national science and industry innovation. While test scores and previous academic performance predict science degree completion, an expanding body of research overwhelmingly demonstrates that sociocultural factors (i.e., social dynamics embedded within larger cultural systems) like a mismatch between home and institutional cultural values, and other contextual factors, like perceived campus climate, play an important role in students' educational trajectories and career aspirations (e.g., Byars-Winston et al., 2010; Chang et al., 2011; Hendricks et al., 1996; Lent et al., 1994, 2018; Nora & Cabrera, 1996; Ong et al., 2018; Solórzano et al., 2013; Vasquez-Salgado et al., 2015, 2021). These educational barriers are critical to examine and address as they have been linked directly and indirectly to STEM career intention (Lent et al., 1994, 2005, 2018; Smith et al., 2014; Xu & Lastrapes, 2021). They may also explain gender and ethnic disparities in STEM career fields, where African American and Latinx workers make up 9% and 8% of the STEM workforce though they represent 11% and 17% of the overall adult workforce in the USA (Fry et al., 2021). Given that STEM jobs offer higher salaries and are expected to outpace non-STEM jobs in growth, if these barriers are unaddressed, social and economic disparities in the USA are at risk of being exacerbated.

Challenges in navigating STEM pathways may differ across higher education contexts. For example, sociocultural factors can impact student pathways to science fields differently at 2-year, community colleges (CC) relative to at 4-year, baccalaureate-granting institutions (BGI). Examining these factors across contexts will fill an important gap in the literature and our understanding of STEM attrition given that CCs provide a critical avenue for student educational engagement and career advancement, particularly for those from underrepresented minority (URM) backgrounds. Based on recommendations from the Master Plan for Higher Education in California (Coons et al., 1960), California established a three-tier system of public higher education consisting of the California Community College System, State College System, and University of California. CCs serve multiple roles for students that include but are not limited to, providers of transfer support as well as remedial education, terminal associate of art/science degrees, and vocational training. When these roles are in conflict or there is emphasis on one function (e.g., vocational training versus clear and explicit guidance on transfer), it can limit the educational goals and aspirations of URM students (Solórzano et al., 2005, 2013). These competing roles can affect the availability of faculty and enriching opportunities such as mentored research, which has been associated with science self-efficacy for CC students (Villasenor et al., 2021). Additionally, because CCs are less expensive, there is greater representation of students from low socioeconomic status backgrounds who are more likely to be URM and first-generation college students with work and family responsibilities relative to students at BGIs (Hurtado et al., 2007; Martin et al., 2014; Solórzano et al., 2005). Indeed, of URM doctoral recipients, nearly a third report having attended a CC at some point in their careers compared to a quarter of their non-URM counterparts (National Science Foundation, 2018). For the Latinx population, nearly half to two-thirds of students begin their postsecondary education at a CC (Shapiro et al., 2018; Solórzano et al., 2005). However, only 7% to 20% of these Latinx CC students will transfer to a BGI. Despite the important role that CCs plays in the educational development of students in science from URM backgrounds, it is not well-understood how sociocultural and contextual determinants of science career development differ for CC students relative to students from BGIs. Our manuscript intends to fill this gap in the literature by testing models of sociocultural and contextual determinants of science self-efficacy, expectations, and career goals in a sample of URM students from a CC and BGI.

