Journal of Counseling Psychology
1986, Vol. 33, No. 3, 265-269

0022-0167/86/$00.75

Self-Efficacy in the Prediction of Academic Performance and Perceived Career Options

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This study explored the relation of self-efficacy beliefs to educational/vocational choice and performance, assessing the extent to which efficacy beliefs, in concert with other relevant variables, predict academic grades, persistence, and perceived career options in students considering science and engineering fields. Subjects were 105 undergraduates who participated in a career planning course on science and engineering fields. Hierarchical regression analyses indicated that self-efficacy contributed significant unique variance to the prediction of grades, persistence, and range of perceived career options in technical/scientific fields. The two self-efficacy scales used were moderately intercorrelated but differentially related to previous academic performance; neither scale was significantly related to general self-esteem or career indecision. Implications for further career self-efficacy research, and for career and academic counseling, are discussed.

Social learning theory approaches to career decision making have highlighted the role of cognitive/behavioral factors in the career development process, and a number of recent studies have explored the relation of certain types of cognitions to career behavior (see Mitchell & Krumboltz, 1984). In particular, one class of cognitive processes, *self-efficacy expectations* (Bandura, 1977, 1982), has received growing attention in the career literature.

According to Bandura's (1977) self-efficacy theory, self-efficacy expectations, which refer to beliefs about one's ability to successfully perform a given task or behavior, may be important mediators of behavior and behavior change. Expectations of personal efficacy are hypothesized to influence one's choice of behavioral settings and activities, as well as how much effort will be expended and how long one will persist in a course of action in the face of obstacles.

In extending self-efficacy theory to vocational behavior, Hackett and Betz (1981) suggested that expectations of personal efficacy help determine the career decisions and achievements of men and women, and may be especially useful in understanding women's career development. Hackett and Betz hypothesized, for example, that efficacy beliefs are related to people's range of perceived career options, and to persistence and success in their chosen fields. Several recent studies have shown consistent support for the relation of self-efficacy beliefs to various indices of career choice behavior, such as range of perceived options, expressed interests, and occupational preferences (Betz & Hackett, 1981, 1983; Wheeler, 1983).

In an initial test of the hypothesis that efficacy expectations should relate to persistence and success in pursuing educational and career goals, Lent, Brown, and Larkin (1984) found that students' beliefs about their ability to complete the educational requirements of various science and engineering fields were predictive of subsequent academic performance: Students reporting relatively strong self-efficacy generally achieved higher grades and were much more likely to persist in technical or scientific majors over a 1-year period than were those with low self-efficacy.

The present study was designed to extend the findings of Lent et al. (1984) by assessing the extent to which self-efficacy beliefs, in concert with other relevant variables, predict academic grades and retention. Additionally, it was designed to extend the results of other studies (e.g., Betz & Hackett, 1981) by assessing the relation of efficacy beliefs to perceived career options in science and engineering students. Specifically, this study explored the utility of self-efficacy, together with ability, achievement, and interest measures, in predicting academic success, persistence, and range of perceived career options in technical/scientific fields. We examined the utility of two different self-efficacy scales, and explored their construct validity by assessing their relation to career indecision and global self-esteem—two variables that should be relatively distinct, conceptually and psychometrically, from the more circumscribed self-efficacy construct.

Method

Subjects

Subjects were 105 students (75 men and 30 women) enrolled in either of two sections of a one-quarter (10-week) career/edu-

An earlier draft of this article was presented at the 93rd Annual Convention of the American Psychological Association, Los Angeles, California, August 1985.

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cational planning course for undergraduates considering science and engineering majors and careers. (See Lent et al., 1984, for a description of the career planning course.) Participants were primarily freshmen and sophomores, with a mean age of 20 years (SD = 2.86).

Procedure and Instruments

Subjects completed measures of self-efficacy, career indecision, self-esteem, expressed vocational interests, and range of perceived vocational options in technical/scientific fields during the first and final class sessions.

