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ABSTRACT

A statistical comparison was made of two test batteries, the Armed Services Vocational Aptitude Battery (ASVAB) and the General Aptitude Test Battery (GATB), using a sample of 406 subjects (98 civilian high school students and 308 military recruit examinees). The sample was predominantly white and male. A first analyses described the sample and its performance on the subtests and composites of the GATB and the Department of Defense Student Testing Program composites of the ASVAB. A second analysis investigated the extent to which the ASVAB can predict GATB subtests and composites, and vice versa. The third analysis was a canonical correlation of the subtests of the two batteries. The fourth analyses consisted of principal components factor analyses of the batteries separately and combined. Results show that the batteries do not overlap enough to be considered equivalent or interchangeable, but that they do share a large amount of variance. Such shared variance is to be expected in batteries that have been developed for occupational selection or guidance. Nineteen tables present analysis results. (Author/SLD)

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AIR FORCE HUMAN RESOURCES LABORATORY

COMPARISON OF THE ARMED SERVICES VOCATIONAL APTITUDE BATTERY TO THE GENERAL APTITUDE TEST BATTERY

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13. ABSTRACT *(Maximum 200 words)*

A statistical comparison of two test batteries, the Armed Services Vocational Aptitude Battery (ASVAB) and the General Aptitude Battery (GATB), is presented. The comparison is based on a sample that is predominantly male and white. Four different analyses were carried out and are reported here.

The first analysis described the sample and its performance on the subtests and the composites of the GATB and the subtests and Department of Defense Student Testing Program composites of the ASVAB. The second analysis investigated the extent to which the ASVAB can predict GATB subtests and composites, and vice versa. The third analysis was a canonical correlation of the subtests of the two batteries. The fourth analysis consisted of principal components factor analyses of the two batteries, both separately and combined.

Results showed that the batteries do not overlap enough to be considered equivalent or interchangeable, but that they do share a large amount of variance. Such shared variance is to be expected in batteries which have been developed for occupational selection or guidance for similar populations.

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SUMMARY

The Armed Services Vocational Aptitude Battery (ASVAB) and the General Aptitude Test Battery (GATB) are both U.S. Government tests that provide career aptitude assessment for use in an occupational exploration setting. A comparison of the cognitive aptitude portions of the two tests showed that although there is a great deal of common variance between them, the overlap is not great enough to consider the tests equivalent. The ASVAB has a technical knowledge component not found in GATB and the GATB has a perceptual component not found in ASVAB.

PREFACE

This study was completed under Air Force Contract No. F41689-86-D-002, Universal Energy Systems Task No. 744-028. This paper was prepared by Operational Technologies Corporation, San Antonio, Texas, for the Air Force Human Resources Laboratory, Manpower and Personnel Division, Brooks AFB, Texas.

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TABLE OF CONTENTS

LIST OF TABLES

COMPARISON OF THE ARMED SERVICES VOCATIONAL APTITUDE BATTERY TO THE GENERAL APTITUDE TEST BATTERY

I. INTRODUCTION

The Armed Services Vocational Aptitude Battery (ASVAB) is the test battery used for selection and classification of enlisted personnel for all branches of the armed services. It is also provided free of charge to the nation's high schools. This enhances service recruiting, expands employment opportunities for students, and provides normed aptitude information on students to their counselors. To this end, it is desirable to demonstrate to school counselors that ASVAB is similar to common commercial aptitude tests and to the test provided by the United States Department of Labor for occupational counseling, namely the General Aptitude Test Battery (GATB). This has been accomplished for the California Achievement Tests, the Differential Aptitude Test, the Flanagan Industrial Tests, and the Flanagan Aptitude Classification Tests (U.S. Military Entrance Processing Command, 1985). This paper is concerned with the GATB.

II. BACKGROUND

ASVAB Student Testing Program

ASVAB versions are administered in the nation's high schools for vocational counseling and for future recruiting purposes. The first high school ASVAB forms were offered free of charge by the Department of Defense (DoD) in 1968. The ASVAB has since become a part of many high school testing programs, with over 1 million students in approximately 14,000 schools being tested annually (U.S. Military Entrance Processing Command, 1987).

The ASVAB is comprised of 10 multiple-choice subtests, 8 power and 2 speeded (Table 1).

High school ASVAB composite scores are reported for educational and career counseling purposes. The composites are divided into two groups, the Academic composites and the Occupational composites. These composite scores are the sum of subtest standard scores converted to percentiles and have demonstrated some degree of predictive validity. They are described in Table 2.

The GATB Testing Program

The GATB was developed and is maintained by the United States Employment Service (USES) of the Department of Labor and has been available for administration through state employment offices since 1947. In addition, many schools and business organizations have obtained permission from the state employment offices to use the GATB for research and career counseling purposes. The GATB is one of the most thoroughly investigated multiple aptitude batteries used in vocational guidance (U.S. Employment Service, 1982).

The GATB is composed of eight paper-and-pencil subtests and four apparatus subtests (Buros, 1959). For the purposes of this study, seven paper-and-pencil subtest raw scores were compared to ASVAB subtests. These subtests and their descriptions are provided in Table 3.

The five additional GATB subtests of Mark Making, Place Apparatus, Turn Apparatus, Assemble Apparatus and Disassemble Apparatus are not included in this investigation because there are no ASVAB subtest counterparts. The GATB subtest scores of interest are weighted, combined and converted into seven composite scores. The composites used in this investigation are described in Table 4 (U.S. Employment Service, 1982).

Three other GATB aptitude composites measure motor coordination, finger dexterity and manual dexterity. These composites were not included in this study because the ASVAB does not measure comparable abilities. As a convenience, Table 5 presents the ASVAB and GATB subtest and composite abbreviations used in the remaining tables.

