Validation of the Armed Services Vocational Aptitude Battery (ASVAB) and the English Diagnostic Test (EDT) for the Basic Journalist (JO) Class "A" School

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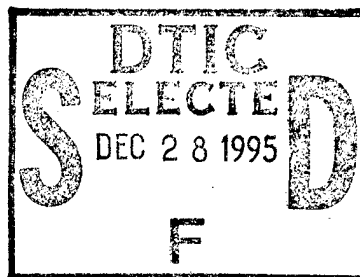Approved for public release;
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13. ABSTRACT (Maximum 200 words)

The study purpose was to validate the Armed Services Vocational Aptitude Battery (ASVAB) and the English Diagnostic Test (EDT) as selection standards for the Basic Journalist (JO) Class "A" school. The study responded to a proposal to implement the EDT at the Military Entrance Processing Stations as a JO selection standard rather than at the JO school as a remediation tool. The ASVAB consists of the following 10 tests: General Science (GS), Arithmetic Reasoning (AR), Word Knowledge (WK), Paragraph Comprehension (PC), Numerical Operations (NO), Coding Speed (CS), Auto and Shop Information (AS), Mathematics Knowledge (MK), Mechanical Comprehension (MC), and Electronics Information (EI). Verbal is comprised of WK and PC. The EDT assesses grammar, comprehension, word knowledge, and sentence structure.

The EDT had higher validity than the most valid ASVAB selector composite, VE + AR (currently operational). Recommendations are to (1) raise the VE + AR minimum qualifying score of 110 to 115, (2) implement the EDT (score of 70) as a selection standard prior to JO assignment (with workbooks or other review materials issued for self-paced study prior to test time), and (3) issue a 5-point waiver for both the ASVAB and the EDT until sufficient data are available to determine the costs versus savings resulting from these recommendations.

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Foreword

This study was conducted in response to a request from the Chief of Naval Personnel (PERS-23) to validate the Armed Services Vocational Aptitude Battery (ASVAB) and the joint-service English Diagnostic Test (EDT) as selection criteria for the Basic Journalist (JO) Class "A" school. The study was requested in review of a proposal to administer the EDT at the Military Entrance Processing Stations (MEPS) as a selection screen rather than at the JO school as a remediation tool. This study was completed and submitted in a letter report in November 1993 (Held, 1993).

The investigation was sponsored by PERS-23 and funded by reimbursable Work Unit 93WRPS578. Results, which are published at this time for archival purposes, are intended for use by the Bureau of Naval Personnel, Navy school officials, and the research community.

Kathleen E. Moreno
Department Director,
Personnel and Organizational
Assessment

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Summary

Problem

This study was conducted in response to a request from the Chief of Naval Personnel (PERS-23) to validate the Armed Services Vocational Aptitude Battery (ASVAB) and the joint-service English Diagnostic Test (EDT) as selection criteria for the Basic Journalist (JO) Class "A" School. The study was requested in review of a proposal to administer the EDT at the Military Entrance Processing Stations (MEPS) as a selection screen rather than at the JO school as a remediation tool.

The ASVAB consists of the following 10 tests: General Science (GS), Arithmetic Reasoning (AR), Word Knowledge (WK), Paragraph Comprehension (PC), Numerical Operations (NO), Coding Speed (CS), Auto and Shop Information (AS), Mathematics Knowledge (MK), Mechanical Comprehension (MC), and Electronics Information (EI). Verbal (VE) is comprised of WK and PC. The EDT is a test of grammar, comprehension, word knowledge, and sentence structure.

Objective

The objectives of this research were to (1) validate the operational ASVAB selector composite against JO school performance measures, (2) identify and evaluate alternative ASVAB composites that may be more effective for determining qualification for school assignment, (3) determine a minimum qualifying score for the recommended ASVAB selector composite that would reduce attrition, and (4) assess the EDT as a school selection standard and as a remediation screen.

