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ABSTRACT

Improving graduation rates among U.S. elementary and secondary school students requires that one be able to detect which students are at greatest risk for dropping out. There may be a variety of social and psychological differences between those who leave and those who graduate, but there is also evidence that those who abandon school are disproportionately low achievers. This study used reading and mathematics data in a discriminant analysis to predict who is most likely to drop out of school. Two groups of 50 students each were selected from students who had taken both reading and mathematics portions of the Scholastic Assessment Test. The first group consisted of randomly selected dropouts; the second group consisted of graduates. Although achievement data were not dramatically different for dropouts than for graduates, they provide a statistically reliable prediction of who will leave school before graduation. (Contains 2 tables and 17 references.) (Author/SLD)

Academic Achievement as a Drop Out Predictor

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Abstract

Improving graduation rates among American elementary and secondary school students requires that one be able to detect which students are at greatest risk for dropping out. There may be a variety of social and psychological differences between those who leave and those who graduate, but there is also evidence that those who abandon school are disproportionately low achievers. The authors used reading and mathematics data in a discriminant analysis to predict who is most likely to drop out of school. Although achievement data were not dramatically different for dropouts than for graduates, they provide a statistically reliable prediction of who will leave school before graduation.

More than a decade ago, the (first) Bush administration and the National Governor's Association adopted six national education goals aimed at making the educational performance of American elementary and secondary school students second to none in the 21st century. One goal dealt specifically with reducing the dropout rate (Walker, 1990). Ironically, the school dropout rate declined dramatically *before* the problem became an issue for state governors and national panels (Deschamps, 1992), but because the consequences of dropping out are increasingly serious it remained a focal point, and for many, it continues to be an important measure of educational and social progress.

Although they are estimates, the economic costs associated with dropping out are difficult to ignore. Goldschmidt and Wang (1999; see also Staying, 1987) reported that the difference between the earnings of high school dropouts and graduates is increasing. They noted that in 1997, among the ranks of 16 to 24-year-olds, only 67% of dropouts participated in the labor force compared to 83% of high school graduates. For that period, dropouts had an unemployment rate of 10.4%, over double the 5.1% rate for high school graduates.

There are other dimensions to the problem. LeCompte and Dworkin, (1991) reported that 82% of all prison inmates are high school dropouts. Although such a finding establishes no causal relationship between dropping out and criminal behavior, the assumption of a relationship is implicit in much of the commentary on the topic.

Poor consistency in the literature regarding what defines a school dropout makes dropout studies difficult to conduct (Deschamps, 1992; Staying, 1987), as does the implicit assumption that those who leave school and those who remain differ only by

virtue of the decision some make not to continue. Indeed, it is clear from the evidence that academic performance is *not* equal for the two groups. It is disproportionately low achievers who elect to leave school before graduation (Barrington and Hendricks, 1989; Hahn, 1987; Hotchkiss, 1984; Staying, 1987; Wittenberg, 1988). Her comprehensive review of studies on the relationship between achievement and dropping out, led Deschamps (1992) to conclude that poor academic performance was a significant factor in the students' decision to leave school in 21 of 23 studies. Such differences between school dropouts and school graduates constitute fundamental problems for those who wish to make economic or social comparisons between the two groups.

Remedial efforts are prevalent enough. Reentry programs offering high school equivalency diplomas are a fixture in most adult schools and community colleges, but Goldschmidt and Wang (1999) report that these programs are largely ineffective. Researchers in Maine suggest that early intervention is the more profitable course, particularly if it occurs in the beginning grades (Staying, 1987).

Intervention programs are unlikely to be effective, unless one can predict those who are most likely to leave. The literature hints at what the indicators might be. Rice, et al. (1988) found, for example, that the dropout rate was strongly associated with students' eighth grade reading equivalency scores suggesting that some academic deficits may figure more prominently than others and it is such possibilities that drive the present study. Reading data are analyzed to determine whether they will predict those who will remain in school and those who will leave. Because the frequent companion in testing and teaching emphasis is mathematics performance, we have also included mathematics

scores as a potential predictor. For purposes of this study, a dropout is one who left the district before graduation with no stated intention to continue studies elsewhere.