III. METHOD

Subjects

The total sample of 406 cases included 98 civilian and 308 recruit examinees. The civilian examinees were high school students whose schools were matched by the National Computer System (NCS), Inc. a commercial scorer of GATB tests, to a government provided list of schools administering the ASVAB. GATB scores were obtained from participating high schools and Air Force recruits. ASVAB scores were provided by the Defense Manpower Data Center (DMDC). The military sample was recruits at Lackland Air Force Base, Texas. Their ASVAB scores were the scores of record used for military qualification.

Data Collection

The high school subsample of ASVAB and GATB scores came from tests administered during the 1986 to 1987 school year. Recruit testing of the GATB occurred during the period of July-December 1987. Their ASVAB scores came from the administration of the ASVAB prior to service accession.

Data Analyses

Descriptive Statistics. After data editing, frequency counts were made for nominal variables, while a full range of other descriptive statistics (mean, mode, maximum, minimum, standard deviation, skewness, kurtosis, and others) were calculated for variables on the test scales.

Regression Analyses. The first set of multivariate analyses assessed the extent to which ASVAB subtests and composites could predict subtest and composite scores on the GATB, and, conversely, the extent to which GATB subtests and composites could account for ASVAB subtest and composite scores.

The correlation matrix used in these regression analyses was corrected for restriction in range (Lawley, 1943) to the 1980 Youth Population (Maier & Sims, 1986) which is the ASVAB normative reference group.

Forward linear stepwise regressions were computed with no specific order of variable entry. There were six sets of regressions. First, GATB subtests predicted ASVAB subtests, second, ASVAB subtests predicted GATB subtests, third GATB subtests predicted ASVAB composites, fourth, ASVAB subtests predicted GATB composites, and fifth and sixth, composites predicted composites.

Canonical Correlation Analysis. A multiple regression analysis typically uses several variables to construct the best prediction system (i.e. minimum squared errors of prediction) for a single dependent variable. Canonical correlation extends that idea to allow a number of variables from one set to predict a number of variables from another set. The procedure starts by finding the weighted linear combination of variables from the first set, in this case the ASVAB subtests, and the weighted linear combination from the second set, the GATB subtests, which are most highly correlated with each other. That set of two linear combinations is called the first canonical variate. One such variate rarely, if ever, accounts for all of the variance in two sets of variables. The procedure then extracts another pair of weighted linear combinations of variables, one from each set. The second set maximizes the variance not previously accounted for, this time with the added restriction that both sides of the new canonical variate are orthogonal to those of the first pair. That process is repeated until all meaningful variance is extracted from the sets of variables. The canonical variates are more useful for estimating the shared variance of sets of variables than they are for providing readily interpretable or named psychological concepts.

Principal Components Factor Analyses. A principal components factor analysis starts by finding the one linear combination of a set of variables which explains the largest possible amount of variance in the set of variables. That linear combination is known as the first principal component. The analysis then finds the linear combination of the variables which explains the next largest amount of variance, given the constraint that the linear combination be uncorrelated or orthogonal to the first. That constraint ensures that each successive factor accounts only for variance previously unaccounted for. The finding (or extracting) of orthogonal linear combinations continues until all of the variance in a set of variables is accounted for, or until specified stop criteria are met. The number of possible principal components is equal to the number of variables, but the number of significant principal components is frequently much smaller.

When a small number of principal components has a large portion of the variance of the full set of variables, that small number of components may be said to explain or account for the variance in the full set. However, the set of principal components is frequently not useful for explaining the full set of variables in any intuitive psychological sense. For the purposes of maximizing explanatory clarity, the principal components can be rotated so that they meet given statistical criteria. The two criteria for rotation used in the present analyses are embodied in the varimax rotation and the oblimin rotation (Norusis, 1986).

Varimax or orthogonal rotation finds a configuration with a minimum number of variables loading highly on a factor. The variables are thus associated with factors, rendering the factors more easily interpretable. Oblimin rotation involves oblique rotation of factors (i.e. factors which need not be orthogonal) and has historically been used in previous research (Ree, Mullins, Mathews, & Massey, 1982).

Three principal components factor analyses were carried out, each with varimax and oblimin rotation. The three analyses were:

1. Analysis of GATB subtests only;
2. Analysis of ASVAB subtests only;
3. Analysis of the combined set of ASVAB and GATB subtests.

The three analyses use the methodology of accepting only factors whose eigenvalues are one or greater, a frequently observed convention.

IV. RESULTS AND DISCUSSION

Descriptive Statistics

Nineteen of the high school cases were found to lack data for the EI subtest of the ASVAB and so were not included in the multivariate analyses. Thus, summary statistics are calculated for the test score distributions on a sample of 387 cases.

Table 6 shows that the sample was largely male (69%) and white (82%). Table 6 also presents the distribution of years of education in the sample. This distribution indicates, as expected from the large proportion of Air Force recruits, that the majority of the subjects has received a high school diploma (75.5%).

Tables 7 and 8 present the ASVAB and GATB summary statistics for the sample.

Regression Analyses

Table 9 presents the intercorrelation matrix of ASVAB and GATB subtests and composites corrected for restriction of range.

For each of the six sets of regression analyses, a table is presented which shows the order in which the predictors entered into the stepwise equations for the prediction of each of the criterion variables. The tables also give both the univariate correlation coefficient (r) between the criterion variable and the first predictor variable to enter, and the multiple correlation (R) for the final prediction equation.

Table 10 shows that the GATB subtests can moderately predict or explain the ASVAB subtests. Multiple correlations range from .57 for AS to .84 for WK. For four of the ASVAB subtests (GS, WK, PC, and CS) the difference between the single best univariate r and the multiple R is 0.03 or less. The GATB subtest TLM appears in only two of the equations; all of the other subtests appear in at least five of the equations. The GATB VOC subtest enters first in six of the prediction equations, and first or second in all of the prediction equations for the power tests in the ASVAB. The GATB NCM subtest enters first in both of the ASVAB speeded subtest regression equations.

The ASVAB subtests AR and MK both resulted in equations with six significant predictor variables, and both increase their correlations from .68 to .79 in going from the univariate to the multivariate prediction equations. This result suggests that the common variance of both of these subtests is spread widely across the GATB subtest scores.

