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RESEARCH REPORT

Testing an Adapted Model of Social Cognitive Career Theory: Findings and Implications for a Self-Selected, Diverse Middle-School Sample

Christian E Mueller[1], Alfred L Hall , Danielle Z Miro

University of Memphis, USA

Abstract: *We tested an adapted version of social-cognitive career theory (SCCT; Lent et al., 1994, 2000) with a self-selected, diverse sample of middle-school students attending a Saturday STEM Academy asking, "Is SCCT valid for examining career choice goal-intentions among a sample of students already expressing interest in math and science-related subjects and careers?" According to SCCT, choosing a STEM-related career involves the complex interplay of personal and contextual factors, many of which become increasingly salient during the middle-school years. There is reason to believe that SCCT may function differently for students who are self-selected, such as those found in the present sample. Main findings in the full regression model showed that math/science motivation (T1), family support for engineering (T1), outcome expectancies (T2), and interest (T2) were significant predictors of (T2) goal intentions; whereas self-efficacy was non-significant as has been shown in much previous research. Relatedly, we found several measurement issues with the SCCT variables among this sample, thus partially answering the larger research question. Implications of the present findings and suggestions for future research are discussed in the context of the career-choice literature, theoretical and practical implications of SCCT, and relatedly, possible measurement issues arising from using SCCT with self-selected, middle-school samples.*

Keywords: Social cognitive career theory, Self-selected, Middle school, STEM

Social-cognitive career theory (SCCT) (Lent, Brown, & Hackett, 1994, 2000) has gained prominence as a framework for examining career-related choices across numerous populations, including science, technology, engineering, and mathematics (STEM) careers (e.g., Wang, 2013a). SCCT proposes that career development and career-related choices are best explored as emerging from the complex interaction between individual factors (i.e., self-efficacy, interests, outcome expectancies, and goals), background/personal factors (e.g., ethnicity, predispositions, and gender), and prior learning and achievement—all viewed through the lens of social-cognitive theory (Bandura, 1986). Further, SCCT places emphasis on the role of distal and proximal influences on career decision-making, which are assumed to have direct and indirect influences (Lent, Lopez, Lopez, & Sheu, 2008). For example, among middle- and high-school aged students, previous investigations have found that both teacher and parental support have positive associations with career decision-making, self-efficacy, and prediction of future goals (Gushue & Whiston, 2006; Zebrak, Le, Boekeloo, & Wang, 2013b). Yet, despite its prominence, Lent & Brown (2006) acknowledged that SCCT has inherent conceptual and measurement issues that must be addressed if accurate hypothesis testing is to occur with applications of their theory. In the present study, we hypothesized that the self-selective nature of the present sample (i.e., students attending a Saturday STEM academy) might impact interrelationships among SCCT variables and that social cognitive variables

[1] Corresponding author. Department of Counseling, Educational Psychology and Research, 100 Ball Hall, University of Memphis, Memphis, TN 38152. E-mail: cemuellr@memphis.edu

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may have varying degrees of influence within this sample.

Concurrently, much research has applied SCCT within the STEM fields (e.g., Wang, 2013a), with diverse student populations (e.g., Turner & Lapin, 2002), with middle- and high-school populations (e.g., Jiang & Zhang, 2012; Wang, 2013b), and among all three (e.g., Navarro, Flores, & Worthington, 2007). These studies are important and have relevance for the present study for two reasons. First, SCCT has been a surprisingly robust predictor of career-related choices in the STEM fields. However, to date, few studies exist that have examined SCCT in the context of middle-school aged students already showing high levels of interest or motivation in science and math, which are precursors to later STEM study. This may be problematic because, as Lent and Brown (2006) acknowledged, "When most people's ratings 'top the chart,' this creates ceiling effects, range restriction, and negative skew in the distribution of […] scores" (p. 25). Here, they were referring specifically to self-efficacy, however, there is reason to believe that these issues may exist for other SCCT factors, as well. Second, increasingly, researchers are turning attention to understanding the non-cognitive factors that help sustain student interest, motivation, and persistence along the STEM educational pipeline (e.g., Andersen & Ward, 2013; Wang & Degol, 2013). Many of these non-cognitive factors represent core constructs in the SCCT model. For example, Lent et al. (2015) found that, among other things, self-efficacy was a significant predictor of academic persistence among undergraduate engineering students, even across gender and racial/ethnic lines. As the nation increases in ethnic and gender diversity, understanding how to retain the best and brightest students all along the STEM educational pipeline becomes increasingly important in sustaining U.S. global competiveness in STEM fields.

