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USES OF PREDICTION IN SECONDARY SCHOOLS

ABSTRACT: Predictive validity of the Differential Aptitude Test (DAT) was investigated by comparing the DAT scores obtained by students in Grade IX against their achievement in Grade XII departmental examinations. Results indicated that the DAT has good predictive power and can be used effectively on a selective basis for counseling and predictive purposes in high schools.

Prediction of success in achievement at the secondary school level and beyond has long been an important concern of educators. Learned and Wood (1938) early in this century began to investigate relationships between high-school and college grades. In some Canadian provinces, Grade XII matriculation examinations serve as entrance to universities, and studies have shown that results of these examinations have high predictive validity for post secondary education (Black, 1966; 1969). There is much evidence to show that past academic achievement is the best predictor of future academic success (Black, 1959; Anastasi, 1961; Cronbach, 1960; Conklin & Ogston, 1968).

In Alberta, external examinations have in the past been administered by the Department of Education on two separate occasions — once in Grade IX and once in Grade XII. Department of Education Special Services Branch studies (1961, 1962) revealed that those students scoring high on the Grade IX aggregate stanine were successful in Grade XII, whereas those Grade IX students who received an aggregate stanine from 1 to 4 inclusive, had virtually no chance of completing a matriculation program in Grade XII. It was also shown that the stanine rating of the aggregate Grade IX achievement was as good a predictor of achievement in any particular Grade XII subject as the mark in the corresponding Grade IX subject. Thus, although the ninth grade tests in Alberta were originally devised for the purpose of passing or failing students, massive data have been collected from which some predictions can be made with some accuracy. Predictive validity is said to exist when scores on the predictor correlate highly with scores on the criterion variable.

"In no other area is predictive validity as important as it is in using tests to help make decisions about schooling (Nunnally, 1970, p. 134)." Here tests are used to predict readiness for first grade, to divide children into levels of instruction, to select students for special programs and to aid in post high school placement. In Alberta schools, Grade IX Departmental Examination results have in the past been used by administrators and counselors to help students with course and program selection. This information has contributed to self-knowledge and to improvement in decision-making.

THE PROBLEM

In the past several years various modifications were made to Alberta Grade IX Examinations and after three years of experimentation, the Department of Education decided to discontinue entirely the administration of examinations to the total Grade IX population. Since courses in Grade IX may now differ significantly in content and educational experience from one school to another, administrators and counselors have to attempt to help students in their selection processes of educational programs without the aid of validated predictive measures. Therefore instruments given to Grade IX students, other than the Grade IX Examinations, could well be used for predictive purposes. One such instrument that appears to fulfill these purposes is the Differential Aptitude Test (DAT).

It was the purpose of this study to assess the predictive validity of the DAT by comparing the DAT scores obtained from students in Grade IX against their achievement on the Grade XII Departmental Examinations.

PROCEDURES

Sample

Grade IX students in several Alberta junior high schools were given the DAT battery several months before writing their final examinations in June, 1968. The students of this group who completed five or more Grade XII Matriculation Examinations before September 1, 1971, and thereby qualifying for University entrance, became the subjects in this study. The total number of Ss in the sample was 101.

Instruments

1. Although the DAT was developed to provide measures of differential abilities for boys and girls in Grades VIII through XII, it has sufficient range of item difficulty so that it can be used with adult groups. The subtests in the DAT battery were not developed directly out of factor-analytic work, but were composed in such a way as to incorporate some of the major findings from factor analysis. The DAT yields 8 scores: Verbal Reasoning (VR), Numerical Ability (NA), Abstract Reasoning (AR), Space Relations (SR), Mechanical Reasoning (MR), Clerical Speed and Accuracy (C), Language Usage I — Spelling (Sp), and Language Usage II — Sentences (Se). These 8 subtest scores plus the combination of VR + NA, which

provides an estimate of scholastic aptitude, constitute 9 variables considered in this study.

Bennett, Seashore, and Wesman (1966) in the DAT Manual present an overwhelming amount of validity data including over 4,000 correlation coefficients. Most of these data are concerned with predictive validity in terms of high-school and college achievement. Many of the coefficients are high, even with intervals as long as three years between test and criterion data.

Reliability coefficients for the tests range from .85 through .93 for boys and from .71 through .92 for girls. The validity of the tests is based on correlations between test scores and scores on other tests of a similar nature and on several longitudinal follow-up studies. Validity coefficients are statistically significant.

Bennett, Seashore, and Wesman (1966) state that the VR and NA tests are among the better predictors for all school subjects. The combination of VR + NA was found to be as good a predictor, or better, than any of the subtests for all subjects including typing and industrial arts.

2. The Grade IX final examinations, which had been written by all Ss in June, 1968, provided these variables: Reading (Read), Literature (Lit), Language (Lan), Social Studies (Soc), Mathematics (Math), Science (Sc), and the Aggregate (Agg) of those six subject areas. A general ability test which is divided into two parts yields verbal (V), quantitative (Q), and total (T) scores.

