Journal of Counseling Psychology
2014, Vol. 61, No. 1, 81–92

0022-0167/14/$12.00 DOI: 10.1037/a0034577

Academic Satisfaction Among Latino/a and White Men and Women Engineering Students

Lisa Y. Flores
University of Missouri

Rachel L. Navarro
University of North Dakota

Hang Shim Lee and Dorothy A. Addae
University of Missouri

Rebecca Gonzalez, Laura L. Luna, Ricardo Jacquez, Sonya Cooper, and Martha Mitchell
New Mexico State University

The current study tests a model of academic satisfaction in engineering based on Lent, Brown, and Hackett's (1994, 2000) social cognitive career theory among a sample of 527 engineering majors attending a Hispanic serving institution. The findings indicated that (a) an alternative bidirectional model fit the data for the full sample; (b) all of the hypothesized relations were significant for the full sample, except the path from engineering interests to goals; (c) social cognitive career theory predictors accounted for a significant amount of variance in engineering goals (26.6%) and academic satisfaction (45.1%); and (d) the model parameters did not vary across men and women or across Latino/a and White engineering undergraduate students. Implications for research and practice are discussed in relation to persistence in engineering among women and Latinos/as.

Keywords: social cognitive career theory, engineering, self-efficacy, Latino, women

The underrepresentation of men and women of color and White women in engineering is well documented, and relatively little research has examined the psychological and psychosocial factors that influence retention in engineering. According to the National Center for Educational Statistics, of all undergraduate engineering degrees awarded in 2009–2010, 82% were awarded to men and 69% to Whites, with women and Latino/as receiving only 18% and 7%, respectively (Aud et al., 2011). When data are disaggregated by gender and race/ethnicity, White women (11.4%), Latinos (5.5%), and Latinas (1.5%) receive a smaller percentage of bachelor's degrees in engineering compared to White men (58%). More research is needed to examine the factors that facilitate the selection of engineering as a major among women and racial/ethnic minorities.

Even though government public officers, education policy makers, and industry leaders have investigated ways to engage more women and racial/ethnic minorities in engineering (Cohoon & Aspray, 2006), there have been little change in the representation of White women and men and women of color with undergraduate engineering degrees over the past 10 years. Thus, in addition to examining external supports such as supportive policies, pursuing integrative perspectives can be useful in addressing this problem. Approaches that include psychosocial factors and interactions between individuals and environments while also considering the unique gendered and racial contexts of women and students of color in engineering settings may provide valuable information about individual and contextual factors related to their entry and persistence in engineering.

Theoretical Framework

Many career theories try to explain the how individuals make academic and career choices. Among them, social cognitive career theory (SCCT; Lent, Brown, & Hackett, 1994, 2000) provides a unifying framework for understanding and predicting psychosocial processes and interactions among individual and environmental factors in vocational psychology. Using SCCT as a theoretical framework, this study identified sociocognitive variables and personal-level contextual variables that are hypothesized to influence persistence in engineering. SCCT is domain specific and explains how academic- and career-choice-related behaviors occur through individual and environmental interactions. The core of this theory proposes that career goals are a function of academic- or

This article was published Online First November 4, 2013.

Lisa Y. Flores, Department of Educational, School, and Counseling Psychology, University of Missouri; Rachel L. Navarro, Department of Counseling Psychology and Community Services, University of North Dakota; Hang Shim Lee and Dorothy A. Addae, Department of Educational, School, and Counseling Psychology, University of Missouri; Rebecca Gonzalez and Laura L. Luna, Department of Counseling and Educational Psychology, New Mexico State University; Ricardo Jacquez, Department of Civil Engineering, New Mexico State University; Sonya Cooper, Department of Engineering Technology and Surveying Engineering, New Mexico State University; Martha Mitchell, Department of Chemical Engineering, New Mexico State University.

A preliminary draft of this paper was presented at the annual meeting of the American Psychological Association in Orlando, Florida, August 2012. This study was based on work supported by the National Science Foundation under Grant HRD-1036713.

Correspondence concerning this article should be addressed to Lisa Y. Flores, Department of Educational, School, and Counseling Psychology, 16 Hill Hall, University of Missouri, Columbia, MO 65211. E-mail: floresly@missouri.edu

career-related self-efficacy beliefs, interests, and outcome expectations. Simply stated, self-efficacy beliefs inform the confidence in an individual's ability to perform a specific task, interests refer to preferences for specific tasks and activities, and outcome expectations are defined as expectancies related to engaging in a specific task. According to SCCT, the more confident an individual is in her or his ability to perform well in a specified domain, the more likely she or he is to believe that the outcomes related to domain-related tasks are valuable to pursue, and the more likely she or he is to develop interests in that domain. Collectively, self-efficacy, outcome expectations, and interests inform goals and persistence behaviors. Finally, self-efficacy beliefs and outcome expectations are critical mediators among learning experiences, personal or individual factors, contextual and environmental factors, and academic- and career-choice-related behavior.

On the basis of both SCCT and Lent's (2004) model of well-being, Lent and Brown (2006, 2008) proposed a model of academic and work satisfaction. In this model, Lent and Brown hypothesize that a combination of social cognitive, behavioral, personality and affective traits, and situational factors explains adjustment and satisfaction in educational and occupational domains. In accordance with the model, self-efficacy beliefs, outcome expectations, and goal behavior are believed to be important contributors to educational and work satisfaction. The current study uses SCCT as the base model and extends the model to include academic satisfaction as the key outcome variable to understand the effects of social cognitive variables on engineering students' academic satisfaction.

Vocational psychologists have highlighted the importance of examining gender and racial/ethnic differences in career-related behaviors. Multigroup comparisons using the SCCT model could extend the knowledge on the career development of women and racial/ethnic minorities regarding the way in which the relations among the SCCT variables are similar or different across groups. For example, Morrow, Gore, and Campbell (1996) reported that outcome expectations might be more salient than self-efficacy in the academic and career choice behavior of marginalized individuals. Because of the low numbers of women and Latino men and women in engineering, the current study tests the SCCT model across gender and race/ethnic minority groups in engineering to better understand the most salient factors and the relations among these variables in engineering persistence behaviors.

SCCT and Engineering Studies

Several studies have tested the SCCT model in engineering domains among college populations by testing the effects of the core SCCT variables on engineering goals or engineering academic satisfaction (Lent et al., 2003; Lent, Brown, et al., 2005; Lent et al., 2013; Lent, Singley, Sheu, Schmidt, & Schmidt, 2007). Empirical findings have supported the SCCT model and indicated that the data were a good fit to the SCCT model. Most SCCT engineering research reported significant relations between engineering self-efficacy and engineering interests (Lent et al., 2003; Lent, Brown, et al., 2005; Lent et al., 2013; Lent, Sheu, Gloster, & Wilkins, 2010; Lent, Sheu, et al., 2008), engineering-related goals (e.g., Lent et al., 2003; Lent, Brown, et al., 2005; Lent et al., 2007; Lent, Sheu, et al., 2008, 2010), and engineering academic satisfaction (Lent et al., 2007; 2013). However, inconsistent results have been reported regarding the effects of engineering outcome expectations on engineering interests and/or engineering goals. For example, some studies reported that engineering outcome expectations were a useful predictor of engineering interests or engineer major choice or goals (Byars-Winston, Estrada, Howard, Davis, & Zalapa, 2010; Lent, Brown, et al., 2005; Lent et al., 2013; Quimby, Seyala, & Wolfson, 2007), and other studies reported nonsignificant effects among these variables (Lent et al., 2003, 2007; Lent, Lopez, Sheu, & Lopez, 2011; Schaefers, Epperson, & Nauta, 1997). Lent et al. (2013) reported a positive relation between engineering outcome expectations and engineering academic satisfaction. More studies that explore specific characteristics of engineering students are needed to test SCCT core variables in the engineering domain and to explain prior inconsistent findings.