Theoretical Framework and Review of Relevant Literature

Social Cognitive Career Theory

As previously discussed, SCCT assumes that individual career choices and goal intentions are best explained through the interaction of numerous factors, including individual, background/personal, and other proximal/distal influences (see Figure 1). The interplay among environmental factors, social factors, and personal factors, in concert directly and indirectly shape outcome expectations and increase motivation in determining career and education paths (Loera, Nakamoto, Oh, & Rueda, 2013). According to Lent, Brown, & Hackett (2002), SCCT is rooted in Albert Bandura's social cognitive theory (Bandura, 1986), which posits that individual actions, choices, and goals are influenced by personal attributes (e.g., self-efficacy), external environmental conditions, and overt behavior. In addition, "Within this triadic system, people become both 'products and producers of their environment' (Wood & Bandura, 1989, p. 362), with the potential for self-regulation" (p. 261).

Career choice, then, is understood within a framework emphasizing individual choice as emanating from the interplay between person factors, such as self-efficacy, outcome expectations, and interests; and other factors, including learned experiences and previous barriers and supports in the environment, such as higher or lower levels of parental or teacher support (Figure 1; Lent et al., 1994). Specifically, the social-cognitive constructs in SCCT include self-efficacy, an individual's perceived competence in a specific area that may predict effort expenditure or persistence (Bandura, 1977); outcome expectations, perceived consequences or successes about performance on a task (Lent et al., 1994); and goal orientation, an individual's determination to engage in a task or activity (Bandura, 1986). Further, person inputs include predispositions, gender, race/ethnicity, and health status that are interrelated to background or contextual factors, such as family or parental support (Byars-Winston & Fouad, 2008). Distal contextual factors can be viewed as perceived barriers or supports to an interest, goal, or action (Lent et al., 1994, 2000). Moreover, learned experiences and the environment shape an individual's self-efficacy, outcome expectations, and goals. SCCT also proposes a bi-directional model between person inputs and other person inputs, which directly influence learning experiences (Navarro et al., 2007).

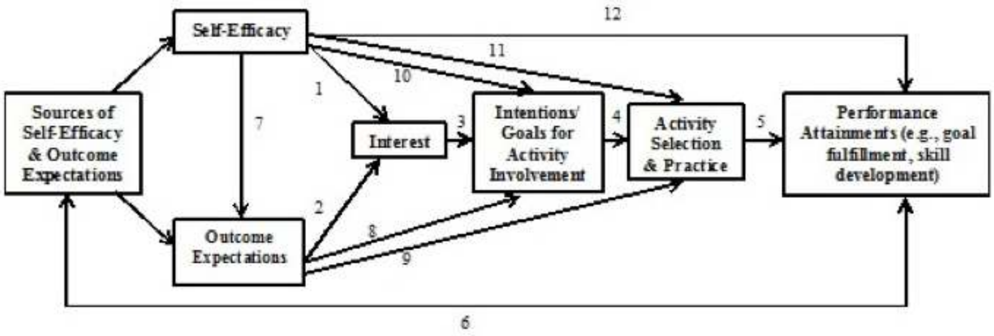

Figure 1. *Social Cognitive Career Theory Reprinted from "Toward a Unifying Social Cognitive Theory of Career/Academic Interest, Choice, and Performance," by R. W. Lent, S. D., Brown, & G. Hackett, 1994, Journal of Vocational Behavior, 45, 79-122. Reprinted with permission.*

SCCT and STEM

With respect to STEM, SCCT has proven to be very robust in predicting career goals and intentions among STEM-related fields. Lent, Singley, Sheu, Schmidt, and Schmidt (2007) found that in predicting engineering goals, progress factors such as outcome expectations, self-efficacy, and environmental supports were influential to career decision choice. These findings suggest there is a need to examine how students monitor and frame their STEM goals, which environmental supports or resources they use, and their STEM self-efficacy. Furthermore, interplay between environmental factors (e.g., STEM labs), social factors (e.g., supportive family, teachers, or engineering professionals), and personal factors (e.g., student satisfaction) shape outcome expectations and increase motivation in determining career and educational paths (Loera et al., 2013).