Approach

The JO students were randomly assigned to a test selection sample (60%) and a holdout sample (40%). Two methods applying multiple regression were used with the test selection sample to develop an experimental ASVAB composite most predictive of final school grade (FSG). Both methods developed a prediction equation starting with the ASVAB test having the highest correlation with FSG, followed by tests that provided the largest increase in the multiple correlation. The first four tests to enter the equation were designated as the experimental composite (the maximum used in military ASVAB composites). Method I did not correct for restriction in range of ASVAB test scores resulting from ASVAB selection, whereas Method II did.

The operational and experimental selector composites were cross-validated in the holdout sample. Validities were compared after correcting ASVAB scores for restriction in range. The operational selector composite warranted replacement if the experimental composite demonstrated a .05 increase in validity or a 2% expected increase in the graduation rate.

The total JO sample was then used to compare the validities of the EDT and the operational ASVAB selector composite (or a replacement if one was warranted). The criteria for recommending EDT as an operational selector composite were the same as the criteria for replacing the operational ASVAB selector composite.

Minimum qualifying scores for the recommended ASVAB selector composite and for the EDT were evaluated from expectancy tables, which show the impact of raising or lowering scores on attrition. Recommendations for minimum qualifying scores were based upon (1) attrition rate, (2) waiver rate, (3) yearly school input requirement, and (4) the number of graduates versus the number of attrites disqualified from the JO school.

Results and Conclusions

The operational ASVAB selector composite (VE + AR) was adequate for the JO school. Raising the minimum qualifying score from 110 to 115 increased the graduation rate by 3% for remediated students (from 84% to 87%) while qualifying approximately 25% of the recruit population for school selection. The EDT had higher validity than the ASVAB. An EDT score of 70 resulted in a 95% expected graduation rate and a 25% expected qualifying rate for the recruit population. Because the correlation (corrected) between the EDT and VE + AR was less than one (.78), the EDT used as a second stage selection screen would qualify less than 25% of the recruit population, whereas using the EDT as an alternative selection standard would qualify more.

Recommendations

The following recommendations regarding the Basic JO Class "A" selection standards are addressed to PERS-23:

1. The operational ASVAB selector composite, VE + AR, should be retained for school selection. The minimum qualifying score should be raised from 110 to 115 to reduce attrition.

2. The EDT should be implemented as a JO school selection standard where logistics determine test administration is most cost effective. The minimum qualifying score should be 70. In preparation for the test, self-paced materials covering EDT content areas should be issued to enlistees interested in the JO rating.

3. The J-Prep curriculum should remain intact for waivers (probably 5 score points for VE + AR and 5 score points for the EDT) because they may be needed to fill school input requirements.

4. Further analyses should be conducted for the JO school when sufficient data become available to determine the impact of implementing the EDT as a second stage selection standard, and to determine if the VE + AR and EDT minimum qualifying scores are appropriate.

Elimination of J-Prep cannot be recommended until an assessment of the self-paced remediation materials has been made and the impact of implementation of the two selection standards has been determined. Depending on the expected impact of downsizing, changes in the recruit ability distribution, and forecasts in yearly school input requirements, the two selection standards used in conjunction may eliminate valuable recruit talent from the JO school. In that case, the ASVAB and EDT could be better utilized as either/or selection standards rather than first and second stage screens (undetermined from this study because all JO students were required to pass the EDT). The JO school could develop an assessment program to evaluate (1) self-paced materials followed by the EDT test versus (2) the EDT test followed by J-Prep followed by EDT test.

Contents

List of Tables

Introduction

Background and Problem

The Chief of Naval Personnel (PERS-23) tasked the Navy Personnel Research and Development Center to validate the Armed Services Vocational Aptitude Battery (ASVAB) selection standards and the English Diagnostic Test (EDT) for the joint-service Basic Journalist (JO) Class "A" school. Concern about attrition prompted this study.

