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RESEARCH REPORT SRR 72-22

APRIL 1972

THE RELATIONSHIP BETWEEN NAVY CLASSIFICATION TEST SCORES AND FINAL SCHOOL GRADES IN 98 CLASS "A" SCHOOLS

Patricia J. Thomas

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SUMMARY

Background and Problem

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The Basic Test Battery (BTB), an important tool in the Navy's enlisted classification system, has been developed to predict performance in Navy schools. Men scoring well above the minimum selection scores are expected to demonstrate greater school success than those who are assigned to the schools with minimum or waivered scores. The purposes of this report were to determine if the BTB is meeting this goal and if the findings of similar reports covering earlier time periods hold true for recent samples.

Approach

Grades collected between January 1969 and January 1971 from almost all "A" Schools were employed as criteria. Validities of the selection test composites were compared with validities obtained from samples collected two years previously. Graphs depicting the relationship between selection composites and school grades were prepared for each of 98 schools. Academic attrition percentages were computed for the data available from each school.

Findings

1. The correlations between school grades and scores on selection composites were generally higher than those reported previously (page 4).

2. The grades of the majority of men who were assigned to the schools despite substandard BTB scores were satisfactory. Ninety-five percent of these relatively low-aptitude men graduated from the Class "A" school assigned (page 5).

3. The attrition rate was unusually high in three schools, even among students whose BTB selector test scores were 10-12 points above the operational cutting score (page 9).

Conclusions

The results of the previous reports concerning the BTB validities were substantiated (page 9). Changes in the cutting scores for certain schools should be considered (page 9). UNCLASSIFIED

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THE RELATIONSHIP BETWEEN NAVY CLASSIFICATION TEST SCORES AND FINAL SCHOOL GRADES IN 98 CLASS "A" SCHOOLS

Patricia J. Thomas

April 1972

521.005.01.AA Research Report SRR 72-22

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Naval Personnel and Training Research Laboratory San Diego, California 92152

A LABORATORY OF THE BUREAU OF NAVAL PERSONNEL

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THE RELATIONSHIP BETWEEN NAVY CLASSIFICATION TEST SCORES AND FINAL SCHOOL GRADES IN 98 CLASS "A" SCHOOLS

A. BACKGROUND AND PURPOSE

The primary determinants of whether an enlisted man receives formal school training for a rating, as opposed to on-job training only, are the scores he earns on the Basic Test Battery (BTB). The BTB is expected to discriminate between men who can succeed in a Class "A" school and those who cannot. This means that scores on test composites used in school selection should be significantly and substantially correlated with school grades. The great majority of men scoring above the established minimum on the BTB composites relevant for an "A" School should pass the course, while men scoring below that minimum and admitted to the school on special waivers would be expected to perform less well in school training. In previous reports (Thomas, 1969; Thomas, 1972) the BTB was found to be doing an effective job. The purposes of this report are to provide an updated evaluation of the BTB for predicting final school grades and to determine the stability of the findings over an extended period of time.

B. PROCEDURE

1. Sample and Data Acquisition

Final grades for students are routinely forwarded to this Laboratory by all Class "A" schools. Data received during calendar years 1969 and 1970 for students who graduated or who failed from these schools for academic reasons form the basis for this graphic report.

All men discharged from the Navy or on inactive duty status at the time of the analyses were not included in the sample since their BTB scores were unavailable. Non-academic drops were excluded because selector tests are not designed to predict such criteria. Schools having fewer than 70 students with complete predictor and criterion data were not analyzed. The total sample consisted of 100,150 men graduating or dropping from 98 Class "A" schools between 1 January 1969 and 1 January 1971.

2. Variables

a. <u>Predictors</u>. Six of the basic and special tests in the Navy Classification Battery were used as predictors. Scores are reported as Navy Standard Scores having a mean of about 50 and a standard deviation of about 10 for an unrestricted recruit population. The tests used were: (1) General Classification Test (GCT)--consisting of 60 verbal analogy and $\overline{40}$ sentence completion items with a single 35-minute time limit.