In determining college majors, SCCT has allowed researchers to examine pathways of persistence as well as deterministic factors that result in individuals majoring in STEM (Lent et al., 2008). Nauta, Epperson, and Kahn (1998) found that individuals with higher perceived abilities and self-efficacy had increased aspirations to enter a STEM career and suggested that self-efficacy mediated the relationship between abilities and STEM-career intention. Of relevance for the present study, many of these studies have focused on students who were already majoring in STEM, rather than those intending to major in STEM, thus leaving a void in understanding the possible supports and barriers for entrance into or sustaining interest along the STEM educational pipeline (Wang, 2013a). SCCT is well-suited to fill this gap via examination of STEM-related social-cognitive variables in populations of highly efficacious and motivated students. In particular, as more STEM-focused curricula and programs are developed, implemented, and researched for their effectiveness in sustaining student interest, motivation, and persistence along the STEM educational pipeline, it is imperative that we gain understanding of these social-cognitive variables when student STEM interest is inchoate, such as coinciding with the middle-school years or before (Maltese & Tai, 2010).

SCCT and Middle/High School Student Populations

Identifying barriers and supports to STEM majors is vital, yet when viewing the entirety of the STEM educational pipeline and persistence therein, there is much research showing that interest in STEM domains (i.e., math and science) forms during the middle-school years, or before. For example, Maltese and Tai (2010) found that retrospective accounts by scientists and engineers reported developing an interest in science well before middle school, which in part, carried them all the way through the STEM education pipeline. Interestingly, Maltese and Tai found that for women their interest in science was related to activities at school, whereas for men, interest was more related to self-initiated activities. In addition, Lindley (2005) suggested that contextual barriers faced by adolescents is a key component to career decision-making and interest formation in STEM, which is well suited to be studied under an SCCT framework.

SCCT posits that perceptions of the self, tasks, and performance on such tasks is influential to adolescent career development and defining later goals to develop ability or demonstrate ability in a subject area (Schultheiss, 2008). To which, in a qualitative study of young adolescents, Shoffner, Newsome, Minton, and Morris (2015) found that careers in STEM were associated with negative outcome expectations, particularly among females. Further, Cantrell, Pekcan, Itani, and Velasquez-Bryant (2006) found that the influence of contextual variables, such as race/ethnicity and socioeconomic status, decreased with middle school students when design science was implemented, suggesting that SCCT is an appropriate framework to examine STEM-related issues with younger populations.

Purpose of the Present Study and Research Questions

Collectively, all of the above research suggests a continued need for understanding how SCCT functions in predicting STEM career decision-making across varied and diverse populations. As such, in the present study we were interested in exploring the larger research question "Is SCCT valid for examining career choice goal-intentions among a sample of students already expressing interest in math and science-related subjects and careers?" To answer this larger question we answered three distinct, but interrelated questions:

1. How strongly do personal and environmental antecedents relate to the social-cognitive factors of self-efficacy, outcome expectancy, interest, and goals with our sample?
   - Hypothesis: We hypothesized significant positive relationships between personal and contextual antecedents and SCCT social-cognitive variables.
2. How strongly do the social-cognitive variables of self-efficacy, outcome expectancy, and interest collectively predict career choice goal-intentions with our sample?
   - Hypothesis: We hypothesized significant positive relationships between our main predictors of self-efficacy, outcome expectancy, and interest, and our outcome variable of career choice goal-intentions.
3. Are there potential measurement issues presented in using SCCT variables (e.g., ceiling effects) with our self-selected sample?
   - Hypothesis: Although we were not certain about the exact nature of potential measurement issues, we hypothesized that the self-selected nature of the present sample would present some issues that needed to be addressed before answering research questions one and two (Lent & Brown, 2006).

