



# Predicting Retention for STEM Students of Color: Social Cognitive Analysis

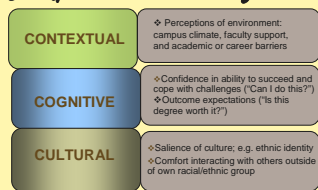
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## Introduction and Purpose

Only 28% of African American, Latino/a, South East Asian, and Native American (ALANA) students who enter college with a Science, Technology, Engineering, and Math (STEM) major will graduate in 6 years (compared to 40% of all STEM freshmen) (Hayes, 2007). To improve retention of ALANA undergraduates in STEM, we must identify what factors are important and for whom in facilitating retention.

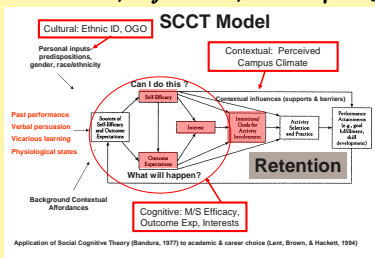
Using Social Cognitive Career Theory (SCCT), we examined what variables predict retention for ALANA STEM students, specifically the predictiveness of contextual, cognitive, and cultural variables on (1) STEM intentions and (2) retention. This study employed a longitudinal research design across two academic years.

## What Is Important in Retaining Students in the Sciences?



## Social Cognitive Career Theory

- Three key constructs within SCCT (Lent, Brown, & Hackett, 1994)
  - Self-efficacy – belief in ability to succeed at task
  - Goals – desired outcome
  - Outcome expectations – anticipated consequences of action(s)
- Self-efficacy and outcome expectations combine to inform interests, which in turn influence intentions and goals, actions and performance.
- SCCT is a culturally-valid model that incorporates the 3 Cs of retention: Contextual, Cognitive and, Cultural factors



## Hypotheses

**Hypothesis 1:** M/S efficacy, outcome expectations, and interests will positively predict intention to graduate with a STEM degree, with interests being the greatest predictor.

**Hypothesis 2:** M/S efficacy, outcome expectations, and STEM interests will account for the greatest amount of variance in retention.

**Hypothesis 3:** Contextual and cultural variables will contribute a small but significant amount to the prediction of degree intentions and retention.

**Hypothesis 4:** Men will have higher M/S efficacy and outcome expectations and thus the slope of the regression coefficient for these predictors will vary by gender across the regression equations. We made no hypotheses regarding variation by college.

## Participants

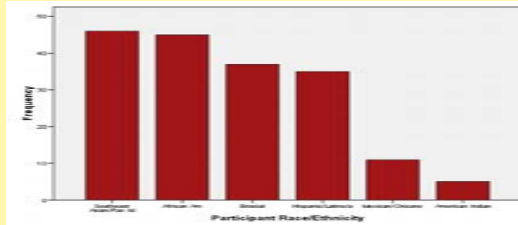
187 ALANA students in engineering or biological/life science majors at a major Midwestern research-intensive university; 66% response rate (population of 333).

GENDER: 53% Male, 44% Female (3% unreported)

COLLEGE: Engineering = 53%; CAIS = 47%

66% of sample has ≥ 3.00 GPA CUIM GPA: 2.91 ACT MATH: 27

Freshmen and Sophomores = 38%; Juniors and Seniors = 62%



## Instruments

M/S Academic Self-Efficacy (Lent, Brown, & Larkin, 1986): 11 items, 9-pt scale

M/S Outcome Expectations (Lent et al., 1991, 2001): 18 items, 5-pt scale

M/S Interest (Lent, Brown, & Larkin, 1986): 15 items, 5-pt scale

Multigroup Ethnic Identity Measure (Phinney, 1992): 14 items for Ethnic Identity; 6 items for Other-Group Orientation (OGO) on 4-pt scale

Perceptions of Campus Climate (PCC; Brown, Morning, & Watkins, 2004): 15 items

Intentions (to complete a degree): 3 items from PCC on a 5-pt scale

All measures were counterbalanced and evidenced acceptable reliability with Cronbach's alpha coefficients ranging between .74 and .92.

