PREDICTING THE ACADEMIC PERFORMANCE OF NAVY HOSPITAL CORPSMEN

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Introduction

The purpose of this study was to investigate the relative efficiency of cognitive and non-cognitive variables as predictors of academic performance of enlisted men at the San Diego Naval Hospital Corps School. The cognitive variables included those currently used in the Navy classification battery; general classification test (GCT), arithmetic (ARI) mechanical (MEC) and clerical (CLER) tests. The non-cognitive variables included age, education and the number of somatic and psychological complaints indicated by scores on the Cornell Medical Index (CMI) and Minnesota Multiphasic Personality Inventory (MMPI). In addition to the usual validating and clinical scales on the MMPI, the MMPI items were also scored for the Manifest Anxiety Scale (Taylor 1953).

At present, scores on cognitive tests (from the Navy classification test battery) are the principal determinants for assigning personnel to class "A" service schools. Course grades have been used as the criterion against which these cognitive tests have been validated. Relatively little attention has been paid to the prediction of on-the-job performance and practically no studies have been directed at the problem of ascertaining the fleet adjustment of enlistees in specific occupational specialties. It has been assumed that academic trainability is highly related to later on-the-job performance and to overall military adaptability. Yet studies (Rimland 1965) are gradually accumulating which suggest that it is not.

On what basis, then, should enlisted personnel be classified? On the three criteria upon which personnel classification could be made--namely, ability to assimilate technical knowledge, on-the-job performance, and fleet adjustment, it would seem that the latter two are more relevant to the needs of the Navy. Yet, graduation from a service school is a prerequisite for fleet assignment in a technical specialty. Under these conditions, perhaps the goal of classification should be the assignment of enlistees for technical training on the basis of specific personal attributes which are predictive of some combination of all three criterion measures. This is the strategy which has been adopted by the authors for research studies dealing with the selection of hospital corpsmen.

Specifically, a longitudinal, four-year study of hospital corps personnel has been initiated by the Navy's Bureau of Medicine and Surgery for the purpose of assessing the inter-relationship of corps school grades, performance and adjustment in a variety of fleet assignments, and enlistees' personal history and early training characteristics. In connection with this program a pilot investigation has been conducted for exploring the predictability of academic performance from both cognitive and non-cognitive variables. The findings from this

pilot investigation are the subject of this report.

Enlisted personnel are presently selected for assignment to the Hospital Corps School on the basis of two Navy basic battery scores--GCT and ARI. Generally, it is required that applicants possess a summed total score of 100 on these two tests. In the past, because of the demand for large numbers of trained personnel, applicants have occasionally been accepted on waivers and have not possessed the required total score of 100 on GCT and ARI. It has been found that such students perform less satisfactorily than those who meet or exceed the minimum total classification score standard. For example, of 150 students accepted on waivers at the Hospital Corps School, San Diego in 1961 and 1962, 40 per cent failed to complete the course requirements, while the average grade point average for the remaining 60 per cent was 81 out of 100. By contrast, for all students during that period, the attrition rate was 12.5 per cent and the grade point average was 85. In another study, Thomas and Thomas (1965) reported that for students who attended the Hospital Corps School in San Diego in 1963, the correlation of the sum of GCT and ARI scores with grade point average was .56. These findings indicate that present selection standards, based upon cognitive abilities, possess significant predictive validity. They do not, on the other hand, provide any indication of the relative merits of non-cognitive variables for predicting Corps School success.

Subjects and Procedure

One hundred and twenty-six subjects were selected from approximately 2500 enlisted men who were assigned to the Hospital Corps School, San Diego, between June and December 1966. The sample subjects were part of a larger study which dealt with the relationship between particular electroencephalographic (EEG) patterns, age, and medical history. For that study, a stratified sampling by age was required and subjects were selected according to the following distribution: age seventeen, 13; age eighteen, 28; age nineteen, 26; age twenty, 25; age twenty-one, 21; age twenty-two and older, 13. Although the age distribution of the sample subjects was not fortuitous, it did reflect the age composition of the population of school enrollees during this time period. In all other respects the sample subjects were selected randomly.

The 126 students were picked individually from among the newly reporting enrollees at the school by noncommissioned officers who were simply directed to provide a given number of subjects each week from specific age groups. Before being given the CMI and MMPI, the nature of the overall research program was explained. Subjects were assured that answers to the questionnaires would be treated confidentially, would not become part of their military records, and would have no bearing upon their military careers. A code number was assigned to each student in the sample in order to insure confidentiality of the records and to facilitate processing of the data. No time limits were imposed upon the subjects in completing the questionnaires.