Methodology

Participants and Procedure

Participants (N = 186) included sixth- through eighth-graders attending a Saturday STEM Academy program in a Mid-southern city during the spring 2015 semester. This program was designed to provide an opportunity for middle-school students to explore STEM-based projects and activities to help develop student interest in STEM and to potentially encourage them to enroll in and complete a high school STEM program of study. Students came from several schools within a larger urban district and chose to attend the academy after a district-wide solicitation effort. There were three Saturday Academy sessions and only students who completed both pre- and post-surveys (n = 104) were included for subsequent analysis. Table 1 presents all descriptive statistics for the sample, and shows that the sample was predominantly female (52.9%), African-American (45.2%), and comprised of sixth-graders (46.2%). IRB approval was obtained prior to pre and post-test data collection.

Table 1
Descriptive Statistics of Sample

Number		104
Gender	Male	49 (47.1%)
	Female	55 (52.9%)
Ethnicity	African/Black American	47 (45.2%)
	American Indian/Alaskan Native1	1 (1.0%)
	Asian & Pacific American	18 (17.3%)
	Latina/Latino/Hispanic American	12 (11.5%)
	White American	14 (13.5%)
	Other	12 (11.5%)
Grade	Sixth	48 (46.2%)
	Seventh	33 (31.7%)
	Eighth	23 (22.1%)

Instrument (Pre-Test)

The pre-test instrument was administered at the beginning of the program and included demographic questions, questions about attitudes toward STEM, and perceived barriers or supports toward STEM goal pursuit. These measures were initially developed and validated by the Advancing Women and Men in Engineering (AWE) program (2008). In the present study, some items were removed from consideration for use on the final scales and subsequent analysis when they violated assumptions of normality (i.e., too much skewness or kurtosis) or when removing items improved the overall reliability estimates for the present sample. Items that were retained were kept in their original form. Details about each of the scales that were administered on the pre-test measure are provided next.

Demographics. Gender, ethnicity, and grade-level served as the main demographic correlates.

Motivation for math/science (α = .70, 8 items). Eight of the original 14 items were retained for the adapted scale and used in the present study, which is designed to measure students' motivation for math and science. Respondents were asked to rate on a four-point scale— strongly disagree (1) to strongly agree (4)—their agreement to items such as, "I look forward to science class in school" and "I like learning how things work."

Math/science future value. Math/science future value was assessed by a single-item asking students to rate on a three-point scale—Not Important, Somewhat Important, Very Important—"How important is it to you to do future work that allows you to use math, computer, engineering or science skills?"

Teacher-support/family-support/community-other support for engineering. Three single-item statements were used to measure students' perceived teacher, family, and community/other support for engineering. Respondents were asked to initially respond to "Has anyone talked to you about becoming an engineer?" If students responded "yes," they were prompted to select among teacher, family, and community/other; responses were then dichotomized to yes (1) or no (0). Each item was treated as an independent factor in subsequent regression analyses.

Instrument (Post-Test)

The post-test measure was administered at the conclusion of the program. Scales were initially developed by Fouad, Smith, and Enochs (1997) and Fouad and Smith (1996) and based on SCCT (Lent et al., 1994, 2000). All of the post-test measures had to be adapted in the same manner as the pre-test measures, including dropping items that violated assumptions of normality and removing individual items when overall reliability estimates were improved. All items that were retained on each scale were kept in their original form. Details about each of the scales that were administered on the post-test measure are provided next.

Math/science interest (α = .76, 13 items). Thirteen of the original 20 items were retained for the adapted scale. The original scale developed by Fouad and her colleagues was designed to measure students' interest in math and science-related activities. Respondents were asked to rate each item as to "How interested you are in these things…" according to dislike, not sure, and like. Examples of retained items include "…Visiting a science museum," "…Using a calculator," and "…Solving computer problems."

Math/science efficacy (α = .80, 7 items). Seven of the original 12 items were retained for the adapted scale. The original scale developed by Fouad and her colleagues was designed to measure students' confidence in their ability to do a series of math and science-related activities. Respondents were asked to rate each item as to how confident they were in terms of their ability on items ranging from "Determine the amount of sales tax on clothes I want to buy" to "Design and describe a science experiment that I want to do." Respondents rated their confidence/ability levels from very low ability (1) to very high ability (5).