The ASVAB, the selection and classification instrument for all the military services, consists of the following 10 tests: General Science (GS), Arithmetic Reasoning (AR), Word Knowledge (WK), Paragraph Comprehension (PC), Numerical Operations (NO), Coding Speed (CS), Auto and Shop Information (AS), Mathematics Knowledge (MK), Mechanical Comprehension (MC), and Electronics Information (EI). These tests, described briefly in Table 1, are used by each service in various test combinations (composites) to select recruits into military occupations. The Navy has 11 operational ASVAB selector composites, listed in Table 2. Periodically ASVAB selector composites are correlated with school performance measures (validated) for each Navy rating to ensure the Class "A" school is using the most effective ASVAB selector composite. The operational ASVAB selector composite for the JO "A" school is VE + AR (General Technical composite).[1] The minimum qualifying score is 110.

The JO "A" school administers a school developed screening instrument, the English Diagnostic Test (EDT), to assess proficiency in grammar, comprehension, word knowledge, and sentence structure. The EDT is administered prior to attending the JO school. Students scoring less than 75 on the EDT are required to attend an approximately 2-week remediation course termed J-Prep. Upon completion of J-Prep, students are retested and must score at least 75 in order to proceed to the JO school.

The EDT is being evaluated in this study because the JO school reports it has high validity in predicting attrition, particularly in the Journalism component of the curriculum (first 11 weeks). Very little attrition occurs in the follow-on component, Broadcasting, Shipboard Information and Training (approximately 5 weeks but will increase subsequent to this study).

The Navy EDT minimum qualifying score for remediation was lowered from 75 to 70 subsequent to this study's data collection. There is concern that 70 is too low because high attrition occurred when 70 was used prior to April 1991. There is also concern that the EDT should be administered as a Navy selection standard (as is done for the Marines, with a required score of 70) at the Military Entrance Processing Stations (MEPS). This would eliminate the costs of transportation, housing, remediation, and "down time" for students who are sent to the JO "A" school but fail to qualify.

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[1]Word Knowledge (WK) and Paragraph Comprehension (PC) are combined into the ASVAB Verbal (VE) composite.

Table 1

Content of ASVAB Tests

Test	Abbreviation	Description
General Science	GS	A 25-item test of knowledge of the physical (13 items) and biological (12 items) sciences--11minutes.
Arithmetic Reasoning	AR	A 30-item test of ability to solve arithmetic word problems--36 minutes.
Word Knowledge[a]	WK	A 35-item test of knowledge of vocabulary, using words embedded in sentences (11 items) and synonyms (24 items)--11 minutes.
Paragraph Comprehension[a]	PC	A 15-item test of reading comprehension--13 minutes.
Numerical Operations	NO	A 50-item speed test of ability to add, subtract, multiply, and divide one- and two-digit numbers--3 minutes.
Coding Speed	CS	An 84-item speeded test of ability to recognize numbers associated with words from a table--7 minutes.
Auto & Shop Information	AS	A 25-item test of knowledge of automobiles, shop practices, and use of tools--11minutes.
Mathematics Knowledge	MK	A 25-item test of knowledge of algebra, geometry, fractions, decimals, and exponents--24 minutes.
Mechanical Comprehension	MC	A 25-item test of knowledge of mechanical and physical principles--19 minutes.
Electronics Information	EI	A 20-item test of knowledge of electronics, radio and electrical principles and information--9 minutes.

[a]Verbal score: VE = WK + PC (raw scores).

Table 2

Navy Operational ASVAB Selector Composites

Composite	Components
General Technical	VE + AR
Mechanical	VE + MC + AS
Electronics	AR + MK + EI + GS
Clerical	VE + NO + CS
Basic Electricity & Electronics	AR + 2MK + GS
Engineering	MK + AS
Cryptologic Technician	V E+ AR + NO + CS
Hospitalman	VE + MK + GS
Machinery Repairman	AR + MC + AS
Submarine	VE + AR + MC
Business/Clerical[a]	VE + MK + CS

Note. See Table 1 for full test names.

[a]Student Testing Program composite implemented July 1987.