Research on female and URM students suggests that negative experiences stemming from racial stereotypes, stigma, and prejudice is a principal impediment to students' development in STEM at both CC and BGI contexts (Chang et al., 2011; Hurtado et al., 2009; Marco-Bujosa et al., 2021; Ong et al., 2018). Encountering discrimination in the classroom and perceptions of a hostile racial climate can have a negative effect on academic and intellectual development for URM and non-URM students across majors in ways that indirectly affect adjustment and persistence (Hurtado et al., 2007; Nora & Cabrera, 1996). However, relative to non-science URM students, URM students in science majors (i.e., biomedical and behavioral science) reported feeling less successful at managing their academic environment (Hurtado et al., 2007). Additionally, a hostile racial climate affected academic environment management more for URM than non-URM students. URM students also report significantly greater prejudice and discrimination in-class, among faculty, and on campus than non-URM students (Nora & Cabrera, 1996), both in terms of overt and subtle everyday forms of discrimination (i.e., racial microaggressions; Sue et al., 2007). For example, URM science students reported encountering skepticism regarding their intellectual talents from peers, faculty, and staff (Hurtado et al., 2009). Over time, the pressure from having to perpetually prove their academic worth, especially in STEM fields where individuals from URM backgrounds are underrepresented, began to affect their sense of connection and motivation. This demonstrates how discrimination, whether intentional or unintentional, overt or covert, put URM students at risk for stereotype threat, the reduced performance from fear that one will conform to negative stereotypes about one's social group (Steele, 1997). Discrimination and prejudice can contribute to creating a negative learning environment, eroding social relationships that could otherwise strengthen science belonging and access to resources through mentorship and advising (Freeman et al., 2016; Hendricks et al., 1996; Hurtado et al., 2009; Nora & Cabrera, 1996). Indeed, a more favorable campus climate, where students feel a sense of belonging, has been associated with greater integration with groups on campus in ways that are positively predictive of academic self-efficacy and science interest (Byars-Winston et al., 2010). Thus, we incorporate microaggressions and prejudice across multiple levels (in-class, among faculty/staff, institutional) as predictors of URM students' science self-efficacy and career development.

The culture of higher education and science can negatively affect URM STEM students in another way. A growing body of work also suggests that mismatch between home and school cultural values (i.e., cultural value mismatch) can affect student adjustment, particularly for first-generation college students who are the first in their families to attend college (Stephens et al., 2012; Vasquez-Salgado et al., 2015, 2021). At home, there may be greater emphasis on prioritizing interdependent family relationships, goals, and obligations (i.e., *familism*) for students from Asian and Latin American backgrounds (Fuligni et al., 1999). This may mismatch with expectations to pursue individual achievement in school contexts (Hurtado et al., 2009; Vasquez-Salgado et al., 2015). Latinx students have reported that these experiences of home-school cultural value mismatch can have a negative impact on their grades and even physical well-being because they generate feelings of guilt, stress, and an inability to concentrate or study (Vasquez-Salgado et al., 2015). Examining home-school cultural value mismatch in the context of science education is important because research suggests that the culture of science is highly independent or individualistic, creating a stronger contrast to students' interdependent values; this contrast can negatively impact URM students' science career development. Indeed, Hurtado et al. (2007) found that a competitive peer environment affected adjustment for URM science students more so than non-URM science students. Although perceptions of the "culture of science" as a competitive and academically intimidating rather than collaborative one can fuel some students to work harder, it can also negatively affect students' confidence and sense of academic self-efficacy, partly through internalized low expectations (Hurtado et al., 2009, 2010). When experiencing the culture of science as intimidating, for example, rejection or failure might lead students to question themselves and wonder "what is wrong with me?" (Hurtado et al., 2009, p. 204) rather than to question a system that neither values belonging nor recognizes the unique skills and capital students bring from their family, cultural, and community backgrounds (Yosso, 2005). Therefore, given the importance of culture in URM students' adjustment in higher education, and the potential salience of cultural mismatch for students pursuing science, we advance the field by incorporating home-school cultural value mismatch as a predictor of science self-efficacy, expectations, and goals.

Theoretical framework

Social cognitive career theory (SCCT; Lent et al., 1994) can be a useful framework from which to examine the role of these sociocultural and contextual factors in shaping science career choice among students across diverse backgrounds (e.g., Lent et al., 2005, 2018). According to SCCT, individual and environmental factors can shape career interest and choice directly or indirectly through self-efficacy ("can I do this?") and career outcome expectations ("if I do this, what will happen?"; Lent et al., 1994, p. 83). There is strong evidence that supports the utility of the framework (e.g., Lent et al., 2018). Experimental manipulation of self-efficacy has led to increases in math and science career interest from pre-treatment to 4 weeks after (e.g., Luzzo et al., 1999). Additionally, longitudinal analyses that assess the temporal relationships of SCCT constructs support the hypothesized path from self-efficacy to career expectations, interest, and persistence (e.g., Lapan et al., 1996; Lent et al., 2010; Nauta & Epperson, 2003; Nauta et al., 2002; Navarro et al., 2014; Perez et al., 2014).