Math/science outcome expectations (α = .71, 4 items). Four of the original seven items were retained for the adapted scale. The original scale developed by Fouad and her colleagues was designed to measure students' beliefs "Regarding the consequences of their potential mathematics and science-related course activities and achievements" (Navarro et al., 2007, p. 325). Respondents were asked to rate how much they agree or disagree with items such as "If I learn math well, I will be able to do lots of different types of careers" and "If I do well in science, then I will be better prepared to go to college." Respondents rated these items on a five-point scale, ranging from strongly disagree (1) to strongly agree (5).

Math/science goal intentions (α = .74, 6 items). All original scale items were retained and were designed to measure middle-school students' future goals to pursue math and science-related courses and careers (Navarro et al., 2007). Respondents were asked to rate their agreement and/or disagreement on a five-point scale—strongly disagree (1) to strongly agree (5)— with items such as "I plan to take math classes in high school" and "I intend to enter a career that will use science." Respondents rated these items on a five-point scale, ranging from strongly disagree (1) to strongly agree (5).

Data Analyses

In the present study, we employed a longitudinal research design to explore the larger research question of "Is SCCT valid for examining career choice goal-intentions among a sample of students already expressing interest in math and science-related subjects and careers?" In order to answer the larger research question, we conducted two sets of regression analyses to explore smaller, but related questions. With respect to the first question, "How do personal and contextual antecedents influence social cognitive variables (interest, self-efficacy, outcome expectancy, & goals) in SCCT with a self-selected, diverse middle-school sample?" we conducted four separate hierarchical regressions. For each regression, the demographic correlates of gender, grade and ethnicity were entered at step 1 of each analysis. At step 2, personal factors (motivation for math/science & math/science future value) and contextual factors (teacher, family, &/or community/other support for engineering) were added as additional predictors for each of the four outcomes.

With respect to the second question, "How well does an adapted version of SCCT work in examining career choice goal intentions for this sample?" we conducted a final regression analysis in which the same demographics were entered at step 1, the same personal and contextual factors were entered at step 2, and as an additional step to test the entire model, the social-cognitive variables of interest, outcome expectancy, and self-efficacy were entered at step 3. Goal intentions served as the outcome variable in the model (see Figure 1).

Table 2
Means (SDs) for Pre- and Post-Test Measures

Variable (Scores 1 to 5)	N (observations total)	Group M (SD)
Pre-Test Motivation for Science/Technology Scale	102	3.36 (.38)
Math/Science Future Value Scalea	104	2.66 (.53)
Post-Test for Math/Science Interest Scale	104	2.52 (.34)
Post-Test for Mat/Science Efficacy Scale	104	3.95 (.73)
Post-Test for Math/Science Outcome Expectancy Scale	102	4.46 (.54)
Post-Test for Math/Science Goals Scale	102	4.25 (.62)

Results

For sake of clarity, results are presented and organized according to how they relate to the primary research questions presented earlier. Table 2 presents means and standard deviations for the entire sample across all pre and post-test measures. Results for the first two research questions are presented next. Discussion around research question three regarding measurement issues is addressed in the Discussion portion of the study.

RQ1: How strongly do personal and environmental antecedents relate to the social-cognitive factors of self-efficacy, outcome expectancy, interest and goals with our sample?

Regressions 1 and 2: Non-significant findings. Non-significant findings were obtained in the hierarchical regressions conducted with self-efficacy and outcome expectancy as main outcomes. Neither the demographic correlates at step 1, consisting of gender, grade, and ethnicity, nor the personal and contextual antecedents, consisting of motivation for math/science, math/science future value and teacher-support, family-support, and community-other support for engineering at step 2, had a significant effect when regressed onto self-efficacy and outcome expectancy. Table 3 presents full findings from these two models.

Regressions 3 and 4: Significant findings. Conversely, when examining interest and goals as the main outcomes, both of the hierarchical regression models were significant. In the third regression, predicting time 2 interest in math/science as the main outcome, the demographic variables of gender, grade, and ethnicity explained a significant proportion of the variance with an adjusted R2 = .06, $p < .05$; however, only gender ($\beta = -.272$, $p < .01$) was significant. This implies that females have significantly less interest in math/science than males within this group. At step 2, in adding the time 1 personal and contextual antecedents, the model again explained a significant proportion of the variance in time 2 interest with an adjusted R2 = .31, $p < .001$. In the presence of the personal and contextual antecedents, all of the demographic variables including gender, became non-significant. In this case, only the time 1 personal factors of motivation for math/science ($\beta = .429$, $p < .001$) and math/science future value ($\beta = .179$, $p < .05$) were significant positive predictors of time 2 math/science interest, therefore showing that higher levels of motivation and valuing of math/science at time 1 led to higher levels of math/science interest at time 2 for this self-selected sample. The contextual antecedents of teacher-support, family-support, and community-other support for engineering were not significant in predicting interest.