Table 11, which shows the results of predicting GATB subtests from ASVAB subtests, mirrors some of the results of Table 10. Since the predictions involved are just the inverse of each other, that is to be expected. The multiple correlations run from a low of .54 (FRM) to a high of .84 (VOC). The three technical subtests play little role. The EI and AS subtests appear in no prediction equations, GS appears in one and then only as the sixth and last to enter. Four of the correlations change by 0.03 or less from the best univariate prediction to the final multivariate prediction, indicating that there is a strong correspondence between individual subtests in the two batteries.

Table 11 also shows that the speeded CS and NO enter into the prediction of five GATB subtests, four times as a first entrant. This result would not ordinarily be expected in the prediction of power subtests and is likely due to a speeded nature of the GATB subtests. Further, MK enters as the second variable in four of the equations, and as the third in another. Only the speeded subtests enter into as many prediction equations. The prediction equations for NCM and for CMP both show substantial increases in correlation (0.09 points) in going from the best univariate to the best multivariate equation. These increases suggest that the variance in common with those GATB subtests is distributed across a number of ASVAB subtests.

Table 12, which shows the results of predicting ASVAB composites from GATB subtests, is characterized by reasonably high multiple correlations. Only the Mechanical Composite composed of the three most poorly predicted subtests has a correlation below .80. The GATB TLM subtest contributes little. All of the other GATB subtests are well represented in the equations, with two of them appearing in all eight equations and three of them appearing in six or seven.

A feature of Table 12 is that the GATB VOC subtest enters first in the prediction of seven of the eight ASVAB composites. It can be seen from the univariate column that the correlation of GATB Vocabulary with ASVAB composites ranges from .64 to .83. Whether the ASVAB composites are so verbally loaded or whether both the ASVAB composites and the GATB Vocabulary depend on an underlying ability cannot be determined.

Table 13 presents the results of predicting GATB composites from ASVAB subtests. The results again resemble earlier tables. The correlations range from a low of .50 to a high of .83, and with two GATB composites (Verbal and Spatial) predicted almost as well by a single predictor as by the best multivariate equation. The ASVAB subtests PC and EI do not enter the prediction equations for any of the GATB composites, and the subtests GS and AS enter only one equation each, and in each case enter last. Six of the 10 ASVAB subtests would do almost as good a job of predicting the GATB composites as does the whole set. The S, or Spatial, Composite of the GATB is correlated least well, with a multiple R of .50, indicating that only 25% of the variance in that composite is accounted for by the ASVAB. The P, or Form Perception, Composite is also moderately correlated, with a multiple R of .57, indicating that about 32% of the variance is predicted by the ASVAB subtests.

The 10 ASVAB subtests do not predict the GATB composites as well as the GATB subtests predict the ASVAB composites. The best-predicted GATB composite is G (Intelligence), with a multiple R of .83. This is consistent with the observation that the ASVAB subtests depend heavily on general cognitive ability.

Table 14 shows the results of predicting ASVAB composites from GATB composites. With the exception of the prediction of the Mechanical Composite (.75), all of the multiple correlations are .80 or higher. In four of the cases there is only a small difference (0.03 correlation points or less) between the best single predictor and the multivariate predictor. The GATB G Composite, or Intelligence, enters first in six of the eight equations, and enters second in the other two. Moreover, the two equations in which it enters second are the equations predicting the VE and the Verbal composites. The GATB V Composite (derived from the Vocabulary subtest) enters first in both of those prediction equations.

The GATB S Composite (Spatial) appears only as the sixth and last variable to enter the prediction of VE; it appears in no other equation. Because the ASVAB has no subtest to measure spatial perception, the lack of the predictive power of GATB S Composite with respect to ASVAB subtests is not surprising, unless one would expect Spatial ability to contribute, perhaps indirectly, to the Mechanical Composite. Finally, it is notable that GATB P Composite, Form Perception, appears in all of the prediction equations except that for the Business Composite, although it almost always appears in third place.

Table 15 shows the results of predicting GATB composites from ASVAB composites. Multiple correlations range from .49 (associated with S) to .83 (associated with G). GATB S (Spatial) and GATB P (Form Perception) are not well predicted, with multivariate Rs of .49 and .54 respectively. The GATB V (Verbal) and GATB G (Intelligence) are well predicted, with multivariate Rs of .80 and .83, respectively. The Business and Clerical ASVAB Composite is the most used of the composites, appearing in five of the six equations, and always entering either first or second. The ASVAB Verbal, Academic, and Electronic and Electrical Composites all appear in only one equation each.

Canonical Correlation Analyses

The results of the canonical correlation analysis appear in Table 16. Four significant canonical variates were extracted. The first variate had a correlation of .90 and an eigenvalue of .81. The eigenvalue is the squared canonical correlation and indicates the proportion of variance accounted for by the canonical variate. Thus the ASVAB and the GATB share 81% of their joint variance through the first canonical variate. It is not possible to give a clear substantive interpretation (i.e. one which assigns a name or identification based on the weightings of the subtests) of the canonical variates. However, it is at least plausible to suggest that the shared variance is associated with general cognitive ability.

The second, third, and fourth canonical variates have eigenvalues of .42, .26, and .16 and correlations of .65, .51, and .40, respectively. Further canonical variates account for insignificant amounts of variance. They are difficult to interpret because of the nontrivial negative coefficients present in each of the four canonical variates.

Principal Components Factor Analyses

The factor analyses were performed in order to compare the structure of ASVAB and GATB. An eigenvalue rule of one or greater was applied to determine acceptance of a factor.

Table 17 gives the results of applying principal components factor analysis to the ASVAB subtests. Two factors emerged accounting for 64% and 13% of the variance for a total of 77%. After varimax rotation, the first factor is associated most clearly with AS, EI, MC, and GS; the second with NO, CS, PC, MK, WK, and AR. The oblimin rotation of the factors gives a similar picture.

