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Career Development Predicts Medical School Success

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A prospective, longitudinal design empirically tested the hypotheses that career development indices account for significant amounts of variance in the prediction of medical school success and account for unique variance beyond that of academic predictors of medical school success. Participants included 111 first-year medical students whose progress was followed during the first 2 years of medical school. The results supported the hypotheses. Logistic regression analyses indicated that career development indices accounted for statistically significant amounts of unique variance beyond that of the academic predictors. Implications for the use of career development indices in practice are discussed. © 1996 Academic Press, Inc.

Although medical school attrition is relatively low, each loss represents a failure in the extensive admission process and each has serious consequences to the student in terms of loan repayment, self-esteem, and the emotional cost of redirecting a career; the government in terms of tuition subsidies; and the school in terms of use of limited resources. Over the years, considerable research has focused on the medical school admissions process as it relates to student success. Nevertheless, this literature has not examined the potential of career development indices to predict medical school performance. Almost 30 years ago Gough (1967) asked "Is there a pattern of nonintellectual variables which will predict performance in medical school?" Spooner (1990), in his summation on the medical school admission process noted that "academic criteria are critical but not sufficient by themselves. They must be integrated with a number of other factors."

Accordingly, the present study examined career development as a nonacademic factor with the potential to contribute uniquely to the medical school admissions process. We expected that degree of career development may predict success in medical school for two reasons. First, students who display greater career maturity can be expected to have been more thorough and realistic in the decisional processes which they used to choose the occupation of physician. Second, a greater degree of career development should also

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indicate a greater readiness to cope with the developmental tasks involved in turning an occupational choice into a reality. In this instance, students with greater career maturity should cope better with the developmental task of implementing their occupational choice, beginning with mastering the medical school curriculum. Initial empirical support for these expectations may be found in the work of Henry, Bardo, and Henry (1992), who reported that a career development seminar for African-American premedical students was effective in increasing the identity and readiness to cope with the developmental tasks of medical school. Thus, the present study tested the hypothesis that career development accounts for statistically significant amounts of the variance in medical school success.

In addition to examining career development as a nonacademic predictor of medical school success, the present study also compared career development and academic development as independent predictors of medical school success. The decision to compare career and academic development measures was prompted, in part, by Westbrook's (1983) contention that mental ability and educational achievement may confound indices of career development. Savickas (1984) presented a theoretical argument in opposition to Westbrook's point of view, but very few empirical studies have contributed toward resolving this issue. Another reason that career and academic development measures are compared is because academic development is currently used in practice as a primary indicant of potential for success in medical school. Thus, to be of practical use, career development should contribute uniquely to the prediction of medical school success beyond the contribution of academic development. Accordingly, the study investigated a second hypothesis, namely, that career development yields unique information and, therefore, differs from academic achievement indices as a predictor of subsequent behavior. Again, our expectation was that the unique information in career development measures pertains to developmental task coping. Thus, individual variation in career development should make a unique contribution to predicting instrumental behaviors in medical school, over and above that predicted by academic indices.

The present study used a prospective, longitudinal design to empirically test the hypotheses that career development indices account for (a) significant amounts of variance in the prediction of medical school success and (b) unique variance beyond that of academic predictors of medical school success.

METHOD

Participants

The participants in the present study were 111 students in the first-year class at a midwestern college of medicine. The entire entering class consisted of 118 students. Thus, the 111 participants represented 94% of the entering class. Each student had been objectively judged as having made a suitable choice by the medical school's admission committee who had examined each student's college grades, ability test scores, and personal statements about career goals. A review of the participants' personal statements revealed no questioning of career goals. Because all the participants had chosen to become physicians, variations in career development attributable to the content of choices was controlled.

The participants were 56% male and 44% female, from 19 to 41 years of age with a mean age of 22. The sample was 61% White, 35% Asian/Polynesian, 3% Black, and 1% Hispanic. Six students did not provide complete data and thus, only 105 students (89% of the entering class) were used for the analyses.