Method

The Stanford Achievement Test (the SAT, Harcourt, Inc., 2001) currently in its 9th edition, is a common measure of elementary and secondary school students' educational performance. In a major suburban school district in the intermountain west, two groups of 50 subjects each were selected from among those who had taken both the reading and mathematics portions of the SAT in the seventh, ninth, and eleventh grades. The first group constituted 50 randomly selected 12th grade students who dropped out during the 1999-2000 academic year. The second group was randomly selected from twelfth graders who graduated at the end of the 1999-2000 school year.

The initial question is whether there are statistically significant differences between the reading and math scores of the two groups. Should there be significant differences, the related question is whether the data allow one to make better-than-chance predictions of which students will leave school and which will remain and graduate.

Results

The descriptive statistics for students' SAT scores by grade, as well as *t*-tests for significant differences between dropouts and graduates appear in *Table 1*.

Place *Table 1* about here

Between Group Comparisons

There are differences between the means of each group, although their measures of variability are quite similar. The t-tests indicate that particularly in the later grades, the SAT scores of those who dropped out of school are significantly different from the scores of those who remained.

Such a finding, however, indicates only that the result is not likely to have occurred by chance and not that it necessarily has any practical importance. To determine whether statistical significance is something more than a mathematical artifact, omega squared (ω^2) values were calculated (Diekhoff, 1992) which reveal how much of the variability can be explained by factors relating to whether or not the student ultimately dropped out of school. The differences between dropouts and graduates explain 5% of the variance in 9th grade mathematics scores, 6% of the variance in 9th grade reading scores, and 6% of the variance in 11th grade reading scores. According to Kirk (1999) these are "medium associations." For 11th grade mathematics scores ω^2 = .14. Fourteen percent is "a large association" (Ibid.).

Predicting the Drop Out

Although there might be several social or psychological variables related to the students' inclination to leave school prematurely, here the focus is on academic variables. We wish to know whether reading or mathematics data from the 7th, 9th, or 11th grades will predict, with statistical reliability, whether subjects will drop out. Of the six sets of scores available (mathematics and reading scores for each of three grades), just the 11th grade mathematics score meet the statistical criteria required for use in discriminant

analysis.[1] None of the other scores sufficiently distinguish between those who dropped out and those who remained (*Table 2*).

The value for Wilks' Lambda (λ) suggests the strength of the analysis in the negative by indicating the proportion of variance in the scores that the model does *not* explain so that the proportion of variance explained by differences in 11th grade mathematics achievement between dropouts and graduates is available by subtraction. In this case, $\lambda = .852$ indicating that 1-.852 or .15 (15%) of the decision to leave school is associated with differences in 11th grade mathematics scores, a value quite similar to the omega squared value from the *t*-test. The remaining 85% is due to other factors.

Place *Table 2* about here

The value of discriminant function analysis resides in how accurately one using the procedure can distinguish between those who will drop out, and those who will remain and graduate before these decision have actually been made. One can test the discriminant function taking a group for whom the outcome is known (our samples, for example), and examine how well the procedure would correctly classify them according to their test scores. A discriminant function based solely on 11th grade mathematics score correctly classified 72% of the 100 subjects involved in this analysis. If all six scores are entered into the analysis, the success rate *declined* to 71% correct predictions (one fewer case was correctly classified[2]).

Limitations, Conclusions, and Implications

Under some circumstances it is difficult to conduct a discriminant analysis and achieve a stable solution with two groups of 50. The authors recognize that larger samples will be a necessary evolution of the research in this area, but suggest that the random selection of these two groups from among several thousand students in a major suburban school district provide evidence that further research will support the findings.