3. The average (Av) of five Grade XII Departmental examinations was used as the criterion against which the other variables were compared.

RESULTS

Data analyses were performed utilizing the Statistical Package for Social Sciences (SPSS) available on the CDC-6400 computer at the University of Calgary Data Centre (Nie, Bent, & Hull, 1970).

Pearson correlations (r's) were computed for the totaal group. This correlation matrix, shown in Table 1, includes all the variables under investigation.

The size of the simple correlation between the Grade IX aggregate scoire (Agg) and the Grade XII average (Av), $r = .74$, indicates that the Agg score accounted for 54.76 percent of the variance in Grade XII. The T score of the Grade IX general ability test shows a marked relationship with the criterion, the Av. All of the nine variables of the DAT, with the exception of C, correlated significantly ($p < .05$) with the Av.

To examine the situation further, step-wise multiple regression analyses were computed (Nie, Bent, & Hull, 1970, pp. 174-195). This statistical approach enables one to examine the relationship of each variable and combinations of variables to the dependent variable (Gr. XII Av) while taking into account the degree of interrelationship between the independent variables. Three runs were made including

TABLE 1

Correlation Matrix of All Variables

	VR	NA	AR	SR	MR	C	Sp	Se	VR+NA	Read	Lit	Lan	Soc	Math	Sc	Agg	T	V	Q	Av
VR																				
NA	.36																			
AR	.35	.32																		
SR	.37	.15	.46																	
MR	.46	.26	.26	.42																
C	.06	.11	.13	.02	−.10															
Sp	.43	.42	.08	.13	.24	.16														
Se	.44	.38	.06	.13	.27	.07	.70													
VR+NA	.83	.79	.35	.32	.45	.03	.53	.52												
Read	.33	.15	.23	.08	.15	−.06	.34	.45	.31											
Lit	.49	.39	.20	.19	.35	.01	.46	.52	.55	.61										
Lan	.42	.36	−.01	.17	.36	−.06	.58	.67	.48	.47	.60									
Soc	.43	.25	.20	.19	.26	.05	.39	.46	.44	.62	.54	.44								
Math	.49	.57	.39	.45	.46	.02	.32	.32	.64	.29	.48	.47	.43							
Sc	.49	.39	.31	.16	.38	−.15	.43	.46	.53	.37	.47	.36	.52	.53						
Agg	.60	.46	.31	.27	.41	.01	.58	.64	.66	.71	.78	.71	.67	.71						
T	.62	.50	.26	.40	.45	−.02	.53	.64	.72	.58	.65	.61	.66	.59	.59	.79				
V	.63	.32	.23	.32	.41	−.01	.46	.57	.63	.64	.65	.54	.70	.46	.51	.74	.88			
Q	.37	.61	.29	.37	.35	.02	.43	.45	.58	.25	.38	.41	.33	.62	.51	.53	.70	.40		
Av	.45	.32	.27	.28	.42	.02	.35	.41	.48	.50	.53	.44	.62	.58	.59	.74	.66	.56	.55	

TABLE 2

Simple Correlations, Multiple Correlations, and Beta Regression Weights for DAT subtests
with Grade XII Average as the Dependent Variable.

DAT Subtests	Total Group (N = 101)			Female Group (n = 53)			Male Group (n = 48)		
	Simple r	Multiple r	Beta Weights	Simple r	Multiple r	Beta Weights	Simple r	Multiple r	Beta Weights
VR+NA	.482	.482	.444				.592	.592	.794
MR	.418	.532	.207	.406	.564	.212	.447	.654	.213
Se	.408	.560	.202	.413	.413	.412			
AR	.273	.571	.130	.345	.531	.270	.199	.667	−.056
NA	.323	.574	−.182				.458	.660	−.318
SR	.285	.575	.031	.203	.577*	−.036	.362	.668*	.048
Sp	.351	.576	.037	.261	.572	−.167	.469	.627	.258
VR	.452	.576*	−.109	.367	.577	.096	.523	.664	−1.95
C							.044	.667	.057
Constant	39.514			42.892			35.201		
Std. Error	8.658			7.848			9.263		

*Indicates total cumulative multiple r.
Note: Significance of simple r (.05 level) for N = 101, r = .196; for n = 53, r = .267; for n = 48, r = .285.