Multiple studies suggest that environmental supports and barriers at various levels and settings have played an important role in URM science career development (e.g., Lent et al., 2005; Trenor et al., 2008). For example, sociocultural factors like social status—economic resources, social power, and social prestige—were found to be positively predictive of self-efficacy for those interested in investigative, research pursuits (Thompson & Dahling, 2012). Contextual institutional factors, like campus climate, have been shown to predict science-related self-efficacy, which was predictive of science interest and career goals among students pursuing degrees in biological science and engineering (Byars-Winston et al., 2010). Social factors like family support are associated with higher career persistence among females in engineering; on the other hand, feeling pressure from family or others to change one's major can significantly lower persistence (Trenor et al., 2008). Trenor and colleagues (2008) also found that family factors may be particularly important for African American, Asian American, and Hispanic students. Interestingly, although more likely to indicate that their parents influenced their career choice, they were also less likely than White students to have reported having parents or knowing other family members employed as engineers and, therefore, have less specific "familial knowledge" about the field. Thus, the current study extends the SCCT framework by incorporating contextual factors (e.g., microaggressions, prejudice) and sociocultural factors (e.g., home-school cultural value mismatch) relevant to URM student adjustment.

Additionally, we test the model for students across two types of institutions of higher education, a CC and BGI. A recent meta-analysis of 143 studies demonstrates that barriers (e.g., economic need) are predictive of lower self-efficacy and outcome expectations which, in turn, affect STEM career interest and choice for both URM and non-URM students (Lent et al., 2018). However, of the impressive compilation of over 60 published studies examining career development among a college population, the majority of participants were from 4-year universities. When there were CC students present in study samples, they were not the focus. For example, in a longitudinal study cited in the meta-analysis that followed 41 female high school students who participated in a science program, researchers reported that 5 students eventually enrolled in a community college or professional or technical school (Scott & Mallinckrodt, 2005). However, given the small sample size, the results were understandably not disaggregated by college type and it remains unclear if there were differences in self-efficacy between those pursuing a science major across institutions. Given the majority of CC students come from URM backgrounds, this exclusion limits our understanding of how barriers affect students from various post-secondary institutions and ethnic backgrounds.

The current study

The current study extends the previous literature and assesses the effect of barriers to science career intention at both a CC and BGI to identify factors leading to push-out at different points in the educational trajectories of URM students in science. We test several hypotheses aligned with SCCT (Lent et al., 1994), which posits that environmental and contextual factors (e.g., supports, barriers) can enhance or constrain the role of self-referent thinking, person-level mechanisms (e.g., self-efficacy, outcome expectations) in guiding career development processes. Specifically, SCCT would suggest that science self-efficacy beliefs directly and indirectly, through outcome expectations, shape an individual's science career goals. We also explore the differential role of sociocultural (i.e., home-school cultural value mismatch) and contextual barriers (e.g., overt and covert forms of discrimination in-class, from individuals like faculty and staff) to science self-efficacy, outcome expectations, and science career goal development for students across a CC and BGI. Because of differences in demographics, resources, family context and obligations across institution types, we expect that home-school cultural value mismatch will be most relevant for CC students' science self-efficacy, outcome expectations, and career goal development. We also explore the role of forms of discrimination at various levels (i.e., in-class, from individuals like faculty and staff, and from general interactions across campus) in negatively predicting science self-efficacy and outcome expectations for students at both a CC and BGI.