Subjects' scores on the CMI represented the total number of "yes" responses to the 195 questionnaire items. In addition, a subset of CMI items, identified

by Gunderson and Arthur (1968) as being predictive of success in special training programs, was scored and labeled as the CMI-G score. For the MMPI, scores were derived for each subject on each of the 13 validating and clinical scales (Hathaway & McKinley 1951) and from items comprising the Manifest Anxiety Scale Taylor (1953). Criterion data (course average) were obtained from records of the the Hospital Corps School, while information pertaining to subjects' education, age, region of residence, and classification test scores were obtained from service records.

The relation of the twenty-three predictor variables to the criterion of course average was ascertained by calculating Pearson product-momen* correlations. The data were scrutinized for the purpose of identifying any predictor-criterion relationships which might deviate significantly from linearity. For those predictors found to correlate significantly with the criterion, a linear multiple regression analysis was undertaken. This analysis served the purpose of establishing the unique contribution of each of the variables and of determining the validity of different predictor composites.

Results

Of the 126 students originally selected, eight were dropped from the study. Six of the eight disenrolled in the first few weeks of school at their own request, one was disenrolled for disciplinary reasons, and the records were incomplete for one subject. Four subjects were disenrolled because of failing grades but the data for these men were kept in the study and their grades at the time they were disenrolled were used in the data analyses.

The attrition rate from the school for the 126 subjects was 9.5 per cent--a value which is very similar to the total school attrition rate of 10.0 per cent during this period. Three of the four subjects who failed academically had GCT scores below 50.

The means and standard deviations of the 23 predictor variables and the criterion of academic performance are shown in Table 1, while Table 2 depicts the variable inter-correlations. Table 3 presents the mean course averages for different age groups and different levels of education and GCT. Only five of the predictor-criterion correlations were found to be of sufficient magnitude to be significantly different from zero. These five were age, education, GCT, ARI, and MECH test scores. Of these, GCT score had the highest correlation (.56) with course average. Clerical score was not significantly related to Corps School performance, nor were any of the CMI, MAS, or MMPI scores. While there was a tendency for students from the western states to have higher course grades, the relationship was not statistically significant. The correlation of the summed score of GCT and ARI with course average was found to be .53.

The five predictors which had significant correlations with the criterion were multiply correlated with course average and the validity of this predictor composite was found to be .67. Two of the variables, namely ARI and MECH scores, yielded standard regression weights which were not significant at the five per cent level of confidence. As a result of eliminating these two variables from

the regression analysis, the multiple correlation was reduced to .65. The formula derived for predicting course average on the basis of age, GCT score, and education is the following: .946 (age) + .554 (GCT) + .948 (education) + 20.003 = Predicted Academic Performance. For example, an 18-year-old subject who has completed 11 years of schooling and possesses a GCT score of 52 would obtain a predicted grade point average of 75.8. Specifically, .946(18) + .948(11) + .544(52) + 20.033 = 75.8.

Table I

Means and Standard Deviations of Predictor and Criterion Variables

Variable	Mean	Std. Dev.
GCT score	60.5	7.59
ARI score	57.6	6.41
MECH score	52.2	7.56
CLER score	51.2	8.29
Age	19.5	2.83
Education	12.5	1.75
Region*	14.7	8.45
CMI - Total score	14.4	11.95
CMI - G score	5.8	6.00
MAS	12.2	7.04
MMPI Raw scores		
L	41.1	2.25
F	5.1	3.93
K	15.1	4.74
Hs	12.0	3.40
D	18.3	5.10
Hy	20.3	4.47
Pd	23.5	4.40
Mf	24.6	4.25
Pa	9.3	3.86
Pt	26.4	5.68
Sc	26.8	6.07
Ma	21.6	4.09
Si	23.2	9.62
Academic Performance (criterion)	83.2	8.04

*The country was divided into seven geographical areas and each section was assigned a value in proportion to the criterion mean.

Table 2

Product-Moment Correlation of Predictors and Criterion. N=118

Variable	Age	GCT	ARI	MECH	Educ	Course Average
Age	-	-.03	.01	.03	.46	.28
GCT		-	.55	.41	.23	.56
ARI			-	.20	.15	.39
MECH				-	.12	.34
Educ.					-	.42
Course Aver.						-

For significance at .05 level, r = .19; for .01 level, r = .24

Table 3

Mean Course Grades for Varying Ages, Education, and GCT

		Course Average		
		Mean	Standard Deviation	N
Age	17	78.4	6.7	11
	18-19	81.8	6.8	53
	20-21	85.3	7.1	42
	22+	86.8	9.6	12
Education	<12 grades	78.2	8.9	6
	12 "	81.1	7.6	76
	>12 "	89.1	4.4	36
GCT	<50	75.1	10.9	11
	50-54	78.9	4.5	19
	55-59	84.6	6.5	20
	60+	85.7	6.8	68

Discussion

From a battery of cognitive and non-cognitive measures, GCT score, education, and age were found to be uniquely and significantly related to academic performance for a sample of Navy Hospital Corps School students. While the size of the sample (N=118) used in this investigation was small relative to the Hospital Corps School population during any six-month period, there is reason to accept the results as being representative of the population of students who attended the San Diego Corps School during the time period of this study. The grade-point average, as well as the attrition rate, for the sample subjects were nearly identical to those of the population. And the obtained correlation of .53 between grade point average and GCT-ARI summed score is almost the same as that reported (.52) for students enrolled in the school during the period of August 1964 and June 1966 (Thomas & Thomas 1967).