Prior SCCT research in domains related to engineering, such as math, science, and computing, have produced similar findings. Several studies reported results that were consistent to the SCCT engineering research in that self-efficacy was a significant predictor of interests, outcome expectations, and goals in the domains of computing (Lent, Lopez, Lopez, & Sheu, 2008; Lent et al., 2011) and math/science (Ferry, Fouad, & Smith, 2000; Fouad & Smith, 1996; Gainor & Lent, 1998; Navarro, Flores, & Worthington, 2007; Waller, 2006). Outcome expectations did not have a significant effect on interests and goals in computing (Lent, Lopez, et al., 2008, 2011), but these relations were significant in math/science (Ferry et al., 2000; Fouad & Smith, 1996; Gainor & Lent, 1998; Navarro et al., 2007).

Vocational psychologists have highlighted the importance of considering contextual influences in the career decision-making process (Blustein, 2001; Fouad & Byars-Winston, 2005; Sheu & Lent, 2009). The SCCT model allows researchers to explain the role of both personal and environmental factors such as gender, school environment, and racial/ethnicity in pursuing career goals. Recently, more studies have used multigroup comparisons in exploring the SCCT model across institutional types, gender, and racial/ethnic groups (Byars-Winston et al., 2010; Lent, Brown, et al., 2005; Lent et al., 2013; Lent, Lopez, et al., 2008, 2011; Lent, Sheu, et al., 2008; Navarro et al., 2007). This research trend is beneficial to understanding the ways in which the relations among the SCCT variables are similar or different across groups. Findings from such studies are valuable in developing specifically tailored programs and interventions for specific student groups. Among the multigroup comparisons conducted in SCCT engineering and engineering-related areas, results indicated that the SCCT model was invariant across gender, institutional settings (between historically Black colleges/universities [HBCU] and predominantly White institutions [PWI]), educational levels, and racial/ethnic groups (Lent et al., 2003, 2011, 2013; Lent, Lopez, et al., 2008; Navarro et al., 2007). However, a few differences in parameter estimates were reported (Lent et al., 2011). These results showed that the path from self-efficacy to outcome expectations was larger for male and White students when compared to female and African American students, respectively (Lent et al., 2011). Also, the path between supports and barriers was larger among engineering students attending HBCUs than PWIs (Lent et al., 2005).

Our study extends the SCCT literature by diversifying the racial/ethnic composition of our sample and including a new type of institution. Most previous SCCT studies in engineering have included samples composed of mostly White male students in engineering (Lent et al., 2003, 2007; Lent, Sheu, et al., 2008). Even though a few studies have tested the SCCT model with racially and ethnically diverse samples in different institutional types, these studies have explored the SCCT model with African American students and students attending either an HBCU or a PWI (Lent, Lopez, et al., 2008, 2011; Lent et al., 2013; Lent, Sheu, et al., 2008). To date, only one study included Latino/a engineering college students; however, the small sample size ($n = 42$) prohibited analyses by racial/ethnic group with this subsample of students (Hackett, Betz, Casas, & Rocha-Singh, 1992). Furthermore, no studies have tested the SCCT model with male, female, and Latino/a engineering students attending a Hispanic serving institution (HSI). More research is needed to test the applicability of SCCT to White male, female, and Latino/a engineering students in diverse institutional types to understand factors related to their satisfaction in engineering.

Purpose of the Study

Our primary purpose in this study was to test several hypotheses in accordance with SCCT propositions with engineering students attending an HSI. First, we investigate whether the SCCT model explains the academic satisfaction in engineering among White and Latino/a engineering students (Model A; see Figure 1). We hypothesized, consistent with SCCT and Lent and Brown's (2006, 2008) work satisfaction model, that (a) interests are predicted by self-efficacy and outcome expectations; (b) choice goals are predicted by self-efficacy, outcome expectations, and interests; and (c) self-efficacy, outcome expectations, and choice goals influence academic satisfaction in engineering.

To ensure that the hypothesized SCCT model (Model A) was the best fit to the data, we compared this model to two alternative models (Models B and C; see Figure 1). Although the original SCCT-based theory (Lent et al., 1994) places greater emphasis upon the direct paths from self-efficacy to outcome expectations and interests and from outcome expectations to interests, there also was some discussion of reciprocal relations among self-efficacy, outcome expectations, and interests within this theory. Furthermore, previous SCCT-related research has found that interests may influence college students' estimation of their own competence (e.g., self-efficacy) in specific subjects such as mathematics (Lent, Brown, Gover, & Nijjer, 1996) or, alternatively, that social cognitive factors (e.g., efficacy) and interests have a reciprocal or

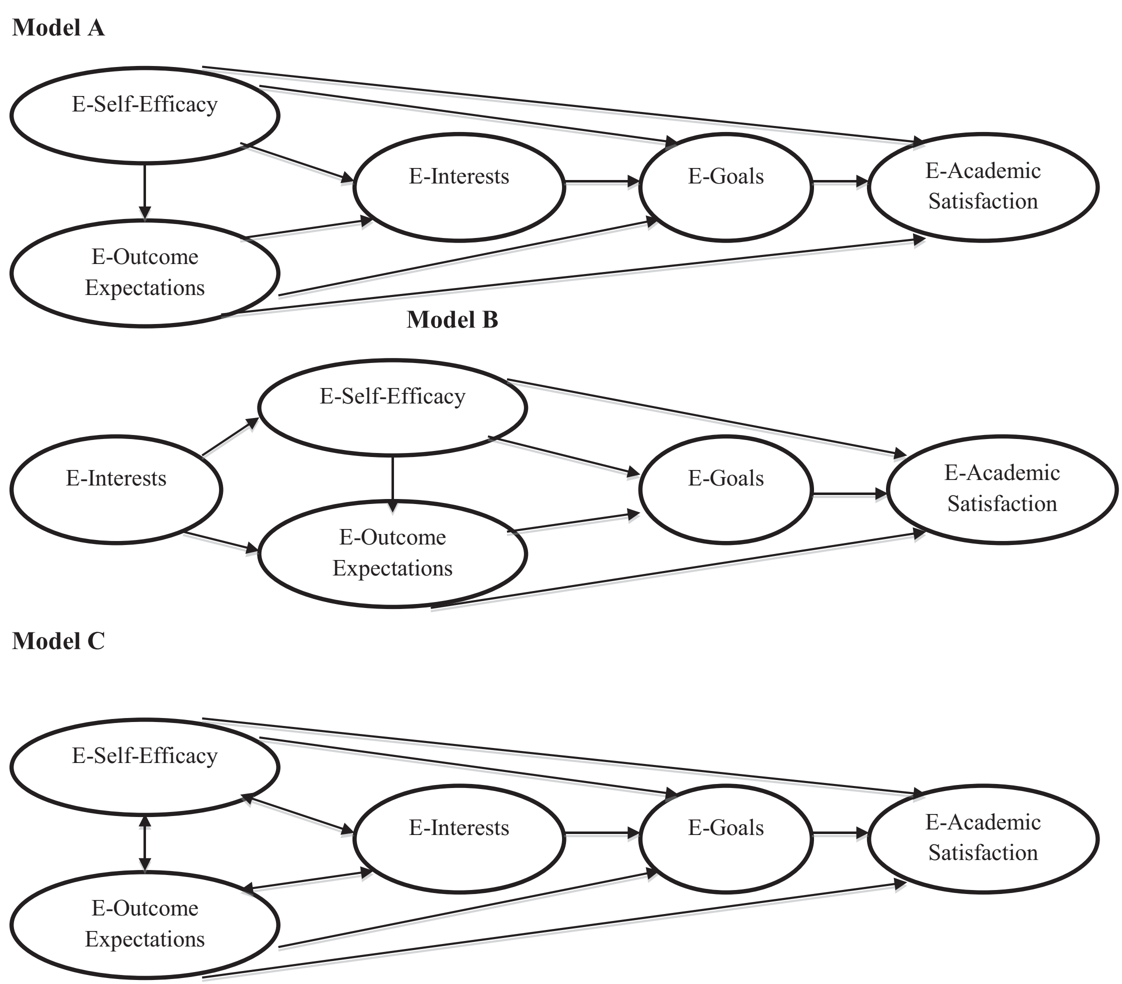

Figure 1. Competing structural models of engineering majors' academic satisfaction. E = Engineering.

bidirectional relation (Nauta, Kahn, Angell, & Cantarelli, 2002). In the first alternative model, Model B, interests indirectly predicted goals and academic satisfaction through self-efficacy and outcome expectations. The second alternative model, Model C, depicted reciprocal relations among self-efficacy, outcome expectations, and interests. Together, these variables predicted goals and academic satisfaction.

