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NAVAL AEROSPACE MEDICAL INSTITUTE
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SUMMARY PAGE

THE PROBLEM

The purpose of this study was to develop a system for the prediction of student success or failure in the Naval Flight Officer (NFO) program for use during Basic NFO training.

FINDINGS

Two initial selection tests (an academic ability test and a mechanical comprehension test) plus two academic performance measures resulted in a multiple correlation coefficient of .45 with a dichotomous criterion of pass/attrite. Decision making regarding the retention of marginal students could be improved by use of the prediction formula generated in this study.

INTRODUCTION

Since 1963, the Aviation Psychology Division of the Naval Aerospace Medical Institute has provided information to Naval aviation training administrators confronted with decisions of whether to drop or retain a student who is having difficulties in flight training (1). Upon request, administrators are given the computed probability of a specific student successfully completing the flight program. These probabilities are obtained by appropriately weighting valid past performance measures such as initial selection test scores, academic course grades, and flight training grades. Knowledge of such probabilities has improved the accuracy of decisions regarding marginal student pilots, leading to increased efficiency in the utilization of pilot training facilities and personnel.

In addition to training pilots, the Naval Aviation Training Command trains Naval Flight Officers (NFO's). These include navigators, radar intercept officers, and other nonpilot aviation officer specialists. Student NFO's complete the same beginning academic courses as do students entering flight training. After this phase, student NFO's begin four months of training in Basic Naval Aviation Officer (BNAO) School. Students are formally designated as NFO's upon graduation from advanced training in their area of specialization.

The majority of attrition from the NFO program occurs in BNAO School. Approximately 20 per cent of the student input appears before a Training Advisory Board sometime during this period. This 20 per cent is divided almost equally between students who are in academic difficulty and students voluntarily requesting separation from the program. Administrators serving on the Training Advisory Board face the same decisions as do administrators in the flight training program and all other educational programs, i.e., which students in academic difficulty should be given additional instructional time and which should be considered unworthy of additional instruction?

The purpose of this study was to develop a system for the prediction of student success or failure in NFO training and thus assist the training administrators in their decisions.

PROCEDURE AND RESULTS

Training records of 966 nonofficer student NFO's entering training between May, 1964 and April, 1966 were used as basic data for this study. Excluded from the analysis were students dropped for reasons of medical disqualification, personal hardship, disciplinary action, and death.

The variables chosen for consideration as possible predictors of a dichotomous criterion of pass/attrite (P/A) included the initial selection test scores and the grades received during the flight preparation portion of the academic courses prior to BNAO School. The means and standard deviations of these variables for students entering BNAO School are shown in Table 1.

Table I

Means and Standard Deviations for Students Entering BNAO School (N = 958)

	Mean	S.D.
I. Initial Selection Tests		
Aviation Qualification Test* (AQT)	78.1	13.6
Mechanical Comprehension Test (MCT)	53.9	9.8
Spatial Apperception Test (SAT)	17.4	6.5
Biographical Inventory (BI)	30.2	14.3
II. Flight Preparation Scores		
Aerodynamics (Aero)	45.5	8.9
Navigation (Nav)	46.1	9.3
Power Plants (Power)	47.1	10.5
Physiology (Phy)	50.5	10.2
Physical Training (P.T.)	50.6	6.0
Peer Rating (P.R.)	50.3	9.6

An intercorrelation matrix including all predictor variables and the P/A criterion is shown in Table II.

Table II

Intercorrelation Matrix Including All Predictor Variables and The Criterion

	MCT	SAT	BI	Aero	Nav	Power	Phy	P.T.	P.R.	P.A.
AQT	.44**	.29	.13	.49	.49	.36	.30	.10	.14	.34
MCT		.38	.42	.44	.31	.42	.34	.17	.16	.35
SAT			.25	.26	.27	.20	.13	.16	.14	.20
BI				.19	.09	.22	.14	.15	.16	.15
Aero					.53	.53	.42	.20	.16	.27
Nav						.43	.31	.24	.29	.35
Power							.44	.16	.17	.30
Phy								.23	.09	.23
P. T.									.28	.10
P. R.										.15

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*a test of academic ability.

**r = .10 required for significance beyond the .01 level, one-tailed.

The Wherry-Doolittle method was used to determine which variables in combination would yield the highest multiple correlation with the criterion. When all variables were used, six were selected as significant predictors. However, the contribution of the last two variables selected was not considered sufficient to warrant their inclusion in the predictor score formula. Thus, the weights to be applied to the first four variables chosen were computed. The variables chosen and the multiple R's are shown in Table III.

