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ABSTRACT

This technical supplement to the Armed Services Vocational Aptitude Battery (ASVAB) Counselor's Manual presents the current research that has accumulated on the ASVAB. Information in this supplement was collected from published and unpublished sources, both civilian and military. This supplement contains both actual results of data analyses and summaries of relevant studies. It is designed to be used with the ASVAB Counselor's Manual for ASVAB-14. It can be used by counselors, administrators, and teachers; however, because much of the material in this supplement is technical in nature, it is intended primarily for educational researchers, psychologists, statisticians, and psychometricians. The document is divided into these sections: (1) background on the ASVAB, including the current Department of Defense student testing program and ASVAB content; (2) development of ASVAB-14, including subtests, factor analysis, and composites; (3) descriptive statistics and norms, focusing on comparisons of subgroups within the 1980 population; item analysis for weighted sex and grade normative groups; means, standard deviations, and intercorrelations; grade and sex differences; norms; and sampling effects; (4) reliability; and (5) validity, divided into subsections on relationship of the ASVAB-14 to other tests and predictive validity of the ASVAB-14. A bibliography and an annotated bibliography are included. The appendix includes item taxonomies and norms. (ABL)

TECHNICAL SUPPLEMENT TO THE COUNSELOR'S MANUAL

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TECHNICAL SUPPLEMENT TO THE COUNSELOR'S MANUAL FOR THE ARMED SERVICES VOCATIONAL APTITUDE BATTERY FORM-14

This document was accomplished under Project 7719, "Development and Validation of Selection Methodologies" and executed as part of the responsibility of the Air Force Human Resources Laboratory as lead laboratory for Armed Services Vocational Aptitude Battery (ASVAB) research and development.

It is a compilation of data and other information on the ASVAB which may be of information to technically minded readers. For further sources of information on the ASVAB and its related systems, the interested reader is directed to the:

Counselor's Manual for ASVAB-14
ASVAB Test Manual for
ASVAB Forms 8, 9, 10, 11, 12, 13, and 14

as well as to the numerous technical publications of the Armed Services personnel research laboratories.

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Introduction

This Technical Supplement to the Armed Services Vocational Aptitude Battery (ASVAB) Counselor's Manual presents the current research that has been accumulated on the ASVAB. Information in this supplement has been collected from published and unpublished sources, both civilian and military.

This supplement contains both actual results of data analyses and also summaries of relevant studies. It is designed to be used with the *ASVAB Counselor's Manual for ASVAB-14*. It can be used by counselors, administrators, and teachers; however, because much of the material in this supplement is technical in nature, it is intended primarily for educational researchers, psychologists, statisticians, and psychometricians.

General ASVAB History

The history of group ability testing in the United States closely parallels the history of aptitude testing within the American military. During World War I, the Army Alpha test was developed to test large groups of recruits. During World War II, the Army General Classification Test (AGCT) and the Navy General Classification Test (NGCT) were used to help classify enlisted personnel after they entered the Service. Each Service used its own procedures prior to induction. Uniform testing throughout the military was not mandated until the passage of the Selective Service Act in 1948.

The mandated test became known as the Armed Forces Qualification Test (AFQT), and it was modeled after the AGCT. Beginning in 1950, the AFQT was used as a measure of general trainability to determine the eligibility of draftees and volunteers to enter any of the Armed Services (United States Department of Defense (DOD) 1980). AFQT norms, or tables converting raw scores to percentile scores, were based upon a sample representing the total officer and enlisted population serving in the military under mobilization conditions during World War II. This reference population was used by the DOD to track the scores of its enlisted accessions until October 1984.

In order to retard cheating and to update vocabulary and content, the AFQT was revised on a continuous basis by the introduction of new forms. Each new AFQT was calibrated back to the AGCT, so that successive AFQT scores would have a constant meaning in terms of the level of trainability associated with scores on AGCT. Starting in 1973 and continuing through 1975, the Services were not required to use a common AFQT. Each Service was permitted to develop conversion tables from its own test battery as a basis for estimating an individual's AFQT score.

AFQT scores are expressed in percentile scores which are intended to show how a person's score compares to the scores achieved by the reference population. Until October 1984, this was the population of males that served in World War II. For example, if a recruit received a 75th percentile score, it means that his or her score was as high or higher than the scores achieved by 75 percent of World War II military personnel. The percentile scores were reported from one to one hundred. A score at the 50th percentile was at the median of scores of officers and enlisted personnel in World War II. In October 1984, a new reference population was adopted (see below).

Along with the AFQT, the individual Services continued to use their own classification instruments. In the 1960s, DOD decided to develop a common selection and classification test, the ASVAB, for use in the nation's high schools. The ASVAB was intended to replace tests used in high schools and the Service-specific enlistment classification batteries. ASVAB testing in high schools began in 1968, with Form 1. The first versions of ASVAB (Forms 6 and 7) used by all Military Services for selection and classification of recruits were introduced in 1976. Form 5 was also introduced in 1976 for use in secondary and postsecondary schools.

The latest forms of ASVAB, Forms 11, 12, 13, and 14, are parallel, or equivalent to the previous military enlistment Forms 8, 9, and 10 which were used from 1980 through 1984. Forms 11 through 14 are equated to ASVAB-8a. Scores on ASVAB-8a based on a nationwide test administration in 1980 comprise the new reference base for ASVAB scores reported after October 1984. Previous ASVAB forms were calibrated to AFQT-7a or AFQT-8a (AFQT forms in use prior to ASVAB).

DoD Student Testing Program

The history of Service testing in civilian schools dates to the pre-ASVAB period. In 1958, high school students were tested with the Airman Qualifying Examination (AQE), an Air Force-developed classification instrument. Shortly thereafter, the Army and the Navy also introduced versions of their classification tests into the high schools.

This redundancy of effort and possible lack of a common standard led to the adoption of the ASVAB for use in the high schools. Although the ASVAB is now used both in the DOD Student Testing Program (for secondary and postsecondary schools) and in the Services' regular enlistment program, the ASVAB was originally developed to be a high school testing instrument. The forms of the ASVAB that have been used since 1968 are shown in Table 1.

Current ASVAB Content

The subtests in ASVAB-14, the current student ASVAB, are shown in Table 2. The student composites that are derived from these subtests are described in Table 3. All subtests (save WK and PC) are unit weighted in composites. WK and PC are unit weighted to form a single subtest.

TABLE 1. Use of Forms of the Armed Services Vocational Aptitude Battery

ASVAB Form	DOD Student Testing Program	Service Personnel Selection and Classification
ASVAB-1	School Years 1968-1973	Not Used
ASVAB-2	School Years 1973-1976	[a]
ASVAB-3	Not Used	1973-1976[b]
ASVAB-4	Not Used	Not Used
ASVAB-5	School Years 1976-1984	[a]
ASVAB-6/7	Not Used	1976-1980
ASVAB-8/9/10	Not Used[c]	1980-1984
ASVAB-11/12/13	Not Used	1984-Present
ASVAB-14	School Years 1984-Present	[a]

[a] Scores from these school ASVAB forms were (or are) valid for enlistment for two years after administration

[b] Used only by US Air Force and Marine Corps prior to 1976.