After determining which of the three SCCT-related models fit the data the best, we tested for group invariance of the retained model along two dimensions: gender and race/ethnicity. Although SCCT addresses the influence of environmental context in shaping gendered and cultural experiences that can influence learning experiences, the theory does not make any predictions about the relations among variables in the model across groups; thus, the latter research question is exploratory. The latter research questions allow us to assess similarities and differences in the relations among the variables in the model based on one's gender and race/ethnicity to determine if the SCCT model is generalizable across groups.

Method

Participants

Participants were 527 engineering students attending a Hispanic-serving public university in the Southwest. Of the participants, 364 (69.1%) were male and 162 (30.7%) were female (1 did not report gender). Most participants self-identified as Latino/a (n = 289; 54.8%), 38% identified as White (n = 200), and 7.2% (n = 38) identified as bi- or multiracial (one of the groups being Latino/a and/or White). When asked to denote their specific Latino/a ethnic groups, 190 of the 280 self-identified Latinos/as did so. Of these 190, the majority identified their ethnic group as Mexican/Mexican American (n = 137, 72.11%); self-identifications among the remainder of the group were Hispanic (n = 34; 17.9%), Spanish/Spanish American (n = 8; 4.2%), Latino/a (n = 4; 2.1%), American (n = 3; 1.6%), White Hispanic (n = 3; 1.6%), and Puerto Rican (n = 1; 0.5%). Participants represented all years in college, with 17.4% freshmen, 21.2% sophomores, 28.7% juniors, 28.5% seniors, and 2.4% "other" (less than 2% did not report year in college). The mean age of the participants was 21.75 years (SD = 3.31 years; range = 18–34). Of the engineering specialties represented, 107 (20.3%) were in mechanical, 98 (18.6%) were in electrical and computer, 103 (19.5%) were in aerospace, 79 (15.0%) were in civil, 62 (11.8%) were in chemical, 40 (7.6%) were in engineering technology, 14 (2.7%) were in industrial, 7 (1.3%) were in engineering physics, 5 (0.9%) were in surveying, and 12 (2.3%) were in "other."

Instruments

Engineering self-efficacy. We used Lent, Brown, et al.'s (2005) Engineering Self-Efficacy Scale, a four-item measure adapted from the Self-Efficacy for Academic Milestones Scale (Lent, Brown, & Larkin, 1986). The original measure assesses students' confidence in their ability to successfully perform a variety of academic tasks in science and engineering majors. The modified version used in the current study assesses only perceived capabilities for performing well in engineering academic requirements. Participants were asked to indicate their belief in their academic abilities to perform well in engineering (e.g., excel in your engineering major over the next semester) using a scale of 1 (*completely unsure*) to 10 (*completely sure*). Scores were averaged across items with high scores indicating high levels of engineering self-efficacy.

Coefficient alpha scores ranging from .91 to .92 have been reported for this measure with college student samples taking introductory engineering courses (Lent, Brown, et al., 2005; Lent et al., 2007). Total engineering self-efficacy scores correlated positively with engineering outcome expectations (Lent, Brown, et al., 2005; Lent et al., 2007), engineering interests and goals (Lent, Brown, et al., 2005), and engineering goal progress and engineering academic satisfaction (Lent et al., 2007). For the present sample, a coefficient alpha of .90 was obtained for the total scale score.

Engineering outcome expectations. The Engineering Outcome Expectations Scale (Lent et al., 2003) included 10 items that measures a variety of positive outcomes that engineering students might anticipate from earning a bachelor's degree in engineering (e.g., receive a good job offer; do work that I would find satisfying). Participants responded to items using a 10-point Likert scale ranging from 0 (*strongly disagree*) to 9 (*strongly agree*). Item responses were averaged across the items with high scores implying strong positive outcome expectations with regard to an engineering career. Studies with engineering student samples have indicated good internal consistency with alphas ranging from .89 to .91 (Lent et al., 2003; Lent, Brown, et al., 2005). Engineering outcome expectations were positively correlated with engineering interests, social support, and goals (Lent et al., 2003; Lent, Brown, et al., 2005; Lent, Sheu, et al., 2008) and engineering academic satisfaction (Lent et al., 2007). The coefficient alpha for the current study was .91.

Engineering interests. Lent et al. (2003) modified a scale originally designed to measure math- and science-related interests (Lopez & Lent, 1992) to assess engineering interests. Participants were asked to indicate their interest levels in seven engineering-related activities (e.g., reading articles or books about engineering issues; solving complicated technical problems) using a Likert-type scale ranging from 1 (*very low interest*) to 5 (*very high interest).* Item responses were averaged, with high scores reflecting strong interests in engineering-related activities. Previous studies assessing engineering interests have reported adequate estimates of reliability, with alpha coefficients ranging from .66 to .84 with engineering student samples (Lent et al., 2003; Lent, Brown, et al., 2005; Lent, Sheu, et al., 2008). Engineering interest scores were correlated in the expected direction with measures of engineering-related self-efficacy, outcome expectations, and goals (Lent et al., 2001; Lent, Brown, et al., 2005; Lent, Sheu, et al., 2008). For the current sample, the alpha coefficient on this scale was .79.

Engineering goals. Engineering goals were measured with Lent et al.'s (2003) four-item scale asking participants to indicate their level of agreement to statements about their academic intentions in engineering (e.g., I intend to major in an engineering field; I think that earning a bachelor's degree in engineering is a realistic goal for me). Responses ranged from 1 (*strongly disagree*) to 5 (*strongly agree).* Scores were calculated by averaging item responses, with high scores suggest strong intentions to pursue an engineering major. In previous studies with students enrolled in introductory engineering courses, reported alpha coefficients ranged from .93 (Lent, Brown, et al., 2005) to .95 (Lent et al., 2003; Lent, Sheu, et al., 2008). Lent et al. (2003) also reported that engineering goals were associated in the expected directions with the core social cognitive variables of self-efficacy, outcome expectations, interests, supports, barriers, and persistence in engineering. A coefficient alpha value of .92 was obtained for the current sample.

Engineering academic satisfaction. Academic satisfaction was assessed with a 7-item scale previously used by Lent et al. (2007) adapted from a general academic satisfaction scale used by Lent, Singley, et al. (2005) to specify "engineering" as the intended major. Participants rated the degree to which they felt satisfied with their academic studies in engineering (e.g., I am generally satisfied with my academic life in engineering; I enjoy the level of intellectual stimulation in my engineering courses) using a scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree).* Items were averaged, with high scores reflecting greater satisfaction with one's academic studies in engineering. Lent, Singley, et al. (2005) reported an internal consistency estimate of .94 with a sample of students in an introductory engineering class. Engineering academic satisfaction scores correlated in the expected direction with engineering self-efficacy, outcome expectations, supports, and goal progress (Lent, Singley, et al., 2005). The coefficient alpha for the current study was .91.

Procedures

All White and Latino/a engineering students enrolled in a public university located in the Southwest were invited to participate in an online survey administered in spring 2011. According to institutional data, Latino/as and Whites represented 42% and 33%, respectively, of the College of Engineering's student enrollment during the academic year in which the data were collected. Other student groups were international (5%), Native American (4%), Asian American (2%), and African American (1%). Ethnicity was unknown for the remaining 12%. Male students constituted 81% of the engineering student population.