The findings of this study strongly suggest that variables other than purely cognitive measures of ability are of value in the prediction of academic performance. By using the current method of selection for Corps School (GCT + ARI summed score), where the correlation is .53, only 28 per cent of the criterion variance is explained. On the other hand, if age, education, and GCT score were used for selection (R=.65), the criterion variance accounted for would be increased to approximately 42 per cent--a substantial gain by any standard. It is important to point out, however, that because of the lack of a cross-validation sample, the true magnitude of these relationships can at present be considered as only tentative.

It is of interest to note that the three variables--age, education, and GCT score, identified in this study as being uniquely related to academic performance in Corps School, have been shown in other studies as being predictive of a variety of criteria of success in military settings. For example, in a sample of naval enlistees, Plag & Hardacre (1965) found that these three variables were significantly related to attrition, pay grade, disciplinary action, division officer ratings of adjustment, and semi-annual marks two years after entrance into service. And, in other branches of the military, Flyer (1959), Gordon & Bottenberg (1962), Fisher, Ward, Holdrege, & Lawrence (1960), and Klieger, Dubisson & deJung (1961) have found significant criterion relationships for one or more of these predictors. It is likely therefore that age, education, and GCT score will, in subsequent research, be found to be related to the fleet effectiveness of hospital corpsmen, and thus a set of core variables will be identified which may be valid for predicting a wide variety of criteria of military success.

This study has demonstrated that questionnaires which purport to measure emotional stability or psychological adjustment are of little use in predicting purely academic performance. While the MMPI scores obtained for these students are quite similar to those reported by Klienmuntz (1963) for subjects of comparable age and intellectual level, none of the scales, with the possible exception of Mf, (r=.18) showed any substantial relation to the criterion. Scrutiny

of the Mf scores revealed that the small amount of criterion variance accounted for by this variable was almost entirely explained by GCT score. Higher Mf scores are consistently found in sujbects with higher intelligence and education and appear to reflect more cultural and literary interests.

In the course of the data analyses several relationships were revealed which might have relevancy in future studies dealing with the prediction of other criteria of corpsmen effectiveness. First, it was noted that those subjects who disenrolled from school at their own request were nearly double the number who were disenrolled for academic reasons. The subjects who disenrolled at their own request obtained MMPI scores on the Pd, Sc, and Ma scales which were higher than those of students who graduated from school. While the small sample size renders this finding statistically insignificant, it does suggest that personality variables along with measures of interest and motivation may be of some utility in the prediction of non-academic criteria. Second, it was found that the subjects in this study obtained CMI scores which were considerably higher (M=14.4) than those obtained by a control group of naval enlistees (M = approximately 7.6), as reported by Gunderson, Arthur, & Richardson (1966). Whether the difference between these two samples reflects a difference in willingness to admit symptoms or a real difference in number of somatic complaints is unknown. While the test taking attitude of the subjects and the reliability of the scale are undoubtedly important factors, it is of interest that Plag, Arthur, & Gunderson (1967) and Gunderson & Arthur (1966) have indicated that corpsmen have a higher incidence of psychiatric illness than enlistees in other occupational specialties. Since a positive relationship has also been reported between the CMI score and psychiatric illness, the CMI may be useful in predicting adjustment difficulties among corpsmen both during and subsequent to corps school. Third, during school, a grade in military bearing--military courtesy, neatness, etc., was collected for each of the sample subjects. While these scores were found to have a high correlation with academic performance (r=.75) the predictors which were significantly related to military bearing included the MMPI score on the psychopathic deviate (Pd) scale. For this predictor the correlation was .20. Again, this finding suggests the possible utility of personality variables in predicting criteria other than academic performance. Whether the relationships suggested by these tentative results are of practical value for selection is a problem for future research.

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13 ABSTRACT

This study served as a pilot investigation of the validity of cognitive and non-cognitive variables for predicting academic achievement among Navy Hospital Corps School students. For a sample of 126 corpsmen, who were considered to be representative of 2500 students attending Corps School, San Diego, between June and December 1966, three variables were identified as being uniquely predictive of academic performance. Age, level of civilian education, and General Classification Test score were found to yield a multiple correlation of .65 with the criterion. This validity represents a substantial improvement over the current selection standard which utilizes only cognitive measures of ability. Scores on the Cornell Medical Index and MMPI were not significantly related to course average.

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