[c] ASVAB-9a contains the same items as Form 14.

TABLE 2. Subtests, Number of Items, and Testing Time for ASVAB-14

Subtest (Abbreviations)	Number of Items	Time (Minutes)
General Science (GS)	25	11
Arithmetic Reasoning (AR)	30	36
Word Knowledge (WK)	35	11
Paragraph Comprehension (PC)	15	13
Numerical Operations (NO)	50	3
Coding Speed (CS)	84	7
Auto & Shop Information (AS)	25	11
Mathematics Knowledge (MK)	25	24
Mechanical Comprehension (MC)	25	19
Electronics Information (EI)	20	9
Total:	334 Items	144 Minutes

TABLE 3. Subtest Composition of ASVAB-14 Composites

ASVAB-14 Subtests	ASVAB-14 Composites						
	AA	VBL	MTH	MC	BC	EE	HST
General Science		X				X	
Arithmetic Reasoning	X		X	X		X	X
Word Knowledge	X[a]	X			X[a]		X[a]
Paragraph Comprehension	X[a]	X			X[a]		X[a]
Numerical Operations							
Coding Speed					X		
Auto & Shop Information				X			
Mathematics Knowledge			X		X	X	
Mechanical Comprehension				X			X
Electronics Information				X		X	

[a]Word Knowledge and Paragraph Comprehension subtests are combined and unit weighted as a single subtest in the composite.

NOTE: Composites are: Academic Ability (AA), Verbal (VBL), Mathematics (MTH), Mechanical & Crafts (MC), Business & Clerical (BC), Electronics & Electrical (EE), and Health, Social & Technology (HST).

Profile Of American Youth Study[1]

In the past, aptitude levels within the military had been referenced statistically to the extensive testing of adult males that took place during World War II. This World War II "reference population" had been the baseline for comparing aptitudes of military examinees and recruits across time. As previously mentioned, the instruments used to measure the aptitutde of military applicants have varied over time. First, the Army General Classification Test (AGCT) was used, followed by versions of the AFQT. More recently, the ASVAB has been used to assess the aptitudes of Service applicants. There have also been several versions of the ASVAB. Recently, it was decided that the contemporary youth population should be examined to facilitate DOD's understanding of the quality and representativeness of its new enlistees.

In order to gain more information about the aptitudes of today's youth, both male and female, DOD contracted with the National Opinion Research Center (NORC) of the University of Chicago to administer ASVAB Form 8a to a nationally representative sample of young people. The study was known as the "Profile of American Youth" and was designed to: (1) assess the vocational aptitudes of young people ages 16 to 23, (2) develop a reference population against which scores on DOD enlistment tests could be interpreted, and (3) compare the aptitudes of current Service recruits with the youth population in general. The study marked the first time that a multiple vocational aptitude test battery was normed on a nationally representative sample.

The nationally representative sample came from the five-year National Longitudinal Survey (NLS) of Youth Labor Force Behavior which is being conducted at the Ohio State University by the Department of Labor in conjunction with DOD. The purpose of the NLS is to assess the behavior of a cross section of American youth in the labor market. Members of the NLS sample are being interviewed annually for five years to track changes in work attitudes and vocational behavior.

In 1979, NORC interviewed 12,686 youths. This base-year sample contained approximately equal proportions of male and female respondents from all major U.S. Census regions. In order to permit valid subgroup comparisons, the procedures called for oversampling of certain groups of interest such as Hispanics, Blacks, economically disadvantaged Whites, and women in the military.

[1]Taken from the U.S. Department of Defense publication (1982).

TABLE 4. Ethnic and Sex Composition of the Profile of American Youth Sample

Subgroup	N in Reference Population: Unweighted	N in Reference Population: Weighted	Percent of Reference Population (Weighted)
White*			
Men	3,531	13,393,060	40.7
Women	3,496	12,946,550	39.3
Total	7,027	26,339,610	80.0
Black			
Men	1,511	2,278,490	6.9
Women	1,511	2,276,440	6.9
Total	3,022	4,554,930	13.8
Hispanic			
Men	902	1,031,890	3.1
Women	927	1,014,310	3.1
Total	1,829	2,046,200	6.2
Reference Population			
Men	5,944	16,703,440	50.7
Women	5,934	16,237,300	49.3
Total	11,878	32,940,740	100.0

*White includes all non-Blacks and non-Hispanics.

During July-October 1980, the ASVAB-8a was administered to available members of the sample interviewed in 1979. A total of 11,878 valid cases were obtained, representing a completion rate of 94 percent. This sample was then statistically weighted to be nationally representative of all American young people. The composition of the sample is shown in Table 4. However, since the Services typically only recruit young people 18 years of age and older, the final analysis presented in the Profile study included only those young people born between January 1, 1957 and December 31, 1962; i.e., the 18 years and older group. This final group consisted of 9,173 individuals who formed the basis for a representative sample of today's American youth between the ages of 18 and 23 (U.S. Department of Defense, 1982). This sample of enlistment eligible age is the reference for the "1980 Youth Population."

After administering the ASVAB, DOD contracted with R. Darrell Bock of the University of Chicago for an evaluation of the ASVAB. Dr. Bock evaluated the test to determine its appropriateness for measuring vocational aptitudes and its equity for minorities and females. He reported:

> They (responses to the ASVAB) provide a sound basis for the estimation of population attributes such as means, medians, and percentile points, for the youth population as a whole and for subpopulations defined by age, sex, and race/ethnicity (Bock & Mislevy, 1981).

Based on this analysis, it can be concluded that the ASVAB is an appropriate device for measuring vocational aptitudes of American youth, civilian or military. Dr. Bock also has stated that the technical quality of the ASVAB equals or surpasses that of commercial aptitude and achievement tests.

Four ASVAB subtests (Arithmetic Reasoning, Numerical Operations (half weighted), Paragraph Comprehension, and Word Knowledge) are combined to form the Armed Forces Qualification Test (AFQT), the test that has been used to reference updated versions of the DOD selection test to the reference population of World War II. Since the implementation of the All-Volunteer Force, the AFQT categories have remained as indices of ability for comparison of the distribution of recruit ability in the various Services. (See Table 5).

Using AFQT percentile scores, the Profile of American Youth study compared the 1980 Youth Population with both the World War II population and also the current group of military accessions. Score comparisons on factors such as sex and age were also made within the 1980 Youth Population. One comparison of interest involved the 1980 Youth Population and the World War II Reference Population. The AFQT category distributions of *male* subjects of the 1980 Youth Population and the World War II reference population are shown in Table 5. Females were not included in this analysis because the World War II reference population was composed entirely of males (both officer and enlisted personnel) on active duty in December 1944.

TABLE 5. Distribution of Armed Forces Qualification Test (AFQT) Scores in the 1980 Male Youth and the World War II Populations (Percent)

	AFQT Category (Percentiles)					
Population Group	I (93-99)*	II (65-92)	III (31-64)	IV (10-30)	V (1-9)	Total
1980 Male Youth	6	34	31	22	7	100
World War II	8	28	34	21	9	100

*A recorded percentile of 100 is coded as 99.

