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AUGUST 1967

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**THE DEVELOPMENT OF THE U. S. NAVY BACKGROUND
QUESTIONNAIRE FOR NROTC (REGULAR) SELECTION**

**Idell Neumann
William H. Githens
Norman M. Abrahams**

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THE DEVELOPMENT OF THE U. S. NAVY BACKGROUND QUESTIONNAIRE
FOR NROTC (REGULAR) SELECTION

Idell Neumann
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August 1967

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San Diego, California 92152

SUMMARY AND CONCLUSIONS

Problem

The purpose of this project was to develop an instrument useful in selecting NROTC (Regular) students with maximum likelihood of ultimately choosing a naval career. The new test would supplement the interviews and the tests of aptitude and interest now used.

Background

Two earlier NROTC selection instruments, Forms 1 and 2 of the NROTC (Regular) Questionnaire, had been constructed and administered in 1956-1958 to applicants for NROTC scholarships for whom criterion information (career decision) recently became available. Forms 1 and 2 were used as an item pool for development of the new instrument.

Approach

The above forms were analyzed and the questions showing the greatest effectiveness in predicting career choice over an eight-year period were identified and assembled into a new instrument, the U. S. Navy Background Questionnaire. Several experimental scoring keys were constructed and cross-validated on a group of subjects not included in the original item analysis.

Findings, Conclusions, Recommendations

Analysis of the data indicated the new form to have sufficient predictive validity to warrant its use in the NROTC selection program. As more information on the career choice of NROTC students tested during 1957-1963 becomes available, refinement of the U. S. Navy Background Questionnaire will be possible and is planned.

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for NROTC (Regular) Selection (SRR 68-3)

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THE DEVELOPMENT OF THE U. S. NAVY BACKGROUND QUESTIONNAIRE
FOR NROTC (REGULAR) SELECTION

A. BACKGROUND AND PURPOSE

Each year the Navy awards some 1,400 NROTC scholarships to qualified high school seniors, entitling each recipient to a four-year college education, which includes training leading toward a commission as a naval officer. Graduates are commissioned in the Regular Navy or Marine Corps and are obligated to serve on active duty for a specified length of time--four years at present. The scholarships are highly desired, as evidenced by the approximately 20,000 applications that are received yearly, and thus are extremely competitive. For this reason and because of the substantial expense to the Navy in sponsoring this program, it is important that the selection process include procedures to assess the applicants' motivation toward a career in the Navy. To this end, a new test, the U. S. Navy Background Questionnaire, was constructed for use in the 1967 NROTC applicant program to supplement current aptitude, interest, and interview information.

Several instruments consisting of interest, personality, and biographical items had been developed some years ago in an attempt to measure the extent to which applicants were motivated toward a naval career. Forms 1 and 2 of the NROTC Questionnaire, the instruments designed specifically for this purpose, were administered as part of the NROTC applicant selection programs conducted from 1956 to 1963. Since obligatory time served on active duty has been fulfilled for many of the officers administered Forms 1 and 2, it was now possible to assess their predictive validity. The specific purpose of this report is to present validation procedures and results for the Questionnaires, and their synthesis into the U. S. Navy Background Questionnaire.

B. PROCEDURE

1. Predictors

A brief description of the development and content of the NROTC Questionnaire (Forms 1 and 2) is provided below.

a. NROTC Questionnaire (Form 1). Form 1 was used only in the 1956 selection program. It consisted of 70 biographical information and personality items followed by 30 items of factual knowledge about the Navy, ships, and nautical affairs (Rimland, 1957). The latter 30 items comprise the Navy Knowledge Test (NKT) (Rimland, 1959). An eight year follow-up investigation into the validity of NKT as a predictor of service tenure resulted in the NKT not being recommended for use in NROTC selection (Githens, Neumann & Abrahams, 1966). Since other studies had demonstrated validity for direct questions of career intention, a career intention question, which was Item 13 in the 70-item personality subtest [to be referred to hereafter as the Career Question

(CQ)], was analyzed separately (Githens & Rimland, 1966). Since the analysis confirmed the previous studies, it was suggested that future NROTC applicants be asked to respond to a direct question on career intention.