Table 18 gives the analysis of the GATB subtests. The first factor accounts for 56% of the variance and the second accounts for 15%. After varimax rotation, CMP, ARS, NCM, and VOC loaded primarily on the first factor, and 3DS, FRM, and TLM variables loaded on the second factor. The oblimin rotation gives similar results.

Finally, Table 19 shows the results of a principal components factor analysis of the combined set of ASVAB and GATB subtests. A common factor from ASVAB (Table 17) and from GATB (Table 18) merges to give a three factor solution. The three factors account for 55%, 11%, and 7% of the variance. The high value for the first factor suggests an overriding influence, perhaps analogous to general ability. Varimax rotation yields three factors. The first factor consists of high factor loadings of ASVAB NO, CS, MK, PC, AR, and WK, and GATB variables of CMP, NCM, ARS, and VOC. The second factor is associated with only AS, EI, MC, and GS, and is the familiar ASVAB technical factor. The third factor possesses high loadings with regard to the GATB 3DS, TLM, and FRM variables representing a spatial perception domain. Oblimin rotation gave virtually the same factors and loadings. This analysis suggests that the technical subtests, MC, EI, AS, and GS have variance which is specific to the ASVAB, while the GATB subtests 3DS, TLM, and FRM have variance which is specific to the GATB.

V. CONCLUSIONS

The GATB and ASVAB clearly cannot be seen as identical or interchangeable test batteries. The GATB tests a spatial domain which the ASVAB lacks, and the ASVAB tests a technical domain which the GATB lacks. Both batteries appear, however, to measure some factor which enters into a large number of the subtests. This is most clearly seen in the principal components analysis of the combined set of subtests. The first factpr is apparently a general ability factor in which a large set of diverse subtests load highly. The second factor is the technical factor consisting of the ASVAB subtests which measure scientific and technical information and ability. The third factor corresponds to the spatial tests of the GATB. In addition, the large first canonical variate of .90, which accounted for 81% of the variance, also suggests a large common factor.

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Table 1. ASVAB Subtest Descriptions

Subtest	Content	# of items	Administration time (minutes)	Type
General Science (GS)	Measures knowledge of physical, chemical and biological sciences	25	11	power
Arithmetic Reasoning (AR)	Measures ability to solve arithmetic word problems	30	36	power
Word Knowledge (WK)	Measures ability to select meanings of words	35	11	power
Paragraph Comprehension (PC)	Measures ability to obtain information from written passages	15	13	power
Numerical Operations (NO)	Measures ability to perform simple computations in a speeded context	50	3	speed
Coding Speed (CS)	Measures ability to match similar sets of numbers with words in a speeded context	84	7	speed
Auto and Shop Information (AS)	Measures knowledge of automobiles, tools, and shop terminology and practices	25	11	power
Mathematics Knowledge (MK)	Measures knowledge of high school mathematics principles	25	24	power
Mechanical Comprehension (MC)	Measures knowledge of mechanical and physical principals	25	19	power
Electronics Information (EI)	Measures knowledge of electricity and electronics	20	9	power

Table 2. ASVAB High School Composite Descriptions

Composite name	Subtest combination	Purpose
Academic Composites		
Academic Ability (ACAD)	VE[a]+AR	Measures potential for further formal education.
Verbal (VERB)	WK+PC+GS	Measures the capacity for verbal activities.
Math (MATH)	MK+AR	Measures the capacity for mathematical activities.
Occupational Composites		
Mechanical & Crafts (MECH)	AR+MC+AS+EI	Measures the potential for performance in career areas dealing with mechanics, machines, carpentry, etc.
Business & Clerical (BUSN)	VE[a]+MK+CS	Measures the potential for performance in career areas dealing with typing, data entry, paralegal duties, and clerical activities.
Electronics & Electrical (ELEC)	AR+MK+EI+GS	Measures the potential for performance in career areas dealing with TV and radio repair, electronics, and technical activities.
Health, Social & Technical (HEAL)	VE[a]+AR+MC	Measures the potential for performance in career areas dealing with medical services, police services, and flight operation services.

[a]VE is WK + PC raw scores summed together and converted to a standard score.

Table 3. GATB Subtest Descriptions

Subtest	Content	# of items	Administration time (minutes)
Name Comparison (NCM)	Compare 2 names	150	6
Computation (CMP)	Addi.ion, subtraction, multiplication, and division	50	6
3-Dimensional Space (3DS)	How would a two dimensional figure look in three dimensions	40	6
Vocabulary (VOC)	Choose two synonyms and two antonyms	60	6
Tool Matching (TLM)	Match identical drawings	49	5
Arithmetic Reasoning (ARS)	Solve word problems	25	7
Form Matching (FRM)	Match identical figure	60	6

Table 4. GATB Composite Descriptions

Composite name	Subtest combination	Purpose
General Learning Ability (G)	3DS+VOC+ARS	Measures the ability to understand instructions and underlying principles; to reason and make decisions.
Verbal (V)	VOC	Measures the ability to understand word meanings and to use them effectively; to comprehend language and relationships between words.
Numerical (N)	CMP+ARS	Measures the ability to perform arithmetic operations quickly and accurately.
Spatial Aptitude (S)	3DS	Measures the ability to comprehend two and three dimensional objects; to recognize relationships resulting from the movement of objects.
Form Perception (P)	TLM+FRM	Measures the ability to perceive detail in pictorial material; to make visual comparisons.
Clerical Perception (Q)	NCM	Measures the ability to perceive detail in verbal or tabular material; speed of perception.