Brief presentations were made in key engineering courses across all levels, flyers were posted around the College of Engineering, and e-mails (including two follow-up reminders) were sent to eligible students inviting them to participate. In an effort to maximize the participation of women engineering students, 2 months after the data collection started, we sent postcards to all female students who had not completed the online survey at that time. A month later, phone calls and text messages were sent to the remaining female students inviting them to participate. Using institutional enrollment data in fall 2010, we estimated the following participation rates: 32% for White men, 33% for Latino men, 62% for Latina women, and 77% for White women. Participants received a $30 gift card to a retail store for their involvement in the study.

Plan of Analysis

Structural equation modeling procedures were conducted to test the fit of the hypothesized model of engineering students' academic satisfaction and to determine if gender and/or race moderated the relations within the model using Mplus 6.11 and maximum likelihood estimation method with robust standard errors (MLR). To ensure more reliable and accurate decisions when choosing models and interpreting findings, we assessed model fit for each analysis with a series of fit indices, including the comparative fit index (CFI), standardized root-mean-square residual (SRMR), and root-mean-square error of approximation (RMSEA). An adequate fit to the data is denoted when CFI $\geq$ .90, SRMR $\leq$ .10, and RMSEA $\leq$ .08, whereas an excellent or close fit to the data is found when CFI $\geq$ .95, SRMR $\leq$ .08, and RMSEA $\leq$ .06 (Kline, 2005). When comparing nested models (i.e., comparing structural models or testing gender and race moderation in the measurement and structural models), we used chi-square tests of difference to determine which models to retain (Kline, 2005). Given the use of MLR, the Satorra–Bentler scaled chi-square tests of difference (SBS$\Delta\chi^2$) were calculated with an equation based on the chi-square values, scaling correction factors, and degrees of freedom of each nested (i.e., more restrictive) and comparison (i.e., less restrictive) model (Satorra & Bentler, 2001).

Prior to model testing, latent variables were created for the unidimensional constructs of engineering self-efficacy, outcome expectations, interests, goals, and academic satisfaction using item parceling procedures (Russell, Kahn, Spoth, & Altmaier, 1998). Item parcels established observed indicators for each latent variable. Prior to creating the item parcels, we screened data using maximum likelihood exploratory factor analysis (EFA) to ensure that each scale had a unidimensional factor structure. Indeed, the examination of scree plots, eigenvalues, and factor loadings indicated that each of the study's variables were unidimensional and thus supported prior research using these same scales (Lent, Brown, et al., 2005; Lent, et al., 2010). Together, the results, prior research, and purpose of the study provided support for item parceling (Little, Cunningham, Shahar, & Widaman, 2002).

To create the item parcels, we used the results of the EFAs to identify and pair items with high, medium, and lower factor loadings to balance loadings across item parcels for each latent variable. Two parcels were created for engineering self-efficacy and goal scales, and three parcels were created for the engineering outcome expectations, interests, and academic satisfaction scales. As suggested by Hagtvet and Nasser (2004), we then conducted a series of second order confirmatory factor analyses to ensure that the parcels adequately loaded onto their corresponding higher order factors.

Next, we tested the adequacy of the measurement model associated with the variables within the hypothesized model of engineering students' academic satisfaction for the full sample and across gender and racial-ethnic groups. We then tested and compared the hypothesized and two alternative structural models. Based on previous research findings (Lent et al., 2003; Lent, Brown, et al., 2005; Lent et al., 2007), Model A suggested that self-efficacy and outcome expectations directly and indirectly predicted academic satisfaction through interests and goals (see Figure 1). However, other research suggests that interests may influence college students' estimation of their own competence (e.g., self-efficacy) in specific subjects such as mathematics (Lent et al., 1996) or, alternatively, that social cognitive factors (e.g., efficacy) and interests have a reciprocal or bidirectional relation (Nauta et al., 2002). Thus, in Model B, interests indirectly predicted goals and academic satisfaction through self-efficacy and outcome expectations (see Figure 1), whereas Model C depicted reciprocal relations among self-efficacy, outcome expectations, and interests and together these variables predicted goals and academic satisfaction (see Figure 1). Models A, B, and C were compared with the Satorra–Bentler scaled chi-square tests of difference to determine which should be retained for further analyses.

Finally, using Mplus and the MLR estimation method, we utilized multiple group analysis with structural equation modeling to determine whether gender or race/ethnicity moderated the relations within the retained model. Following the recommendations of Kline (2005), we first fit the retained model across both gender or racial/ethnic groups at the same time without constricting any parameters (e.g., unconstrained model). Second, we fit the retained model across both gender or racial/ethnic groups constraining all parameters to be equal (e.g., fully constrained model). We then determined if gender or race/ethnicity moderated relations within the model by calculating the SBS$\Delta\chi^2$ between the unconstrained and fully constrained models. If a significant difference was found, we determined that gender or race/ethnicity moderated relations within the model.

Results

Preliminary Analyses

Data screening. We screened for missing data, examined statistical assumptions, and tested for gender and racial-ethnic differences across the variables of interest using IBM SPSS 20.0. When screening the data for missing values using SPSS's multiple imputation feature, we found that there were 797 missing values out of 18,784 in 29 out of 587 cases across the items making up the 5 main variables (i.e., engineering self-efficacy, outcome expectations, interests, goals, and academic satisfaction) used in the present study. According to Little's MCAR test, we found that the data were missing completely at random, as indicated by a nonsignificant chi-square statistic, $\chi^2(62) = 69.54$, $p = .24$. Looking more closely at the data, we found all 29 participants with missing data completed less than 80% of the items representing the study's main variables meeting criterion for deletion (Schlomer et al., 2010). Also, one participant did not provide details about his or her gender and another identified his or her gender as "other." Last, 20 participants were identified as univariate or multivariate outliers, whereas 11 participants were identified as age outliers in that they were over the age of 35 and in career transition, thus having very different life experiences than others in the sample.

Given the information above, we excluded 60 participants who either had missing data or were identified as univariate, multivariate, or age outliers from further analyses. We also excluded 38 self-identified multiracial participants from any analyses based on racial differences. Thus, aforementioned combination of missingness, deletion of outliers, and partial exclusion of those who identified as multiracial resulted in a different number of participants used in the analyses when conducted with the full sample or when racial and gender differences were explored. Out of the original 587 participants, only 527 were included in the full sample analyses, 489 (289 Latinas/os, 200 Whites) were included in analyses examining racial-ethnic differences, and 526 (162 women, 364 men) were included in analyses examining gender differences. Demographic information for 527 participants included in the full sample analyses was reported in the Method section.

We then examined item parcels associated with the present study's variables of interest for skewness and kurtosis with the remaining sample of 527 participants. The statistics and standard errors suggested that engineering outcome expectations and academic satisfaction were moderately, negatively skewed (values between −0.50 and −1.00), whereas engineering self-efficacy and goals were highly, negatively skewed (values less than −1.00). Additionally, engineering goals had a leptokurtic distribution based on kurtosis greater than 3. These findings point to the nonnormality of the data.

Measurement model. On the basis of the fit indices, the measurement model of the latent variables had an excellent fit to the data for the full sample (see Table 1). Additionally, all item parcels significantly loaded on their respective factors (see Table 2). We conducted a series of multiple group analyses, in which where we compared an unconstrained model (i.e., all paths were allowed to vary across groups) to a constrained model (i.e., all factor loadings were constrained across groups) for gender and then for race/ethnicity to determine whether the measurement model differed by these groupings (see Table 1 for model fit indices). No significant differences between the unconstrained and constrained models were found by gender, SBS$\Delta\chi^2(8) = 8.17$, $p > .05$, or race/ethnicity, SBS$\Delta\chi^2(8) = 15.46$, $p > .05$. Taken together, these results suggested that the measurement model was an excellent fit to the data for the full sample and for both gender and racial-ethnic groups.

