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ABSTRACT

Confined to existing monetary and human resources, the Navy's Postgraduate Selection Board is responsible for selecting officers for graduate education who will both perform well and develop skills applicable to later Navy billets. Although different methods have been employed for this selection process, most decisions have been based on officer fitness reports and prior academic records. Data from the Graduate Record Exam (GRE), Strong Vocational Interest Blank (SVIB), and a biographic data form were used in attempts to predict Naval Postgraduate School grade averages in four separate curricula: Operations Research/Systems Analysis, Aeronautical Engineering, Communications Management, and Management. Results indicate that academic aptitude and biographic data could be used for selection to the Naval Postgraduate School. Implementation would require the availability of biographical data and GRE scores for all candidates. The costs of developing these data would seem small when compared to (1) the time saving that could accrue by streamlining the postgraduate selection process, and (2) the more effective use of officer/student human resources. (BJG)

Selection of Officer Students for Graduate Education[1]

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The U.S. Navy and the other U.S. services spend millions of dollars every year on the graduate education of their officers. In recent years, about 570 U.S. Navy officers a year have received Navy funded graduate degrees at the Naval Postgraduate School (Congressional Record, 1973, p. 617). The justification for these educational programs has been that certain Navy officer billets require the incumbent to have such an education to perform optimally in the job (SECNAVINST 1520.4A). The best payoff to the Navy comes, then, when officers are selected for educational curricula in which they perform well, and in which they develop skills they wish to apply in their later Navy billets.

Present Selection Procedures

The Navy's Bureau of Personnel (BuPers) derives the educational quotas for the different curricula by juxtaposing billets requiring a graduate officer with the populations of officers having that education. These educational quotas are then reviewed in light of existing monetary and manpower constraints. Ultimately, shortfalls are published, classified by educational area, year group and designator (e.g., aviator). BuPers then provides the shortfall data to the Postgraduate Selection Board. The Postgraduate Selection Board is annually formed by BuPers and requires a month or more to complete its work. The Board's members are ranking officers from each Navy designator, and many of them hold graduate degrees. The Board's task is to examine the records of officers who could be selected for graduate education. These records include the officer's fitness reports and his prior academic records. Occasionally, the officer's scores on the Graduate Record Exam (GRE) would also be in his records. Also available to the Postgraduate Selection Board for most officers are their curricular preferences. Given the officers' records and preferences, and the educational quotas, the Postgraduate Selection Board proceeds with the selection of Navy officers for graduate education programs. The FY 75 Board considered 15,406 officers and selected only 1,285. In making their evaluation

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of each of the thousands of officers, prior academic work is supposed to be weighted 40% and Navy performance (as assessed by fitness reports) 60%. Once the Postgraduate Selection Board has finished its month or more of work, the list of officers' names is sent to the officer detailing section of BuPers. The detailers have the final responsibility for assigning officers to graduate curricula.

Method

The investigators felt that the methods and procedures for selecting Navy officers could be made less time and manpower consuming, and, probably, more valid. Consequently, a concurrent validation study was designed and conducted, using as subjects U.S. Navy officer/students on-board at NPS.

The Strong Vocational Interest Blank (SVIB), the GRE and a biographic data collection form were administered to the groups shown in Table I during fiscal year 1974.

Table I

Curricula and Numbers of Students

Curriculum	Number of Students
Ops. Res./Sys. Anal.	80
Computer Systems Mgt.	48
Computer Science	24
Aero Eng.	103
Communications Mgt.	42
Sys. Acq. Management	52
Management	130
TOTAL	479

NPS grade averages (TQPRs) were also gathered from these officer/students.

Preliminary Analyses

As the grade average was to be used as the criterion measure in this research, it was necessary to understand its behavior. The first question addressed concerned the accuracy of self-reported TQPRs.

The NPS academic transcripts of 55 Management students were gathered and the computed TQPRs compared with the self-reported NPS

TQPRs. The correlation between the reported and actual TQPRs was .99, and the means were 3.37 and 3.34 (on a scale where A = 4.00), respectively (Welch, 1974, p. 19). A similar analysis was done with the records of the 42 U.S.N. students in Communications Management. In all 42 cases, the actual and self-reported NPS TQPRs were identical. Obviously, the investigators could use self-reported NPS TQPR as criterion data and avoid retrieving each officer's transcript.

A second study of TQPRs investigated the longitudinal stability of individuals' TQPRs. This investigation was important for two reasons. First, if grades are quite unstable over time, then they might be unpredictable, or different variables might be required to predict TQPRs in different quarters of an academic curriculum. The second reason for doing the grade stability study arose from the relatively small sample sizes in the different curricula. The set of students in a particular curriculum consisted of two or more subsets of students that had been in the curriculum different lengths of time. If TQPRs were stable over time, then TQPR data from students who had finished only a few quarters could be considered as indicative of what their TQPR would be upon completing their curriculum. In other words, if TQPRs were quite stable, the data from the different student subsets in a curriculum could possibly be aggregated. Table II is representative of the patterns of correlations found in the curricula investigated. The correlations are high--even given that they are part-whole correlations. In summary, the correlations indicate that TQPRs after two, or at most, three quarters are very predictive of TQPRs after six quarters.

