Predicting the Academic Engagement of Women and Students at Historically Black Universities: A Social Cognitive Approach

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Abstract

We examined the utility of social cognitive career theory (SCCT) in predicting the academic persistence goals of (a) women versus men and of (b) students at historically Black versus predominantly White universities. Participants (487 students enrolled in introductory engineering courses at three universities) completed measures of SCCT's central person (e.g., self-efficacy) and contextual (e.g., social support) variables. Findings indicated that the set of SCCT variables accounted for a large proportion of the variance in academic goals, regardless of student sex or university type. Implications for future research and for practical efforts to attract and retain women and students of color within engineering are discussed.

Introduction

Social cognitive career theory[4] (SCCT) is aimed at explaining the processes through which people develop basic academic and career-related interests, translate their interests into choices, and achieve performances of varying quality in their educational and occupational pursuits. Among its predictions, SCCT maintains that people develop interests in activities which they believe they can perform effectively and for which they anticipate receiving positive outcomes. (Beliefs about how well one can perform particular activities are referred to as "self-efficacy" beliefs; beliefs about the consequences of performing particular activities are termed "outcome expectations.") The theory also holds that the academic and career choices that people make are influenced by their interests, self-efficacy, and outcome expectations, as well as by the environmental supports and barriers they have experienced, or expect to experience, in relation to particular choice alternatives.

SCCT has been attracting a good deal of inquiry in recent years[5]. In a subset of studies

specifically aimed at college students pursuing engineering and science majors, self-efficacy and certain other social cognitive variables have been found to be good predictors of students' interests, goals, persistence, and performance [3,6,7,9,10,12,13.]. Although some of this research has explored the predictive utility of social cognitive variables relative to women[13] or students of color,[3] there remains an important need to examine the extent to which hypothesized predictor-criterion relationships hold across sex and race/ethnicity in science and engineering. There is also a need to better understand the role of environmental supports and barriers relative to choice and persistence in science and engineering majors[10,13]. Such research may shed light on the reasons why particular groups of students are underrepresented within science and technology-oriented fields – and may suggest theory-derived methods to help attract and retain these students.

In the present study, we administered measures of SCCT variables to engineering students at three universities (one predominantly White and two historically Black). We hypothesized that the set of theoretical variables (self-efficacy, outcome expectations, interests, and social supports and barriers) would predict students' intentions to remain in engineering (i.e., persistence goals). In particular, we hypothesized that the SCCT variables would have utility in predicting the persistence goals of women as well as men, and of students at historically Black as well as at predominantly White universities.

Method

Participants were 487 students attending introductory engineering classes at one of three Eastern universities. Two of the three were historically Black universities, one a private and one a state university. The 221 students from these two universities included 70 women and 150 men (one student did not indicate sex). They were primarily first-year (76%) and second-year (16%) students, with a mean age of 19.13 years, SD = 2.14. In terms of race/ethnicity, 87% self-identified as Black or African American, 2% as White or European American, 2% as Native American, 1% as Hispanic American, 1% as Asian American, and 7% reported other racial/ethnic identifications. Participants from the third university, a predominantly White state university, included 266 students (52 women, 214 men), who were also mostly in their first (80%) or second (13%) years of college. Their mean age was 18.52 years, SD = 2.53. Self-reported racial/ethnic designations included Black or African American, 9%; White or European American, 63%; Hispanic American, 3%; Asian American, 22%; and 3% reported other racial/ethnic identifications.

All participants completed the research measures in class during the last two weeks of the same semester (Fall, 2001). Measures included two types of efficacy beliefs (academic milestone self-efficacy and coping efficacy), outcome expectations, interests, goals, and social supports and barriers related to pursuit of engineering majors. The academic milestone self-efficacy measure asked students to indicate their confidence in their ability to successfully perform specific academic tasks required for success in engineering majors (e.g., "how much confidence do you have in your ability to *excel* in your academic major over the next semester"). The coping efficacy measure asked participants to indicate their

confidence in their ability to cope with a variety of barriers, or problems, that engineering students could potentially experience (e.g., "cope with a lack of support from professors or your advisor").

The outcome expectations measure listed positive outcomes that could result from earning a BS degree in engineering (e.g., “earn an attractive salary”). Interests were measured by asking participants to indicate their degree of interest in performing engineering-related activities (e.g., "solving complicated technical problems"). To assess social supports and barriers, participants were asked to indicate how likely they would be to experience a variety of supportive (e.g., “get encouragement from your friends for pursuing this major”) and non-supportive (e.g., “feel pressure from parents or other important people to change your major to some other field”) conditions if they were to pursue an engineering major. The goal measure asked students to indicate their level of agreement with statements about their academic intentions (e.g., “I intend to major in an engineering field”). (Psychometric data for the measures can be obtained from the first author.)