As shown, 40 percent of the 1980 group were in the top two of the five AFQT categories as compared to 36 percent of the World War II reference population. In the middle category a complementary difference was found; i.e., 34 percent for the World War II population and 31 percent for the 1980 Youth Population. In the bottom two AFQT categories there was a net difference of only 1 percentage point. Overall, the two distributions of AFQT scores are fairly similar.

In summary, the Profile of American Youth study established new national norms for the ASVAB. This study marked the first time that data on a vocational aptitude test have been collected on a nationally representative sample of youth, both in and out of school. The Profile of American Youth study data base contains a wealth of information that will benefit both military and civilian analysts.

ASVAB-14 Subtests

ASVAB-14 consists of 10 subtests (see Table 2). Eight subtests are power subtests that allow maximum performance in a generously timed situation. Two subtests are highly speeded. There are three versions of ASVAB-14: Forms 14a, 14b, and 14c. All versions contain the same items but in different order to minimize test compromise. ASVAB-14 is parallel to ASVAB Forms 8 through 10 and 11 through 13; and in fact, ASVAB-14 contains the same items as does ASVAB-9a.

The subtests that compose ASVAB-14 are not the same as those in ASVAB-5, the previous high school (DOD Student Testing Program) ASVAB test. A Paragraph Comprehension subtest has been added to provide an improved measure of reading skills. Auto Information and Shop Information have been combined into one subtest, and Coding Speed has replaced the Attention to Detail subtest. General Information and Space Perception were eliminated because they contributed little to the predictive validity of the ASVAB. The average number of items on power subtests for ASVAB-14 has been increased to 25, compared to an average 21.5 for ASVAB-5. Domain specifications outlining the content of each current ASVAB subtest are contained in Appendix A, Item Taxonomies.

Most of the information reported on ASVAB-14 is based on the research that has been done on versions parallel to ASVAB-14. More specifically, much of the research reported on ASVAB-14 is based on results from ASVAB-8a, the version of ASVAB that is the reference test[1] for these series. However, ASVAB-8a has been shown to be parallel to ASVAB-9a/14 (Ree, Mathews, Mullins, & Massey, 1982).

Data on the relationship between ASVAB Forms 8a and 14 are shown in Table 6. These data are based on military service applicants tested in 1983. Subsamples were experimentally administered portions of ASVAB-8a, and then later were given a complete ASVAB-14.

TABLE 6. Descriptive Statistics for ASVAB-14 and ASVAB-8a

Sub-test	N	Correlation Between 8a and 14		Standad Score Mean		Standard Deviation		Ratio of Mean Difference
		r	r_c	14	8a	14	8a	To SD
GS	1222	.79	.83	49.59	50.30	9.69	8.73	−.08
AR	1275	.88	.90	50.46	49.73	8.81	8.90	+.08
WK	1275	.88	.92	48.88	49.95	8.49	7.96	−.13
PC	1275	.65	.71	48.17	50.43	8.84	7.99	−.27
NO	1275	.72	.82	50.49[a]	50.78[a]	7.82	8.08	−.03
CS	1275	.78	.84	47.86[a]	47.78[a]	8.54	8.36	+.01
AS	1222	.84	.86	53.52	52.16	9.51	9.25	+.14
MK	1255	.84	.87	48.88	49.54	9.23	8.37	−.10
MC	1222	.79	.82	52.24	50.85	9.07	9.49	+.15
EI	1255	.72	.78	51.87	51.41	8.83	8.95	+.05

[a]Due to administration order effects for speeded tests, these means are based on 2,620 applicants given ASVAB-8a and 2, 590 additional applicants given ASVAB-14.

NOTE: 1. r_c is the correlation coefficient corrected (to the 1980 Youth Population) for restriction in range caused by prior selection.

[1]The reference test (8a) is administered for equating purposes along with new forms so that scores on the new forms can be placed on the same scale or metric as the reference test (in this instance the 1980 Youth Population metric).

ASVAB Factor Analysis

Factor analysis is a procedure used to identify major structural components of a se' of variables. Both ASVAB-5, the previous high school test battery, and ASVAB Forms 8, 9, and 10 subtest scores have been factor analyzed.

Fischl, Ross, and McBride (1977) and Kenny (1979) conducted separate factor analyses of ASVAB-5. Their respective results are summarized in Table 7 (see Wilfong, 1980, p. 61-63 for a comparison of the factor loadings). Fischl et al. and Kenny both found a common set of factors with a five-factor solution appearing optimum. These five factors were Verbal, Clerical, Math, Trade Technical, and Space/Mechanical. Other authors (e.g. Sims & Mifflin, 1978; Vanderploeg & Mueller, 1978; and Fletcher & Ree, 1976) have found similar factor solutions, regardless of the type of factor extraction or rotations (orthogonal or oblique) used.

TABLE 7. Names Appled to Factors Obtained from Factor Analyses of ASVAB-5

Factor Names	
Fischl et al. (1977)	Kenny (1979)
Verbal	Verbal
Clerical/Perceptual	Clerical Ability
Analytic/Math	Math
Trade Technical	Trade Technical
Mechanical	Mixed

Sims and Hiatt (1983) conducted a simultaneous factor analysis of ASVAB Forms 5, 6 and 7 and Forms 8, 9, and 10. These forms were adminstered to a sample of 2,620 male applicants for all Services in January and February 1980. The data were factor analyzed using an iterated principal factor solution with estimated communalities, followed by an oblique rotation. The resulting factors, presented in Table 8, show that the ASVAB Forms 5, 6, and 7 and ASVAB Forms 8, 9, and 10 have similar factor structure. The space factor found for ASVAB-5 was not found in Forms 8, 9, and 10 because the Space Perception subtest was dropped due to insufficient unique predictive validity. Because of the similar factor structures, validity results can be generalized between the two sets of ASVAB forms with some confidence.

TABLE 8. Joint Factor Analysis of ASVAB Forms 5, 6, and 7 and ASVAB Forms 8, 9, and 10

Forms 5/6/7 Factors	Forms 8/9/10 Factors
Verbal	Verbal
Speed	Speed
Technical	Technical
Quantitative	Quantitative
Space	*

*The Space Perception subtest, the dominant subtest in the ASVAB Forms 5/6/7 Space factor, was dropped from ASVAB Forms 8, 9, 10, and 14.

Ree, Mullins, Mathews, and Massey (1982) conducted several factor analyses on data from ASVAB Forms 8, 9, and 10. The data consisted of test responses from applicants for Service enlistment. Each applicant took one form of the ASVAB along with the reference test in use then, the Armed Forces Qualification Test Form 7a (AFQT-7a). Because the World War II reference base contained only males, female applicants were deleted from these samples. The remaining male samples were weighted to produce a flat distribution of AFQT-7a decile scores, an ability distribution similar to that found in the World War II reference population. The number of subjects who completed each of the six ASVAB forms ranged from 2,417 to 2,621.