Method

Participants

Participants were students (N = 263; M_{age} = 22.96, SD = 5.70, 72.4% female) from a community college (CC: n = 203; M_{age} = 23.32, SD = 6.11, 69.7% female) and baccalaureate-granting institution (BGI: n = 60; M_{age} = 21.68, SD = 3.71, 82.1% female) pursuing STEM majors. The majority of students were from the social sciences (e.g., Psychology, Sociology, Child Development, Chicano Studies; n = 162), followed by other sciences (e.g., Chemistry, Biology, Kinesiology, Nursing, Computer Engineering, Nutrition, Math; n = 64), and, finally, non-science majors (e.g., Graphic Design, English, History; n = 37). Approximately 88.1% of CC students were URM students (1% African American, 82.1% Latino, and 5% Southeast Asian or Pacific Islander relative to 9% East and South Asian, .5% Caucasian, and 7.5% other ethnicities) and 52.6% of BGI students were URM students (e.g., 3.5% African American, 47.4% Latino, and 1.7% Southeast Asian or Pacific Islander relative to 10.5% East and South Asian, 22.8% Caucasian, and 15.8% other ethnicities). There were no participants from Native American, Alaskan Native, or Native Hawaiian backgrounds.

Average parent education level for CC students was between secondary and high school education and between vocational/technical program with or without high school diploma for BGI students. The majority of CC students were first-generation college students (i.e., neither of their parents had attended or graduated from college; 69.5%) compared to 31.7% of BGI students. Students ages 18 or older were recruited via emails to department and course lists. After reviewing a consent form, participants completed a survey online and were entered into a raffle to win one of ten $20 gift cards. All procedures were approved by the institutional review board at the BGI and with CC administrative approval.

Measures

Microaggressions—Microaggressions in the last 6 months were assessed using items relevant to the school context from the Racial Ethnic Microaggressions Scale (REMS; Nadal, 2011; e.g., “I was ignored at school or work because of my race” and “Someone assumed that my work would be inferior to people of other racial groups”) on a 5-point scale from 1 = *I did not experience this event* to 5 = *I experienced this event 10 or more times* (α = .81).

Institutional Climate and Prejudice—Perceptions of prejudice and discrimination on campus were assessed with Campus Climate (Nora & Cabrera, 1996) subscales capturing perceptions of prejudice and discrimination (a) at an institution (“I have observed discriminatory words, behaviors or gestures directed at minority students at this institution,” α = .82), (b) in-class (i.e., “I have been singled out in class and treated differently than other students”), and (c) from faculty and staff (e.g., “I feel there is a general atmosphere of prejudice from faculty at this institution,” α = .94) on a 5-point scale from 1 = *strongly* *disagree* to 5 = *strongly agree*. Higher scores across all three subscales indicate greater perceived prejudice and discrimination.

Home-School Cultural Value Mismatch—Mismatch between the behavioral enactment of interdependent family obligations and independent academic obligations identified in the literature (Vasquez-Salgado et al., 2015) was assessed on a 5-point scale (α = .92) from 1 = *never* to 5 = *very frequently* across 10 items (e.g., “Since you started at [institution], how often have you had to choose between your academic work and the following things” “…attending family events,” “…doing tasks your family needs done”). This measure has been psychometrically validated with a multi-ethnic college sample (Vasquez-Salgado et al., 2021).

Science self-efficacy and outcome expectations—Science self-efficacy was assessed from items such as confidence to “complete a science degree” and “pursue a graduate degree in science” (α = .93) and science outcome expectations was assessed from items such as “a research science career would allow me to …do work that makes a difference in people’s lives or society” and “earn an attractive salary” (α = .83) on a 5-point scale from 1 = *no confidence* to 5 = *complete confidence* based on prior research (Byars-Winston et al., 2016).

Science career goal—Similar to previous research (Byars-Winston et al., 2010), a single item was used to assess science career goal (i.e., “I want to pursue a career in science, technology, engineering or math”) on a scale from 1 = *not at all* to 5 = *definitely*.