b. NROTC Questionnaire (Form 2). Form 2, which was used from 1957 to 1963, consisted of 100 personality and biographical type items, many of which were taken from Form 1. Eighteen of the items were of the 5-alternative multiple-choice type, while the remaining 82 items were in diad form. A more detailed account of the development and preliminary validation of Form 2 appears in an earlier report (Rimland, 1957). Encouraging results were previously obtained with a career motivation scale based on Form 2 items (Rimland & Steinemann, 1958). Several groups whose level of career motivation was inferable, such as Academy transfers from the NROTC program, voluntary drops from the NROTC program, and NROTC selected applicants were compared on mean Form 2 scores. Although group differences were not large, they were in the expected direction and recommendations were made for a longitudinal investigation of the validity of the instrument, to supplement the six short-term studies which had been made during the test development stage.

2. Samples

Included in the present validation of Forms 1 and 2 were applicants who (1) accepted a Regular NROTC scholarship, (2) completed either Form 1 or Form 2 as part of their NROTC selection processing in 1956, 1957, or 1958, (3) satisfactorily completed their college work and received a commission in the Regular Navy, and, (4) for whom retention status was available. Table 1 presents a breakdown of sample sizes by form and year commissioned.

Since criterion information was available for all officers in the Form 1 sample, a total of 767 questionnaires were available for analysis. In the Form 2 sample, only those officers who were commissioned in 1961 had reached a point of career decision. Therefore, the number of Form 2 questionnaires that could be analyzed was limited to 397. The remaining 698 Form 2 questionnaires will be analyzed at a later date as the career decision of the officers commissioned in 1962 and 1963 becomes known.

3. Criterion

Potential high tenure as a naval officer was the criterion against which the two questionnaires were validated. At least six months of active duty beyond the original obligated service time was designated as the requirement for inclusion in the high tenure category. Evaluations based on a six-month criterion have been shown to hold up when later examined using an eighteen-month criterion (Githens & Rimland, 1966). For those entering the NROTC program in 1956, the obligated active duty time from date of commissioning was three years. Beginning with the year 1957 and continuing until the present, the active duty obligation time was increased to four years. With this change taken into account, high and low tenure officers were identified in both samples.

TABLE 1

Form 1 and Form 2 Sample Sizes by Year Commissioned

Questionnaire	Year Commissioned	N
Form 1 (1956) ^a	1959	136
	1960	469
	1961	162
Form 2 (1957-58)	1961	397
	1962	536 ^b
	1963	162 ^b

Notes --

^aYears in parentheses refer to year of application.

^bCriterion data not available at time of analyses.

4. Analysis

Since the procedures followed in analyzing Forms 1 and 2 were essentially the same, the ensuing description of the analyses applies to both questionnaires. After the sample was categorized on the criterion, a portion of each category was randomly selected for key construction purposes. The remainder was set aside for cross-validation of keys. A breakdown for each questionnaire by tenure category and subsample designation is presented in Table 2.

Using the key construction sample, differences in percentage of endorsement between high and low tenure groups were determined for each item response. Several keys were then constructed with minimum difference levels for item response inclusion varying from 6 to 13 per cent. Validities for each of the experimental keys were obtained for the appropriate hold-out sample.

C. RESULTS AND DISCUSSION

Table 3 presents a summary of results in the cross-validation sample for the three experimental Form 1 keys. The three keys differed on the minimum percentage difference required for item inclusion. Minimum differences of 6, 8, and 10 per cent were required for each respective key.

TABLE 2

Number of Officers in Form 1 and Form 2 Subsamples
by Tenure Category

Tenure Criterion	Form 1		Form 2	
	Key Construction	Cross- Validation	Key Construction	Cross- Validation
High	200	109	140	87
Low	200	258	105	65

Totals	400	367	245	152

For all three keys, biserial validity coefficients were low but were significantly different from zero on cross-validation ($p < .05$, $\bar{z} > 1.96$). The 8-item response key based on a minimum difference of 10 per cent and the 14-item response key based on a minimum difference of 8 per cent resulted in virtually identical validities. Both keys were slightly superior to the 6 per cent key in their ability to discriminate between tenure groups.

While the validity found was lower than had been hoped, the very favorable selection ratio in the NROTC program tends to enhance a test's usefulness in selection.