Table III

Variables Selected for Predictor Score Formula

Variables Selected	Cum. Multiple R	Cum. Shrunken R
Navigation	.360	.352
MCT	.445	.434
AQT	.458	.448
Power Plants	.463	.452

By appropriately weighting each of the four variables selected, predictor scores were computed for all students included in the analysis sample. Predictor score frequency distributions were constructed for the group that completed training and for the group of dropped students. From these frequency distributions, the percentile ranks and "percentage completion" statements shown in Appendix A were derived.

Crossvalidation was accomplished by dividing the sample randomly and applying the Wherry-Doolittle method to each subsample. Crossvalidation resulted in essentially the same variable weights and multiple correlation coefficients for each subsample and the total group.

DISCUSSION

As can be seen in Table II, all variables were significantly correlated with the criterion. However, after the best four were chosen, little or no improvement was added to the predictor score formula by the others.

An encouraging result of the study is the face validity of the four variables chosen. The variable receiving the largest weight was the Navigation grade. It is logical that scores received in a navigation course are predictive of future performance in a training program heavily loaded with instruction in navigation. The AQT and MCT can be considered measures of a student's potential performance. Scores received in Navigation and Power Plants, however, can be considered measures of how well the student actually uses his potential in academic situations similar to those encountered later in training.

As described in Appendix B, the predictor scores will be converted into percentile ranks and "percentage completion" statements. Percentile rank refers to that percentage of successful students in the past whose predictor score fell below a given point on the distribution.

The "percentage completion" statements indicate the proportion of students in various segments of the predictor score distribution who eventually completed training. As can be seen in Appendix A, two separate scales of "percentage completion" statements are presented. The first scale pertains to all students entering BNAO School who began NFO training as nonofficers (NAOC's or AOC's). The second scale pertains only to students (former NAOC's or AOC's) in academic difficulty, i.e., students who are about to appear before a Training Advisory Board. The two scales are presented so that "percentage completion" statements can be used accurately for two separate populations. For example, students not in academic difficulty have a higher expected completion rate than students with similar predictor scores who appear before the Training Advisory Board. Therefore, use of the first scale would apply to those about to enter BNAO School and those requesting transfer from another program. However, for students who are in difficulty, the expected completion rate is greatly reduced. Therefore, the second scale is constructed to indicate the proportion of students who, in the past, have been retained by the Training Advisory Board and who have completed training.

Data used in the present study were obtained from training records of students who entered the program as NAOC's or AOC's (college graduates with no previous military experience). The use of the predictor score formula obtained in this study is not warranted for students entering the program through any other procurement source. Due to the smaller number of students procured through other sources, more training data should be collected to properly develop additional formulas. One such predictor score formula presently being developed applies to students entering NFO training as officers.

REFERENCE

1. Shoenberger, R. W., Wherry, R. J., Jr., and Berkshire, J. R., Predicting success in aviation training. NSAM-873. Pensacola, Fla.: Naval School of Aviation Medicine, 1963.

APPENDIX A

Predictor Score Conversion Table

Predictor Score Intervals	Percentile Rank*	Percentage Completion	
		I Students Entering BNAO School	II Students Appearing Before Training Advisory Board
Less than 250	00		
250 - 289	00	No completions	No completions
290 - 329	00		
330 - 369	00		
370 - 409	01		
410 - 449	02	40 out of 100	
450 - 489	03		
490 - 529	05		20 out of 100
530 - 569	08		
570 - 609	13		
610 - 649	18	70 out of 100	
650 - 689	27		
690 - 729	35		
730 - 769	42		
770 - 809	51		
810 - 849	60		
850 - 889	67		
890 - 929	72		
930 - 969	78	95 out of 100	70 out of 100
970 - 1009	85		
1010 - 1049	90		
1050 - 1089	93		
1090 - 1129	96		
1130 - 1169	98		
1170 - 1209	99		
more than 1210	99		

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*compared with successful students

APPENDIX B

Described below are the mechanics of the student prediction system developed for use in BNAO School:

1. When information on a student is needed, the student's name will be reported to the Student Prediction Section of the Naval Aerospace Medical Institute (NAMI).

2. On record at NAMI are the scores required for the predictor score formula (AQT, MCT, Navigation, and Power Plants). Providing the student entered training as an NAOC or AOC, a predictor score will be computed.

3. The predictor score will be referred to a table of percentile ranks and "percentage completion" statements.

4. Reported back will be the following information:

"Compared with the records of previously designated NFO's, this student's predictor score ranks in the _____ percentile. In the past, approximately _____ of 100 students entering BNAO School with a similar predictor score have completed training. Of students with a similar predictor score who appeared before a Training Advisory Board because of academic difficulty, only about _____ of 100 have completed training."

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13. ABSTRACT

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