Analytic strategy

Given the theoretical conceptualization of collective barriers, correlations between main study variables will be examined and exogenous sociocultural and contextual factors allowed to covary in the final model (omitted from Figure 1 to avoid visual clutter). Additionally, t-tests will explore gender and ethnic differences. Significant group differences in sociocultural and contextual factors, if any, will be included as covariates in the final model. AMOS 26.0 software will be used to test paths from sociocultural and contextual determinants to science self-efficacy, outcome expectations, and science career goal as the SCCT framework hypothesizes direct and indirect effects of contextual barriers to career goals. For model parsimony, non-significant paths (*p*s > .10) will be trimmed (e.g., Lent et al., 2003). Multi-group path analyses will be used to test the differences in paths to science career intention across institution type. We hypothesize that the effects will differ across institutions and will test the unconstrained model (where paths are allowed to vary across institutions) with a constrained model (where paths are restricted and not allowed to vary across institutions).We will use a chi-squared (noted as χ^2) goodness of fit test to examine whether the final models fit the observed data and a change in χ^2 (noted as $\Delta\chi^2$) to test whether the paths significantly differ across institutions. Similar multi-group analyses will be used to examine the effect of other moderating factors (e.g., URM status, gender).

Results

Table 1 shows the zero-order correlations between study variables. Notably, microaggressions were significantly correlated with perceptions of prejudice and discrimination at multiple levels (i.e., in-class prejudice, faculty/staff prejudice, and institutional climate) only for CC students. Additionally, greater home-school cultural value mismatch was significantly associated with higher perceptions of prejudicial institutional climate only for CC students. Preliminary t-tests showed no gender differences in study variables except in intention to pursue a science career, whereby males reported greater career goal intention ($M = 2.71$, $SD = 1.62$) compared to females ($M = 2.05$, $SD = 1.49$), $t(233) = 2.94$, $p = .004$. Similarly, students in the social sciences were less likely to report science career intention ($M = 1.87$, $SD = 1.36$) compared to those in other sciences ($M = 2.74$, $SD = 1.67$), $t(226) = 4.26$, $p < .001$. Lastly, t-tests showed no significant differences in the model variables between URM compared to non-URM or first-generation compared to continuing-generation students (*p*s > .05). Given the lack of differences across groups in sociocultural and contextual factors, we did not include sociodemographic variables as antecedents in the final model. This is also in line with SCCT, which postulates that gender and racial/ethnic differences in career interest are diminished when controlling for opportunity structures, supports, and barriers (Lent et al., 1994).

The final unconstrained model was a good approximation of the observed data ($\chi^2 = 10.70$, $df = 20$, $p = .954$) and differed significantly from the constrained model ($\Delta\chi^2 = 16.53$, $df = 8$, $p = .035$) indicating divergent pathways across institutions. As shown in Figure 1, multi-group path analysis of the final model suggests that proximal factors like in-class prejudice (i.e., being singled out in class) was predictive of lower science self-efficacy which, in turn, was predictive of science career goal for BGI students. For CC students, home-school cultural value mismatch was directly related to being less inclined to pursue a science career goal. Table 2 shows tests of model fit differences after each path was constrained, indicating significant differences across institutions particularly in the path from in-class prejudice to science self-efficacy. Among CC students, sociocultural and contextual factors explained 23% of the variance in science career goal, 2% for science self-efficacy, and 12% for outcome expectations. Among BGI students, sociocultural and contextual factors explained 38% of science career goal, 16% in science self-efficacy, and 45% in outcome expectations.

We did not separate students by URM status, college generation status, or major within each institution type due to the small sample sizes that would have resulted at each institution (e.g., BGI: 27 non-URM students, 19 first-generation college students, and 14 non-social science majors). Instead, follow-up multi-group path analyses comparing URM and non-URM students across the entire sample showed the final unconstrained model was consistently a good fit of the data ($\chi^2 = 19.72$, $df = 20$, $p = .476$). The constrained model ($\chi^2 = 31.12$, $df = 28$, $p = .312$) was not significantly different ($\Delta\chi^2 = 11.41$, $df = 8$, $p = .180$), thus we conclude no moderation by URM status. There was also no significant difference by gender ($\Delta\chi^2 = 4.86$, $df = 8$, $p = .772$) between the unconstrained model ($\chi^2 = 13.32$, $df = 20$, $p = .863$) and constrained model ($\chi^2 = 18.18$, $df = 28$, $p = .922$). Additionally, the unconstrained ($\chi^2 = 17.68$, $df = 20$, $p = .609$) and constrained model ($\chi^2 = 22.43$, $df = 28$, p