Please see Table 1 for fit indices for the measurement and structural models. See Table 2 for the means, standard deviations, and factor loadings for the study's measured variables for the full sample and by gender and race/ethnicity. See Table 3 for the correlations among the latent variables by gender and race/ethnicity. Correlations for the full sample can be obtained from the first author.

Primary Analyses

Comparing structural models of engineering students' academic satisfaction. We first fit the hypothesized structural model of academic satisfaction (Model A) with the full sample of 527 engineering students finding a close model-to-data fit (see Table 1 and Figure 1). Additionally, all paths were significant except the path from engineering interests to goals. In particular, the CFI was greater than .95, the SRMR was below .08, and the RMSEA was.06, all suggesting an excellent fit to the data (Loehlin, 1998). Overall, Model A explained 9.7%, 19.1%, 26.5%, and 42.7% of the variance in engineering students' engineering outcome expectations, interests, goals, and academic satisfaction.

We then tested two alternative structural models of engineering students' academic satisfaction (Models B and C). In Model B, the fit indices indicated a close fit to the data (see Table 2 and Figure 1), and again all paths were significant except for the path from engineering interests to goals. Model B explained 13.0%, 14.8%, 24.7%, and 40.7% of the variance in engineering self-efficacy, outcome expectations, goals, and academic satisfaction, respectively. In Model C, the fit indices indicated a close fit to the data (see Table 2 and Figure 1), and all the paths were significant except engineering interests to goals. Model C explained 26.6%

Table 1
Summary of Fit Statistics for the Multiple Groups Analyses and the Chi-Square Tests of Difference

Model	χ^2	*df*	CFI	SRMR	RMSEA	95% CI
Measurement model						
Full sample	137.90	55	.97	.04	.05	[.042, .065]
Gender						
Unconstrained[a]	255.42	118	.96	.05	.07	[.055, .078]
Constrained factor loadings[a]	260.72	126	.96	.07	.06	[.053, .075]
Race						
Unconstrained[a]	237.58	118	.96	.05	.06	[.052, .076]
Constrained factor loadings[b]	252.94	126	.96	.08	.06	[.053, .076]
Structural models						
Full sample						
Model A	152.74	56	.97	.05	.06	[.046, .068]
Model B	156.37	57	.97	.06	.06	[.047, .068]
Model C	137.90	55	.97	.04	.05	[.042, .065]
Gender: Model C						
Fully constrained[a]	263.82	136	.96	.08	.06	[.049, .071]
Race/ethnicity: Model C						
Fully constrained[b]	267.85	136	.96	.10	.06	[.046, .118]

Note. All χ^2 were significant at the $p = .001$ level. Full sample, $n = 527$. χ^2 = chi-square; *df* = degrees of freedom; CFI = comparative fit index; SRMR = standardized root-mean-square residual; RMSEA = Steiger's root-mean-square error of approximation; CI = confidence interval.
[a] Indicates multiple groups analysis for gender (men = 364; women = 162). [b] Indicates multiple group analysis for race/ethnicity (Latina/o = 289; White = 200).

and 45.1% of the variance in engineering goals and academic satisfaction, respectively.

Given that Models A B, and C were nested, we compared their chi-square values using SBS$\Delta\chi^2$. According to these analyses, Model A did not significantly differ from Model B (SBS$\Delta\chi^2(1)$ = 3.58, $p > .05$), and thus both models fit the data equally well. However, Model C did significantly differ from both Model A (SBS$\Delta\chi^2(1) = 13.74$, $p < .001$) and Model B (SBS$\Delta\chi^2(2)$ = 17.55, $p < .001$), suggesting it was a better fit to the data. Based on these findings, the bidirectional structural model (Model C) was retained for use in all subsequent analyses. See Figure 2 for the path coefficients for the full sample.

Gender as a moderator in the bidirectional structural model. To determine if gender moderated the relations within the bidirectional structural model (Model C), we tested a structural model where gender groups were not allowed vary on any of the model parameters (i.e., the fully constrained model) and found an adequate to good fit to the data, RMSEA = .06 (.049, .071); CFI =

Table 2
Means and Standard Deviations of Measured Variables for Total Sample and by Gender and Race/Ethnicity

	Full sample			Men			Women			Latinas/os			Whites		
Variable	*M*	*SD*	Factor loading	*M*	*SD*	Factor loading	*M*	*SD*	Factor loading	*M*	*SD*	Factor loading	*M*	*SD*	Factor loading
Engineering self-efficacy															
Parcel 1	8.62	1.38	.87	8.70	1.29	.88	8.43	1.53	.86	8.58	1.37	.84	8.71	1.29	.87
Parcel 2	8.37	1.62	.92	8.47	1.55	.92	8.15	1.77	.93	8.43	1.55	.98	8.26	1.71	.89
Engineering outcome expectations															
Parcel 1	8.66	1.11	.88	8.59	1.10	.88	8.82	1.12	.90	8.71	1.11	.87	8.60	1.07	.89
Parcel 2	8.71	1.10	.87	8.61	1.14	.85	8.94	0.99	.90	8.88	1.07	.87	8.52	1.09	.88
Parcel 3	8.78	1.02	.90	8.69	1.01	.91	8.97	1.03	.88	8.92	0.95	.90	8.59	1.04	.89
Engineering interests															
Parcel 1	3.94	0.64	.75	3.96	0.64	.74	3.91	0.65	.75	3.99	0.64	.75	3.89	0.64	.72
Parcel 2	3.75	0.79	.78	3.82	0.78	.79	3.60	0.80	.81	3.81	0.75	.77	3.65	0.83	.77
Parcel 3	3.98	0.76	.76	3.99	0.78	.75	3.98	0.72	.76	4.05	0.75	.78	3.90	0.76	.75
Engineering goals															
Parcel 1	4.77	0.48	.89	4.76	0.49	.87	4.80	0.45	.92	4.77	0.48	.86	4.79	0.46	.84
Parcel 2	4.77	0.47	.86	4.75	0.48	.85	4.81	0.45	.89	4.76	0.47	.87	4.79	0.46	.90
Engineering academic satisfaction															
Parcel 1	4.37	0.58	.93	4.36	0.56	.93	4.39	0.64	.92	4.41	0.54	.91	4.33	0.61	.94
Parcel 2	4.22	0.72	.85	4.23	0.69	.85	4.19	0.77	.86	4.24	0.69	.80	4.20	0.70	.87
Parcel 3	4.32	0.64	.85	4.31	0.62	.83	4.33	0.68	.90	4.34	0.62	.83	4.28	0.65	.87

Note. All factor loadings are statistically significant at the $p < .01$.level.

Table 3
Correlations Between Latent Variables by Gender and Race/Ethnicity

Variable	Gender					Race/ethnicity				
	ESE	EOE	EI	EG	EAS	ESE	EOE	EI	EG	EAS
Engineering self-efficacy (ESE)	—	.32	.36	.41	.50	—	.25	.20	.29	.39
Engineering outcome expectations (EOE)	.36	—	.34	.42	.46	.31	—	.35	.38	.27
Engineering interests (EI)	.28	.46	—	.29	.45	.46	.40	—	.27	.47
Engineering goals (EG)	.43	.38	.35	—	.51	.50	.50	.30	—	.50
Engineering academic satisfaction (EAS)	.48	.47	.39	.57	—	.55	.55	.40	.55	—

Note. Values for men are above the diagonal and values for women are below the diagonal on the left side of the table; values for Latinas/os are above the diagonal and values for Whites are below the diagonal on the right side of the table. All correlations were significant at $p < .001$.

.96; SRMR = .08. The measurement model with factor loadings constrained across gender groups and structural paths allowed to vary (i.e., covariances and/or direct path among latent variables) was then compared to the fully constrained structural model, resulting in a nonsignificant change in chi-square, $SBS\Delta\chi^2(10) = 6.11$, $p > .05$, and suggesting no detectable model differences. Thus, it was concluded that gender did not moderate relations within the bidirectional structural model (Model C). Relations within this model explained 26.3% and 27.9% of the variance in engineering goals and 46.5% and 40.0% of the variance in engineering academic satisfaction for men and women, respectively, in our sample.