Measures

Career development. The Career Development Inventory College and University Form (CDI; Super, Thompson, Lindeman, Jordaan, & Meyers, 1981) was used to operationally define career development. The CDI is the instrument of choice when measuring the attitudes and competencies required of university students to specify a suitable occupational choice (Savickas, 1990). The CDI consists of two parts: (I) Career Orientation and (II) Knowledge of Preferred Occupation. Part I measures the first four dimensions of Super's (1974) theoretical model of career maturity during adolescence. Section A, Career Planning (CP), measures involvement in thinking about the future and in planning career activities. Section B, Career Exploration (CE), measures the quality of exploratory attitudes and willingness to find and use good resources for career planning. Section C, Career Decision Making (DM), measures ability to apply knowledge and insight to career planning and decision making. Section D, World of Work Information (WW), measures knowledge of the types of occupations and ways to obtain and succeed in jobs. Item and scale factor analyses show that Career Exploration and Career Planning are attitudinal scales, whereas World of Work and Decision Making are cognitive scales (Thompson & Lindeman, 1982). Part II, Knowledge of Preferred Occupational Group (PO), measures familiarity with the type of work indicated as the individual's primary interest. In the present study this was Medical Doctor.

The CDI manual reports alpha coefficients of internal consistency for the subscales as follows: CP, .91; CE, .80; DM, .62; WW, .67; PO, .61. The last three scales have only moderately acceptable reliabilities, however, they are sufficiently large for use in analyzing group differences.

Academic development. Predictors of medical school academic success traditionally used by medical school admissions offices (Mitchell, 1987) were chosen to operationally define academic development. The four predictors used in the present study were undergraduate science grade point average (science GPA) along with the biology (BIOL), chemistry (CHEM), and quantitative (PROB) sections from the Medical College Admissions Test (MCAT). The MCAT is a standardized test designed to (a) assess understanding of science concepts and principles identified as prerequisite to the study and practice of medicine, (b) evaluate basic analytical skills in the context of medically relevant problems and data, and (c) help admissions committees predict which of their applicants will perform adequately in the medical school curriculum. Support for the predictive validity of the MCAT includes significant correlations in the expected direction between the MCAT and first and second year medical school grades, and the results of Parts I, II, and III of national board examinations in medicine. Reliabilities of the MCAT tests are reported to range from .84 to .88 (Mitchell, 1989).

Academic difficulties. Academic difficulties were operationally defined as a dichotomous variable reflecting success in medical school. Success meant unimpeded progress through the first 2 years of the curriculum. Difficulties meant withdrawal, leave of absence, or failure. Withdrawal from the curriculum denoted that the student by her or his own volition or by recommendation of the faculty left the medical school. Leave of absence meant that the student requested a moratorium from medical school to explore other career options. Failure meant that a student failed enough courses to be required to repeat an entire academic year but not enough courses to be dismissed from the curriculum. This study did not differentiate among these difficulties.

Procedures

The CDI was administered to the participants upon entry to the medical school, during orientation activities. Participation in the study was voluntary. The students academic careers were followed by the Academic Review and Promotions Committee, which compiles records for the medical students after each term. Data accumulated for the 2 years subsequent to admission were examined to determine whether they encountered significant difficulties in implementing their occupational choice. The study was completed after 2 years because students rarely encounter difficulties during the final 2 years of medical school.

The hypotheses were tested using logistic regression analyses to examine the fit of three models for predicting academic difficulties. Model A entered only the career development indices, as a block, into the logistic regression equation. Analyzing the results of this analysis tests the first hypothesis—that career development accounts for significant amounts of variance in medical school success. Model B-1 entered only the academic achievement indices, as a block, into the prediction equation and Model B-2 entered the block of career development indices on top of the traditional academic indices. Comparing the results of the three analyses tests the second hypothesis—that career development accounts for significant amounts of unique variance beyond that of the academic achievement indices.