Objectives

The objectives of this study were to (1) validate the operational ASVAB selector composite against JO "A" school performance measures, (2) identify and evaluate alternative ASVAB composites that may be more effective for determining qualification for school assignment, (3) determine a minimum qualifying score for the recommended ASVAB selector composite that would reduce attrition, and (4) assess the EDT as a school selection standard and as a remediation screen.

Approach

Predictors

The predictors were the 10 tests of ASVAB Forms 8 through 14 and the EDT. The ASVAB is described briefly in Table 1. Raw test scores were standardized to a mean of 50 and a standard deviation of 10 using norms obtained from the American Youth Population (Department of Defense, 1982). The EDT scores, provided by the JO school, were on a 0 to 100 scale.

Criteria

The criteria were final school grade (FSG) and scores on the Journalism component of the JO school curriculum. Scores for both criteria, provided by the JO school, were on a 0 to 100 scale. Attrites were retained for analyses to provide a representative sample of all JO students. A mathematical procedure developed by Abrahams and Alf (1992) and detailed in Appendix A estimated FSGs for attrites.

Samples

The data, collected from September 1990 to May 1993, were obtained from the JO "A" school. The final sample size was 243; 26 academic drops and 217 graduates (2 nonacademic drops were deleted from the sample).

Data Analyses

The JO students were randomly assigned to a test selection sample (60%) and a holdout sample (40%). Prior to this assignment, students were sorted by Student Action Code (SAC) to ensure that each sample had equal percentages of graduates and attrites.

Two methods applying multiple regression were used with the test selection sample to develop an experimental ASVAB composite most predictive of FSG. Both methods developed a prediction equation starting with the ASVAB test having the highest correlation with FSG, followed by tests that provided the largest increase in the multiple correlation. The first four tests to enter the

equation were designated as the experimental composite.[2] Method I did not correct for restriction in range of ASVAB test scores resulting from ASVAB selection, whereas Method II did.

The operational and experimental selector composites were cross-validated (against FSG) in the holdout sample using integer weights of one for each test.[3] Composite validities were compared after correcting for restriction in range (to obtain the validity for a typical recruit applicant population, rather than a selected sample). A multivariate correction procedure (Lawley, 1943) was used for Method II and is explained in Appendix B. Results from the multiple regression analyses for Methods I and II are in Appendix C. Candidate ASVAB replacement composites were evaluated when the experimental composite demonstrated (1) a .05 increase in the validity or (2) a 2% expected increase in the graduation rate.[4]

The total JO sample was then used to evaluate the EDT relative to the ASVAB in predicting both FSG and the Journalism component of the curriculum. The criteria for including the EDT as a formal selection standard were those used to evaluate the ASVAB (a .05 increase in the validity or a 2% expected increase in the graduation rate).

Minimum qualifying scores for the recommended ASVAB selector composite and for the EDT were evaluated from expectancy tables. Expectancy tables show expected changes in the graduation rate when the minimum qualifying score is raised or lowered. The school data are used to develop the expectancy table for the operational composite (if the recommendation is to retain it for school selection). The theory-based Taylor-Russell tables are used if there is a recommended replacement, and for the EDT. Theory-based expectancy tables are used to evaluate a replacement ASVAB selector composite (and an added selection instrument in this study) rather than empirical expectancy tables because improvements in the graduation rate cannot be adequately evaluated for students who have already been selected by the correlated ASVAB operational selector composite.

The impact of raising the EDT score from 70 to 75 (mid-FY91) on attrition was assessed from summary data obtained from the Navy Integrated Training Resources and Administration System (NITRAS) for a 4-year period.

The following factors were considered in evaluating minimum qualifying scores: (1) attrition rate, (2) waiver rate, (3) yearly school input requirement, and (4) the number of graduates versus the number of attrites disqualified from the JO school.

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[2] Four tests are designated as the experimental composite, rather than the tests that provide significant increases in prediction, because four is the maximum number of tests used in the eleven NAVY operational ASVAB selector composites. Unless the experimental composite has been derived repeatedly for schools of an occupational group, the Navy ASVAB composite most similar to the experimental composite is recommended for school selection (if the validities for both composites warrant the change).