Two indices of self-efficacy, the educational requirements scale employed by Lent et al. (1984) and a newer measure focusing on more specific academic behaviors, were used in this study. The Lent et al. (1984) Self-Efficacy for Technical/Scientific Fields measure was based on procedures used by Betz and Hackett (1981). Self-efficacy was assessed by asking subjects to indicate whether they believed they could successfully complete the educational requirements (ER) and job duties performed in 15 science and engineering fields. Level of self-efficacy (ER-L) scores are obtained by summing the number of fields subjects believe they can complete. Strength of self-efficacy (ER-S) is assessed by having subjects estimate their degree of confidence in their ability to complete these educational requirements and job duties. Strength (or confidence) is indicated on a 10-point scale ranging from *completely unsure* (1) to *completely sure* (10). Strength scores for each subject are calculated by dividing the summed strength estimates by 15, the total number of major/career fields. Test–retest correlation for ER-S over an 8-week period was .89; coefficient alpha, used to estimate internal consistency reliability, was also .89; ER-S correlated significantly with ER-L, r = .81 (Lent et al., 1984). Only ER-S was used in the present study because of its conceptual relevance to the academic criteria of interest and because it effectively subsumes information contained in the level measure.

Hackett and Betz (1984a) have raised the issue of whether task-specific measures might be superior to the more global approaches to self-efficacy assessment represented by ER. Thus, in contrast to ER-S (which requires subjects to rate their efficacy relative to academic major titles), the second measure of self-efficacy, developed for the present study, asks subjects to rate their ability to perform specific accomplishments critical to academic success in science and engineering majors (e.g., "complete the mathematics requirements for most engineering majors"). Confidence ratings, made on a 10-point scale identical to ER-S, are summed across items and divided by the total number of items (11), yielding a measure we termed *strength of self-efficacy for academic milestones* (AM-S). The coefficient alpha value for this scale, computed on pretest data, was .89.

Osipow's (1980) Career Decision Scale (CDS) was used as a measure of educational/vocational indecision. The sum of 16 of its items provides an index of indecision and the remaining 2 items reflect degree of decidedness. Only the indecision subscale (CDS-I) was used in this study. Osipow (1980) reports reliability and validity data for the CDS. For example, test–retest reliability ranges between .70 and .90, and the measure can discriminate between career-decided and undecided students.

Rosenberg's (1965) Self-Esteem Scale (R-SES) was used as an index of global or general self-esteem. The R-SES contains 10 statements about the self that subjects respond to on a 4-point scale, yielding a favorable-to-unfavorable dimension of attitudes toward the self. Higher scores indicate greater self-esteem. Rosenberg (1965) reported that the scale has adequate psychometric properties, such as test–retest reliability of .85, and appropriate correlations with relevant measures such as depression. The R-SES was administered only to the second course section, n = 50.

Expressed vocational interest and range of perceived vocational options relative to technical/scientific fields were assessed using measures adapted from Betz and Hackett (1981). The interest measure required subjects to indicate their degree of interest in each of the 15 fields contained in ER-S; responses of "like," "indifferent," and "dislike" received scores of 3, 2, and 1, respectively. Summed ratings were used to reflect the extent of interest in science and engineering careers. On the perceived career options measure, subjects were asked to indicate the extent to which they had seriously considered pursuing each of the 15 science and engineering fields on a 10-point scale ranging from *haven't considered at all* (0) to *considered very seriously* (9). The range of perceived options was calculated by summing ratings across fields.

Finally, several measures were obtained from university records, including high school ranks (HSR), Preliminary Scholastic Aptitude Test (PSAT) scores, college grades, and declared major choices for each quarter during the year after participation in the career planning course.

Results

To examine potential gender or course section differences in self-efficacy, the two self-efficacy measures were each subjected to a three-way repeated measures analysis of variance (Gender × Course Section × Pre–Post). Results of the analyses revealed no significant main or interaction effects, suggesting that (a) men and women were comparable in their self-efficacy beliefs, (b) there were no reliable differences between the course sections, and (c) self-efficacy did not vary significantly over time. Thus, self-efficacy scores were combined over gender and course sections in subsequent analyses.