Results

We first performed a 3 (university site) x 2 (sex) multivariate analysis of variance on the set of predictor and criterion variables, finding significant ($p < .001$) omnibus differences as a function of university site [$F (14, 920) = 3.96$, Wilks’ lambda = .89; $\eta^2 = .06$) and sex [$F (7, 460) = 5.94$, Wilks’ lambda = .92; $\eta^2 = .08$); the site x sex interaction was, however, non-significant [$F (14, 920) = .53$, Wilks’ lambda = .98; $\eta^2 = .01$). As shown in Table 1, students at both historically Black universities reported significantly ($p < .05$) higher academic milestone self-efficacy, coping efficacy, outcome expectations, and social supports than did students at the predominantly White university. Students at the historically Black state university also expressed stronger technical interests than did their counterparts at the predominantly White university. However, students at the three universities did not differ significantly in their major choice goals or experience of social barriers. Women differed significantly from men on two variables, reporting stronger social supports and weaker social barriers (see Table 2).

Although statistically significant, the magnitude of the differences on most variables as a function of university type and student sex, indexed by η^2, was relatively small. Because of the absence of significant differences between students at the two historically Black universities across the set of variables, we combined them into a single group for the subsequent correlation and regression analyses. Likewise, because of the absence of site x sex interactions, we combined women over sites in subsequent analyses.
Our primary research questions involved the roles of university type and sex as possible moderators of predictor-criterion relations. To test whether the theoretical variables were differentially predictive of persistence goals as a function of university type, we regressed goals on three sets of independent variables, entered in successive blocks: (a) university type, (b) the social cognitive predictors (self-efficacy, coping efficacy, outcome expectations, interests, supports, and barriers), and (c) the interactions of university type with each social cognitive predictor. A significant main effect for university type (at step

1) would indicate that students at the universities differ in their major choice goals. A significant effect at the second step would suggest that the set of social cognitive predictors accounts for unique variance in goals, above and beyond university type. A significant effect at the third step would indicate a moderator pattern in which the relations of the social cognitive predictors to goals vary as a function of university type.

Results of this regression are shown in Table 3. University type was found to explain a small, though significant amount of variance in goals (R^2 = .01) at step 1. The set of social cognitive variables accounted for a substantial amount of unique variance at the second step (R^2 change = .55). However, the set of university type x predictor terms did not explain additional significant variance (R^2 change = .01) after controlling for the two sets of main effects. These findings suggest that, while students at the historically Black universities reported slightly stronger persistence goals than did students at the predominantly White university, the social cognitive variables served as useful predictors of students' goals, regardless of university type. The full equation explained 57% of the variance in students' persistence intentions.

A similar regression strategy was used to examine student sex as a moderator of predictor-goal relations. In this instance, we regressed goals on the following blocks of predictors: (a) student sex, (b) the set of social cognitive predictors, and (c) the set of sex x social cognitive variable interaction terms. Findings, also displayed in Table 3, indicated that sex was not a significant predictor of goals (R^2 = .00). The set of social cognitive predictors explained substantial unique variation in goals (R^2 change = .55), while the set of interaction terms did not account for additional variance beyond the main effects (R^2 change = .01). Thus, the social cognitive variables were useful predictors of goals for students of both sexes (i.e., sex did not moderate predictor-goal relations).

Discussion

The present findings are consistent with prior results indicating that elements of SCCT serve as strong predictors of the academic choice goals of engineering students[10]. These findings extend prior research by suggesting that the predictive utility of the social cognitive variables is not moderated by student sex or by university type (as defined by the racial composition of students at various universities). That is, SCCT may help to explain intentions to persist in engineering majors for women as well as men, and for students at historically Black as well as at predominantly White universities. These findings are important in that relatively few studies have specifically examined social cognitive hypotheses in samples of women[13] or students of color[3] in engineering. They are also important because persistence goals have been found to be strongly predictive of actual academic persistence in engineering[10].

It is noteworthy that students at both historically Black universities reported stronger academic milestone self-efficacy, coping efficacy, outcome expectations, and social support than did their peers at the predominantly White university. In addition, women expected to encounter more social support and fewer social barriers than did the men.

These differences should be viewed cautiously for several reasons. In particular, where they were found, most differences were fairly small in magnitude. Also, one cannot rule out the possibility that these differences are attributable to selection biases or special, unmeasured attributes of our participants (e.g., students with stronger pre-existing self-efficacy and support systems may have been more likely to select historically Black universities; women with weaker support systems may have opted out of engineering altogether) – rather than to special qualities of the educational environment in historically Black universities or to growing receptivity to women in engineering.