Last, in the fourth regression predicting time 2 goals as the main outcome, the model at step 1 with all of the demographic variables was non-significant. However, the model at step 2, with the time 1 personal and contextual variables added, explained a significant proportion of the variance in time 2 goals with an adjusted R2 = .17, $p < .001$. Furthermore, in addition to the personal variable of motivation for math/science ($\beta = .362$, $p < .001$), the contextual variable of family-support for engineering ($\beta = .233$, $p < .05$) was a significant positive predictor of time 2 goals. In this case, having higher levels of motivation for math/science and higher perceived levels of family support for pursuing engineering as a career, impacted future goals about math/science at time 2. Table 3 presents all results from these significant models.

Table 3
RQ1 Results: Hierarchical Regression Analyses Predicting Post-Math/Science Interest, Efficacy, Outcome Expectancies, & Goals

	Post-math/science efficacy		Post-math/science outcome expectancies		Post-math/science Interest		Post-math/science goals	
Variable	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Controls								
Gender	-.096	-.015	-.197*	-.139	-.272***	-.133	-.084	.022
Ethnicity	-.034	-.011	-.126	-.087	-.998	-.035	.042	.116
Grade	.005	-.011	-.003	-.026	-.263	-.039	.051	.021
Direct Effects								
Motivation for Science/ Technology Scale		.244**		.187*		.429****		.362****
Math/Science Future Value Scale		.108		.138		.179**		.109
Teacher Support Engineering Scale		-.038		-.010		-.003		-.041
Family Support Engineering Scale		.082		.093		.156*		.233**
Community/Other Support Engineering Scale		.025		-.010		-.013		-.095
F total	.370		2.117		3.171**		.421	
R^2	-.019	.025	.033	.063	.061	.314	-.018	.166
Δ F		1.891		1.626		8.252****		5.244****
Δ R^2		.091		.077		.280		.221

* p < .10
** p < .05
***p < .01
****p < .001

RQ2: How strongly do social-cognitive variables of self-efficacy, outcome expectancy and interest collectively predict career choice goal-intentions with our sample?

As can be seen, the full model was not significant at step 1 (demographics only), but was significant at step 2 with an adjusted R2 = .17, p < .001 with the personal and contextual factors added, and an adjusted R2 = .51, p < .001 at step 3 with the social-cognitive variables added. This indicates that the social-cognitive variables were robust predictors of career goal intentions, as they explained an additional 33% of the variance, even after controlling for the other variables. As seen in Table 4, gender and ethnicity were non-significant at all three steps in the model, thus indicating that neither gender nor ethnicity showed any effect for this self-selected sample. Interestingly, grade was not significant at the first two steps of the regression, but did retain significance at step 3, demonstrating there were significant differences across grades for career goal intentions. Further, these differences only manifested in the presence of the social-cognitive variables, thus indicating that perhaps some of the variability explained by grade at step 3 was more a reflection of a statistical anomaly rather than being indicative of a meaningful finding (see Shieh, 2006, for discussion on suppression in multiple regression).

With respect to the personal and contextual variables in the full regression model, there were some interesting findings as well. At step 2, time 1 math/science motivation (β = .362, p < .001) and time 1 family support for engineering (β = .233, p < .05) were significant positive predictors of time 2 career goal intentions. At step 3, in the presence of the social-cognitive variables, both of these became non-significant; however, family support for engineering did still approach significance (β = .140, p = .08). Among the social-cognitive predictors, time 2 interest (β = .223, p < .05) and time 2 outcome expectancy (β = .497, p < .001) retained significance, but contrary to previous findings in the literature, self-efficacy was not significant. Table 4 presents the full findings of this final regression.