Next, to partially replicate the Lent et al. (1984) study and compare the two self-efficacy instruments, subjects were divided into high- and low-self-efficacy groups based on posttest ER-S and AM-S scores. Subjects scoring in the upper and lower quartiles of the distribution were designated as high- and low-self-efficacy groups, respectively. High and low groups were compared on two academic outcomes, (a) grade point average in science and technical course work (TGPA) 1 year later and (b) number of quarters completed as a student in the college of technology over the follow-up year (QTRS). The TGPA was used to reflect quality of academic performance, whereas QTRS was used as a measure of persistence in technical/scientific majors. Table 1 presents means and standard deviations for high- and low-self-efficacy groups on the TGPA and QTRS measures. Analyses of these data revealed significant mean differences between high and low groups on each measure: Differences consistently favored high-self-efficacy subjects, who achieved higher grades and remained enrolled longer in the college of technology than did the low-self-efficacy groups.

Correlations were calculated to assess the relations between self-efficacy, vocational interests, and traditional predictors of academic success. Math PSAT scores and HSRs were used as objective indices of academic aptitude and achievement. (These measures are used for official admis-

Table 1
Means, Standard Deviations, and t *Values for High- and Low-Self-Efficacy Groups on Academic Outcomes*

Academic variable	Self-efficacy condition			
	Educational requirements, strength		Academic milestones, strength	
	High[a]	Low[a]	High[b]	Low[b]
TGPA				
M	2.80	2.43	2.79	2.26
SD	0.47	0.83	0.63	0.73
t	1.97*		2.78**	
QTRS				
M	3.30	2.33	3.00	1.88
SD	1.17	1.78	1.50	1.68
t	2.35*		2.53*	

Note. TGPA = grade point average in technical or science courses. QTRS = number of quarters enrolled in the college of technology.
[a]$n = 27$. [b]$n = 26$.
*$p < .05$. **$p < .01$.

sions purposes in the technical college at which this study was conducted.) As Table 2 shows, the general pattern of correlations among these variables at posttest was low, although ER-S correlated with interests ($r = .32$), AM-S correlated with HSR ($r = .21$), and ER-S and AM-S were, themselves, moderately related ($r = .52$). Neither self-efficacy measure correlated with PSAT scores. Thus, the two self-efficacy measures reflected related but somewhat different aspects of perceived efficacy for academic performance in technical/scientific fields. Tests of differences revealed that AM-S was more highly related than ER-S to previous academic performance (HSR; $t = 2.12$, $p < .05$), and ER-S was somewhat, though not significantly, more related to vocational interests ($t = 1.96$, $p < .10$).

Although the mean differences data comparing high- and low-self-efficacy groups on TGPA and QTRS suggest that efficacy expectations are related to academic performance, they do not reveal the unique contribution of self-efficacy

Table 2
Means, Standard Deviations, and Correlations of Self-Efficacy, Vocational Interest, and Academic Ability

Variable	*M*	*SD*	Variable			
			1	2	3	4
1. Educational requirements, strength	6.13	2.16				
2. Academic milestones, strength	7.12	2.06	.52**			
3. Vocational interest	32.03	4.13	.32**	.14		
4. High school rank	82.91	15.39	.01	.21*	−.17	
5. Math PSAT score	56.58	6.45	.03	.02	.05	.22*

Note. $N = 105$ (75 men and 30 women). PSAT = Preliminary Scholastic Aptitude Test.
*$p < .05$. **$p < .001$.