Race/ethnicity as a moderator in the bidirectional structural model. We then tested race/ethnicity to determine if it moderated the relations with the bidirectional structural model. First, we tested a fully constrained structural model where the racial/ethnic groups were not allowed to vary on any of the parameters and found an adequate to good fit to the data, RMSEA = .06 (.052, .074); CFI = .96, SRMR = .10. We then compared the chi-squares for the fully constrained model to the unconstrained model across these groups using $SBS\Delta\chi^2$ and found no detectable differences between racial/ethnic groups, $SBS\Delta\chi^2(7) = 6.05$, $p > .05$. Given this, we determined that race/ethnicity did not moderate the relations within Model C. Relations within this model explained 25.0% and 31.0% of the variance in engineering goals and 46.1% and 40.3% of the variance in engineering academic satisfaction for Latinos/as and Whites, respectively, in this sample of undergraduate engineering majors.

Discussion

The current study adds to the SCCT literature in the domain of engineering, and it extends this literature by investigating gender (women vs. men) and racial/ethnic (Latino/a vs. White) differences among a sample of engineering students attending a Hispanic serving institution (HSI). After comparison of three SCCT-based models depicting academic satisfaction in engineering, the findings of the present study indicated that (a) a bidirectional model fit the data for the full sample; (b) all of the hypothesized relations were significant for the full sample, except the path from engineering interests to goals; (c) SCCT predictors accounted for a significant amount of variance in engineering goals and academic satisfaction; and (d) the model parameters did not vary across men and women or across Latino/a and White engineering undergraduate students. Collectively, these results provide strong support for the validity of SCCT in explaining the academic satisfaction of men and women engineering students as well as Latino/a and White engineering students attending an HSI, and they also expand

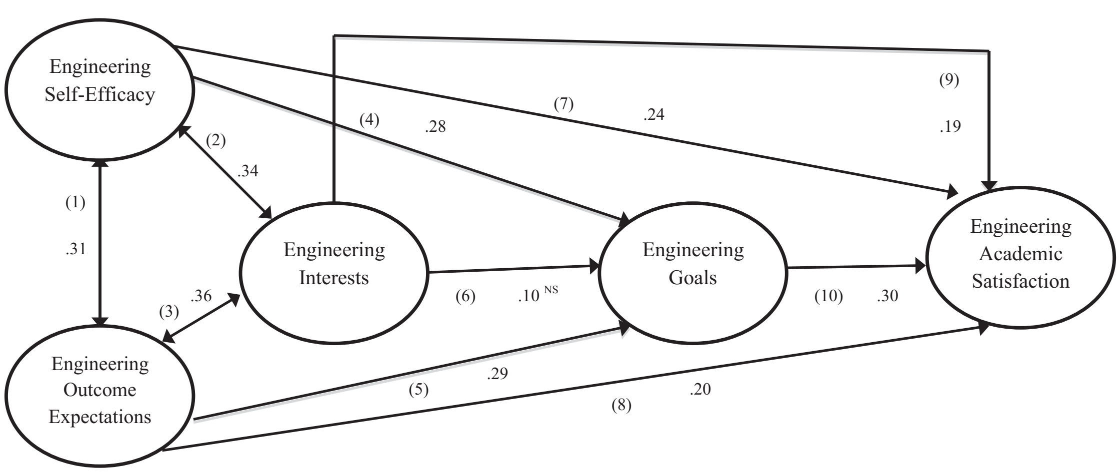

Figure 2. The bidirectional model of engineering majors' academic satisfaction for the full sample. Path coefficients (i.e., standardized regression weights) appear outside parentheses; individual path numbers appear inside parentheses. All paths were significant at .001, except one path denoted with NS for nonsignificant.

our understanding of the relations among self-efficacy, outcome expectations, and interests. To our knowledge, this is the first SCCT engineering-related study to obtain a sizable number of Latino/a engineering students to conduct racial/ethnic comparisons. Below, we highlight important findings from the study.

First, though the data closely fit the hypothesized model and two alternative models that we tested, our results indicated that the bidirectional model, which supports the reciprocal relations among self-efficacy, outcome expectations, and interests, was a significantly better fit to the data than the hypothesized model and the model in which interests was an antecedent to self-efficacy and outcome expectations. This finding suggests that, in addition to SCCTs propositions regarding these variables, self-efficacy is informed by one's anticipated outcomes and engaging in activities of interest, and interests are a source of outcome expectations. Prior longitudinal studies have also supported the bidirectional relations between self-efficacy and interests (Lent, Sheu, et al., 2008, 2010; Nauta, 2007; Nauta et al., 2002; Tracey, 2002), self-efficacy and outcome expectations (Lent, Sheu, et al., 2008, 2010), and outcome expectations and interests (Lent, Sheu, et al., 2008). Future longitudinal research is needed to test these bidirectional relations with samples of engineering students attending HSIs.

Congruent with SCCT propositions and similar to those of prior SCCT studies in the domain of engineering (Byars-Winston et al., 2010; Lent et al., 2003, 2007, 2010, 2013; Lent, Brown, et al., 2005; Lent, Sheu, et al., 2008), our results largely supported the relations between self-efficacy, interests, and goals, suggesting that engineering students attending HSIs develop interests in engineering activities when they possess high confidence in their abilities to successfully perform engineering tasks and they formulate goals that are consistent with their self-efficacy beliefs. Our findings are also comparable to those of previous studies in which engineering academic satisfaction was positively associated to engineering self-efficacy (Lent et al., 2007, 2013), interests (Lent et al., 2013), and goals (Lent et al., 2007). The link among these variables suggests that engineering students who are highly satisfied with their academic program in engineering are likely to believe that they can perform well in their engineering academic pursuits, to report high interests in engineering activities, and to have high intentions to persist as engineering majors.

All paths in the model associated with outcome expectations were significant for the full sample. Most prior SCCT engineering studies failed to provide support for the effects of engineering outcome expectations on engineering interests (Lent et al., 2003, 2007, 2010; Lent, Sheu, et al., 2008), engineering goals (Lent et al., 2003, 2007, 2010; Lent, Brown, et al., 2005; Lent, Sheu, et al., 2008), and engineering academic satisfaction (Lent et al., 2007). However, the current study indicated that the links from outcome expectations to these variables were significant and positive. Thus, the anticipation of positive outcomes for receiving a bachelor's degree in engineering was likely to result in higher interests, goals, and academic satisfaction in engineering among our sample of engineering students. It is possible that the academic climate at this HSI provided more learning opportunities (i.e., role modeling, verbal encouragement) for women and Latino/as that influenced their anticipation of positive outcomes associated with engineering. Future research should explore whether these findings are generalized to engineering students attending other HSIs as well as the effects of academic environment factors on engineering students across institutional types.

Our findings are consistent with prior engineering-related studies that indicated that the SCCT predictors accounted for a significant amount of variance in engineering goals (Lent et al., 2003; Lent, Brown, et al., 2005) and engineering academic satisfaction (Lent et al., 2007, 2013). However, with a few exceptions, the strength of the relations among the variables in our study was weaker and the variance accounted for in engineering goals and academic satisfaction was smaller than those reported in other studies. The path coefficients reported in our study appear to be more similar to those found in other SCCT engineering studies that included samples composed of students from underrepresented racial/ethnic groups in engineering (e.g., Byars-Winston et al., 2010; Lent et al., 2010). Thus, although the data fit the bidirectional model well, the effects of the core SCCT predictor variables are apparently more modest with racially/ethnically diverse samples. Other contextual variables not included in the current study may serve as important predictors in the formulation of interests, goals, and academic satisfaction among engineering students who are from underrepresented racial/ethnic groups or who are attending institutions where White students are not the numerical majority.