TABLE 3

Simple Correlations, Multiple Correlations, and Beta Regression Weights for Grade IX
Subjects with Grade XII Average as the Dependent Variable

Grade IX Subjects	Total Group (N = 101)			Female Group (n = 53)			Male Group (n = 48)		
	Simple r	Multiple r	Beta Weights	Simple r	Multiple r	Beta Weights	Simple r	Multiple r	Beta Weights
SOC..................	.624	.624	.277	.652	.652	.354	.611	.744	.215
MATH................	.582	.715	.277	.479	.727	.237	.648	.648	.313
SC..................	.588	.738	.218	.603	.771	.190	.624	.757	.106
READ...............	.499	.748	.123	.625	.756	.259	.420	.757*	−.027
LIT.................	.529	.750	.060	.503	.774*	.025	.583	.724	.181
LAN.................	.440	.750*	.017	.343	.774	−0.97	.559	.754	.143
Constant...............	16.111			18.221			16.397		
Std. Error..............	6.934			6.082			7.929		

*Indicates total cumulative multiple r.

total, female, and male groupings to obtain simple correlations, multiple correlations, and beta weights for each of the DAT subtests and the Grade IX subjects with the Grade XII Av.

As indicated by Table 2 the DAT subtests, as they constitute prediction equations for Grade XII Av, vary in order and weight from group to group. The prediction equation for the total group, which includes DAT subtests VR + NA, MR, Se, AR, NA, Sp and VR, accounted for 33.19 percent (multiple $r = .567$) of the variance in the Grade XII Av. The prediction equation for the female group which includes DAT subtests Se, AR, MR, Sp, VR and SR, accounted for 33.33 percent (multiple $r = .577$) of the variance in the Grade XII Av. In contrast the prediction equation for the male group, which includes the DAT subtests VR + NA, Sp, MR, NA, VR, C, AR and SR. accounted for 44.64 percent (multiple $r = .668$) of the variance in the Grade XII Av. It should be noted that variables with missing simple r's, multiple r's and beta weights did not add anything of significance to the prediction equation and were thus not included in the step-wise multiple regression analysis.

Table 3 revealed similar variability in composition of prediction equations based upon Grade IX subjects. The prediction equation for the total group — Soc. Math, Sc, Read, Lit, and Lan — accounted for 55.25 percent (multiple $r = .750$) of the variance in the Grade XII Av. The order of the variables is changed somewhat for the female and male group and account for 59.91 percent and 57.31 percent of the variance respectively in the Grade XII Av.

DISCUSSION

The results of this study clearly confirm evidence cited above that (a) past achievement is a good predictor of academic success and (b) the DAT battery, with the exception of the C subtest, has good predictive validity in terms of high-school achievement.

Several points must be considered in view of these findings. First is that there are now no standard examinations for Grade IX Alberta students administered on a provincial level. Thus predicting Grade XII success from these is no longer possible. Helping students to make future educational plans is often more meaningful when hard data are available. Second, since the content of subjects and testing criteria will vary from school to school, generalization from regression equations using present Grade IX school subjects will have very limited applicability.

Selective use of the DAT can add significantly to students' self-knowledge and thus to possibly better educational and vocational planning. Counselors and administrators should note the difference in amount of variance attributed to the specific prediction equations for each of the three groups. Thus for helping students with further educational and vocational planning, a complete DAT battery may be of benefit but for prediction purposes a total DAT need not be used.

Certain specific subtests can be chosen for male and female groups. For females the top three subtests are Se, AR and MR. These subtests account for 31.81 percent (cumulative multiple $r = .564$) of the variance in the Grade XII Av. For males the top three subtests are VR + NA, Sp and MR. These subtests account for 42.77 percent (cumulative multiple $r = .654$) of the variance in the Grade XII Av. It is interesting to note that the top predictor for females adds nothing of significance for prediction of Grade XII success for boys and conversely VR + NA, the top predictor for success of males in Grade XII, adds nothing to prediction for females. Where VR + NA is the top predictor, such as in the total group and the male group, both VR and NA have negative beta weights indicating that individually VR and NA have been subsumed in the total VR + NA and act as suppressor variables (Whitla, 1968). Thus when the composite VR + NA is included before the individual variables VR and NA the regression equation so developed indicates that these individual variables have already been accounted for.

It would appear that the DAT can be used selectively for predictive and counseling purposes with some assurance. It should be remembered, however, that this study did not attempt to investigate predictive powers of the DAT for students entering programs other than a matriculation program and then for only those who succeeded in this program. While delimited to this sample, this study can serve as an indicator and point the way for applied field research by both counselors and administrators. To evolve prediction equations for specific senior high schools would appear to be a feasible and valid endeavor. Thus school personnel may find instruments which can prove valuable in assisting the process of educational and vocational planning in high schools.

RESUME: On a étudié la validité prédictive de la batterie de tests d'Aptitudes Différentiels (DAT) en comparant les cotes du DAT obtenues par des étudiants de 9e année avec leurs résultats subséquents aux examens officiels de 12e année. Les résultats ont démontré que le DAT a une bonne valeur prédictive et qu'on peut l'utiliser efficacement à des fins de counseling et de prédiction au niveau secondaire.

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