Table 5. Abbreviations Used for ASVAB and GATB Subtests and Composites

ASVAB Subtests		GATB Subtests	
GS	General Science	NCM	Name Comparison
AR	Arithmetic Reasoning	CMP	Computation
WK	Word Knowledge	3DS	3-Dimensional Space
PC	Paragraph Comprehension	VOC	Vocabulary
NO	Numerical Operations	TLM	Tool Matching
CS	Coding Speed	ARS	Arithmetic Reasoning
AS	Auto Shop Information	FRM	Form Matching
MK	Mathematics Knowledge		
MC	Mechanical Comprehension		
EI	Electronics Information		
ASVAB Composites		**GATB Composites**	
VE	WK + PC	G	Intelligence
VERB	Verbal	V	Verbal
MATH	Mathematical	N	Numerical
ACAD	Academic Ability	S	Spatial
MECH	Mechanical & Crafts	P	Form Perception
BUSN	Business & Clerical	Q	Clerical Perception
ELEC	Electronic & Electrical		
HEAL	Health, Social, & Technology		

Table 6. Frequencies of Nominal Data

Group		Frequency	Percent
	Sex of Examinee		
Female		119	30.7
Male		268	69.3
	Total	387	100.0
	Race of Examinee		
White		318	82.2
Black		42	10.9
Asian		12	3.1
Other		11	2.8
American Indian		4	1.0
	Total	387	100.0
	Hispanic Examinees		
Non - Hispanic		378	97.7
Hispanic		9	2.3
	Total	387	100.0
	Educational Certification		
Currently in High School		79	20.4
High School Diploma		292	75.5
Home Study Diploma		2	.5
Test Equivalence Diploma		1	.3
Completed 1 Semester of College	1	.3	
Associate Degree		4	1.0
Baccalaureate Degree		6	1.6
Masters Degree		2	.5
	Total	387	100.0

Table 7. ASVAB Subtest and Composite Summary Statistics

Statistic	GS	AR	WK	PC	NO	CS	AS	MK	MC	EI
n	387	387	387	387	387	387	387	387	387	387
Mean	17.700	21.778	27.982	12.227	42.274	57.589	15.494	15.641	16.062	12.134
Median	18.000	22.000	28.000	13.000	43.000	56.000	16.000	16.000	17.000	12.000
Mode	15.000	22.000	30.000	15.000	49.000	56.000	17.000	17.000	18.000	10.000
Std. Dev.	3.978	5.581	4.856	2.463	6.750	12.057	5.197	4.908	4.727	4.137
Variance	15.822	31.147	23.577	6.067	45.567	45.383	27.012	24.086	22.348	17.117
Range	18.000	24.000	25.000	12.000	32.000	64.000	21.000	20.000	21.000	19.000
Minimum	7.000	6.000	10.000	3.000	18.000	20.000	4.000	5.000	4.000	1.000
Maximum	25.000	30.000	35.000	15.000	50.000	84.000	25.000	25.000	25.000	20.000
Skewness	-.212	-.534	-.724	-.916	-.838	.075	-.073	-.022	-.454	-.224
Kurtosis	-.633	-.378	.382	.480	.188	-.321	-.972	-.824	-.536	-.453

Statistic	ACAD	VERB	MATH	MECH	BUSN	ELEC	HEAL
n	387	387	387	387	387	387	387
Mean	107.044	158.961	107.036	209.866	162.075	210.178	160.403
Median	108.000	161.000	107.000	212.000	163.000	209.000	162.000
Mode	111.000	153.000	116.000	225.000	156.000	212.000	153.000
Std. Dev.	11.787	17.866	13.335	28.962	15.252	25.354	18.885
Variance	138.923	319.193	177.823	838.785	232.624	642.820	356.651
Range	59.000	86.000	57.000	126.000	88.000	121.000	87.000
Minimum	68.000	101.000	76.000	141.000	112.000	140.000	107.000
Maximum	127.000	187.000	133.000	267.000	200.000	261.000	194.000
Skewness	-.771	-.860	-.152	-.317	-.360	-.203	-.642
Kurtosis	.557	.626	-.705	-.585	.152	-.325	.106

Table 8. GATB Subtest and Composite Summary Statistics

Statistic	NCM	CMP	3DS	VOC	TLM	ARS	FRM
n	387	387	387	387	387	387	387
Mean	50.855	23.140	19.894	19.793	32.363	11.244	30.256
Median	51.000	23.000	20.000	19.000	32.500	11.000	30.000
Mode	51.000	22.000	19.000	19.000	36.000	11.000	26.000
Std. Dev.	11.864	4.329	6.110	5.795	5.830	2.657	6.352
Variance	140.756	18.739	37.332	33.578	33.988	7.057	40.351
Range	74.000	29.000	32.000	37.000	32.000	15.000	37.000
Minimum	17.000	10.000	4.000	4.000	15.000	4.000	14.000
Maximum	91.000	39.000	36.000	41.000	47.000	19.000	51.000
Skewness	.209	.294	-.204	.471	-.083	.325	.239
Kurtosis	.259	.296	-.227	.708	-.234	.488	-.067

Statistic	G	V	N	S	P	Q
n	387	387	387	387	387	387
Mean	102.163	99.302	99.956	109.251	116.346	110.948
Median	102.000	98.000	99.000	110.000	117.000	110.000
Mode	95.000	98.000	99.000	124.000	127.000	109.000
Std. Dev.	12.707	12.513	13.083	19.120	17.521	14.431
Variance	161.479	156.564	171.156	365.567	306.983	208.246
Range	68.000	132.000	78.000	127.000	89.000	89.000
Minimum	72.000	11.000	65.000	33.000	71.000	71.000
Maximum	140.000	143.000	143.000	160.000	160.000	160.000
Skewness	.362	-.418	.471	-.401	-.053	.187
Kurtosis	.268	6.513	.343	.150	-.371	.295