Finally, the SCCT model was invariant across both men and women and Latino/a and White students in engineering. Invariance in the SCCT model has also been reported in prior SCCT research related to science, technology, engineering, and mathematics (STEM) fields across both gender (Lent, Brown, et al., 2005; Lent, Lopez, et al., 2008) and racial groups (Lent, Brown, et al., 2005; Lent, Lopez, et al., 2008, 2011). In short, all of the core SCCT variables that we tested were significant sources of engineering academic satisfaction. We believe that our findings provide additional support for the generalizability of this bidirectional SCCT-based model in predicting the engineering-related goals and academic satisfaction across diverse student groups based on race/ethnicity and gender.

Implications for Practice

Though tentative due to the cross-sectional nature of the present study, these results suggest different avenues for interventions targeted at increasing the academic satisfaction of engineering students attending an HSI. Psychologists who develop and evaluate STEM academic and career interventions, particularly for underrepresented groups in engineering such as Latino/as and women students, can consider ways to apply these findings to help high school and college students develop engineering career goals. The bidirectional model indicates reciprocal relations among self-efficacy, outcome expectations, and interests; thus, interventions that target increases in any one of these areas are suggested. Programs that focus on developing self-efficacy may benefit from designing interventions similar those used in prior studies (e.g., Betz & Schifano, 2000; Turner & Lapan, 2005), which provided evidence that relatively brief interventions can increase girls and women students' self-efficacy beliefs. High school math and science courses, engineering enrichment programs, and college-access programs can plan educational activities that incorporate Bandura's (1977, 1986) four sources of self-efficacy (i.e., performance accomplishments, social persuasion, vicarious learning, and managing emotional arousal) may help Latino/a and women students to develop self-efficacy beliefs in engineering. Counseling psychologists can also work with high school and college students to address expectations for engaging in engineering-related activities and help students assess both positive and negative anticipated outcomes for pursuing engineering. Interventions can focus on the positive benefits to self, family, community and society for pursuing engineering careers as well as the potential negative expectancies that students might encounter, particularly those specific to being a member of an underrepresented group in engineering. Future research should evaluate the effects of engineering-related academic and career interventions on engineering outcome expectations. Professionals should also expand their interventions with families, teachers, and educational institutions to provide stereotype-free learning environments that convey positive messages about engineering to women and Latino/a students and to educate these key adults on their influences on the development of engineering self-efficacy beliefs and outcome expectations in these youths and young adults. Finally, exposing students to and allowing them to engage in engineering-related activities that they are interested in is another potential avenue for developing and strengthening students' engineering interests. Future research can examine the effectiveness of interventions that include one, two, or three of these components (self-efficacy, outcome expectations, interests) in enhancing students' engineering goals or academic satisfaction.

Limitations and Conclusion

The findings of this study should be considered in the context of the study's limitations. First, the use of cross-sectional data limits our understanding of the temporal relations among the variables in the model. Future longitudinal research is needed to assess the results of this study and to examine whether the bidirectional model is superior to other models in explaining the academic satisfaction of engineering students. Another limitation is the mono-method and mono-source approach to data collection, in particular, our use of single interest and self-efficacy scales. With regard to the latter, Tracey (2012) has argued that narrow interest and self-efficacy measures, such as those used in STEM studies that focus on a limited area of interests, are susceptible to bias and create problems in interpretation of the findings. Future research should include broader interest and self-efficacy measures (Tracey, 2012) and consider obtaining data through other means and sources, such as teachers' and professors' evaluations of students' skills in engineering. Participants were drawn from a single institution. Future research should be conducted at multiple HSIs to explore whether these findings extend to engineering students attending other similar institutions. Also, we did not explore the effects of contextual variables or other key variables (i.e., personality and affective traits) in Lent and Brown's (2006, 2008) model. Future research that incorporates these variables is needed to determine if these variables explain additional variance in HSI engineering students' goals and academic satisfaction and to identify additional venues for intervention to increase engineering-related self-efficacy, interests, goals, and academic satisfaction among these students. Other researchers can also examine whether year in school moderates the relations among the variables, as it is possible that the relations among the SCCT variables are stronger for juniors and seniors who have experienced some level of success and persisted in engineering (and in college) than their first-year counterparts. Additionally, future research should test the link between goals and satisfaction to actual persistence behaviors or academic performance (i.e., GPA) to determine their relations to these outcomes. Findings from such studies can be utilized to improve retention efforts among engineering students enrolled at an HSI.

In conclusion, the findings of this study provide strong support for a bidirectional model of SCCT in which self-efficacy, outcome expectations, and interests are reciprocally related with Latino/a and White and men and women engineering students attending an HSI. However, our findings also indicate that other variables besides the core SCCT variables may be helpful in explaining the engineering goals and academic satisfaction among HSI engineering students. Future research can build on these findings by adding gender and cultural variables to the model that may account for a larger proportion of variance in the outcome variables. Further, future research that draws engineering students from multiple sites can incorporate institutional factors (i.e., percentage of women engineering faculty, percentage of Latino/a engineering faculty, mentoring) to assess potential institutional and climate differences for women and Latino/a students.

References

Aud, S., Hussar, W., Kena, G., Bianco, K., Frohlich, L., Kemp, J., & Tahan, K. (2011). *The condition of education 2011* (NCES 2011–033). Washington, DC: U.S. Government Printing Office.

Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Upper Saddle River, NJ: Prentice Hall.

Betz, N. E., & Schifano, R. S. (2000). Evaluation of an intervention to increase Realistic self-efficacy and interests in college women. *Journal of Vocational Behavior, 56,* 35–52.

Blustein, D. L. (2001). Extending the reach of vocational psychology: Toward an inclusive and integrative psychology of working. *Journal of Vocational Behavior, 59,* 171–182.

Byars-Winston, A., Estrada, Y., Howard, C., Davis, D., & Zalapa, J. (2010). Influence of social cognitive and ethnic variables on academic goals of underrepresented students in science and engineering: A multiple-groups analysis. *Journal of Counseling Psychology, 57,* 205–218. doi:10.1037/a0018608

Cohoon, J. M., & Aspray, W. (Eds.). (2006). *Women and information technology: Research on underrepresentation*. Cambridge, MA: MIT Press.

Ferry, T. R., Fouad, N. A., & Smith, P. L. (2000). The role of family context in a social cognitive model for career-related choice behavior: A math and science perspective. *Journal of Vocational Behavior, 57,* 348–364.

Fouad, N. A., & Byars-Winston, A. M. (2005). Cultural context of career choice: Meta-analysis of race/ethnicity differences. *Career Development Quarterly, 53,* 223–233.

Fouad, N. A., & Smith, P. L. (1996). A test of a social cognitive model for middle school students: Math and science. *Journal of Counseling Psychology, 43,* 338–346. doi:10.1037/0022-0167.43.3.338

Gainor, K. A., & Lent, R. W. (1998). Social cognitive expectations and racial identity attitudes in predicting the math choice intentions of Black college students. *Journal of Counseling Psychology, 45,* 403–413. doi:10.1037/0022-0167.45.4.403

Hackett, G., Betz, N. E., Casas, J. M., & Rocha-Singh, I. A. (1992). Gender, ethnicity, and social cognitive factors predicting the academic achievement of students in engineering. *Journal of Counseling Psychology, 39,* 527–538. doi:10.1037/0022-0167.39.4.527

Hagtvet, K. A., & Nasser, F. M. (2004). How well do item parcels represent conceptually defined latent constructs? A two-facet approach. *Structural Equation Modeling, 11,* 168–193. doi:10.1207/s15329007sem1102_2

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York, NY: Guilford Press.