= .761) did not significantly differ ($\Delta\chi^2$ = 4.75, *df* = 8, *p* = .784) by college generation status (i.e., first-generation college students relative to continuing-generation college students). Lastly, the unconstrained model (χ^2 = 19.31, *df* = 20, *p* = .502) and constrained model (χ^2 = 27.70, *df* = 28, *p* = .480) did not significantly differ ($\Delta\chi^2$ = 8.39, *df* = 8, *p* = .396) by major type (i.e., social sciences majors compared to other majors).

Discussion

Consistent with SCCT (Lent et al., 1994), sociocultural and contextual factors were predictive of science self-efficacy and outcome expectations, which was, in turn, associated with science career goal. However, although we found a significant path from science self-efficacy to science career goals, outcome expectations were not significantly predictive of science career goal and this is inconsistent with the original SCCT model. Previous research among science majors found a similarly non-significant path (Lent et al., 2003) and the authors suggest that it may be due to a strong bidirectional relationship between self-efficacy and outcome expectations (Nauta et al., 2002). This is consistent with our bivariate correlational results for the two variables and the original conceptualization of SCCT that is based on social cognitive theory which acknowledges both feed-forward and feedback mechanisms in how individuals are shaped by as well as actively create meaning from interaction with their environment in cumulative, “reinforcement histories” (Lent et al., 1994). Future research should test the directions of causality between science self-efficacy, outcome expectations, and goal for CC and BGI students.

As expected, the effect of sociocultural and contextual factors on students’ science self-efficacy, outcome expectations, and goal differed across institution types. For BGI students, more proximal factors like being singled out in class was predictive of science self-efficacy, an antecedent of science career goal. Experiences of prejudice in interactions with faculty or staff were also significantly predictive and home-school cultural value mismatch was marginally predictive of science career outcome expectations for BGI students. For CC students, home-school cultural value mismatch had a significant, direct effect on sscience career goal and broader contextual factors like microaggressions and institutional climate had a marginal effect on science self-efficacy and outcome expectations when this mismatch was accounted for. Previous research has similarly found that sociocultural factors like support and encouragement from home (i.e., from parents) may have a stronger effect on college persistence than perceptions of prejudice (Nora & Cabrera, 1996). Additionally, microaggressions and discrimination at the institutional level may have a reduced effect on students who have learned to “depersonalize” or cope with racism (Hendricks et al., 1996).

It is notable that greater mismatch between home (where there is likely a greater sense of *familism*, a cultural orientation to prioritize family relationships) and school (which is more likely to emphasize independent goals) was predictive of lower science career intention for CC students and marginally predictive of lower science career outcome expectations for BGI students. This partially supports our hypothesis that cultural value mismatch would have a more influential role for CC relative to BGI students in science career development. This provides insight into the negative relationship between home-school cultural value mismatch and science career goal for CC students. It also appears that home-school cultural value mismatch may reduce expectations for a science career to be fulfilling (e.g., make a difference in people's lives, get respect, earn an attractive salary) for BGI students. Previous research found that *familism* as well as identifying with an American cultural orientation was related to higher career self-efficacy for Latinx college students (Flores et al., 2010). This suggests that bicultural students who are able to navigate both interdependent home cultures and the independent "culture of science" or academia may fare best, further highlighting the need for supports early in students' trajectories as they acculturate to new college contexts. Policies like the Experimental Grading Policy at Massachusetts Institute of Technology (MIT) that allow entering students to designate up to three science core courses where they will not be graded on a letter grade allow for exploration and adjustment during the transitional first term (Hurtado et al., 2009). Additionally, interventions to reduce mismatch between home and academic contexts can also be fruitful to improving science identity while maintaining racial and cultural identity. For example, interventions that frame the university as interdependent (i.e., being part of a community) have been shown to reduce stress and increase academic task performance, particularly among first-generation college students (Stephens et al., 2012). These interventions can and should be implemented with students who begin their educational careers at a CC.