The results of the factor analyses were that the number and type of factors were similar across all forms of ASVAB 8, 9, and 10. A four-factor, oblique solution appeared the most interpretable for all forms and corresponded to the structure found in factor analyses of previous forms of the ASVAB. The four-factor solution accounted for 73 to 74 percent of the total test variance across the forms. The results of the factor analysis of ASVAB Form 14 are presented in Table 9.

Factor loadings were interpreted in the conventional manner, with values of .30 or more judged to be significant. The percentage of variance accounted for by the factors in ASVAB 8a was 73.3. Factor I consisted of WK, PC, GS, and EI; this was labeled a Verbal Abilities factor. Factor II contained AS, MC, and EI; this was labeled a Vocational Technical Information factor. Factor III consisted of MK and AR, a Mathematics factor. NO and CS loaded on Factor IV, designated as Clerical/Speed.

TABLE 9. Factor Analysis of ASVAB Subtests for Form 14 (Oblique Solution)

Subtests	Rotated Factor Loadings I	II	III	IV	Rankings[a] I	II	III	IV
General Sciences (GS)	.29	.56	.18	−.06		2		
Arithmetic Reasoning (AR)	.13	.21	.56	.22			2	
Word Knowledge (WK)	.23	.62	.12	.16		1		
Paragraph Comprehension (PC)	.19	.51	.18	.21		3		
Numerical Operations (NO)	.08	.04	.16	.64				1
Coding Speed (CS)	.22	−.03	.11	.61				2
Auto & Shop Information (AS)	.72	.16	.07	.04	1			
Mathematics Knowledge (MK)	.13	.12	.62	.16			1	
Mechanical Comprehension (MC)	.55	.11	.35	.00	3		3	
Electronics Information (EI)	.66	.19	.15	.01	2			

Correlation Matrix of Factors

	I	II	III	IV
I	1.00			
II	.58	1.00		
III	.53	.52	1.00	
IV	.31	.32	.49	1.00

[a]Only factor loadings greater than .30 were ranked.
Note. Analysis by Ree, et al., 1982b.

Overall, the factors found in this study were similar across all forms of the 8, 9, and 10 series. Consequently, the forms appear to be parallel in factorial content. An oblique factor analysis of ASVAB-8a subtests was also done by Bock and Moore (1984). This analysis used weighted intercorrelations based on the 1980 Profile of American Youth reference sample of ages 15 to 23. Demographic effects involving age, sex, race, region, and socioeconomic status were eliminated from the correlations prior to factoring. The results are almost identical to those obtained by Ree et al., as the three subtests with the highest loadings on the first four factors are the same in both studies. The four factors found in ASVAB 8, 9, and 10 are very similar to four of the factors obtained from the factor analyses of ASVAB-5 (Fischl et al., 1977; Kenny, 1979).

ASVAB-14 Composites

ASVAB subtests are combined to produce two types of composite scores (see Table 3). *Academic Composites* are used both to indicate a student's potential for advanced academic training and to predict performance in educational areas requiring verbal and mathematical skills. The Academic Composites are (1) Verbal, (2) Math, and (3) Academic Ability. The Verbal and the Math composites were developed using a factor analytic technique. The Academic Ability composite contains key subtests from the Verbal and Math composites and has historically been used by schools as an indicator of academic aptitude.

Occupational Composites indicate a student's aptitude in several career areas and can be used to make predictions about future job performance. Occupational Composites are (1) Mechanical and Crafts, (2) Business and Clerical, (3) Electronics and Electrical, and (4) Health, Social, and Technology. These composites were derived through analysis of validity studies involving prediction of success in military technical training programs.

The Military Services use sets of composites with score metrics different from the student test composites, although most Service composites have subtest content the same as or similar to that of the Occupational Composites. These military composites are used to determine enlistment and training program eligibility and are based on empirical evidence of the validity of these composites for predicting success in these training programs. While different from the Service composites, ASVAB-14 school composites are similar to them in their ability to predict performance in military technical training courses. This is especially true for the Occupational Composites (Maier & Truss, 1984).

Computing Subtest And Composite Scores

Raw ASVAB subtest scores (RS) computed as the sum of correct responses are linearly transformed into standard scores with a mean of 50 and a standard deviation of 10. The transformation is based on the data obtained from the Profile of American Youth study (see Chapter 1), using the weighted Youth Population of 18-23 year old males and females. The formula is:

Standard score = (10/SD)([RS-Mean]) + 50
where SD = standard deviation and
RS = raw score

The equation for each subtest is presented in Table 10.

Individual subtest standard scores are combined for each composite to form a sum of subtest standard scores (SSS). The SSSs are then transformed into a composite standard score, based also on the 1980 Youth Population. Composite equations are presented in Table 11.

Composite standard scores are converted into percentiles based on normative grade and gender subgroups of the reference 1980 Youth Population (18-23 year olds).

Separate and combined gender percentile norm tables for the composites for grades eleven and twelve and for two-year college students are presented in Appendix B. Also included are standard score-to-percentile conversion tables based on the 1980 Youth Population data. This latter group was used to construct the score scale for all military selection and classification composites. The 1980 Youth Population percentiles are also used in the *Military Career Guide* (see Chapter V) to estimate an individual's probability of qualifying for a military occupational cluster, as based on scores on ASVAB-14 Occupational Composites.

TABLE 10. Equations to Convert ASVAB-14 Raw Scores (RS) to Subtest Standard Scores

Subtest	Equation	
General Science	(10/5.010)(RS-15.950)	+ 50
Arithmetic Reasoning	(10/7.373)(RS-18.009)	+ 50
Word Knowledge	(10/7.710)(RS-26.270)	+ 50
Paragraph Comprehension	(10/3.335)(RS-11.011)	+ 50
Numerical Operations	(10/10.800)(RS-37.236)	+ 50
Coding Speed	(10/16.763)(RS-47.606)	+ 50
Auto & Shop Information	(10/5.550)(RS-14.317)	+ 50
Mathematics Knowledge	(10/6.393)(RS-13.578)	+ 50
Mechanical Comprehension	(10/5.349)(RS-14.165)	+ 50
Electronics Information	(10/4.236)(RS-11.569)	+ 50
VE (WK + PC)	(10/10.595)(RS-37.281)	+ 50

NOTES: 1. If standard score is less than 20, raise it to 20.
2. If standard score is greater than 80, lower it to 80.

TABLE 11. Equations to Convert Sum of Subtest Standard Scores (SSS) to Composite Standard Scores

Composite	Equation	
Academic Ability	(10/18.527) (SSS-99.926)	+ 50
Verbal	(10/27.555) (SSS-149.919)	+ 50
Math	(10/19.115) (SSS-99.970)	+ 50
Mechanical & Crafts	(10/34.992) (SSS-199.909)	+ 50
Business & Clerical	(10/25.575) (SSS-149.951)	+ 50
Electronics & Electrical	(10/35.359) (SSS-199.844)	+ 50
Health, Social & Technology	(10/26.468) (SSS-149.928)	+ 50

Comparisons Of Subgroups Within The 1980 Population

The normative groups against which students are compared on the ASVAB were based on subsamples. weighted to be nationally representative, of the larger 1980 reference population (16-23 year olds). These subsamples include the following:

1. The Grade 11 Population consists of 1304 students in grade 11. Tenth graders, as well as eleventh graders, were compared to this population as no grade 10 norms exist.[1]
2. The Grade 12 Population consists of 1253 students in grade 12.
3. The Two-Year College Population consists of 12 students in two-year postsecondary schools.
4. The Youth Population is a subgroup of the Reference Population consisting of 9173 men and women, ages 18-23. Table 12 displays the number of subjects by gender of the respective subsamples in unweighted and weighted forms.