(2) Arithmetic Reasoning Test (ARI)--consisting of 30 arithmetic reasoning items with a 35-minute time limit.

(3) Mechanical Test (MECH)--consisting of two separately timed 50-item subtests yielding a single score. The tool knowledge section has a 10-minute time limit and the mechanical comprehension section has a 25-minute time limit.

(4) <u>Clerical Test (CLER)</u>--consisting of 100 number matching items. This highly speeded test has a 5-minute time limit.

(5) <u>Shop Practices Test (SP)</u>--consisting of 30 items with a 17minute time limit.

(6) Electronics Technician Selection Test (ETST)--consisting of three separately timed sections: Mathematics (20 items in 25 minutes); Science (20 items in 15 minutes); and Electricity and Radio (30 items in 20 minutes). A single score is obtained.

Scores on these tests are summed for various two- and three-test composites to determine eligibility for Class "A" schools. The test combinations used for school selection are called "selectors" throughout this report.

Men scoring below the minimum selection score may be assigned to Class "A" schools under certain circumstances. Recruits may have up to six points waived on two-test composites or up to nine points waived on three-test composites if: (1) the supply of fully qualified recruits falls below the number required to meet school quotas; or (2) the recuits have been enlisted under the direct procurement program for high school and junior college graduates. Fleet personnel may have the same number of points waived on their selection scores; or, if they have shown proficiency in a rating, they may be assigned to school training in that rating with permission from the Bureau of Naval Personnel despite nonqualifying BTB scores.

b. <u>Criteria</u>. The Final School Grade (FSG), used as the major criterion in this report, is most commonly a weighted sum of grades earned on daily and/or weekly quizzes, measures of practical proficiency, and the score on the final examination.

Another criterion of interest is the pass-fail status of the student. As stated earlier, only school graduates and academic failures are included in this report. Because of the methods of statistical analysis used to prepare the graphs, the attrition rates reported in the Appendix are based on the students having complete predictor and criterion data. For some schools, due to incomplete reporting, this attrition rate is an underestimate of the actual number of academic drops.

3. Analysis of Data

The students from each school were treated as separate samples in the analyses. The validity of the selector and the median FSG were determined for each school, as was the academic attrition rate for the students in each sample. An additional attrition analysis was performed, based on all available data, to determine whether the percentages of academic drops in the samples were realistic.

Since school assignment usually was contingent upon achieving a minimum score on several of the tests being validated, considerable restriction of range was evident in that the selector scores of the students within a school were higher than in the general recruit population, and the range of scores was considerably smaller. This results in lower test validities than would be obtained with more heterogeneous samples. The obtained validities were statistically corrected to yield estimates of test validities for a full-range recruit population as well as to present validities on a common base to make them comparable across schools. These corrected correlation coefficients, presented in the school graphs, are not strictly comparable to those in previous BTB reports because a different statistical correction method was used.¹

In constructing the graphs, the selector scores of students were arranged in rank order and combined into groups with intervals of from five to six score points, depending on whether two or three tests comprised the selector. The percentage of men in each interval who scored above the median Final School Grade was computed.

Various comparisons were made between the results of this study and those reported for the time period most recently analyzed (Thomas, 1972). The validities of the selection composites were compared to determine whether the effectiveness of the BTB is remaining stable. Failure rates for schools found to have high attrition in the previous study were examined to see if the attrition problem still exists in these schools. In addition, the data of the lower aptitude men were analyzed separately in an attempt to determine whether credence may be placed in the graduation rate found previously.

C. RESULTS

The detailed findings for the individual Class "A" schools are presented in the series of graphs in the Appendix. They are preceded

¹A correction technique for restriction of range, developed by Lawley (1943), was previously used. Recent work at this Laboratory led to the conclusion that this method yields inflated correlations when large inequities among the sample sizes of the variables occur, as is not uncommon with the BTB. Therefore, the more commonly used Pearson method of correction was applied in this study.

by an introductory page of notes that explain the abbreviations and statistical terms appearing on the graphs.