RESULTS

Table 1 presents means, standard deviations, and correlations for the career development and academic measures. The results indicate low to moderate

TABLE 1
Means, Standard Deviations, and Correlations for Academic and Career Development Variables

				Medical College Admissions Test			Career Development Inventory			
Variable	Mean	*SD*	Science GPA	Biology	Chemistry	Problem solving	CP	CE	DM	WW
Science GPA	3.26	0.41								
Medical College Admissions Test										
Biology	8.90	1.70	.21*							
Chemistry	8.34	1.72	.36*	.52*						
Problem solving	8.46	1.66	.34**	.65**	.77**					
Career Development Inventory										
CP	109.32	16.36	−.10	.12	−.06	.03				
CE	105.30	18.16	−.09	−.22*	−.15	−.15	.14			
DM	101.60	16.99	−.06	.08	−.01	−.06	−.02	.16		
WW	107.10	19.19	−.08	.06	−.10	−.16	−.01	.00	.61**	
PO	111.19	15.90	.20*	.18	.15	.09	.00	−.19	.10	.30**

Note. Science GPA, undergraduate science GPA. Career Development Inventory scales: CP, Career Planning; CE, career exploration; DM, Career Decision Making; WW, World of Work Information; PO, Knowledge of Preferred Occupation.

correlations among the career development indices, low to moderate correlations among the academic achievement indices, and low correlations between the career development indices and the academic achievement indices.

To examine the data, two groups were formed consisting of the 81 students who experienced no significant difficulties and the 24 students who experienced significant difficulty at some time during the 2 years. Descriptive statistics for the two groups, including means and standard deviations for the predictors appear in Table 2. With the exception of both cognitive CDI scales (World of Work and Decision Making), the group experiencing no significant academic difficulties scored higher on the career development and academic achievement indices than the group who did experience academic difficulties. Statistical tests of significance were computed to determine whether the two groups differed on mean age (*t* test), proportion of each gender (chi-square), or proportion of each race (chi-square). None of the tests were significant at the .05 level.

The career development and academic achievement variables were standardized to a mean of 100 and standard deviation 20 to make the comparative contributions of the variables more easily interpretable. The remainder of the analyses were based on the standardized scores.

Two stepwise logistic regression analyses were conducted to test the two hypotheses. In the first logistic regression (''Model A'' in the tables), only

TABLE 2
Means and Standard Deviations by Group for Academic and Career Development Variable

	No difficulties (n = 81)		Difficulties (n = 24)	
Variable	Mean	*SD*	Mean	*SD*
Science GPA	3.29	0.42	3.15	0.35
Medical College Admissions Test				
Biology	9.14	1.61	8.08	1.79
Chemistry	8.52	1.67	7.75	1.80
Problem solving	8.65	1.56	7.79	1.87
Career Development Inventory				
CP	111.35	15.32	102.50	18.17
CE	105.54	18.86	104.50	15.89
DM	100.07	17.27	106.75	15.24
WW	105.64	20.76	112.00	11.53
PO	112.22	15.55	107.71	16.93

Note. Science GPA, undergraduate science GP. Career Development Inventory scales: CP, Career Planning; CE, Career Exploration; DM, Career Decision Making; WW, World of Work Information; PO, Knowledge of Preferred Occupation.

the block of career development indices were included in the analysis. In the second logistic regression (''Model B-1'' in the tables), the academic achievement indices were entered alone, as a block. This logistic regression analysis was extended by entering a second block—the career development indices—on top of the academic block (''Model B-2'' in the tables). All tests of significance in the analyses were conducted at the .05 level.

The first hypothesis—that career development contributes significantly to the prediction of medical school academic success—was tested by observing three indicants of the contribution of career development to the prediction of medical school success. First, we individually examined the regression coefficients of Model A (career development indices only) for statistical significance. In logistic regression analyses, the Wald statistic tests the null hypothesis that each regression coefficient is zero. The results indicate that among the coefficients in Model A, only CDI-CP is statistically significant at the .05 level (see Table 3).

Second, to test the hypothesis that the block of predictors as a whole account for statistically significant amounts of variance in academic success we use the model χ^2 test, a statistic comparable to the F-change test in multiple linear regression. The model χ^2 test for Model A, $\chi^2(5, N = 105) = 13.54$, $p = .02$, indicates that the block of career development indices accounts for statistically significant variance over that of the constant alone.