Item Analysis For Weighted Sex And Grade Normative Groups

Item Difficulty

Item difficulty is the proportion of test takers who answered an item correctly. ASVAB-14 difficulty proportions (not corrected for guessing) are presented in Table 13. Mean difficulties ranged from .40 on Auto & Shop Information (AS) for 11th grade females to .74 on Paragraph Comprehension (PC) for 12th grade females. Proportions for all 11th graders ranged from .48 on AS to .67 on PC, and proportions for all 12th graders ranged from .52 on AS to .72 on PC. This indicates that the subtests are of moderate difficulty level for 11th-12th grade students. This is appropriate because subtests are most reliable when the items are neither too easy nor too hard.

Item Discrimination

The validity of an item in relation to the construct it is purported to measure is often assessed by its correlation with the total score for the subtest (the point-biserial coefficient). This coefficient can also be used as an index of how well the item discriminates between high-scoring and low-scoring individuals. Table 14 presents the median item discrimination correlations for ASVAB-14 high school norm groups.

Median item-test point biserial correlations for power tests ranged from .16 on Auto and Shop Information (AS) for 12th grade females to .49 on Math Knowledge (MK) for 11th grade females. The range for all 11th graders was .25 on AS to .49 on MK, and the range for all 12th graders was .28 on AS to .46 on MK. Item-test correlations for items of extreme difficulty for a group are underestimated by the point biserial. This is one reason why the item-test correlations of technical subtests (such as AS and EI) are around .20 for females compared to .35 for males. Despite this underestimation, the item-test correlations were found to be acceptable.

Omits

One useful measure of test appropriateness is the number of items omitted, skipped, or left blank on a test. This measure is only meaningful for power tests, since speeded tests are designed to produce omitted items. Table 15 presents the proportions of students omitting the last item for ASVAB-14 subtests. The proportions ranged from .02 on MK for 12th grade females to .14 on Word Knowledge (WK) for 11th grade males. For all 11th graders, omits ranged from .04 on MK to .10 on WK. For 12th graders, omits ranged from .03 on MK to .08 on WK. These low proportions support the assertion that the power subtests are not speeded. There was a tendency for males to omit the last item more often than females, especially for 11th graders on WK, .14 versus .07.

[1]Because of the age range in the reference sample, only about 400 10th grade students were tested.

TABLE 12. Distribution of Subgroups in ASVAB Norm Groups by Sex

Norm Group	n in Norm Group Unweighted	Weighted	Percent of Norm Group (Weighted)
Grade 11			
Male	680	2,133,110	51
Female	624	2,035,400	49
Total	1,304	4,168,510	100
Grade 12			
Male	642	1,814,130	51
Female	611	1,726,570	49
Total	1,253	3,540,700	100
Two-Year College			
Male	305	982,000	44
Female	437	1,259,000	56
Total	742	2,241,000	100
Youth Population[a]			
Male	4,550	12,891,200	51
Female	4,623	12,517,900	49
Total	9,173	25,409,100	100

[a]The youth population is the 18-23 year old group which constitutes the military reference population.

TABLE 13. ASVAB-14 Subtest Mean Difficulty (Proportion Correct) By Grade and Sex[a]

Subtest	Females 11th Grade	Females 12th Grade	Males 11th Grade	Males 12th Grade	Total 11th Grade	Total 12th Grade
General Science	.55	.58	.61	.65	.58	.61
Arithmetic Reasoning	.53	.54	.56	.61	.54	.58
Word Knowledge	.68	.70	.66	.72	.67	.71
Paragraph Comprehension	.71	.74	.64	.70	.67	.72
Numerical Operations	.69	.69	.61	.65	.65	.67
Coding Speed	.54	.56	.49	.49	.49	.52
Auto & Shop Information	.40	.41	.56	.62	.48	.52
Mathematics Knowledge	.55	.54	.51	.55	.53	.54
Mechanical Comprehension	.45	.46	.57	.61	.51	.54
Electronics Information	.43	.44	.54	.61	.49	.53

[a]Weighted samples.

TABLE 14. ASVAB-14 Median Item-Test Point Biserial Correlations[a] By Grade and Sex[b]

Subtest	Females 11th Grade	Females 12th Grade	Males 11th Grade	Males 12th Grade	Total 11th Grade	Total 12th Grade
General Science	.32	.36	.34	.37	.33	.37
Arithmetic Reasoning	.40	.42	.44	.47	.42	.45
Word Knowledge	.43	.42	.48	.45	.45	.44
Paragraph Comprehension	.36	.40	.44	.43	.40	.42
Numerical Operations	.56	.52	.53	.51	.55	.52
Coding Speed	.50	.45	.48	.47	.49	.46
Auto & Shop Information	.18	.16	.31	.39	.25	.28
Mathematics Knowledge	.49	.4[illegible]	.48	.48	.49	.46
Mechanical Comprehension	.21	.23	.35	.37	.28	.30
Electronics Information	.21	.20	.34	.35	.28	.28

[a]Corrected for overlap.
[b]Weighted samples.

TABLE 15. Proportion Omitting Last Item of the Power Tests of ASVAB-14 by Grade and Sex[a]

Subtest	Females 11th Grade	Females 12th Grade	Males 11th Grade	Males 12th Grade	Total 11th Grade	Total 12th Grade
General Science	.04	.05	.09	.07	.07	.06
Arithmetic Reasoning	.07	.07	.08	.08	.08	.08
Word Knowledge	.07	.07	.14	.09	.10	.08
Paragraph Comprehension	.03	.04	.07	.05	.05	.04
Auto & Shop Information	.04	.04	.06	.07	.04	.06
Mathematics Knowledge	.03	.02	.04	.04	.04	.03
Mechanical Comprehension	.05	.04	.06	.07	.06	.06
Electronics Information	.03	.03	.04	.05	.04	.04

[a]Weighted samples.

Means, Standard Deviations, And Intercorrelations

Subtest means and standard deviations for ASVAB Form 8a are in Table 16. These data are based on the 1980 Youth Population of 18 to 23 year olds. (U.S. Department of Defense, 1982).

TABLE 16. Means and Standard Deviations (SD) for ASVAB 8a[a] (Raw Score Units)

Subtest	Mean	SD
General Science (GS)	15.950	5.010
Arithmetic Reasoning (AR)	18.009	7.373
Word Knowledge (WK)	26.270	7.710
Paragraph Comprehension (PC)	11.011	3.355
Numerical Operations (NO)	37.236	10.800
Coding Speed (CS)	47.606	16.763
Auto & Shop Information (AS)	14.317	5.550
Math Knowledge (MK)	13.578	6.393
Mechanical Comprehension (MC)	14.165	5.349
Electronics Information (EI)	11.569	4.236
Verbal (VE)	37.281	10.595

[a]Weighted sample of youth population, ages 18-23.