1. Stability of the Validities of BTB, Form 7

In the previous BTB graphic report (Thomas, 1972) it was reported that with the exception of GCT+CLER, the effectiveness of all of the selectors had increased slightly. This conclusion was based on a comparison of the mean corrected validities for 1966-1968 samples of students with those reported for 1964-1966 samples (Thomas, 1969). A similar comparison was made in the present study using the uncorrected validities of the selectors, since the method of correcting for restriction of range differed in these most recent reports. Table 1, below, presents the results of this analysis. The validity of the BTB is clearly higher for the more recent data.

In the 80 schools which used the same selector composites during the four years covered by these studies, an increase in validity was obtained in 45 schools, a decrease in 28 schools, and identical correlations in seven schools. Again, it appears that the effectiveness of BTB-7 as a classification instrument has increased somewhat with respect to the prediction of school performance.

TABLE 1

Selector	N of Schools	Mean Validi	ty
	_	1966- 196 1968 197	
GCT+ARI	24	.48 .5	1
GCT+MECH+SP	34	.44 .4	-5
GCT+CLER	6	.35 .4	0
ARI+2ETST	16	.49 .6	6
All Selectors	80	.46 .5	3

Comparison of the Uncorrected Validities of BTB Selectors for 1966-68 Samples and 1969-70 Samples

Note.--Individual school <u>rs</u> were weighted by the <u>N</u> of the school sample and averaged through the <u>r</u> to <u>z</u> transformation to obtain the average mean <u>rs</u> presented in this table.

2. Students with Selection Score Waivers

The school performance of men whose selection scores were below the official cutting scores is of particular interest. A high success ratio suggests the minimum score could be lowered. Stewards were not included in the analysis of cutting scores because most were directly procured during the period covered by this study and were not required to meet a minimum score on any selector.

During the 1969-1970 period, 12 percent of the students entered with waivers, compared with the ten percent in the period covered by the previous report. The graduation rate among these students was 95.2 percent. Among the students who equalled or exceeded the operational cutting score, it was 98.6 percent. Thus, the conclusion that "the great majority of men who entered schools on waivers were able to graduate" (Thomas, 1972) continues to be true.

As mentioned previously, the analyses for the graphs in the Appendix were based on men having complete predictor and criterion data. Therefore, an additional analysis was performed to investigate the possibility that school grades or test scores were more apt to be missing for dropped students than for graduates. If such a situation existed, the graduation rate of men with lower aptitude would be lower than is reported above.

Table 2 presents a comparison of the academic attrition rates that would have been reported if all students (those with both complete and incomplete data) had been used. The two columns of percentages are very similar. The greatest difference within any school between the attrition for all students and attrition reported in the graphs in the Appendix was less than four percentage points. While these results provide no answers concerning the number of students entering the schools versus the number for whom data were submitted, they do indicate that the men upon whom the analyses were based were representative of the total available sample in terms of the percentages of failures.

3. Schools with Attrition Rates Exceeding Five Percent

Twelve schools had academic failure rates exceeding five percent, suggesting that it might be desirable to raise the cutting scores for these ratings. To investigate this question, the percentages of academic drops were computed for the selector score interval and the next two intervals above it. An arbitrary standard of 90 percent probability of passing for those within the score interval was decided upon as the criterion of acceptability. These data are presented in Table 3.

In three of the 12 schools the attrition rate in the cutting score interval was less than ten percent, requiring no change in cutting score. Indications are that the minimum selection scores should be raised one interval in five schools and two intervals in one school. Comparison Between the Percentage of Academic Attrition for Total Sample and Attrition for Samples Included in Graphs