in predicting academic success. Thus, hierarchical regression analyses were conducted to assess what self-efficacy adds to the prediction of academic performance (TGPA, QTRS) above and beyond measures of actual ability, achievement (PSAT, HSR), and vocational interest. In each analysis, self-efficacy was entered last into the regression equation to determine its unique contribution in predicting performance. Separate analyses were conducted for ER-S and AM-S. Table 3 presents the results of these analyses. In predicting TGPA, both math PSAT and HSR contributed significant variance; however, the self-efficacy variables each accounted for additional significant variance beyond the other predictors. A slightly different pattern emerged on the QTRS persistence criterion: HSR and self-efficacy were the only predictors contributing significantly to the regression equation, with self-efficacy adding unique variance beyond HSR. Interests did not enter significantly into either equation. Although AM-S accounted for slightly more variance than ER-S in the two equations, differences between the contributions of the two efficacy measures did not reach significance.

A third set of regression analyses was run to examine the relation of self-efficacy and the other predictors to range of perceived technical/scientific career options. The results,

Table 3
Hierarchical Regression Analyses Predicting Technical Grades, Persistence, and Perceived Career Options

Dependent variable, predictor	*R*	R^2 change	*r*	*F* change
Technical grades (TGPA)				
Math PSAT	.24	.06	.24	6.57*
High school rank	.37	.08	.32	9.03**
Interests	.37	.00	−.07	0.16
Self-efficacy:				
AM-S[a]	.46	.08	.32	9.81**
ER-S	.42	.04	.18	4.77*
Persistence (QTRS)				
Math PSAT	.14	.02	.14	2.06
High school rank	.26	.05	.22	5.11*
Interests	.27	.01	.04	0.61
Self-efficacy:				
AM-S	.41	.09	.35	11.30***
ER-S	.33	.03	.20	3.79*
Perceived career options				
Math PSAT	.14	.02	.14	2.17
High school rank	.15	.00	.01	0.04
Interests	.56	.29	.54	42.08***
Self-efficacy:				
AM-S	.61	.07	.34	10.57**
ER-S	.62	.08	.44	12.19***

Note. $N = 105$ (75 men and 30 women). PSAT = Preliminary Scholastic Aptitude Test. QTRS = number of quarters completed as a student in the college of technology during the follow-up year. TGPA = grade point average in science and technical courses 1 year later.
[a]Regression analyses were run separately for the two self-efficacy measures, strength of self-efficacy for academic milestones (AM-S) and strength of self-efficacy for completing educational requirements (ER-S).
*$p < .05$. **$p < .01$. ***$p < .001$.

which are also presented in Table 3, indicate that only interests and self-efficacy variables increased the multiple correlation of this equation, and that both self-efficacy variables added unique and comparable amounts of variance beyond interests. Collectively, results of the regression analyses suggest that self-efficacy may aid significantly (and independently of interests, math ability, and past achievement) in predicting technical grades, retention, and range of perceived career options.

Finally, correlations were calculated to assess the relation of self-efficacy to general self-esteem (R-SES) and career indecision (CDS-I). These correlations were nonsignificant, suggesting that the self-efficacy variables are not simply reflecting global self-confidence or career choice certainty.

Discussion

The major findings of this study support and extend previous results showing that self-efficacy expectations are related to indices of academic performance behavior (Hackett & Betz, 1984b; Lent et al., 1984) as well as vocational interests and range of perceived career options (Betz & Hackett, 1981, 1983). Hierarchical regression analyses indicated that self-efficacy does contribute significantly to the prediction of technical grades, persistence, and range of career options considered even when the variance attributable to objective math ability, high school achievement, and vocational interest had been removed in previous steps of the regression equation. However, the two self-efficacy measures were not interchangeable; they intercorrelated at only a moderate level, suggesting that they reflect related but somewhat different aspects of efficacy expectations. Further, only ER-S correlated significantly with interests, and AM-S alone correlated significantly with HSR. In the regression analyses, AM-S and ER-S were similarly useful in predicting range of technical career options considered, whereas AM-S contributed slightly, though not significantly, more variance in predicting grades and persistence.