Predictive validities for three Form 2 experimental keys requiring minimum percent differences of 13, 10, and 8, respectively, are presented in Table 4. A percent difference criterion of 13 provided 12 item responses which met the requirement. Although this key worked as well as or better than the other two keys, the obtained validity, an r_b of .11, is not significant at the .05 level. As the criterion matures and it becomes possible to increase the sample size for item analysis of Form 2, more stable estimates of item differences can be expected.

On the basis of the foregoing analyses, the 1967 U. S. Navy Background Questionnaire was constructed for aiding in the selection of NROTC scholarship recipients. Items from both forms were included--eight from Form 1, Key B, and 31 from Form 2, Key C. Since five of the valid items appeared on both forms, a total of 34 items comprised the 1967 Background Questionnaire.

Various alternatives were available in selecting the most efficient scoring key for operational use. It was first necessary to decide whether the operational key should be scored on Form 1 items only, Form 2 items only, or a combination of items from both forms. Since none of the Form 2 key

TABLE 3

Validities of Experimental Form I Keys
for Cross-Validation Sample

Key	Minimum Percent Difference Level	No. of Item Responses	Hi Tenure (N=109)		Lo Tenure (N=258)		Percent Overlap	r_b
			\bar{X}	S.D.	\bar{X}	S.D.		
A	10	8	0.85	1.89	0.32	1.96	89	.17*
B	8	14	0.21	2.45	-0.49	2.55	89	.17*
C	6	36	0.64	4.46	-0.44	4.12	90	.15*

*Significant at the .05 level.

TABLE 4

Validities of Experimental Form 2 Keys
for Cross-Validation Sample

Key	Minimum Percent Difference Level	No. of Item Responses	Hi Tenure (N = 87)		Lo Tenure (N = 65)		Percent Overlap	r_b
			\bar{X}	S.D.	\bar{X}	S.D.		
A	13	12	1.24	2.44	0.83	2.30	93	.11
B	10	23	1.14	3.16	0.54	3.52	93	.11
C	8	47	-0.95	4.03	-1.45	4.75	95	.07

validities were statistically significant on the cross-validation sample, they were not used for operational scoring at this time.

It was necessary to choose one of the three keys based on Form 1. Keys A and B of Form 1 were equally effective in classifying the sample on the tenure criterion, as can be seen in Table 3. Since longer keys tend to have higher reliability, the eight per cent key was selected. The U. S. Navy Background Questionnaire was first used operationally in January 1967, as part of the selection battery administered to NROTC (Regular) applicants.

The non-keyed items, all of which have demonstrated potentially useful validity, were retained on the form so further validation information could be gathered on them.

In order to estimate improvement in retention provided by the key, the score distributions of the cross-validation sample were used. However, since the number of cases and the retention base rate in the cross-validation sample differed from the best estimate of these values, which is the total sample, it was necessary to make appropriate adjustments. Table 5 in the Appendix presents distributions for both actual and adjusted frequencies of the cross-validation sample.

Use of the adjusted frequencies yielded a total of 110 officers (14.3 per cent) who obtained a score of three or better on the operational key. Since Form 1 influenced selection only minimally in 1956, it may be assumed that scores for an applicant population would be distributed like those of the present sample. If this assumption is made and only the top 14 per cent of the applicants (identified by the operational key) were selected, then 53.6 per cent would be expected to become high tenure officers (see Figure 1). This would represent an increase of 13.3 percentage points over the base rate of 40.3 per cent in the selected population. Since such a stringent cut-off would probably not allow for a sufficient number of selectees in terms of the existing selection procedures, other cut-offs must be considered. If the cut-off score were lowered one point, to include all those with a score of two or above, approximately 24 per cent of the applicant population would be available. This cut-off yields 87 high tenure officers from a possible 182 (47.8 per cent) or an increase of 7.5 percentage points over the base rate. If it should become necessary to further lower the cut-off score to one or better, approximately 38 per cent of the population would be selected with the resulting increase of only three percentage points over the base rate. The effects of using these three alternate cut-offs are illustrated in Figure 1.

D. CONCLUSIONS AND RECOMMENDATIONS

1. A key based on NROTC (Regular) Questionnaire (Form 1) was found to discriminate significantly, though not markedly, between high and low tenure officers in cross-validation samples.