[3] Integer weights generalize to cross-validation samples more successfully than exact weights derived from regression analysis (Dawes & Corrigan, 1974). However, regression weights determine optimal assignment in models of classification efficiency (Brogden, 1955).

[4] The Taylor-Russell tables (Taylor & Russell, 1939) were used to translate gain in validity into expected gain in the graduation rate.

Results and Conclusions

ASVAB and EDT Validity

The experimental composite, VE + AR + MK + NO, was identified in the test selection sample by both Methods I and II. The cross-validity in the holdout sample (all reported validities are corrected for restriction in range) was higher for the operational composite (.73) than for the experimental composite (.69). Therefore, replacing the operational ASVAB selector composite is not warranted.

The comparison of validities for VE + AR and the EDT was made using the total sample (N = 243). Table 3 lists the validities for VE + AR and the EDT using both FSG and the Journalism component of the JO school as criteria.

Table 3

**VE + AR and English Diagnostic Test (EDT) Validities
with FSG and Journalism Component as Criteria**

	Predictors	
Criteria	VE + AR	EDT
FSG	.71	.75
Journalism Component	.67	.70

Note. All validities have been corrected for restriction in range using multivariate procedures.

For predicting FSG, the validity of .75 for the EDT was .04 higher than the validity of .71 for the operational selector composite, VE + AR. This gain in validity translates into a near 2% increase in the expected graduation rate and warrants consideration of including the EDT as a JO school selection standard.

For predicting the Journalism component of the curriculum, the validity of .70 for the EDT was .03 higher than the validity of .67 for the operational selector composite, VE + AR. This gain in validity is consistent with the gain obtained from the VE + AR/EDT comparison using FSG as the criterion and provides additional support for including the EDT as a JO school selection standard.

Minimum Qualifying Scores: VE + AR

Table 4 is an expectancy table used to evaluate VE + AR minimum qualifying scores. The analysis was performed for 129 students who scored less than 75 on the EDT and attended J-Prep. This group was analyzed instead of the entire JO sample (N = 243) for two reasons. First, the impact of raising the VE + AR minimum qualifying score on attrition cannot be accurately assessed for the entire JO sample because some benefited from J-Prep whereas others did not. Second, attrition for students scoring 75 or greater on the EDT was insignificant.

Table 4

Expectancy Table for the Operational Selector Composite (VE + AR)

Composite Score	School Sample					At or Above Composite Score in Recruit Population	Expectancies per 1,000 Recruits		
	Grad N	Drop N	Total N	Grad %	Drop %	%	Total %	Grad %	Drop %
≥128	2	0	2	100	0				
≥ .	.	.	.	.	.	.	.	.	.
≥ .	.	.	.	.	.	.	.	.	.
≥120	34	2	36	94	6	14	140	132	8
≥119	38	4	42	91	9	16	160	146	14
≥118	46	5	51	90	10	19	190	171	19
≥117	51	5	56	91	9	21	210	191	19
≥116	60	8	68	88	12	24	240	211	29
≥115[a]	74	11	85	87	13	27	270	235	35
≥114	80	14	94	85	15	29	290	247	43
≥113	87	15	102	85	15	32	320	272	48
≥112	91	15	106	86	14	35	350	301	49
≥111	100	17	117	86	14	38	380	327	53
≥110[b]	103	19	122	84	16	41	410	344	66
≥109	104	19	123	85	15	44	440	374	66
≥108	107	20	127	84	16	47	470	395	75
≥107	108	20	128	84	16	50	500	420	80
≥106	108	20	128	84	16	53	530	445	85
≥105	108	20	128	84	16	56	560	470	90
≥ .	.	.	.	.	.	.	.	.	.
≥ .	.	.	.	.	.	.	.	.	.
≥102	108	21	129	84	16	65	650	546	104

Note. N = 129 remediated students. Of the 7 students who scored below the 110 minimum qualifying score (129 - 122 = 7 waivers), 2 (29%) were attrites. Attrites are designated as drops.
[a]Alternative minimum qualifying score.
[b]Current minimum qualifying score.