Table 9. Corrected Correlation Matrix of ASVAB and GATB Subtests and Composites

	GS	AR	WK	PC	NO	CS	AS	MK	MC	EI
GS	1.000	.722	.801	.689	.524	.452	.637	.695	.695	.760
AR	.722	1.000	.708	.672	.627	.515	.533	.827	.684	.658
WK	.801	.708	1.000	.803	.617	.550	.529	.670	.593	.684
PC	.689	.672	.803	1.000	.608	.560	.423	.637	.521	.573
NO	.524	.627	.617	.608	1.000	.701	.306	.617	.408	.421
CS	.452	.515	.550	.560	.701	1.000	.225	.520	.336	.342
AS	.637	.533	.529	.423	.306	.225	1.000	.415	.741	.745
MK	.695	.827	.670	.637	.617	.520	.415	1.000	.600	.585
MC	.695	.684	.593	.521	.408	.336	.741	.600	1.000	.743
EI	.760	.658	.684	.573	.421	.342	.745	.585	.743	1.000
NCM	.526	.624	.627	.625	.715	.743	.261	.664	.404	.422
CMP	.367	.571	.449	.432	.621	.536	.168	.583	.274	.281
3DS	.449	.456	.382	.307	.277	.299	.442	.429	.531	.449
VOC	.716	.656	.818	.733	.608	.551	.437	.675	.542	.587
TLM	.367	.373	.368	.406	.506	.573	.207	.438	.342	.313
ARS	.514	.680	.551	.486	.575	.487	.394	.627	.467	.440
FRM	.306	.346	.312	.311	.453	.484	.259	.326	.335	.287
VE	.797	.718	.982	.894	.637	.568	.511	.686	.588	.673
VERB	.904	.763	.945	.905	.635	.567	.577	.727	.657	.732
MATH	.741	.956	.721	.684	.651	.542	.497	.956	.673	.651
ACAD	.818	.931	.907	.845	.684	.590	.565	.816	.689	.718
MECH	.805	.823	.720	.626	.504	.406	.864	.695	.907	.901
BUSN	.759	.808	.857	.817	.766	.819	.451	.862	.598	.625
ELEC	.899	.907	.810	.728	.620	.517	.660	.879	.771	.850
HEAL	.837	.912	.860	.789	.635	.540	.676	.800	.861	.785
G	.693	.768	.730	.632	.626	.565	.524	.730	.633	.603
V	.675	.618	.775	.687	.561	.529	.406	.642	.516	.546
N	.433	.642	.503	.466	.632	.539	.249	.627	.345	.341
S	.401	.413	.335	.268	.224	.255	.399	.379	.489	.406
P	.269	.294	.262	.291	.471	.524	.149	.351	.270	.222
Q	.418	.527	.521	.521	.667	.688	.153	.593	.288	.306

	NCM	CMP	3DS	VOC	TLM	ARS	FRM	VE	VERB	MATH
GS	.526	.367	.449	.716	.367	.514	.306	.797	.904	.741
AR	.624	.571	.456	.656	.373	.680	.346	.718	.763	.956
WK	.627	.449	.382	.818	.368	.551	.312	.982	.945	.721
PC	.625	.432	.307	.733	.406	.486	.311	.894	.905	.684
NO	.715	.621	.277	.608	.506	.575	.453	.637	.635	.651
CS	.743	.536	.299	.551	.573	.487	.484	.568	.567	.542
AS	.261	.168	.442	.437	.207	.394	.259	.511	.577	.497
MK	.664	.583	.429	.675	.438	.627	.326	.686	.727	.956
MC	.404	.274	.531	.542	.342	.467	.335	.588	.657	.673
EI	.422	.281	.449	.587	.313	.440	.287	.673	.732	.651
NCM	1.000	.607	.376	.677	.640	.555	.538	.648	.645	.674
CMP	.607	1.000	.223	.521	.395	.700	.334	.462	.454	.604
3DS	.376	.223	1.000	.422	.473	.335	.471	.377	.413	.463
VOC	.677	.521	.422	1.000	.469	.574	.429	.833	.823	.697
TLM	.640	.395	.473	.469	1.000	.347	.572	.387	.414	.424
ARS	.555	.700	.335	.574	.347	1.000	.368	.558	.563	.684
FRM	.538	.334	.471	.429	.572	.368	1.000	.325	.337	.352
VE	.648	.462	.377	.833	.387	.558	.325	1.000	.970	.735
VERB	.645	.454	.413	.823	.414	.563	.337	.970	1.000	.779
MATH	.674	.604	.463	.697	.424	.684	.352	.735	.779	1.000
ACAD	.689	.558	.447	.798	.414	.666	.362	.921	.933	.915
MECH	.489	.370	.537	.637	.354	.567	.351	.713	.781	.794
BUSN	.805	.618	.430	.801	.549	.651	.443	.877	.883	.874
ELEC	.632	.510	.505	.745	.421	.640	.358	.813	.885	.934
HEAL	.636	.495	.514	.764	.419	.644	.381	.868	.903	.895
G	.676	.642	.661	.811	.509	.873	.516	.737	.746	.784
V	.628	.501	.369	.938	.422	.567	.395	.788	.776	.659
N	.611	.945	.274	.564	.386	.882	.360	.515	.509	.664
S	.333	.172	.961	.367	.424	.275	.426	.330	.364	.414
P	.592	.371	.487	.418	.921	.337	.788	.281	.299	.338
Q	.973	.594	.342	.615	.613	.524	.535	.546	.530	.586

Table 9 (Concluded)