ASVAB-14 subtest means and standard deviations, categorized by sex and grade normative groups, are presented in Table 17.

TABLE 17. Subtest Raw Score Means and Standard Deviations (SD) for ASVAB-14 School Norm Groups[a]

	Grade 11				Grade 12			
	Females		Males		Females		Males	
Subtest	Mean	SD	Mean	SD	Mean	SD	Mean	SD
GS	13.86	4.47	15.21	4.87	14.43	4.57	16.17	4.81
AR	15.88	6.41	16.73	7.05	16.34	6.67	18.25	7.09
WK	23.69	6.89	23.27	7.70	24.67	6.88	25.15	7.20
PC	10.64	3.17	9.57	3.68	11.03	3.09	10.54	3.38
NO	34.70	9.86	30.65	10.13	34.70	9.63	32.29	10.22
CS	45.54	13.50	37.48	13.95	46.86	13.38	40.96	13.33
AS	10.00	3.39	13.90	4.98	10.26	3.41	15.41	5.04
MK	13.76	6.24	12.76	6.42	13.41	5.96	13.74	6.24
MC	11.26	3.98	14.16	5.08	11.56	3.90	15.35	5.03
EI	8.60	3.14	10.81	4.02	8.89	3.35	12.19	4.05

[a]Weighted samples.

ASVAB subtest correlations, categorized by sex and grade, are presented in Tables 18 through 21. The median intercorrelations were slightly higher for males (.63 and .60 for 11th and 12th grades, respectively) than for females (.55 and .58 for 11th and 12th grades, respectively).

The highest intercorrelations (around .8) were between the two math subtests, AR and MK, and between two verbal subtests, GS and WK. The lowest intercorrelations involved the speeded subtests, NO and CS.

ASVAB student composite correlations are presented in Table 22 for the combined 11th and 12th grades, and for the combined male and female sample. Composite correlations for separate groups are contained in the *Counselor's Manual for ASVAB-14*, Appendix D. The magnitude of the intercorrelations varies according to the degree of subtest overlap among composites. The lowest correlations are .68, between Mechanical & Crafts (MC) and Business & Clerical (BC) and .77 between Verbal (VBL) and Math (MTH). These pairs of composites share no common subtests. The correlations of MC with VBL and MTH are .77 and .78, respectively. One subtest out of four in MC is also in VBL and MTH. The highest correlation is .96, between Academic Ability (AA) and Health, Social, & Technology (HST) which both contain Arithmetic Reasoning (AR), Word Knowledge (WK), and Paragraph Comprehension (PC). Although the ASVAB-14 composites are factorially complex, the intercorrelations reflect distinct verbal, math, clerical (BC), and technical (MC) aptitudes.

TABLE 18. ASVAB Subtest Intercorrelations for 11th Grade Females[a]

	GS	AR	WK	PC	NO	CS	AS	MK	MC	EI
GS		.66	.80	.66	.47	.42	.52	.67	.56	.62
AR			.65	.67	.58	.50	.49	.79	.62	.56
WK				.76	.53	.48	.53	.69	.59	.64
PC					.55	.49	.47	.67	.55	.59
NO						.67	.34	.59	.36	.40
CS							.31	.52	.34	.35
AS								.44	.49	.44
MK									.59	.55
MC										.54
EI										

[a]Weighted samples.

TABLE 19. ASVAB Subtest Intercorrelations for 12th Grade Females[a]

	GS	AR	WK	PC	NO	CS	AS	MK	MC	EI
GS		.64	.75	.64	.41	.33	.60	.66	.59	.64
AR			.68	.64	.52	.41	.55	.82	.69	.62
WK				.75	.46	.36	.57	.66	.58	.61
PC					.46	.43	.52	.62	.57	.53
NO						.65	.32	.51	.36	.33
CS							.32	.44	.33	.31
AS								.51	.59	.61
MK									.64	.61
MC										.60
EI										

[a]Weighted samples.

TABLE 20. ASVAB Subtest Intercorrelations for 11th Grade Males[a]

	GS	AR	WK	PC	NO	CS	AS	MK	MC	EI
GS		.72	.81	.72	.53	.45	.65	.67	.71	.76
AR			.73	.71	.61	.55	.53	.84	.66	.63
WK				.79	.59	.55	.60	.69	.71	.74
PC					.64	.60	.53	.70	.63	.66
NO						.68	.34	.61	.49	.49
CS							.33	.55	.48	.45
AS								.45	.69	.66
MK									.62	.61
MC										.71
EI										

[a]Weighted samples.

TABLE 21. ASVAB Subtest Intercorrelations for 12th Grade Males[a]

	GS	AR	WK	PC	NO	CS	AS	MK	MC	EI
GS		.68	.79	.68	.51	.49	.62	.63	.67	.73
AR			.67	.68	.60	.49	.49	.79	.66	.60
WK				.77	.54	.51	.55	.66	.60	.71
PC					.55	.53	.51	.63	.61	.64
NO						.60	.33	.61	.41	.40
CS							.31	.53	.42	.39
AS								.38	.71	.71
MK									.58	.54
MC										.70
EI										

[a]Weighted samples.

TABLE 22. ASVAB-14 Composite Intercorrelations for Combined Males and Females[a] in Grades 11-12

Composite	AA	VBL	MTH	MC	BC	EE	HST
Academic Ability		.93	.92	.82	.89	.92	.96
Verbal			.77	.77	.86	.88	.90
Math				.78	.87	.93	.89
Mechanical & Crafts					.68	.90	.92
Business & Clerical						.85	.84
Electronics & Electrical							.93
Health, Social & Technology							

[a]Weighted samples.

Grade And Sex Differences

Composite standard score means and standard deviations for weighted grade and sex samples are shown in Table 23. The standard scores are referenced to the Youth Population, ages 18-23, with raw score means and standard deviations transformed to 50 and 10, respectively. For the total (combined sex) groups, grade 11 means ranged from 46.2 on Mechanical & Crafts to 48.5 on Math. Grade 12 means ranged from 48.0 on Mechanical & Crafts to 49.5 on Math. Increases from grades 11 to 12 were about two standard score points (or about .2 of a standard deviation) except on Math which increased one point. Grade 12 means were about one point below those for the 1980 Youth Population, except on Mechanical & Crafts which was two points below. Composite standard score means for students attending two-year colleges ranged from 52.0 on Mechanical & Crafts to 53.7 on Business & Clerical. These means were about three points above those for the 1980 Youth Population.

Grade Differences, 11th-12th Grade

Grade differences were generally larger for males than for females. Male standard score increases from the 11th to the 12th grades ranged from about two points on Math to three points on Mechanical & Crafts; the overall average was 2.5 standard score points. For females, increases from the 11th to the 12th grades ranged from zero points on Math to about one point on Verbal; the overall average was two-thirds of a standard score point. It is possible that the lack of score improvement for females in Math from grades 11 to 12 is due to the relatively substantial proportion of females who do not take any math courses in the 12th grade.