Table 4 lists a range of operational selector composite minimum qualifying scores that include the 110 score currently used. A breakdown for each score includes actual graduation and attrition rates (attrites are designated as drops) for the school sample (N=129) and expected rates (per 1,000) for the recruit population (N = 58,825). Expected rates are based on school rates.

Attrition was 16% for those scoring at or above the current 110 minimum qualifying score. Raising the minimum qualifying score to 115 improved the graduation rate by 3% (from 84% to 87%), but at the cost of eliminating 29 graduates from school selection. However, the JO "A" school could benefit from this raise considering (1) the waiver rate is low (3%, or 7/243), (2) the yearly student input requirement relative to other Class "A" schools is low (approximately 150 for

FY93), and (3) the percentage of the recruit population that would qualify should be sufficient (27% for FY92).

Minimum Qualifying Scores: EDT as a Selection Standard

Table 5 is the theory-based expectancy table used to evaluate EDT minimum qualifying scores and expected graduation rates.

Table 5

Expectancy Table for the English Diagnostic Test (EDT)

EDT Score	At or Above EDT in Population %	Expectancies in Population %	%
≥79	10	99	1
≥75	15	98	2
≥73	20	96	4
≥70	25	95	5
≥69	30	93	7
≥67	35	92	8
≥65	40	90	10
≥63	45	88	12
≥61	50	86	14

Note. This table was derived from the theoretically based Taylor-Russell tables (Taylor & Russell, 1939) and values obtained from multivariate correction for range restriction procedures using the Navy applicant population (see Appendix B). The values are only expected values (actual population EDT values are not available for a population). The applicant population was expected to produce slightly different results than the recruit population.

Table 5 shows that implementing an EDT minimum qualifying score of 75 (presumed before remediation) results in an expected 98% graduation rate. However, only 15% of the recruit population qualify for school selection. The JO school, having relatively low student input requirements, can afford to be selective, however several factors must be considered: (1) Using EDT = 75 as a selection standard rather than a remediation diagnostic would have eliminated over half of the graduates in this study from school selection, (2) JO requirements that are too stringent will create shortages of JOs in the field, and (3) despite military downsizing, the demand for JOs is still stable (Navy input requirements for FY94 are greater than 150).

An EDT minimum qualifying score of 70 (now implemented in the JO school as a remediation standard) results in an expected 95% graduation rate and qualifies 25% of the recruit population for school selection (close to the 27% qualified with VE + AR = 115). Because the correlation (corrected) between the EDT and VE + AR was less than one (.78), the EDT used as a second stage selection screen would qualify less than 25% of the recruit population, whereas using the EDT as an alternative selection standard would qualify more.

Minimum Qualifying Scores: EDT as a Remediation Diagnostic

Table 6 lists attrition rates, setback rates, and planned input requirements for FY89 through FY92 (obtained from NITRAS).

Table 6

JO Attrition Rates, Setbacks, and Input Requirements for FY89-92

Fiscal Year	Attrition Rate (%)			Setbacks	Planned Input Requirement
	Academic	Nonacademic	Total		
1989	13	6	19	34	96
1990	12	9	21	50	118
1991[a]	12	1	13	17	129
1992	9	1	10	10	161

Note. Data obtained from Navy Integrated Training Resources and Administration System (NITRAS).
[a]EDT was raised from 70 to 75 April 1991.

Table 6 shows academic attrition was reduced by 3% in FY92, the last FY following the raise in the EDT minimum qualifying score from 70 to 75. The recent reinstatement of EDT = 70 could result in a 3% increase in attrition if all other things remain equal (i.e., ASVAB selection standard, EDT use, recruit ability distribution, motivation, and yearly input requirements).

Recommendations

The following recommendations regarding the Basic JO Class "A" selection standards are addressed to PERS 23:

1. The operational ASVAB selector composite, VE + AR, should be retained for school selection. The minimum qualifying score should be raised from 110 to 115 to reduce attrition.