However, given that historically Black universities do intentionally try to offer strong same-race mentoring and (faculty and peer) role modeling experiences, it is also quite possible that these findings do reflect actual advantages of the historically Black university environment. Likewise, the growing availability of women's support services (e.g., Society of Women Engineers) and increasing numbers of female role models may have been responsible for our female participants' expectations regarding social supports and barriers. These possibilities notwithstanding, women and most racial/ethnic minority groups continue to be substantially underrepresented in science and engineering fields, and the educational environment is often viewed as part of the problem[14]. Whether this environment has actually begun to change, or whether our hopeful findings may be an artifact of the universities we sampled, is a question for future research.

Several directions for future research might be cited. First, it would be valuable to extend these findings to women and racial/ethnic minority students in engineering at other universities. Second, it would be especially useful to examine the extent to which self-efficacy and the other SCCT variables promote actual academic persistence over time, using longitudinal designs. Third, the time is also ripe for theory-derived intervention studies aimed at promoting the educational progress of particular groups that are underrepresented in engineering. The current study, along with prior research, suggest that such interventions may profitably be targeted at strengthening self- and coping efficacy perceptions; instilling positive, yet realistic outcome expectations; and building support systems and barrier-coping strategies (for examples of theory-derived intervention studies and recommendations for practice, see)[1,2,10,11]. In sum, the present findings suggest that social cognitive variables may be helpful in understanding the educational choice behavior of engineering students, regardless of sex or university type (i.e., predominantly White versus historically Black universities). These findings also contribute to the growing base of research extending SCCT to different domains of academic and career behavior across gender, race/ethnicity, and cultural lines. [5,8] Moreover, along with other recent findings and theory-based intervention efforts, these findings may provide a conceptual foundation for future efforts to facilitate the inclusion and retention of women and students of color in engineering and other fields in which they have traditionally been underrepresented.

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Table 1
Social Cognitive Variables as a Function of University Type

	Predominantly White University		Historically Black Private University		Historically Black State University			
Variable	M	SD	M	SD	M	SD	F	η^2
Acad. Milest. SE	6.66_a	1.64	7.44_b	1.77	7.34_b	1.76	10.59*	.04
Coping Efficacy	6.41_a	1.50	7.04_b	1.42	6.96_b	1.36	9.67*	.04
Outcome Expect's	6.96_a	1.09	7.50_b	1.13	7.44_b	1.16	12.12*	.05
Interests	3.61_a	.65	$3.76_{a,b}$	.65	3.89_b	.59	8.57*	.03
Goals	4.24_a	.84	4.36_a	.88	4.44_a	.74	2.57	.01
Social Support	3.75_a	.61	4.10_b	.61	4.13_b	.64	20.61*	.08
Social Barriers	2.02_a	.86	1.94_a	.97	1.97_a	.91	.73	.00

Note. N's for the three conditions were, respectively, 261, 99, and 112. Means with different subscripts in the same row differ significantly from one another ($p < .05$, Scheffe post hoc comparisons); those sharing the same subscript are not significantly different.
*$p < .001$; df = 2, 472.

Table 2

Social Cognitive Variables as a Function of Student Sex

	Women		Men			
Variable	M	SD	M	SD	F	η^2
Acad. Milest. SE	6.82_a	1.84	7.05_a	1.69	1.70	.00
Coping Efficacy	6.82_a	1.42	6.62_a	1.49	1.67	.00
Outcome Expect's	7.24_a	1.12	7.17_a	1.15	.30	.00
Interests	3.66_a	.58	3.72_a	.67	.69	.00
Goals	4.28_a	.80	4.33_a	.82	.40	.00
Social Support	4.13_a	.58	3.84_b	.64	19.11*	.04
Social Barriers	1.74_a	.76	2.06_b	.95	10.77*	.02

Note. N's for women and men, respectively, were 120 and 352. Means with different subscripts in the same row differ significantly from one another ($p < .05$, Scheffe post hoc comparisons); those sharing the same subscript are not significantly different.
*$p < .001$; df = 1, 471.

Table 3

Hierarchical Regression Analyses Predicting Major Choice Goals by University Type and Student Sex

Target Group/ Predictor Set	Step	R	ΔR^2	ΔF
University Type				
University Type	1	.10	.01	4.60*
Social Cognitive Predictors	2	.75	.55	98.18**
SC Predictors x Univ. Type	3	.76	.01	1.48
Student Sex				
Student Sex	1	.03	.00	.40
Social Cognitive Predictors	2	.75	.55	96.76**
SC Predictors x Sex	3	.75	.01	1.26

Note. N = 473 for University Type analysis; N = 472 for Student Sex analysis. SC Predictors = set of social cognitive predictor variables.
* $p < .05$; ** $p < .001$.

Biographical Information

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