Lent, R. W. (2004). Toward a unifying theoretical and practical perspective on well-being and psychosocial adjustment. *Journal of Counseling Psychology, 51,* 482–509. doi:10.1037/0022-0167.51.4.482

Lent, R. W., & Brown, S. D. (2006). Integrating person and situation perspectives on work satisfaction: A social-cognitive view. *Journal of Vocational Behavior, 69,* 236–247. doi:10.1016/j.jvb.2006.02.006

Lent, R. W., & Brown, S. D. (2008). Social cognitive career theory and subjective well-being in the context of work. *Journal of Career Assessment, 16,* 6–21. doi:10.1177/1069072707305769

Lent, R. W., Brown, S. D., Brenner, B., Chopra, S. B., Davis, T., Talleyrand, R., & Suthakaran, V. (2001). The role of contextual supports and barriers in the choice of math/science educational options: A test of social cognitive hypotheses. *Journal of Counseling Psychology, 48,* 474–483. doi:10.1037/0022-0167.48.4.474

Lent, R. W., Brown, S. D., Gover, M. R., & Nijjer, S. K. (1996). Cognitive assessment of the sources of mathematics self-efficacy: A thought-listing analysis. *Journal of Career Assessment, 4,* 33–46. doi:10.1177/106907279600400102

Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior, 45,* 79–122. doi:10.1006/j.jvb.1994.1027

Lent, R. W., Brown, S. D., & Hackett, G. (2000). Contextual supports and barriers to career choice: A social cognitive analysis. *Journal of Counseling Psychology, 47,* 36–49. doi:10.1037/0022-0167.47.1.36

Lent, R. W., Brown, S. D., & Larkin, K. C. (1986). Self-efficacy in the prediction of academic performance and perceived career options. *Journal of Counseling Psychology, 33,* 265–269. doi:10.1037/0022-0167.33.3.265

Lent, R. W., Brown, S. D., Schmidt, J., Brenner, B., Lyons, H., & Treistman, D. (2003). Relation of contextual supports and barriers to choice behavior in engineering majors: Test of alternative social cognitive models. *Journal of Counseling Psychology, 50,* 458–465. doi:10.1037/0022-0167.50.4.458

Lent, R. W., Brown, S. D., Sheu, H.-B., Schmidt, J., Brenner, B. R., Golster, C. S., . . . Treistman, D. (2005). Social cognitive predictors of academic interests and goals in engineering: Utility for women and students at historically Black universities. *Journal of Counseling Psychology, 52,* 84–92. doi:10.1037/0022-0167.52.1.84

Lent, R. W., Lopez, A. M., Lopez, F. G., & Sheu, H.-B. (2008). Social cognitive career theory and the prediction of interests and choice goals in the computing disciplines. *Journal of Vocational Behavior, 73,* 52–62. doi:10.1016/j.jvb.2008/01.002

Lent, R. W., Lopez, F. G., Sheu, H.-B., & Lopez, A. M. (2011). Social cognitive predictors of the interests and choices of computing majors: Applicability to underrepresented students. *Journal of Vocational Behavior, 78,* 184–192. doi:10.1016/j.jvb.2010.10.006

Lent, R. W., Miller, M. J., Smith, P. E., Watford, B. A., Lim, R. H., Hui, K., . . . Williams, K. (2013). Social cognitive predictors of adjustment to engineering majors across gender and race/ethnicity. *Journal of Vocational Behavior, 83,* 22–30. doi:10.1016/j.jvb.2013.02.006

Lent, R. W., Sheu, H.-B., Gloster, C. S., & Wilkins, G. (2010). Longitudinal test of the social cognitive model of choice in engineering students at historically Black universities. *Journal of Vocational Behavior, 76,* 387–394. doi:10.1016/j.jvb.2009.09.002

Lent, R. W., Sheu, H.-B., Singley, D., Schmidt, J. A., Schmidt, L. C., & Gloster, C. S. (2008). Longitudinal relations of self-efficacy to outcome expectations, interests, and major choice goals in engineering students. *Journal of Vocational Behavior, 73,* 328–335. doi:10.1016/j.jvb.2008.07.005

Lent, R. W., Singley, D., Sheu, H.-B., Gainor, K., Brenner, B. R., Treistman, D., & Ades, L. (2005). Social cognitive predictors of domain and life satisfaction: Exploring the theoretical precursors of subjective well-being. *Journal of Counseling Psychology, 52,* 429–442. doi:10.1037/0022-0167.52.3.429

Lent, R. W., Singley, D., Sheu, H.-B., Schmidt, J. A., & Schmidt, L. C. (2007). Relation of social-cognitive factors to academic satisfaction in engineering students. *Journal of Career Assessment, 15,* 87–97. doi:10.1177/1069072706294518

Little, T. D., Cunningham, W. A., Shahar, G., & Widaman, K. F. (2002). To parcel or not to parcel: Exploring the question, weighing the merits. *Structural Equation Modeling, 9,* 151–173. doi:10.1207/s1538007sem0902_1

Loehlin, J. (1998). *Latent variable models: An introduction to factor, path, and structural analysis* (3rd ed.). Mahwah, NJ: Erlbaum.

Lopez, F. G., & Lent, R. W. (1992). Sources of mathematics self-efficacy in high school students. *Career Development Quarterly, 41,* 3–12.

Morrow, S. L., Gore, P. A., Jr., & Campbell, B. W. (1996). The application of a sociocognitive framework to the career development of lesbian women and gay men. *Journal of Vocational Behavior, 48,* 136–148.

Nauta, M. M. (2007). Career interests, self-efficacy, and personality as antecedents of career exploration. *Journal of Career Assessment, 15,* 162–180. doi:10.1177/1069072706298018

Nauta, M. M., Kahn, J. H., Angell, J. W., & Cantarelli, E. A. (2002). Identifying the antecedent in the relation between career interests and self-efficacy: Is it one, the other, or both? *Journal of Counseling Psychology, 49,* 290–301. doi:10.1037/0022-0167.49.3.290

Navarro, R. L., Flores, L. Y., & Worthington, R. L. (2007). Mexican American middle school students' goal intentions in mathematics and science: A test of social cognitive career theory. *Journal of Counseling Psychology, 54,* 320–335. doi:10.1037/0022-0167.54.3.320

Quimby, J. L., Seyala, N. D., & Wolfson, J. L. (2007). Social cognitive predictors of interests in environmental science: Recommendations for environmental educators. *Journal of Environmental Education, 38,* 43–52.

Russell, D. W., Kahn, J. H., Spoth, R., & Altmaier, E. M. (1998). Analyzing data from experimental studies: A latent variable structural equation modeling approach. *Journal of Counseling Psychology, 45,* 18–29. doi:10.1037/0022-0167.45.1.18

Satorra, A., & Bentler, P. M. (2001). A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika, 66,* 507–514.

Schaefers, K. G., Epperson, D. L., & Nauta, M. M. (1997). Women's career development: Can theoretically derived variables predict persistence in engineering majors? *Journal of Counseling Psychology, 44,* 173–183. doi:10.1037/0022-0167.44.2.173

Schlomer, G. L., Bauman, S., & Card, N. A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counseling Psychology, 57,* 1–10.

Sheu, H.-B., & Lent, R. W. (2009). A social cognitive perspective on well-being in educational and work settings: Cross-cultural considerations. *International Journal of Educational Vocational Guidance, 9,* 45–60.

Tracey, T. J. G. (2002). Development of interests and competency beliefs: A 1-year longitudinal study of fifth- to eighth-grade students using the ICA-R and structural equation modeling. *Journal of Counseling Psychology, 49,* 148–163. doi:10.1037/0022-0167.49.2.148

Tracey, T. J. G. (2012). Problems with single interest scales: Implications of the general factor. *Journal of Vocational Behavior, 81,* 378–384. doi:10.1016/j.jvb.2012.10.001

Turner, S. L., & Lapan, R. T. (2005). Evaluation of an intervention to increase non-traditional career interests and career-related self-efficacy among middle-school adolescents. *Journal of Vocational Behavior, 66,* 516–531.

Waller, B. (2006). Math interest and choice intentions of non-traditional African-American college students. *Journal of Vocational Behavior, 68,* 538–547.

Received May 10, 2013
Revision received July 18, 2013
Accepted July 18, 2013 ■