On Graphs 0.0 0.3 5.9 6.6 2.9 1.6 0.0 0.4 0.0 1.8 1.4 0.6 0.3 0.1 0.0 2.6 5.1 0.0 0.0 0.1 0.0 4.1 Academic Attrition Percentage of Total Sample 0.4 0.0 2.3 2.8 0.9 0.5 0.0 2.5 1.4 1.20.0 0.3 0.0 0.5 6.7 4.5 8.5 3.1 2.7 0.1 8.1 0.1 2 zI Total 296 408 458 1110 264 145 1364 2164 914 1282 1077 170 280 137 411 1967 379 1079 1614 1113 3754 892 3134 485 91 School Number 6119 6062 6086 6070 6159 6097 6138 6133 6125 6020 6100 6053 6054 6009 6105 6120 6061 6171 6071 6067 6129 6130 6134 6135 6124 Rating CTI CTI CTO CTR CTT CYN DC DC S DK DP S ETET On Graphs 0.280.00 0.0 0.0 0.0 2.6 0.1 0.0 0.0 Academic Attrition 0.0 0.0 0.0 0.0 0.0 Percentage of Total Sample 0.2 0.6 0.53.7 0.0 9.8 1.2 0.0 0.0 0.0 0.2 0.0 0.0 0.0 0.0 0.0 4.0 0.0 0.0 4.1 0.0 0.0 0.0 z Total 662 905 3476 612 9493 8698 742 415 396 308 609 1197 3553 1543 5267 579 1866 1981 1225 991 750 407 169 388 531 Schoo1 Number 6513 6512 6527 6509 6502 6515 6520 6522 6516 6517 6518 6506 6535 6530 6503 6532 6537 6528 6150 6501 6531 6069 6148 6081 6079 Rating AO AQ ASE ABE ABF ABH ADJ ADR AME AMH AMS ATN AVI AG AK AV AC AE AW AZ AZ ΒT BU CE

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(Table continued on next page)

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TABLE

TABLE 2 (continued)

Rating	School Number	Total <u>N</u>	Percentage Academic Attr Total Sample On	itage of Attrition .e On Graphs	Rating	School Number	Total <u>N</u>	Percentage Academic Attr Total Sample O	tage of Attrition e On Graphs
ET	6136	1399	0.1	0.1	MQ	6002	144	0.0	0.0
ET	6137	527		0.5	RM	6144	5761	0.0	0.0
FT	6026	209		4.1	RD	6141	1883	8.3	7.5
FT	6108	220	0.0	0.0	SD	6000	3275	0.0	0.0
FT	6027	427	0.0	0.0	SF	6106	1689	0.0	0.0
GM	6115	393	0*0	0°0	SK	6059	1678	2.3	2.1
GM	6117	107	0.0	0.0	SK	6060	1335	5.5	5.4
GMT	6025	343	4.4	4.6	SM	6005	1203	7.3	4 . 8
GMT	6170	115	0.0	0.0	SM	6006	119	0.8	1.1
HM	6085	6481	0.0	0°0	ST	6160	453	0*0	0.0
MH	6084	7936	10.3	8.0	ST	6015	708	0.4	0.2
IC	6072	166	0.0	0.0	STS	6017	119	0.0	0.0
IC	6073	1161	1.2	1.1	Q.L	6521	397	0.0	0.0
MM	6066	513	0.0	0.0	MT	6021	254	0.0	0.0
NW	6041	295	4.1	6.1	ML	6022	178	0°0	0.0
MR	6068	365	0*0	0°0	TM	6023	223	0°0	0°0
PC	6089	232	3.4	3.5	MT	6024	184	0.0	0.0
PE	6146	2374	28.0	25.6	MT	6034	136	0.0	0°0
Hd	6523	716	6.8	6.9	MT	6036	154	0°0	0.0
PN	6031	546	0.0	0°0	TM	6169	114	0.0	0 ° 0
NM	6101	121	0.0	0°0	UT	6083	348	0°0	0.0
PN	6102	910	2.3	2.6	ΥN	6057	715	0.3	0.3
PR	6519	735	1.5	1.1	ΥN	6058	417	0.7	0.3
ΡТ	6529	264	6.4	6.5			C		
МQ	6001	1146	7.5	7.1	UVETAIL		006,121	R. 7	2°2

TABLE 3

Percentage of Academic Drops in Three Successive Selector Test Intervals for Each of 12 Schools with an Academic Attrition Rate of More than Five Percent