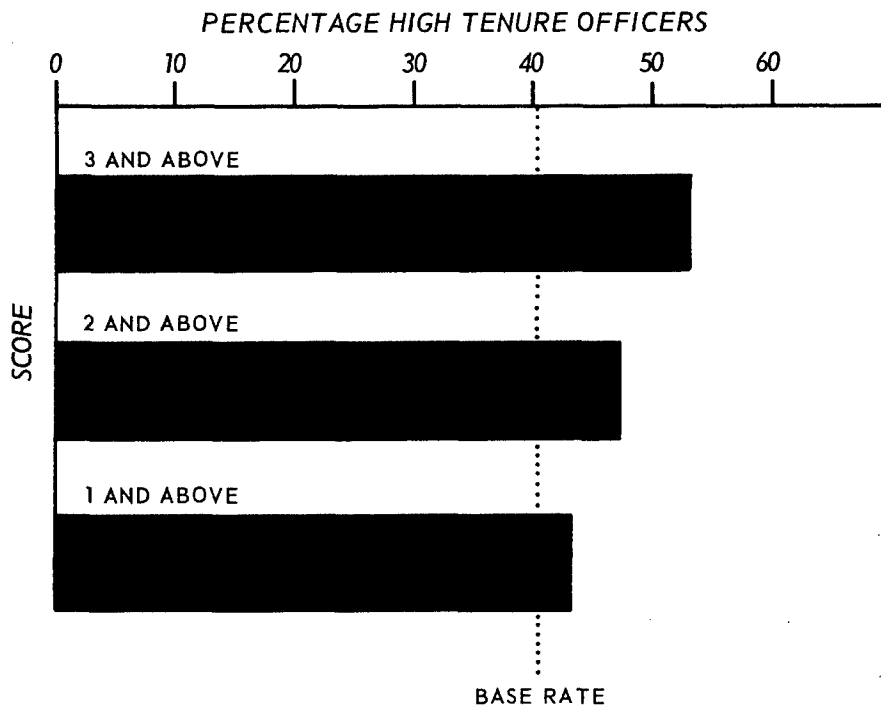


Figure 1. Percentage of High Tenure Officers Expected for Various Cut-Offs on U. S. Navy Background Questionnaire (Based on Form 1 Score Distributions)

2. A similar analysis of NROTC (Regular) Questionnaire (Form 2) did not produce a significantly valid key at this time. Since the criterion data were available for only a portion of the Form 2 sample, it is recommended that further analyses be undertaken when a larger criterion group becomes available.

3. The 1967 U. S. Navy Background Questionnaire was developed to aid in the selection of NROTC (Regular) scholarship recipients. This questionnaire was composed of selected items from both Forms 1 and 2, although the operational key consisted of Form 1 items only. As the tenure criterion matures further, it is recommended that the present key be enlarged and updated.

4. Forms 1 and 2 may prove useful in predicting criteria other than career status. Information is available on those 1956-1958 NROTC (Regular) selectees who were dropped from college for academic reasons, as well as for those who do not receive their commissions for a variety of other reasons. Further analyses of Forms 1 and 2 against these criterion is indicated.

APPENDIX

TABLE 5

Score Distributions for Actual and Adjusted Frequencies
of Cross-Validation Sample

Score	Actual				Adjusted ^a			
	High Tenure		Low Tenure		High Tenure		Low Tenure	
	f	cf	f	cf	f	cf	f	cf
6	1	1	1	1	3	3	2	2
5	4	5	7	8	11	14	12	14
4	6	11	9	17	17	31	16	30
3	10	21	12	29	28	59	21	51
2	10	31	25	54	28	87	44	95
1	14	45	40	94	40	127	71	166
0	25	70	37	131	71	198	66	232
-1	14	84	38	169	40	238	68	300
-2	8	92	31	200	23	261	55	355
-3	11	103	22	222	31	292	39	394
-4	3	106	22	244	8	300	39	433
-5	2	108	9	253	6	306	16	449
-6	1	109	4	257	3	309	7	456
-7	0	109	1	258	0	309	2	458
Total	109		258		309		458	

Note --

^aAdjusted to represent base rate of retention.

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