The third test of the first hypothesis was conducted by examining the accuracy of the prediction equation, where participants are predicted as being

TABLE 3
Estimated Regression Coefficients and Related Statistics for the Logistic Regression Analyses

Model	Variable	*B*	*SE*	WALD	SIG	*R*	Exp (*B*)
A	CP	−.029	.013	5.40	.020	−.17	.971
	CE	−.009	.014	.38	.539	.00	.991
	DM	.020	.017	1.44	.231	.00	1.021
	WW	.025	.020	1.64	.200	.00	1.025
	PO	−.028	.015	3.62	.057	−.12	.973
	Constant	.648	2.791	.054	.817		
B-1	Science GPA	−.012	.013	.887	.346	.00	.988
	Biology	−.026	.016	2.491	.115	−.066	.975
	Chemistry	−.003	.019	.024	.876	.000	.997
	Problem solving	−.0069	.023	.093	.760	.000	.993
	Constant	3.471	1.803	3.706	.054		
B-2	Science GPA	−.013	.015	.774	.379	.000	.987
	Biology	−.038	.019	4.071	.044	−.141	.963
	Chemistry	−.002	.022	.006	.938	.000	.998
	Problem solving	−.012	.027	.180	.672	.000	.989
	CP	−.030	.014	4.692	.030	−.161	.970
	CE	−.029	.018	2.624	.105	−.077	.972
	DM	.031	.018	2.819	.093	.089	1.031
	WW	.033	.023	2.088	.149	.029	1.033
	PO	−.028	.017	2.622	.105	−.077	.973
	Constant	7.07	3.70	3.518	.061		

Note. Science GPA, undergraduate science GPA. Career Development Inventory Scales: CP, Career Planning; CE, Career Exploration; DM, Career Decision Making; WW, World of Work Information; PO, Knowledge of Preferred Occupation.

more likely to experience difficulties or not. This was done by comparing the predicted to the actual observed classification of participants. The results for Model A show that the career development indices correctly classified 79.05% of the participants (see Table 4). Almost 98% of the students who experienced no academic difficulty and 17% of the students who did experience academic difficulty were correctly classified.

Two ancillary statistics were used to test the first hypothesis. The large significance level of the −2 log likelihood statistic, $\chi^2(99, N = 105) = 99.35$, $p = .47$, precludes rejection of the null hypothesis that the observed probabilities are the same as those predicted by the career choice readiness indices. The large significance level of the goodness-of-fit statistic, $\chi^2(99, N = 105) = 98.96$, $p = .48$, prevents rejection of the null hypothesis that the career choice readiness model fits the data, that is, the model does not differ significantly from the ''perfect'' model.

A second logistic regression analysis was performed to test the second hypothesis—that career development indices account for unique variance in

TABLE 4
Classification Tables for Observed versus Predicted Outcomes for the Participants

		Predicted			
Model	Observed	No difficulties	Difficulties		% Correct
A	No difficulties	80	1		98.77
	Difficulties	22	2		8.33
				overall	78.10
B-1	No difficulties	79	2		97.53
	Difficulties	20	4		16.67
				overall	79.05
B-2	No difficulties	77	4		95.06
	Difficulties	16	8		33.33
				overall	80.95

medical school success beyond that of traditional academic achievement indices. In this analysis, the academic achievement indices were entered in step one (Model B-1), followed by the career development indices (Model B-2). The model chi-square statistic (analogous to the F-change test in multiple regression) for Model B-2, $\chi^2(9, N = 105) = 24.519$, $p = .004$, indicates that the additional variance accounted for by the career development indices over the variance accounted for by academic achievement was statistically significant.

The second indicant of the unique contribution of the career development measures is the change in the magnitudes of the regression coefficients from each block of predictors alone (Models A and B-1) and when they are entered in the regression equation together (Model B-2). Four of the five career choice readiness indices show an increase in magnitude (see Table 2). Among the career development indices, only the coefficient for CDI-PO decreased (.4%, from −.0278 to −.0277). The other four career development measures increased in magnitude by 1.7% (CDI-CP from −.0299 to −.0304), 31.6% (CDI-WW from .0250 to .0329), 50% (CDI-DM from .0204 to .0306), and 228% (CDI-CE from −.0088 to −.0289). The regression coefficients for the academic achievement indices, with one exception, also increased following the entry of the career development indices to the regression equation. The regression coefficient for CHEM decreased by 43% (from −.0030 to −.0017); however, the coefficients for the other three academic indices increased by 5.6% (scienceGPA from −.0124 to −.0131), 49% (BIOL from −.0256 to −.0381), and 67% (PROB from −.0069 to −.0115).