2. The EDT should be implemented as a JO school selection standard where logistics determine test administration is most cost effective. The minimum qualifying score should be 70. Self-paced materials covering EDT content areas should be issued to enlistees interested in the JO rating in preparation for the test.

3. The J-Prep curriculum should remain intact for waivers (probably 5 score points for VE + AR and 5 score points for the EDT) because they may be needed to fill school input requirements.

4. Further analyses should be conducted for the JO school when sufficient data become available to determine the impact of implementing the EDT as a second stage selection standard, and to determine if the VE + AR and EDT minimum qualifying scores are appropriate.

Elimination of J-Prep cannot be recommended until an assessment of the self-paced remediation materials has been made and the impact of implementation of the two selection

standards has been determined. Depending on the expected impact of downsizing, changes in the recruit ability distribution, and forecasts in yearly school input requirements, the two selection standards used in conjunction may eliminate valuable recruit talent from the JO school. In that case, the ASVAB and EDT could be better utilized as either/or selection standards rather than first and second stage screens (undetermined from this study because all JO students were required to pass the EDT). The JO school could develop an assessment program to evaluate (1) self-paced materials followed by the EDT test versus (2) the EDT test followed by J-Prep followed by EDT test.

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[5]Cited in Foreword.

[6]Cited in Appendix C.

Appendix A

Scoring Failures

Scoring of Failures

The scoring of failures procedure is based on the assumption that, for an applicant population, criterion scores for successes (graduates) and failures (attrites) when combined are normally distributed. A mathematical procedure (Abrahams & Alf, 1992) is used to assign failure scores at the appropriate lower point of the criterion distribution. The following values and formulas are used for the procedure.

$$p \quad = \quad \text{the proportion of graduates.}$$
$$q \quad = \quad \text{the proportion of attrites.}$$
$$\overline{X}_g \quad = \quad \text{the mean final school grade for the graduates.}$$
$$SD_g \quad = \quad \text{the standard deviation of FSGs for graduates.}$$
$$z \quad = \quad \text{the z-score (standard score) above which the proportion p falls.}$$
$$y \quad = \quad \text{the height of the normal curve at z.}$$

Step 1

The mean for attrites, $\overline{X}_a$, can be determined as follows:

$$\overline{X}_a = \overline{X}_g - A(SD_g), \text{ where}$$

$$A = \frac{y/(pq)}{\sqrt{1+(zy/p) - (y/p)^2}}$$

Step 2

Assign the estimated mean criterion score determined in Step 1 to each attrite.

Step 3

Compute the correlation between each predictor and the criterion for the combined distribution of graduates and attrites.

Step 4

Correct the correlations from Step 3 for coarse grouping (assigning a mean criterion score to every attrite reduces variance and, therefore, the correlation coefficient). The formula used for this correction is:

$$r_c = r_{xy} / SD_z', \text{ where}$$

$$SD_z' = \sqrt{1 - q + zy + y_2/q}$$

Appendix B

Correction Procedure Used in Method II

Correction Procedure Used in Method II

Regression analysis used to derive the ASVAB composite most predictive of final school grade (FSG) is biased against the tests of the school selector composite or tests highly correlated to them. This bias is known as restriction in range. Correcting test scores for restriction in range is accomplished in Method II by using a Navy applicant population ASVAB/FSG matrix where correlations between ASVAB tests and FSG are estimated using the general multivariate correction formulas (Lawley, 1943). The ASVAB tests are treated as explicit selector variables (known values for the population and restricted sample), whereas FSG is treated as the incidental selector variable (known values for the restricted sample only).

Table B-1 gives two matrices (including means and standard deviations) required for the multivariate correction procedure. The first is the ASVAB/FSG matrix for the JO test selection sample (see Table 1 for the full test names). The second is an ASVAB matrix for the FY92 Navy applicant population (N = 115,986). At the bottom of the page are the estimated population correlations between ASVAB and FSG.