	ACAD	MECH	BUSN	ELEC	HEAL	G	V	N	S	P	Q
GS	.818	.805	.759	.899	.837	.693	.675	.433	.401	.269	.418
AR	.931	.823	.808	.907	.912	.768	.618	.642	.413	.294	.527
WK	.907	.720	.857	.810	.860	.730	.775	.503	.335	.262	.521
PC	.845	.626	.817	.728	.789	.632	.687	.466	.268	.291	.521
NO	.684	.504	.766	.620	.635	.626	.561	.632	.224	.471	.667
CS	.590	.406	.819	.517	.540	.565	.529	.539	.255	.524	.688
AS	.565	.864	.451	.660	.676	.524	.406	.249	.399	.149	.153
MK	.816	.695	.862	.879	.800	.730	.642	.627	.379	.351	.593
MC	.689	.907	.598	.771	.861	.633	.516	.345	.489	.270	.288
EI	.718	.901	.625	.850	.785	.603	.546	.341	.406	.222	.306
NCM	.689	.489	.805	.632	.636	.676	.628	.611	.333	.592	.973
CMP	.558	.370	.618	.510	.495	.642	.501	.945	.172	.371	.594
3DS	.447	.537	.430	.505	.514	.661	.369	.274	.961	.487	.342
VOC	.798	.637	.801	.745	.764	.811	.938	.564	.367	.418	.615
TLM	.414	.354	.549	.421	.419	.509	.422	.386	.424	.921	.613
ARS	.666	.567	.651	.640	.644	.873	.567	.882	.275	.337	.524
FRM	.362	.351	.443	.358	.381	.516	.395	.360	.426	.788	.535
VE	.921	.713	.877	.813	.868	.737	.788	.515	.330	.281	.546
VERB	.933	.781	.883	.885	.903	.746	.776	.509	.364	.299	.530
MATH	.915	.794	.874	.934	.895	.784	.659	.664	.414	.338	.586
ACAD	1.000	.831	.910	.929	.962	.808	.753	.623	.398	.312	.578
MECH	.831	1.000	.711	.912	.926	.724	.597	.452	.488	.267	.365
BUSN	.910	.711	1.000	.864	.864	.791	.761	.656	.375	.452	.713
ELEC	.929	.912	.864	1.000	.943	.791	.702	.578	.453	.321	.522
HEAL	.962	.926	.864	.943	1.000	.806	.723	.568	.464	.320	.514
G	.808	.724	.791	.791	.806	1.000	.777	.782	.599	.492	.625
V	.753	.597	.761	.702	.723	.777	1.000	.551	.321	.376	.570
N	.623	.452	.656	.578	.568	.782	.551	1.000	.218	.374	.601
S	.398	.488	.375	.453	.464	.599	.321	.218	1.000	.439	.304
P	.312	.267	.452	.321	.320	.492	.376	.374	.439	1.000	.612
Q	.578	.365	.713	.522	.514	.625	.570	.601	.304	.612	1.000

Table 10. Predicting ASVAB Subtest Scores from GATB Subtest Scores

ASVAB subtest (criterion)	GATB subtests (predictors)								
	NCM	CMP	3DS	VOC	TLM	ARS	FRM	r	Mult R
GS		4	2	1		3	5	72	75
AR	4		3	2	5	1	6	68	79
WK	3	5		1		2	4	82	84
PC	2			1			3	73	76
NO	1	2		3		4		72	77
CS	1	3			2			74	76
AS		4	1	2		3		44	57
MK	3	6	4	1		2	5	68	79
MC		4	2	1		3		54	66
EI		4	2	1		3		59	64

Note The numbers in the table indicate the order in which the predictor variables entered the stepwise regression equations. The column headed by r indicates the bivariate correlation (multiplied by 100) between the predicted variable and the variable which entered first, while the column labeled Mult R indicates the multiple correlation when all of the indicated variables have entered.

Table 11. Predicting GATB Subtest Scores from ASVAB Subtest Scores

GATB subtest (criterion)	ASVAB subtests (predictors)											
	GS	AR	WK	PC	NO	CS	AS	MK	MC	EI	r	Mult R
NCM				4	3	1		2			74	83
CMP	6	4			1	5		2	3		62	71
3DS								2	1		53	55
VOC			1	3		4		2			82	84
TLM					2	1			3		57	60
ARS		1			2			3			68	71
FRM			4		3	1			2		48	54

Notes The numbers in the table indicate the order in which the predictor variables entered the stepwise regression equations. The column headed by r indicates the bivariate correlation (multiplied by 100) between the predicted variable and the variable which entered first, while the column labeled Mult R indicates the multiple correlation when all of the indicated variables have entered.

Table 12. Predicting ASVAB Composite Scores from GATB Subtest Scores

ASVAB composite (criterion)	GATB subtest (predictors)								
	NCM	CMP	3DS	VOC	TLM	ARS	FRM	r	Mult R
VE	2	5		1		4	3	83	85
VERB	2	4	6	1		3	5	82	85
MATH	3	6	4	1		2	5	70	82
ACAD	3		4	1	6	2	5	80	86
MECH		4	2	1		3		64	74
BUSN	1			2		3		81	89
ELEC	4		3	1		2	5	75	82
HEAL	4		3	1		2	5	76	83

Note The numbers in the table indicate the order in which the predictor variables entered the stepwise regression equations. The column headed by r indicates the bivariate correlation (multiplied by 100) between the predicted variable and the variable which entered first, while the column labeled Mult R indicates the multiple correlation when all of the indicated variables have entered.

Table 13. Predicting GATB Composite Scores from ASVAB Subtest Scores

GATB composite (criterion)	ASVAB subtests (predictors)											
	GS	AR	WK	PC	NO	CS	AS	MK	MC	EI	r	Mult R
G		1	2			3		5	4		77	83
V			1			3		2			78	79
N	6	1			2	5		4	3		64	73
S		2							1		49	50
P			3		2	1			4		52	57
Q					3	1	4	2			69	77

Note The numbers in the table indicate the order in which the predictor variables entered the stepwise regression equations. The column headed by r indicates the bivariate correlation (multiplied by 100) between the predicted variable and the variable which entered first, while the column labeled Mult R indicates the multiple correlation when all of the indicated variables have entered.

Table 14. Predicting ASVAB Composite Scores from GATB Composite Scores

ASVAB composite (criterion)	G	V	N	S	P	Q	r	Mult R
	GATB composites (predictors)							
VE	2	1	5	6	3	4	79	83
VERB	2	1	3		4	5	78	82
MATH	1				3	2	78	80
ACAD	1	2			3	4	81	85
MECH	1		2		3		72	75
BUSN	1	3				2	79	86
ELEC	1	2			3		79	81
HEAL	1	2	4		3	5	81	83

Note The numbers in the table indicate the order in which the predictor variables entered the stepwise regression equations. The column headed by r indicates the bivariate correlation (multiplied by 100) between the predicted variable and the variable which entered first, while the column labeled Mult R indicates the multiple correlation when all of the indicated variables have entered.