Table 4
RQ2 Results: Testing Adapted Version of SCCT with Goals as Main Outcome

Covariates		Model 1	Model 2	Model 3
	Gender	-.84		
	Grade	.042		
	Ethnicity	.051		
	F total	.421		
	R^2	.013		
Covariates			Model 2	
	Gender		.022	
	Grade		.116	
	Ethnicity		.021	
	Motivation for Science/Technology Scale		.362****	
	Math/Science Future Value Scale		.109	
	Teacher Support Engineering Scale		-.041	
	Family Support Engineering Scale		.233**	
	Community Support Engineering Scale		-.095	
	Δ F		5.244****	
	R^2		.166	
	Δ R^2		.221	
Covariates				Model 3
	Gender			.124
	Grade			.164**
	Ethnicity			.049
	Motivation for Science/Technology Scale			.141
	Math/Science Future Value Scale			-.006
	Teacher Support Engineering Scale			-.026
	Family Support Engineering Scale			.140*
	Community Support Engineering Scale			-.092
Direct Effects				
	Post Math/Science Self-Efficacy Scale			.223**
	Post Math/Science Outcome Expectations Scale			.104
	Post Math/Science Interest Scale			.497****
	Δ F			22.612****
	R^2			.513
	Δ R^2			.334

* p < .10
** p < .05
***p < .01
****p < .001

Discusson

Situated in the literature surrounding career goal theory, social-cognitive theory, and STEM-education persistence, the present study sought to explore how robustly SCCT predicted career goal intentions among a sample of middle-school students already showing high levels of interest in math and science. Given the difficulty in examining all aspects of the model simultaneously, we sought to answer the larger question through exploration of narrower, but related questions. Findings from the present study add to the growing SCCT literature in distinct and important ways—our general conclusion is that indeed, SCCT is a robust way to examine career goal intentions among self-selected students. As with any good theory, however, the story is not always as straightforward as it seems. In the next few sections, we explore the implications of select findings as they relate to previous research; they are organized and presented in relation to the three research questions posed at the beginning of the study.

RQ1: How strongly do personal and environmental antecedents relate to the social-cognitive factors of self-efficacy, outcome expectancy, interest and goals with our sample?

Not surprisingly, gender was found to be a significant predictor of student interest and outcome expectancy, which is supported by previous findings (Lent, Sheu, Gloster, & Wilkins, 2010). However, of note, the impact of gender lessened and was mitigated by personal factors such as math/science motivation and math/science future value, two antecedents appearing to help females in the present sample. Referring back to the findings of Maltese and Tai (2010), it may be important to consider how personal factors, gender, and school-based interventions intersect, as Maltese and Tai found that school-based activities were listed as a significant influence on developing math/science interest for females. It bears worth mentioning again that the females in the present study were from a self-selected group. To gain a broader understanding of how motivation and valuing influence decision-making along the STEM pipeline, future researchers should test these motivational relationships across broader samples and at different points along the pipeline (Anderen & Ward, 2013; Perez, Cromley, & Kaplan, 2014; Wang & Degol, 2013). Nevertheless, it is encouraging that once again, positive outcomes seem to result from an increased interest in math and science, and that interventions can be designed to increase interest all along the STEM education pipeline (Hidi & Renninger, 2006).

Interestingly, but again not surprisingly, family support for engineering was the only significant contextual predictor of future goals for our sample. In essence, for students already showing high levels of interest in math and science, perceived family support for engineering was significant in predicting future goals, which points to the importance of family in helping students persist along the STEM pipeline. It is also encouraging that neither gender nor ethnicity was significant with respect to goals—these findings are all the more encouraging given the longitudinal design of the study. Previous literature has also shown this to be true; for example, Ferry, Fouad, and Smith (2000) found that parental encouragement directly impacted their child's math/science learning experiences. Although we used the term "support" differently than in previous studies, and there are certainly more comprehensive ways to capture the true nature of what is meant by support, we are nonetheless encouraged that family support, in any form, appears important for career decision-making along the STEM education pipeline for this group.

RQ2: How strongly do social-cognitive variables of self-efficacy, outcome expectancy and interest predict career choice goal-intentions with our sample?