The authors acknowledge that there are multiple aspects to the drop out problem. Rumberger (1995) noted, for example, that retention in grade is the single most powerful predictor of the tendency to drop out. He also notes a number of other components of the problem relating to ethnicity, social class, and the social climate of the school. Our focus on achievement differences is an effort to make at least one dimension of the problem manageable for those at the school level who must cope with it directly. It is not a move to minimize other important elements of what is a complex and difficult problem.

Short of programs designed for all students, effective drop-out intervention requires some basis for predicting those who are most likely to leave school, and those who will remain. There are probably many social and psychological differences between these two groups of students, but some of the difference is reflected in achievement scores. Whatever the relationships between socio-psychological differences and achievement, there is evidence that those who leave school before graduation are disproportionately low achievers (Barrington and Hendricks, 1989; Hahn, 1987; Hotchkiss, 1984; Staying, 1987; Wittenberg, 1988). We analyzed those differences for their value in predicting who will drop out and who will remain.

Results were mixed and dependent upon the subject's grade. From a statistical point of view, the 7th grade scores of those who remained and those who left may reflect only random differences. However, because within-group variability was minimal among 11th grade students, comparatively small difference in reading scores were statistically significant. The largest difference between the two groups is in 11th grade mathematics achievement where scores explained a substantial amount of the variance ($\omega^2 = .14$) in the decision to drop out. Similar magnitudes "are not generally encountered in sociobehavioral research" (Pedhazur and Schmelkin, 1991, p. 338-339). The 11th grade mathematics scores allowed a significantly better-than-chance opportunity to predict who will leave school prematurely. Although the variance that remains unaccounted for in the analysis is substantial ($\lambda = .852$), the discriminant function provides an economical prediction based, as it was in this study, on just one quite accessible predictor.

It is not clear from this analysis whether lower levels of academic success are a major factor in students' decision to drop out, or whether scoring differences are symptomatic of other conditions (Alexander, Entwisle, Horsey, 1997; Garnier, Stein, & Jacobs, 1997; Mensch and Kandel, 1988). If research supports Deschamps' (1992) finding that achievement differences are a major factor in the decision to leave school, educators probably have a greater measure of control than they can exercise if low achievement is an indicator of some other, less apparent difficulty in the students' lives. The social/psychological conditions that may contribute to dropping out are probably less accessible and more difficult to alter.

Early identification holds the greatest promise (Staying, 1987), but it is complicated by the fact that, at least for these subjects, significant differences do not emerge before the 9th grade, and only 11th grade mathematics scores significantly predict who will drop out. The silver lining to that finding, however, is that many students may not make the decision to leave school until relatively late, a condition that might be preempted by effective early secondary school intervention.

Footnotes

[1]The the stepwise selection criteria for including/excluding variables in the analysis were the SPSS defaults, $F = 3.84$ to enter a new variable and $F = 2.71$ to remove.

[2]The data for the second discriminant analysis were not included but are available from the first author by request. He can be reached at davidt@csufresno.edu.

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Table 1. SAT Scores for Dropouts and Graduates by Grade

Grade	*N*			Mean	Std.Dev	*t*	Sig.	ω^2
7	50	Math	Dropped	48.200	28.755	1.863	.065	
			Graduated	59.260	30.571			
	50	Read	Dropped	47.120	28.603	1.606	.111	
			Graduated	56.120	27.410			
9	50	Math	Dropped	42.900	29.899	2.604	.011	.05
			Graduated	58.320	29.315			
	50	Read	Dropped	42.760	31.439	2.682	.009	.06
			Graduated	59.180	29.757			
11	50	Math	Dropped	49.140	16.462	4.123	.000	.14
			Graduated	62.280	15.389			
	50	Read	Dropped	47.900	17.461	2.809	.006	.06
			Graduated	57.420	16.417			

Table 2. Predicting Dropouts with Discriminant Analysis

Variables					
Excluded	Included	Lambda	Chi Square	Correct Predict	
	Math11	.852; p<.001	15.597; p<.001	Dropped	Grad
Read11				33 of 50	39 of 50
Math9					
Read9					
Math7					
Read7					

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