Rating	Cutt	Cutting Score Interval	ore l	First Interval Above Cutting Score	First Interval ve Cutting Sco	rval Score	Second Inter Above Cutting	Second Interval ove Cutting Sco	srval Score
	Score	z	% of Drops	Score	Z	% of Drops	Score	z	% of Drops
*AE	156-161	686	12.2	162-167	721	9.6	168-173	659	8.5
DK	105-109	27	7.4	110-114	26	11.5	115-119	22	9.1
*ET (A-1)	171-176	40	22.5	177-182	71	14.1	183-188	86	10.5
*ET (A-2)	171-176	19	11.1	177-182	41	12.2	183-188	75	6.7
HM	100-104	823	15.4	105-109	868	9.7	110-114	866	7.0
MN	156-161	32	6.3	162-167	30	6.7	168-173	23	4.3
*PE	171-176	234	48.7	177-182	251	45.4	183-188	336	34.2
Hd*	105-109	95	7.4	110-114	65	4.6	115-119	77	7.8
ΡŢ	105-109	28	17.9	110-114	41	7.3	115-119	29	0
*QM	110-114	154	11.7	115-119	152	3.3	120-124	122	4.9
SK	105-109	164	12.2	110-114	190	4.2	115-119	139	3.6
*RD	100-104	49	20.4	105-109	170	19.4	110-114	296	12.8

Note.--Ratings marked with an asterisk were reported to have an attrition rate of over five percent in the previous study also.

In the remaining three schools, the 90 percent passing standard could not be achieved even if the score were raised 10-12 points.

The results of the attrition analysis are similar to those reported for the 1966-1968 samples in seven of the schools (Thomas, 1972). The Polaris Electronics schools continued to report the highest rate of attrition of any Class "A" school, 26 percent during the most recent reporting period. As can be seen from the graph (page 47), the cutting score would have to be raised to an unrealistic level (ARI+2ETST=201) before 90 percent of the students in that interval would be predicted to pass the course. Changing the minimum scores for the other ratings would be feasible and is probably warranted, now that the previous findings have been found to be still applicable.

D. CONCLUSIONS

The results of this study clearly support the conclusions reached in the most recent study in this series; namely:

1. The BTB is an effective predictor of school performance.

2. The great majority of men who entered schools with BTB score waivers were able to graduate.

3. Adjustments (either upward or downward) in the cutting scores required for entrance to many Class "A" schools appear to be both warranted and desirable.

REFERENCES

- Thomas, E. D. <u>Navy Recruit Classification Tests as predictors of</u> performance in 87 Class "A" enlisted schools (1964-1966). San Diego: U. S. Naval Personnel Research Activity, February 1969 (SRR 69-14)
- Thomas, Patricia J. The relationship between Navy classification test scores and final school grade in 104 Class "A" schools. San Diego: Naval Personnel and Training Research Laboratory, January 1972. (SRR 72-15)



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APPENDIX



Explanation of Terms on Graphs

Numbers below refer to encircled numbers in sample graph above:

- Title of school. If more than one school must be attended to complete the course of training, the phase offered by this school is given in parentheses.
- (2) Four-digit code number as designated in BUPERS 1tr Pers-B224-ss of 11 Jun 1971.
- (3) Combination of BTB tests and cutting score used for selection to this school.
- (4) Intervals of selector scores, ranging from high to low.
- (5) Total number of students having selector scores within listed interval.
- (6) Number of academically disenrolled students who scored within listed interval.
- (7) Interval within which lies the minimum score used in recruit assignment to school.
- (8) Median final school grade, based on all students in the sample.
- (9) Validity of selectors.
- (10) Validity of selectors corrected for restriction in range.
- (11) Percentage of academic failures.






































































































		~		
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	ABF	Av. Boatswain's Mate (Fuels)	Lakehurst	12
	ABH	Av. Boatswain's Mate (Aircraft Handling)	Lakehurst	13
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	ADR	Av. Machinist's Mate (Reciprocating)	Memphis	14
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