While promising, there are several limitations to the current study. Given our focus on students from across institution types, we focused on sociocultural and contextual barriers common to URM and first-generation college students. However, several other individual and contextual barriers and supports can play a role in science self-efficacy and career intention. For example, personality (e.g., Rottinghaus et al., 2002) and supports such as the presence of role models (e.g., Qimby & DeSantis, 2006) or reassurance of worth (Cross & Vick, 2001) can influence career choice and buffer against the negative effects of cultural value mismatch on persistence. Also, the diversity of URM students in the current study and at each institution (BGI: 52.8% Latinx; CC: 66.9% Latinx) is representative of diversity in Southern California (e.g., Los Angeles 48.6% Latinx; US Census, 2019) and may not generalize to other regions in the country. Our sample was also majority female. This is consistent with other undergraduate research where females are often over-represented (Dickinson et al., 2012) and may explain the lack of significant gender differences as we focused on behavioral and health-related majors where females are less underrepresented (Fry et al., 2021). Examining school records and academic outcomes is one strategy for addressing the limitations of representation in future psychological studies in which participants self-select into participating. Additionally, although we did not find differences across students pursuing a social science degree relative to students pursuing a degree in other sciences, the "other sciences and majors" category was kept intentionally broad. We included a broad range of majors because CC students, particularly those in the current sample in general education courses, have flexibility in major selection and may not yet identify as science majors (e.g., biology students pursuing careers like nursing may identify more strongly as allied health majors rather than science majors; [Ashcroft et al., 2021]). Future research should sample and compare specific majors, such as in Byars-Winston et al. (2010), or focus on biomedical students as the vast breadth of literature has focused on psychology and engineering majors (Lent et al., 2018). Lastly, although there is strong evidence for a causal SCCT model (e.g., Lent et al., 2008; Luzzo et al., 1999), the crosssectional design of the current study using self-report data limits our ability to establish causal links.

Conclusion

Despite limitations, the findings have important implications. First, the results underscore the collective and detrimental effects of discriminatory experiences in-class and on-campus at both CC and BGI institutional environments on students' science self-efficacy, career expectations, and, ultimately, science career goal. Additionally, beyond the predictive validity of home-school cultural value mismatch, we found that the construct was uncorrelated with microaggressions and many other campus climate measures, establishing discriminant validity of the measure and future studies should explore the unique effect of mismatch between home and school cultural contexts as a barrier to science career expectations, intention, and outcome. Finally, these results identify factors in the baccalaureate context (e.g., in-class prejudice, prejudice from faculty and staff) and pre-transfer, CC context (e.g., cultural value mismatch) to target for STEM educational interventions that can be beneficial for all students regardless of ethnic background. Addressing barriers at critical points across educational pathways may be the key to expanding the pool of talent and diverse perspectives in science in ways that can innovatively address global technological and healthcare needs.

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Data availability

The datasets used/or analyzed during the current study are available from the corresponding author on reasonable request.