Table 15. Predicting GATB Composite Scores from ASVAB Composite Scores

GATB Composite (Criterion)	VE	VERB	MATH	ACAD	MECH	BUSN	ELEC	HEAL	r	Mult R
	ASVAB Composites (Predictors)									
G				1	3	2		4	81	83
V	1					2			79	80
N			1			2	3		66	70
S					1				49	49
P	2		3			1		4	45	54
Q		2			3	1			71	75

Note The numbers in the table indicate the order in which the predictor variables entered the stepwise regression equations. The column headed by r indicates the bivariate correlation (multiplied by 100) between the predicted variable and the variable which entered first, while the column labeled Mult R indicates the multiple correlation when all of the indicated variables have entered.

Table 16. Canonical Correlation of ASVAB and GATB Variables

Canonical Correlation

Number	Eigenvalue	Canonical correlation	Wilk's Lambda	Chi-square	D.F.	Signi-ficance
1	.80864	.89925	.06575	1020.72550	70	.000
2	.42043	.64841	.34359	400.61692	54	.000
3	.25647	.50643	.59283	196.06566	40	.000
4	.15798	.39747	.79733	84.93395	28	.000
5	.03672	.19164	.94692	20.45278	18	.308
6	.01356	.11647	.98302	6.42181	10	.779
7	.00346	.05884	.99654	1.30036	4	.861

Coefficients for Canonical Variables of the First Set

	Canvar[a] 1	Canvar 2	Canvar 3	Canvar 4
GS	.00442	.33175	.13872	.35896
AR	.09676	-.18781	-1.01069	-1.05218
WK	.34852	.81183	.47052	-.64313
PC	.06707	.09094	.65359	.19934
NO	.16866	-.52277	.09047	-.15460
CS	.24149	-.60582	.01449	.75284
AS	-.02364	.11638	-.51400	-.02113
MK	.28419	-.14360	.01886	-.18919
MC	-.01161	.18626	-.30904	.88757
EI	-.02118	-.04899	.18028	.28360

Coefficients for Canonical Variables of the Second Set

	Canvar[a] 1	Canvar 2	Canvar 3	Canvar 4
NCM	.43634	-.55535	.24576	-.08273
CMP	.07366	-.56663	-.01501	-.63385
3DS	.06454	.33678	-.77431	.22255
VOC	.45525	1.04724	.73258	-.03286
TLM	.01677	-.28669	.24037	.66302
ARS	.19228	.13266	-.80156	-.18769
FRM	-.07382	-.28268	-.09297	.39134

[a]Canvar indicates "Canonical Variate."

Table 17. Principal Components Factor Analysis of ASVAB Subtests

Statistics Factor	Eigenvalue	Pct of var	Cum pct
1	6.39330	63.9	63.9
2	1.28971	12.9	76.8

Orthogonal Rotation - Factor Loadings

	Factor 1	Factor 2
AS	.88890	.07968
EI	.85694	.29524
MC	.84718	.26766
GS	.73655	.50820
NO	.17631	.85710
CS	.06063	.85445
PC	.43940	.72135
MK	.48874	.68751
WK	.57297	.67118
AR	.59675	.64464

Oblique Rotation - Factor Pattern Loadings

	Factor 1	Factor 2
AS	.96581	-.17426
EI	.86692	.07496
MC	.86416	.04717
GS	.67037	.34746
CS	-.18356	.93251
NO	-.05561	.90125
PC	.27706	.67243
MK	.34190	.62020
WK	.44044	.57712
AR	.47470	.54057

Table 18. Principal Components Factor Analysis of GATB Subtests

Factor	Statistics: Eigenvalue	Pct of var	Cum pct
1	3.89469	55.6	55.6
2	1.04742	15.0	70.6

Orthogonal Rotation - Factor Loadings

	Factor 1	Factor 2
CMP	.88926	.11796
ARS	.85513	.18812
NCM	.67472	.53494
VOC	.67333	.44316
3DS	.10461	.78387
FRM	.23719	.78229
TLM	.30457	.77280

Oblique Rotation - Factor Pattern Loadings

	Factor 1	Factor 2
CMP	.94675	-.11718
ARS	.89267	.04251
VOC	.61827	.30113
NCM	.59424	.40186
3DS	-.10314	.83457
FRM	.04335	.79598
TLM	.12021	.76681

Table 19. Principal Components Factor Analysis of Combined GATB and ASVAB Subtests

Factor	Eigenvalue	Pct of var	Cum pct
1	9.33037	54.9	54.9
2	1.90684	11.2	66.1
3	1.24933	7.3	73.5

Orthogonal rotation - Factor loadings

	Factor 1	Factor 2	Factor 3
CMP	.80254	.03951	.14975
NO	.77792	.19312	.28684
NCM	.75278	.17429	.45438
CS	.70688	.08544	.43492
ARS	.68453	.32337	.13432
MK	.67505	.50013	.14869
PC	.65878	.49536	.08147
VOC	.65261	.49519	.22073
AR	.63399	.60637	.12272
WK	.63301	.62271	.06852
AS	.05107	.85636	.14740
EI	.25914	.84589	.13116
MC	.20171	.83059	.23909
GS	.45788	.76402	.10667
FRM	.25559	.12605	.80161
TLM	.38344	.10071	.75365
3DS	.02741	.50950	.65141

Oblique Rotation - Factor Pattern Loadings

	Factor 1	Factor 2	Factor 3
CMP	.88037	.21478	.00439
NO	.80737	.05137	.14186
NCM	.74776	.07086	.32649
ARS	.71602	-.12175	-.01386
CS	.70960	.14934	.32201
MK	.68187	-.31033	-.01181
PC	.67719	-.31337	.07985
VOC	.64262	-.30890	.06951
WK	.63562	-.45616	-.09959
AR	.62791	-.43622	-.04072
AS	-.07026	-.87995	.07443
EI	.17128	-.80488	.01873
MC	.08626	-.80182	.14572
GS	.41211	-.65786	-.03792
FRM	.11805	-.01753	.79401
TLM	.27519	.04705	.72629
3DS	-.15673	-.49931	.64469