Grade percentile differences can be determined from the norms contained in Appendix B. Median (50th) percentile score changes are shown in Table 24. Increases from grade 11 to grade 12 varied from five to ten percentile points on Math and Academic Ability, respectively.

As was the case with standard scores, percentile differences between grades 11 and 12 were greater for males than for females. At the median (50th percentile), the increase for males averaged ten percentile points, while the increase for females averaged about 4.5 percentile points.

Grade Differences, 10th-11th Grade (ASVAB-5 Data)

ASVAB-5 norms, which are based on students who were enrolled in high school and tested during School Year 1980-1981, were compared for grades 10 versus 11. Three composites (VBL, MTH, and MC) with high ASVAB-5 and ASVAB-14 similarity were examined. These three composites also have minimal overlap in subtest content (i.e., MTH and MC have only the subtest AR in common). The assumption was made that changes from 10th to 11th graders on ASVAB-14 would be similar to changes from 10th to 11th graders on ASVAB-5. Table 25 shows the percentile (in the youth population metric) increases that would be expected for students of different aptitude levels on ASVAB-14 based on data from ASVAB-5. At the median, an increase of 9-11 percentile points is expected. Probable changes between grades 10 and 11, however, appear to be influenced more by aptitude level (i.e., low, average, or high) than by sex or particular composite. Sex or composite differences account for, at most, an increase of three percentile points. In contrast, 10th grade students with moderate scores can be expected to improve by 8 or 9 percentile points more than those with extreme scores (Wilfong & Graham, 1981).

Sex Differences

Table 26 presents ASVAB-14 composite standard score differences between sexes for the 10th and the 12th grades. Male and female Academic Composite scores are nearly identical in the 10th grade, but by the 12th grade male average scores are higher than female average scores. For the Occupational Composites, male average scores are higher for the MC, EE, and HST composites, while female average scores are higher for the BC composite. These differences persist across grades.

Norms

Current norms for ASVAB-14 are presented in Appendix B. These norms are displayed by composite, sex, and grade. Norms are also provided for the 1980 Youth Population and for students attending two-year colleges.

Table 23. ASVAB–14 Composite Standard Score Means and Standard Deviations[a]

Composites	11th Grade Mean	11th Grade SD	12th Grade Mean	12th Grade SD	Two-Year College Mean	Two-Year College SD
FEMALES						
Academic Ability	46.96	8.77	48.01	8.91	51.37	7.84
Verbal	46.85	9.02	48.16	8.91	52.28	7.14
Math	48.63	9.14	48.67	9.19	51.30	8.63
Mechanical & Crafts	43.39	6.88	44.05	7.34	47.45	7.28
Business & Clerical	48.91	9.00	49.50	8.49	53.38	7.71
Electronics & Electrical	46.12	8.47	46.63	8.67	50.07	8.00
Health, Social, & Technology	45.87	8.34	46.76	8.46	50.31	7.81
MALES						
Academic Ability	46.83	10.02	49.37	9.49	55.13	7.65
Verbal	46.48	10.27	49.08	9.63	54.59	7.34
Math	48.39	9.87	50.30	9.58	55.42	8.80
Mechanical & Crafts	48.78	9.27	51.74	9.27	57.82	8.73
Business & Clerical	45.78	9.27	48.28	9.16	54.09	7.76
Electronics & Electrical	48.21	9.72	50.71	9.41	56.37	8.43
Health, Social, & Technology	47.82	10.01	50.44	9.52	56.25	8.05
TOTAL						
Academic Ability	46.89	9.44	48.73	9.24	53.30	7.87
Verbal	46.66	9.69	48.63	9.30	53.29	7.32
Math	48.51	9.52	49.51	9.43	53.11	8.94
Mechanical & Crafts	46.17	8.64	47.98	9.22	51.39	9.47
Business & Clerical	47.32	9.56	48.87	8.86	53.69	7.65
Electronics & Electrical	47.18	9.20	48.72	9.29	52.83	8.77
Health, Social, & Technology	46.87	9.29	48.67	9.23	52.92	8.45

[a]Weighted samples.

Table 24. Average ASVAB-14 Composite Percentile Changes at the Median from the 11th to the 12th Grade

Group	AA	VBL	MTH	Composite MC	BC	EE	HST
Male	12	11	9	11	8	12	8
Female	8	8	−1	5	4	1	6
Average	10	9	5	8	6	6	7

Table 25. Expected Percentile Increases From 10th to 11th Grade for ASVAB-14 Composites

	Composites								
	Verbal		Math		Mechanical & Crafts*		Average		
Percentile Range	Male	Female	Male	Female	Male	Female	Male	Female	Total
01-10	1-3	1-3	1-3	1-2	1-4	1-3	1-3	1-3	1-3
11-20	3-6	3-5	3-5	2-4	4-6	3-4	3-6	3-4	3-5
21-30	6-8	5-7	5-7	4-5	7-9	5-6	6-8	5-7	6-7
31-40	9-10	7-9	7-8	5-7	10-11	6-8	8-10	6-8	7-9
41-80	10-12	9-10	9-10	7-9	12-14	8-9	10-12	8-9	9-11
81-90	5-9	5-8	5-8	4-6	7-11	4-7	6-9	4-7	5-8
91-95	2-4	2-4	2-4	2-4	2-6	2-4	2-5	2-4	2-4
96-98	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2

*Based on ASVAB-5 Trade Technical Composite.

Note: These percentile change data are based on ASVAB-5 norms for School Year 1980-1981 (Wilfong & Graham, 1981).

TABLE 26. ASVAB-14 Means and Standard Deviations of Composite Standard Scores by Sex and Grade[a]

Grade/Sex	Composite						
	VBL	MTH	AA	MC	BC	EE	HST
10th Grade							
Males							
Mean	38.41	41.75	39.19	42.19	38.11	40.99	40.28
SD	8.97	6.77	8.33	7.57	7.79	7.42	8.00
Females							
Mean	38.49	41.14	38.97	36.17	40.10	39.06	38.76
SD	8.80	6.09	7.62	5.48	7.67	6.52	7.21
Sex Difference/SD[b]	−.01	−.09	.03	.93	−.26	.28	.20
% of Variance[c] (r^2 Difference)	.000	.002	.000	.216	.017	.020	.010
12th Grade							
Males							
Mean	49.08	50.30	49.37	51.74	48.28	50.71	50.44
SD	9.63	9.58	9.49	9.41	9.16	9.41	9.52
Females							
Mean	48.16	48.67	48.01	44.05	49.05	46.63	46.76
SD	8.91	9.19	8.91	7.34	8.49	8.67	8.46
Sex Difference/SD[b]	.10	.17	.15	.92	−.14	.45	.41
% of Variance[c] (r^2 Difference)	.002	.007	.005	.212	.005	.051	.042

[a]Weighted samples.
[b]Sex Difference/SD is the difference between male and female means divided by the combined standard deviations.
[c]Percent (%) of variance is the proportion of score variance accounted for by the sex difference as estimated by the squared point biserial correlation coefficient (r). The two variables in the correlation are gender, dichotomized 1 for male and 0 for female, and test scores.

