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Longitudinal relations of self-efficacy to outcome expectations, interests, and major choice goals in engineering students ☆

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ABSTRACT

We examined the nature of the temporal relations among the core person variables in the social cognitive model of academic and career choice [Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance [Monograph]. *Journal of Vocational Behavior, 45*, 79–122.]. Participants were 209 students taking beginning level engineering courses at either a predominantly White or a historically Black university. They completed measures of self-efficacy, outcome expectations, interests, and goals near the end of two consecutive semesters. Path analyses indicated support for a model in which self-efficacy served as a temporal precursor of outcome expectations, interests, and goals. There was less support for a model in which the latter variables produced reciprocal paths to self-efficacy. Implications for future longitudinal research on SCCT's (social cognitive career theory's) choice hypotheses are discussed.

1. Introduction

Social cognitive career theory (SCCT; Lent, Brown, & Hackett, 1994, 2000) has become a frequently used framework for studying academic and career development in recent years (Betz, 2008; Lent, 2005). The theory initially consisted of three interrelated models of interest development, choice-making, and performance (Lent et al., 1994). A fourth SCCT model, aimed at explaining educational and work-related satisfaction, was recently proposed (Lent & Brown, 2006). The four models incorporate an overlapping set of person (e.g., self-efficacy), environmental (e.g., social support), and behavioral (e.g., goal implementation) variables that are assumed to help direct the flow of academic and career development.

One major stream of research on SCCT has focused on the pursuit (or avoidance) of science, technology, engineering, and mathematics (STEM) related coursework and academic majors. Findings indicate that individual SCCT variables (e.g., self-efficacy) are good predictors of science and math-intensive interests, goals, persistence, and performance (e.g., Betz & Hackett, 1983; Fouad & Smith, 1996; Gainor & Lent, 1998; Hackett, Betz, Casas, & Rocha-Singh, 1992; Lapan, Boggs, & Morrill, 1989; Lent, Brown, & Larkin, 1984, 1986; Lent, Lopez, & Bieschke, 1991, 1993; Schaefers, Epperson, & Nauta, 1997). Given the underrepresentation of women and students of color in many STEM fields, it is noteworthy that a number of these studies have specifically focused on SCCT's utility within samples of women and minority group members.

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In recent years, research has extended beyond the predictive utility of individual social cognitive variables and begun testing fuller versions of SCCT's interest and choice models. Model tests have, for example, included self-efficacy (beliefs about one's ability to successfully perform particular behaviors or courses of action), outcome expectations (beliefs about the consequences of given actions), interests (activity liking), choice goals (intent to choose or persist at a particular course of action), and contextual supports and barriers related to one's goal pursuit. These fuller model tests have generally found good support for SCCT's basic interest and choice hypotheses both in general samples of college students (Lent et al., 2001) and in samples of STEM (engineering: Lent et al., 2003, 2005; Schaefers et al., 1997; computing: Lent, Lopez, Lopez, & Sheu, 2008) students. Some of these studies have examined the fit of SCCT's choice model across student gender, class year, and university type (predominantly White and historically Black universities) (Lent et al., 2005, 2008).

Although their findings suggest that SCCT is a useful explanatory framework with a fairly wide range of generalizability, most of the studies that have thus far tested aspects of SCCT's interest and choice models have been limited by their cross-sectional nature. That is, the typical study has assessed both predictors and criterion variables at a single point in time and used correlational or regression analyses to examine relations among the variables as specified by the theory. Such a design can establish that obtained relations are consistent with SCCT's hypotheses, but it cannot demonstrate that the predictors are causally related to students' interest in and choice of particular fields.