Table II

Correlations Among TQPRs After Completion of Different Numbers of Quarters of the Ops. Res./Sys. Anal. Curriculum: Longitudinal Data (N = 25 U.S.N. Officers)[1]

		Quarters Completed					
		1	2	3	4	5	6
Quarters Completed	1	1.00	.95	.92	.92	.90	.89
	2		1.00	.98	.97	.96	.95
	3			1.00	.99	.98	.97
	4				1.00	.99	.99
	5					1.00	1.00
	6						1.00

[1]Source: Welch, 1974, p. 21

Further analyses of the TQPR data uncovered two other facts: First, the variance among inputs (an input being a group of students entering the curriculum at the same time) on TQPR is much smaller than

the TQPR variance within an input in a curriculum; second, an input group's average TQPR tends to sneak upwards as their time spent in the curriculum increases.

Because of the results of the analyses conducted on NPS TQPRs, the decision was made to standard score the TQPRs for each input into each curriculum. Thus, the standardization process yielded equal TQPR means and standard deviations for all of the inputs and curricula.

TQPR Prediction Study Results

Data from the Graduate Record Exam (GRE), Strong Vocational Interest Blank (SVIB), and a biographic data form were used in attempts to predict TQPRs in four separate curricula: Ops. Res./Sys. Anal., Aero Eng., Communications Mgt., and Management. Multiple linear regression was the primary analytical technique used in the prediction studies. Within each curriculum, developmental and cross-validation groups were randomly formed. Prediction equations generated using the data from a developmental group, and yielding a statistically significant multiple correlation coefficient in the relevant cross-validation group, will be reported in the following paragraphs.

Aeronautical Engineering

Several useful prediction equations were developed for this curriculum; the equation presented here for predicting standardized TQPR is the most face valid one and yielded a multiple correlation of .63 in the cross-validation group of 30 students (Sofge, 1974, p. 52).

$$TQPRZ = -4.20 - .635(VAR001) + .691(VAR004) + .00184(GREV) + .00322(GREQ) + .00568(INDEX) - 1.02(BQPR)$$

Where:
- TQPRZ = Standardized TQPR
- VAR001 = Naval Academy Graduate: yes = 1; no = 0
- VAR004 = Lt. or below: yes = 1; no = 0
- GREV = GRE Verbal Score
- GREQ = GRE Quantitative Score
- BQPR = Self-reported baccalaureate grade average
- INDEX = BQPR × Qual (Qual is an estimate of the quality of the individual's baccalaureate institution from Hoyt's data.)

$$TQPRZ = -3.632 + 1.746(4GPA) + 1.454(VAR001) - .6546(VAR002) - .606(3GPA)$$

Where:
- TQPRZ = Standardized TQPR
- 4GPA = Calculated grade average in the individual's fourth undergraduate year
- VAR001 = 1 if the individual had an undergraduate major in engineering
- VAR001 = 0 if the individual was not an undergraduate engineering major
- VAR002 = 1 if the officer had graduated from the Naval Academy
- VAR002 = 0 if the officer had not graduated from the Naval Academy
- 3GPA = The individual's grade average in his third undergraduate year

The equation yielded a multiple correlation coefficient of .63 in the cross-validation group (N = 12).

Discussion

The results shown above clearly indicate that academic aptitude and biographic data could be used to select U.S. Navy officers for attendance at the Naval Postgraduate School. Other analyses, not reported here, have shown the SVIB to be useful also in predicting TQPR. The results reported here seem impressive when it is considered that the students in the study had already been through the Postgraduate Selection Board screening--a process which should have led to restriction of range on a number of variables, with a consequent lowering of the multiple correlation coefficients.

For the Navy's Bureau of Personnel to use the findings reported here, biographic data and GRE scores would have to be available for the officers being considered for graduate education. The costs of developing these data would seem to be small when compared to: (1) the time saving that could accrue by streamlining the Postgraduate selection process, and (2) the more effective use of the officer/student human resource that could be achieved through more valid selection methods.

Management

A rather simple prediction equation was found to be useful in predicting TQPRs in the Management curriculum.

$$TQPRZ = -3.94 + .0059(GREQ) + .6897(VAR001)$$

Where: TQPRZ = Standardized TQPR
GREQ = GRE Quantitative Score
VAR001 = 1 if chronological age ≤ 30.
VAR001 = 0 if chronological age > 30.

This equation yielded a multiple correlation of .65 in the cross-validation sample (N = 20).

Operations Research/Systems Analysis

The multiple regression analysis conducted with the data from this curriculum yielded an equation having in it three predictor variables.

$$TQPRZ = -2.3445 + .00322(INDEX) + .4067(VAR001) + .2668(VAR002)$$

Where: TQPRZ = Standardized TQPR
VAR001 = 1 if the officer speaks a foreign language
VAR001 = 0 if the officer does not speak a foreign language
VAR002 = 1 if the officer's age is ≤ 30.
VAR002 = 0 if the officer's age is > 30.
INDEX = BQPR × Qual (BQPR was self-reported baccalaureate grade average. Qual is an estimate of the quality of the officer's baccalaureate institution from Hoyt's data.)

This equation yielded a multiple correlation of .45 in the cross-validation sample (N = 20).

Communications Management

A multiple regression equation using four predictors was developed for this curriculum (Cook, 1974).

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