## Results

Table 1: Descriptive Statistics and Correlations

	M	SD	1	2	3	4	5	6	7
1. Acad SE	7.37	1.58	---						
2. OE	3.91	.61	.25**	---					
3. Interests	3.48	.64	.40**	.28**	---				
4. OGO	3.26	.52	.15*	.54**	.10	---			
5. Ethnic ID	3.06	.54	.04	.22**	.02	.30**	---		
6. PCC	3.56	.65	.24**	.37**	.18*	.36**	-.04	---	
7. Intentions	4.82	.42	.34**	.23**	.18*	.04	.08	.12	---

## Acknowledgements

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## What Contextual, Cognitive, And Cultural Factors Influence ALANA Students' STEM Intentions and Retention?

### Hypothesis 1

Table 2: Summary of Hierarchical Regression for Variables Predicting Math/Science Degree Intentions

Step and Variable	B	SE B	β	p	R	Adj R <sup>2</sup>	ΔR <sup>2</sup>	ΔF
Step 1								
Other-group Orientation	.01	.06	.01	.86	.28	-.01	.01 <sup>a</sup>	.41
Ethnic Identity	.05	.06	.06	.43				
Step 2					.39	.13	.14 <sup>b</sup>	9.85***
Other-group Orientation	-.12	.07	-.15	.08				
Ethnic Identity	.04	.06	.05	.49				
M/S Academic SE	.08	.02	.31***	.00				
M/S Outcome Expectations	.15	.06	.22**	.01				
Interests	-.00	.05	-.00	.99				
Step 3					.39	.12	.00 <sup>c</sup>	.09
Other-group Orientation	-.13	.07	-.16	.08				
Ethnic Identity	.04	.06	.06	.46				
M/S Academic SE	.08	.02	.30***	.00				
M/S Outcome Expectations	.15	.06	.22**	.01				
Interests	-.00	.05	-.00	.98				
Perceived campus climate	.02	.05	.02	.76				

Note: <sup>a</sup>F(2, 174) = .41, p < .67. <sup>b</sup>F(5, 171) = 6.10, p < .00. <sup>c</sup>F(6, 170) = 5.07, p < .00.

### Hypothesis 2

Out of 187 participants, 175 had MAXIMAL PERSISTENCE (either graduated or still enrolled in STEM). High M/S academic self-efficacy MORE LIKELY TO BE RETAINED. M/S outcome expectations scores were independent of self-efficacy scores. Those who did not persist reported positive outcome expectations similar to those who did persist.

Acad SE	Total	% Total	OE	Total	% Total
<6.00	30	17%	<3.00	9	5%
6.00-7.49	32	18%	3.00-3.99	85	48%
>=7.50	104	59%	4.00-4.49	36	20%
(blank)	10	6%	>=4.50	37	21%
Grand Total	176	100%	(blank)	9	5%
			Grand Total	176	100%

### Hypothesis 3

Table 3: Summary of Regressions for Ethnic Variables Predicting Social Cognitive Variables

Variable Set	B	SE B	β	p	R	Adj R <sup>2</sup>	F (model)
					.15	.01	F(2, 174) = 2.04, p < .13
Other-group Orientation	.47	.24	.15	.05			
Ethnic Identity	-.03	.23	-.01	.91			
					.54	.28	F(2, 175) = 36.11, p < .00
Other-group Orientation	.60	.08	.52**	.00			
Ethnic Identity	.07	.07	.06	.36			

### Hypothesis 4

MANOVA revealed no gender differences [F(4, 145) = 2.32, p < .06] on Academic SE, Outcome Expectations, Interests, or Intentions. Small College differences on SE, OE, Interests (Engineering).

Hierarchical regressions run separately for men (n=84) and women (n=76) revealed that the model explained similar variance in intention (23% and 27%, men vs. women). Interestingly:

OGO emerged as negative predictor for MEN (-.30\*\* in STEP 2, with SE and OE) and

Ethnic ID emerged as positive predictor for WOMEN (.29\*\* in STEP 1 & 2, with SE and OE)

## Implications

Retention efforts should address Cognitive, Cultural, and Contextual Factors for ALANA STEM students. Specifically:

- Students' beliefs about their academic ability and their academic expectations
- 1) paying attention to gender differences
- 2) Students' experiences with and negotiation of themselves as cultural beings (bicultural competence)