Fortunately, several studies have used experimental or longitudinal designs to test SCCT hypotheses. By manipulating an independent variable and observing its effect on a dependent variable under controlled conditions, experimental designs offer the most compelling evidence that the independent variable leads to, rather than merely predicts or covaries with, the dependent variable. Longitudinal designs are also useful in the search for causal relations, though they are less able to rule out competing hypotheses than are experimental designs. In particular, longitudinal designs allow one to test a key logical requirement of causal interpretations, namely, that the presumed cause precedes the effect in time (this is not possible in cross-sectional designs wherein putative causes and effects are measured at the same point in time). They also offer a viable way to examine the temporal ordering of variables under naturalistic conditions and where experimental manipulation may not be feasible. However, because unmeasured variables, other than the independent variable under investigation, can be responsible for change in the dependent variable, longitudinal designs do have their limitations. They can test the plausibility of a causal interpretation but cannot establish it conclusively.

In one relevant experiment, Silvia (2003) manipulated level of self-efficacy at a simple physical task, finding support for the hypothesized effects of self-efficacy on task interest. Focusing on math and science-relevant activities, Luzzo, Hasper, Albert, Bibby, and Martinelli (1999) found that interventions involving exposure to two of the hypothesized sources of efficacy information (personal performance accomplishments, vicarious learning) produced significant increases in math/science interests between pre- and post-treatment. Participants in the performance accomplishments condition also reported enhanced math/science interests and choice behavior at a 4-week follow-up. Using longitudinal designs, Lapan, Shaughnessy, and Boggs (1996) and Lent et al. (2003) found that, as hypothesized by SCCT, choice goals were predictive of later choice actions or persistence in STEM-related college majors.

A few longitudinal studies have provided relatively sophisticated tests of temporal predominance and bidirectional relations among certain SCCT variables. For example, Nauta, Kahn, Angell, and Cantarelli (2002) used a cross-lagged panel design in which self-efficacy and interests were both measured at the same point in time and then again later, at 3-, 4-, and 7-month lags. By controlling for autoregressive paths (e.g., the relation of interest at time 1 with interest at time 2) and exploring paths from time 1 (T1) self-efficacy to time 2 (T2) interest as well as from T1 interest to T2 self-efficacy, they were able to examine whether either variable was temporally predominant in predicting the other. Their findings were generally consistent with a bidirectional, or reciprocal, relationship between self-efficacy and interests over time (i.e., self-efficacy predicted changes in interest and vice versa). A few other studies using a similar design have also found reciprocal relations between competency beliefs (which are conceptually related to but somewhat different than self-efficacy) and interests over time (e.g., Lent, Tracey, Brown, Soresi, & Nota, 2006; Tracey, 2002).

The present study was aimed at extending the longitudinal study of SCCT's interest and choice hypotheses in several ways. In particular, we examined four of the variables in SCCT's choice model (self-efficacy, outcome expectations, interests, and goals), rather than only self-efficacy and interests, at two points in time, 5 months apart. This allowed us to test longitudinally a greater portion of the model, potentially adding to the current understanding of how the four variables relate to one another over time. Second, we included a sample of engineering students, most of whom were in their first semester of studies. By examining the precursors of choice stability in engineering students, we might shed light on variables responsible for persistence in (or attrition from) STEM fields, which is seen as a prominent societal issue in the US at present (e.g., Committee on Science & Public Policy, 2006). Third, we included students from predominantly White and historically Black universities, potentially adding to the generalizability of our findings.

According to SCCT's interest and choice models, self-efficacy helps determine outcome expectations; self-efficacy and outcome expectations are both precursors of interests; and interests, self-efficacy, and outcome expectations jointly lead to choice goals (Lent et al., 1994). Translating these basic causal predictions into the framework of the longitudinal study, we posited, as shown in Fig. 1, that (a) T1 self-efficacy would predict T2 outcome expectations; (b) T1 self-efficacy and outcome expectations would each predict T2 interests; and (c) T1 self-efficacy, outcome expectations, and interests would each predict T2 goals. In each case, we expected that the T1 predictors would explain unique variance in the T2 criterion variables after controlling for autoregressive paths (i.e., the relation of each variable with itself between times 1 and 2) as well as covariances among T1 variables and those among T2 variables. This sort of design allows for examination of the extent to