The finding that math PSAT and HSR were not more highly related to academic outcomes may have been due to the effects of restricted range of ability of the sample (e.g., mean HSR was at the 83rd percentile). Given this high ability range, the correlations of math PSAT and HSR with academic performance and self-efficacy were probably attentuated. In addition, the distribution of HSRs was negatively skewed, further limiting its correlation with other variables. The high ability of our sample reflects the demanding admissions standards generally characteristic of engineering schools. Thus, our results support earlier findings that measures other than actual ability (e.g., self-efficacy) have utility in predicting the academic performance of intellectually homogeneous student groups such as engineering majors (Molnar & DeLauretis, 1973).

Although self-efficacy added significant unique variance beyond objective ability and achievement measures in predicting academic performance, the size of its practical contribution could be challenged (e.g., an additional 3%–9% of the explained variance in performance). However, the pattern of relations was generally consistent with the self-efficacy model, which posits that efficacy beliefs provide valuable, but often not sufficient, information for predicting behavior. It seems important to explore further other forms of efficacy assessment as well as other factors that according to social learning or competing theories, may account for additional variance in performance, such as outcome expectations, incentives for performance, performance attributions, and student–environment congruence.

The present results regarding the relation of self-efficacy to general self-esteem and career indecision are also noteworthy. Lent et al. (1984) had discussed the need to assess the relation of career self-efficacy to such other measures as global self-esteem and certainty of career choice. The small correlations observed suggest that self-efficacy was not simply reflecting global self-confidence or career decidedness. The self-efficacy measures were also somewhat related to, yet distinguishable from, past academic achievements and current vocational interests. Collectively, these results provide some support for the discriminant validity of career self-efficacy, as we have operationalized it.

In terms of implications for counseling, our results suggest the desirability of exploring self-efficacy beliefs in addition to commonly assessed client attributes (e.g., interests, values, objective abilities) in career planning, because efficacy beliefs may contribute to clients' range of perceived career options. Also, efficacy expectations could be explored in relation to academic problems like poor grades, inefficient study habits, or multiple major changes, because self-efficacy also appears related to academic achievement and persistence. Counselors might be particularly sensitive to clients who underestimate their ability with respect to a desired educational or vocational goal. In such cases, programs might be designed to assist clients in modifying their efficacy beliefs.

We need to underscore that these implications for practice are highly speculative; further research, particularly studies demonstrating a *causal* relation between self-efficacy and career-relevant behaviors, could provide a more convincing basis for applying the self-efficacy model to counseling practice.[1] Also, our implications may need to be restricted to relatively high-ability students who are considering science and engineering fields. Finally, because the few existing measures of career-related self-efficacy are experimental in nature, and their suitability for use in counseling is undetermined, the assessment of efficacy expectations in actual counseling must remain largely an art at this time. In keeping with the task-specific nature of efficacy expectations (Hackett & Betz, 1984a), different self-efficacy measures may be appropriate when exploring different aspects of career behavior.

In summary, these findings suggest that self-efficacy is related to career-relevant behavior in ways that are consistent with Bandura's (1977) theory and its extension to vocational behavior (Hackett & Betz, 1981). In particular,

[1]The present findings are consistent with—though they cannot prove—a causal relation between self-efficacy and academic performance inasmuch as the self-efficacy measures were collected prior to the subsequent academic performance criteria.

self-efficacy may be an important cognitive factor mediating the educational/vocational behavior of students considering technical/scientific fields. It seems important to extend these findings to other populations, such as students with other types of vocational interests, at differing levels of academic ability, and those who have not participated in a career planning intervention. It would also be useful for further research to develop and test instruments that tap self-efficacy beliefs in relation to a wide variety of career choice, adjustment, and achievement behaviors. Such efforts should include a focus on the construct validity of career self-efficacy, determining the relation of self-efficacy measures to other relevant constructs. Clearly, emerging findings from several lines of research (Bandura, 1982) suggest that expectations of personal efficacy, particularly in relation to career and other counseling-relevant behavior, merit further study by counseling psychologists.

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Received September 20, 1985
Revision received January 16, 1986 ■