With regards to SCCT as a theoretical framework for understanding career choice goal intentions among self-selected middle schoolers, we found that the broader model was indeed robust, with the several significant social-cognitive predictors. Interestingly, self-efficacy was a non-significant factor in our model, which further highlights the complicated nature of career choice. Typically, self-efficacy is found to be a significant predictor in the SCCT model (Lent et al., 2015), however, it seems natural that students with strong STEM self-efficacy are more likely to pursue STEM-related programs (Byars-Winston & Fouad, 2008), such as was the case with the present sample attending a Saturday STEM academy. In the present sample, not only was there a ceiling effect for self-efficacy, but skewed scores also led to violations of normality on many items. This fact is further explored in the next section. Perhaps of more relevance for the present study are ways in which high levels of interest and self-efficacy can be sustained all along the STEM education pipeline. We refer the reader to related literature on the developmental nature of interest and self-efficacy (e.g., Britner & Pajares, 2006; Hidi & Renninger, 2006; & Usher & Pajares, 2008).

Present findings also pose the question as to if there are alternative SCCT models that may better help understand this population and better fit the data. Our results reflected those of Lent et al. (2005) that found that although their measurement model provided good fit to their data, structurally, it did not ideally fit their data, suggesting the theoretical model had some inadequacies in assessing social-cognitive relationships. Clearly SEM models would need to be conducted in order to test simultaneous SCCT relationships with the present sample; however, findings from present regression models do at least, in part, indicate the nature of these relationships. While our findings extend support for SCCT as a whole with this sample, in that math/science interests and outcome expectancies accounted for 50% of the variance in goal intentions, developing alternative frameworks may assist in improving understanding of STEM-related career choices among highly-efficacious students. Perhaps, future models should place more emphasis on contextual factors and their direct or indirect pathways to goal intentions (Schaefers, Epperson, & Nauta, 1997).

Methodological Implications

With respect to the methodological implications of using SCCT with a self-selected sample, we found main issues around violations of normality (e.g., excessive skewness or kurtosis), and in some cases, correspondingly low reliability estimates. Our findings supported Navarro et al.'s (2007) call for developing instruments that are domain specific and utilize many measures to capture a broader range of SCCT's constructs. In addressing measurement and conceptualization issues of SCCT constructs, Lent and Brown (2006) suggested that researchers design instruments that mirror the operationalization and context of the construct. Additionally, for educational researchers, further study on predictors and contextual factors that affect student interest, participation, and self-efficacy in STEM (especially for middle school populations of students from disadvantaged backgrounds) is needed. In the present study, we were left with dropping some items due to violations of normality. We ultimately decided against the use of transformational procedures as these procedures are often difficult to interpret, and our target audience was not just educational researchers. In future, we would suggest adapting the items more specifically to population and context as suggested by Navarro et al. (2007), and Lent and Brown (2006).

Limitations

One of the limitations of this study was the non-normality of data within this sample. Because of the nature of the sample, students who attended the STEM Saturday Academy likely had high math/science interest and self-efficacy prior to data collection, which certainly impacted the predictive utility of these constructs in subsequent analyses. We also did not examine differences of math or science beliefs individually, but rather conjointly. This may have impeded some of the findings, such as females being more likely to have negative attitudes towards mathematics than boys (Yee & Eccles, 1998).

Implications

This research study has implications for education researchers and STEM educators wanting to understand sources/antecedents for these social-cognitive factors—where do they come from and how do we help develop them? Before this question can be answered, more research measurements and analyses are needed to assess their effect on student development. Future investigations should also test the effectiveness of such questions via hypothesis testing and examining the effectiveness of such STEM programs.

Moreover, among self-selected students, sustaining their STEM motivation is crucial for continuity in the STEM education pipeline and to ensure a viable STEM workforce in the future. For educational researchers, further study on predictors and contextual factors that affect student interest, outcome expectancy, and self-efficacy in STEM (especially for middle-school populations of students from disadvantaged backgrounds) is needed. These findings also suggest that as STEM educators and program developers work to provide meaningful opportunities to develop long-term goal intentions in STEM, student interest, grade level, and outcome expectancies must also be addressed in the recruitment, support, and retention efforts of various STEM programs. Developing authentic learning experiences in STEM that are related to real-life application may address students' perceptions of STEM and their career-related choice decisions.

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