The correction procedure to determine the EDT validity for the total sample used the ASVAB as explicit selection variables, and the EDT, Journalism component, and FSG as incidental selection variables (unknown for the population). In addition to corrected validities, the correction procedure also calculates expected population means and standard deviations for the incidental selection variables. The EDT means and standard deviations were used to construct Table 5 (EDT expectancy analysis).

Table B-1

Required Multivariate Matrices and Output

	GS	AR	NO	CS	AS	MK	MC	EI	VE	FSG	Mean	SD
ET-NF BE&E Test Selection Sample Matrix With Means and Standard Deviations												
GS	1.000	.361	-.010	-.061	.351	.321	.374	.495	.440	.216	57.53	4.28
AR		1.000	.182	.131	.282	.604	.370	.340	.149	.356	59.84	2.58
NO			1.000	.504	-.131	.218	-.020	-.108	-.051	.223	56.66	5.36
CS				1.000	-.120	.147	-.053	-.114	.040	.088	55.95	7.04
AS					1.000	.068	.467	.589	.161	.125	51.97	6.29
MK						1.000	.315	.168	.162	.351	59.52	2.74
MC							1.000	.495	.202	.167	56.92	5.53
EI								1.000	.257	.150	52.83	5.86
VE									1.000	.198	58.49	3.00
FSG										1.000	81.21	4.95
Population (Applicant FY92) With Means and Standard Deviations												
GS	1.000	.567	.189	.179	.510	.518	.609	.595	.693		51.66	8.30
AR		1.000	.405	.340	.376	.695	.580	.442	.571		51.97	8.20
NO			1.000	.600	.020	.430	.158	.093	.273		53.41	7.42
CS				1.000	.029	.355	.165	.097	.294		52.64	7.46
AS					1.000	.201	.599	.634	.386		50.78	8.72
MK						1.000	.479	.357	.490		53.56	8.24
MC							1.000	.603	.507		52.70	8.75
EI								1.000	.476		50.42	8.40
VE									1.000		52.67	6.44
Correlations (Validities) for Population From Correction Program and Above Matrices												
FSG	.500	.630	.434	.311	.295	.585	.428	.362	.585			

Appendix C

Multiple Regression for Methods I and II

Multiple Regression for Methods I and II

STEP	TEST	MULTR	RSQ	F	FSIG	RSQCH	FCH	SIGCH	REG-DF	RES-DF
			JO Test Selection Sample Method I (AR + MK + NO + VE)							
1	AR	.3519	.1238	20.35	.000	.1238	20.35	.000	1	144
2	MK	.3902	.1522	12.84	.000	.0284	4.79	.030	2	143
3	NO	.4137	.1711	9.77	.000	.0189	3.24	.074	3	142
4	VE	.4377	.1916	8.35	.000	.0205	3.57	.061	4	141
			Recruit Applicant Population (FY92) Method II (AR + VE + NO + MK)							
1	AR	.6300	.3969			.3969			1	115,984
2	VE	.6871	.4721			.0752			2	115,983
3	NO	.7104	.5047			.0326			3	115,982
4	MK	.7217	.5209			.0161			4	115,981

Note. See Table 1 for full test names.

The multiple regression results ($SPSS^X$, 1983) for Method I show that MK is entered into the composite equation at Step 2, at which point the multiple correlation for the composite AR + MK is .3902. The squared multiple correlation (the proportion of final school grade variance accounted for by the composite) is .1522. The F statistic to determine the significance of the predictive relationship between the composite AR + MK and final school grade is 12.84. The probability that this predictive relationship is due to chance is less than .001. The change in the squared multiple correlation upon entering the MK test into the equation is .0284. The F statistic for change (to determine the significance of the increase in the predictive relationship by adding the MK test into the equation) is 4.79. The probability that the significance of this addition is due to chance is less than or equal to .03. The degrees of freedom (number of observations minus the number of estimated parameters) are 2 for regression and 143 for residual.

Method II is based on corrected correlations. Since there are no appropriate significance tests for corrected correlations, the F tests for this method do not apply.

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