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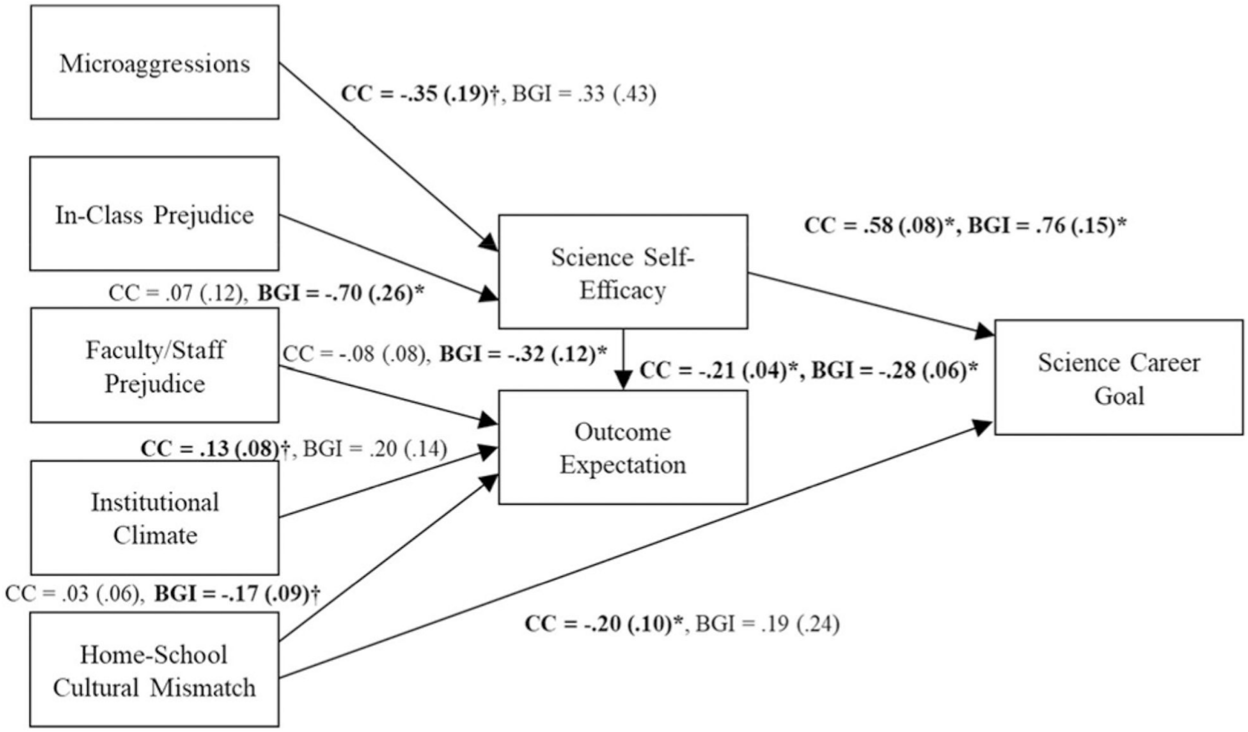

Figure 1.

Path coefficients for college students across institutions in final model informed by SCCT. *CC* community college, *BGI* baccalaurate-granting institution. Exogenous sociocultural and contextual variables were allowed to covary (omitted from figure to avoid visual clutter). †$p < .10$. *$p < .05$

Table 1

Correlations between main study variables

	1	2	3	4	5	6	7	8
1. Microaggressions	–	.24*	.15*	.19*	− .01	− .13	.11	− .11
2. In-class prejudice	.04	–	.31*	.50*	.14	.01	.08	− .02
3. Faculty/staff prejudice	.08	.49*	–	.63*	.10	− .06	.02	− .05
4. Institutional climate	.11	.49*	.77*	–	.18*	.02	.10	.05
5. Home-school cultural mismatch	.16	.09	.18	.13	–	− .03	.07	− .15†
6. Science self-efficacy	.08	− .24	− .14	− .05	− .04	–	− .32*	.47*
7. Outcome expectations	− .11	.24	− .22	− .05	− .25	− .48*	–	− .15*
8. Science career goal	− .10	− .16	− .06	− .07	.07	.58*	− .42*	–

Correlations for community college students are represented above the diagonal and correlations for baccalaureate-granting institution students are represented below diagonal

† $p < .10$,

* $p < .05$

Table 2

Chi-square difference tests in multi-group analyses for constrained paths

Path	χ^2 (1)	*p*-value
Microaggressions to science self-efficacy	2.15	.14
In-class prejudice to science self-efficacy	4.64	.03
Faculty/staff prejudice to outcome expectations	2.62	.11
Institutional climate to outcome expectations	.16	.69
Home-school cultural values mismatch to outcome expectations	3.43	.06
Home-school cultural values mismatch to science career goal	2.17	.14
Science self-efficacy to outcome expectations	.88	.35
Science self-efficacy to science career goal	1.09	.30