The third test of the second hypothesis compared the accuracy of the prediction equations made by Models A and B-2. The results indicate that the overall correct classification rate increased from 78.1% by the academic indices alone to 80.95% by both sets of indices together (see Table 4). The correct classification of students who experienced no difficulties decreased—from 98.77% for academic achievement indices alone to 95.06% for both career development and academic indices. However, the correct classification of students who did experience difficulties increased—from 8.33% for academic achievement indices alone to 33.33% when career development indices were added.

The large significance levels of the −2 log likelihood statistic (χ^2(95, N = 105) = 88.366, p = .672) and the goodness-of-fit statistic (χ^2(95, N = 105) = 101.458, p = .306) preclude rejecting the null hypothesis that the observed probabilities are the same as those predicted by both sets of indices and the null hypothesis that the model incorporating both sets of indices fits the data.

Several statistics permit the relation between individual variables and the probability of experiencing academic difficulty to be directly interpreted in terms of practical outcomes. First, the statistic denoted "*R*" (see Table 2) is the partial correlation between the dependent variable (medical school success) and each of the independent variables. For example, the *R* value of −.17 for CDI-CP in Model A indicates that individuals with higher scores on CDI-CP have less of a likelihood of experiencing academic difficulties. Second, the statistic denoted "Exp(*B*)" is the mathematical constant *e* raised to the power of the regression coefficient. This yields the factor by which the odds change when the independent variable associated with the coefficient is increased by 1 unit (the odds are the ratio of the probability that the event (academic difficulty) will occur to the probability that the event will not occur). An increase of *x* units in the independent variable would correspond to the odds changing by a factor of Exp(*B*) raised to the *x*th power. For example, the value of Exp(*B*) for CDI-CP in Model A is .971, which indicates that the odds for a participant with a score of 101 on CDI-CP are only .971 the odds for a participant with a score of 100. The odds for a participant with a score of 120 on CDI-CP (1 *SD* in the standardized units) has only $(.971)^{20}$ = .56 the odds of a participant with a score of 100.

DISCUSSION

Overall, the results provide strong support for both hypotheses. First, career development contributes significantly to the prediction of medical school academic success. Second, the contribution of career development is distinct from the contribution made from academic predictors. These two conclusions will be discussed in turn.

Career Development Predicts Medical School Success

With regard to the results of the classification of participants based only on career development, two observations pertaining to errors in prediction are particularly salient in terms of practical implications. One error which might be made in practice would be to deny admission to individuals who would succeed if admitted. Although we would expect the accuracy of prediction to decrease when cross-validated on another sample, only 2 of the 81 participants (2.4%) who had no difficulty were incorrectly predicted to have difficulty. That is, the career development measures, with the largest contribution made by career planning, correctly classified 98% of the participants who experienced no academic difficulties in medical school. This low error rate is particularly desirable because misclassifying able students in practice means erroneously denying entry to medical school to students with the potential for success; an error costly both to the applicant denied admission and to society denied an able physician.

It is not surprising that career planning attitudes made the largest contribution to effectively predicting the 98% of participants who would not encounter difficulties. Future orientation and planfulness have always been the active ingredient in career maturity while future orientation has been the core of mental health in Western societies. The results of the present study were unexpected in one regard, however. Those individuals who experienced academic difficulties had, as a group, a greater store of occupational information than the individuals who did not experience significant difficulties. Nevertheless, their pattern of scores suggests that they do not relate this information to planning their own lives and careers (Savickas, 1990).

A second error which might be made in practice would be to admit individuals who subsequently experience difficulties. The career development measures identified only 4 (17%) of the 24 participants who actually experienced difficulties. Nevertheless, only 6 participants were predicted to have difficulties, so that the 4 correct classifications represent a 67% hit rate among those predicted to have difficulties. Although we would expect this success rate to decrease somewhat on a new sample, if this result generalized to other samples, this would be a strong diagnostic tool that admissions committees could use. The ability to identify a small number of applicants as having a high probability of experiencing difficulties would permit the admissions staff to examine these applicants more carefully, perhaps considering additional criteria which would be considered too extensive to apply to the entire pool of applicants.

Although the 17% correct classification rate of participants who did experience difficulties may seem small by absolute standards, 17% is noteworthy given that the participants consisted of a highly homogeneous group which had been selected through a thorough screening process that included the use of academic indicators (MCAT scores and GPA), reference letters, a personal statement, and an interview with a three-person committee. Furthermore, the 17% compares favorably to the 8% figure achieved by the academic development measures alone (see Table 4). Apparently, career development is a better predictor of difficulties for enrolled medical students than is academic development. It would be interesting to compare academic and career development predictors for a less homogeneous group. For example, the academic predictors might be better than career predictors of performance for a heterogenous group of medical school applicants.

Career and Academic Development Are Independent Predictors

The results of the present study also supported the second hypothesis that career development indices yield unique information and therefore differ from academic indices as predictors of subsequent behavior. The correlations show clearly that career development is distinct from academic achievement, at least as they are operationally defined in the present study. When the career development measures were added to the academic development measures, they added statistically significant amounts of unique variance to that accounted for by the academic predictors.

Comparing the improvement of the combined predictive power of academic development and career development predictors over that of the academic predictors only, the correct classification of individuals who experienced no significant difficulties decreased slightly, from 98.77 to 95.06%. However, the correct classification of individuals who experienced significant academic difficulties increased from 8.33 to 33.33%. It seems that academic development may be slightly better predictors of medical school success and career development is superior in predicting difficulties.

Eight of the 12 participants predicted to have difficulties were correctly classified, maintaining the 67% hit rate achieved by career development indices alone. By identifying these individuals for closer examination, admissions decisions can be made that perhaps lower the resulting numbers of students experiencing difficulties. The error of admitting students into medical school who subsequently experience difficulties has a high cost, in terms of monies invested by the student and government, time and esteem lost by the student, and resources that could be utilized by students not admitted—but who could have been had admissions screening been more effective. In terms of the monetary cost of this type of misclassification, the average student at the medical school where the study was conducted has approximately $25,000 in student loans by the end of the second year and the subsidized portion of the student's tuition is approximately $40,000. The cost of misclassification in terms of time and esteem are also considerable. These students find themselves with several years of time invested and in desperate need of new career goals.

A strong indication of the unique variance accounted for by career development beyond that of academic achievement is observed in the increase in the magnitude of seven of the nine regression coefficients when both academic and career development predictors are included in the regression. This indicates that not only are the career development and academic achievement indices accounting for unique variance, but they are mutually suppressing variance unrelated to medical school academic success. A comparison of the correct classifications made by the models supports this position. The academic indices (Model B-1) correctly predicted 8%, the career choice readiness indices correctly (Model A) correctly predicted 16%, and the academic and career choice readiness indices (Model B-2) correctly predicted 33% of the students who did experience significant academic difficulties. The hit rate of 33% for the model using both academic and career predictors is higher than the sum of the hit rates for the models using the predictors separately (8% + 16% = 24%). This pattern suggests that the career development variables are acting as suppressor variables for the traditional predictors and vice versa.

Limitations in the size and composition of the research participants temper the generalizability of the results. Also, because logistic regression involves a maximization procedure, the accuracy of the prediction equations resulting from this study would be expected to decrease when cross-validated on a new sample, as would occur with any study using a maximization procedure. Therefore, further support for the hypotheses is required before the results of this study can be reliably used in practice.

In sum, the results of the present study strongly support the hypothesis that career development contributes unique information over that of indices of mental ability and educational achievement in predicting medical school academic difficulties. The results suggest the potential for career development measures to provide unique and important information to professional school admissions committees and counseling programs. The results also provide strong support for the developmental theorem. Coping with developmental tasks predicted coping with the next developmental task. In particular, coping responses for the task of specifying an occupational choice predicted success in instrumental coping with the tasks of professional training for implementing the specified choice. Finally, the study documents, at least for the Career Development Inventory, that career maturity is not the same as academic achievement and intelligence.

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