Sampling Effects

The reference population was designed to be nationally representative. The sampling procedures were reviewed and approved by an independent panel of experts which included a representative of the U.S. Bureau of the Census and the author of a leading text on survey sampling (See Annotated Bibliography, Frankel & McWilliams, 1981). Statistical weighting and stratified probability sampling selection procedures were employed to ensure stable and unbiased results for major minority subgroups (including Hispanics and Blacks) and to adjust for any bias resulting from the lack of test scores for about 6 percent of the original sample which was not tested.

One standard error (SE) of the mean is the value within which the observed sample mean will vary from the true mean about 68 percent of the time. In order to obtain good estimates of the SEs of ASVAB score means and percentiles, the *effective sample sizes* should be used. Table 27 gives the effective sample sizes and the SE of means of composites for the various norm groups.

The SE of the means are all around .5 standard score points. For each composite, the SE of the median

(50th percentile) is about .7 standard score points across all samples. These sampling deviation values are considerably less than the SE of Measurement, which is about 2.5 standard score points for each composite. These results indicate that the sample sizes for the normative groups are adequate.

TABLE 27. Effective Sample Sizes and Standard Errors of Means for Norm Groups in Standard Score Units

Norm Group	Effective Sample Size	Composite Standard Score Standard Errors						
		AA	VBL	MTH	MC	BC	EE	HST
Grade 11								
Male	472	.46	.47	.45	.43	.45	.45	.46
Female	414	.43	.44	.45	.34	.44	.42	.41
Grade 12								
Male	431	.46	.46	.46	.45	.44	.45	.46
Female	398	.45	.45	.46	.37	.43	.43	.42
Two-Year College								
Male	187	.56	.54	.64	.64	.55	.62	.59
Female	268	.48	.44	.53	.44	.47	.49	.48

Reliability concerns the degree to which errors of measurement affect test scores. Measurement errors are not usually related to the aptitude or behavior being assessed; rather these errors are related to factors that prevent an individual from achieving the identical score over repeated measurement sessions.

The most straightforward approach to assessing reliability is the simple test-retest technique. However, this technique presents certain problems. For example, scores obtained in a retest session could reflect the effect of gains due to practice. Also, if the period between the initial test and the retest is brief, the retest score could include an effect due to simple recall. Consequently, techniques other than the test-retest procedure have been employed to assess reliability. These are (1) internal consistency and (2) alternate form reliability. Discussions of various reliability techniques are in such texts as Anastasi (1982), Cronbach (1970), and Gulliksen (1950).

Internal Consistency

One measure of reliability is interitem consistency and is based on the consistency of responses of all items on the test; that is, the degree of similarity with which each individual item appears to distinguish high scorers on the subtest from low scorers. Estimates of ASVAB-14 subtest interitem consistency based on Kuder-Richardson Formula 20 (KR 20) are presented in Table 28. These figures indicate the extent to which all the subtest items measure the same construct.

The KR 20 reliabilities are fairly high for the total grade groups, being in the .8 to .9 range except for the short (20 item) EI subtest (.72 for 11th and .77 for 12th grades). Very little difference exists between grades. The technical subtests (AS, MC, & EI) are moderately reliable for females (ranging from .57 to .67). However, the KR 20 reliability of the Mechanical & Crafts composite which contains these subtests is .87 and .89 for 11th and 12th grade females, respectively (from Table D-3 of the *Counselor's Manual for ASVAB-14*) (1984).

TABLE 28. ASVAB-14 Subtest Reliability Coefficients[a] by Grade and Sex[b]

	Females		Males		Total	
Subtest	11th Grade	12th Grade	11th Grade	12th Grade	11th Grade	12th Grade
General Science	.77	.78	.82	.82	.80	.81
Arithmetic Reasoning	.87	.88	.90	.90	.88	.90
Word Knowledge	.89	.89	.91	.91	.90	.90
Paragraph Comprehension	.76	.76	.81	.79	.79	.78
Numerical Operations[c]	—	—	—	—	—	—
Coding Speed[c]	—	—	—	—	—	—
Auto & Shop Information	.57	.57	.81	.82	.78	.81
Mathematics Knowledge	.89	.88	.90	.89	.89	.88
Mechanical Comprehension	.67	.66	.81	.82	.78	.79
Electronics Information	.58	.64	.77	.78	.72	.77

[a]Reliability estimated by KR 20.
[b]Weighted samples.
[c]KR 20 is inappropriate for speeded tests.

Alternate Form Reliability

In this procedure, the same person takes two alternate forms of the test. The correlation between the scores obtained on the two forms is an assessment of the reliability of the test. Alternate form reliabilities for ASVAB Forms 8, 9, and 10 were calculated using responses from Service applicants. The reliability coefficients for grades 11-12 are based on 5, 517 Service applicants, ages 16-18, who took two forms of the ASVAB in 1983. The coefficients have been adjusted for attenuation according to the standard deviation for each subsample of the reference population (ages 16 to 23) which took Form 8a in 1980 (see Table 12). This adjustment, based on formula 10-5 in Gulliksen (1950), allows Service applicant groups to be used to estimate reliabilities for other populations. The coefficients for the postsecondary and American Youth populations are based on 13,772 Service applicants from the full age range of service applicants who took two forms of the ASVAB in 1983. ASVAB Form 8a was taken first, followed by ASVAB Forms 9 or 10 on the next day. Subtest reliability coefficients for grade and sex groups are presented in Table 29, and composite reliabilities are presented in Table 30.

TABLE 29. ASVAB-14 Alternate Form Reliability Estimates

Subtest	11th Grade		12th Grade	
	Male	Female	Male	Female
General Science (GS)	.82	.78	.82	.79
Arithmetic Reasoning (AR)	.89	.85	.89	.86
Word Knowledge (WK)	.90	.87	.89	.87
Paragraph Comprehension (PC)	.83	.75	.80	.74
Numerical Operations (NO)	.78	.76	.78	.75
Coding Speed (CS)	.77	.73	.75	.73
Auto & Shop Information (AS)	.82	.63	.82	.63
Mathematics Knowledge (MK)	.89	.87	.88	.85
Mechanical Comprehension (MC)	.79	.71	.79	.70
Electronics Information (EI)	.76	.57	.76	.62

TABLE 30. Alternate Form Reliabilities for ASVAB-14 Composites

Composite	Grade 11	Grade 12	Two-Year College	Youth Population
Academic Ability	.93	.93	.88	.93
Verbal	.93	.93	.89	.94
Math	.92	.92	.92	.94
Mechanical & Crafts	.89	.90	.92	.93
Business & Clerical	.94	.93	.90	.93
Electronics & Electrical	.93	.93	.92	.94
Health, Social, & Technology	.94	.93	.93	.95

The Service applicants did not have time to take all of the subtests in ASVAB-8a. As a result, data were not available for all of the subtests in two ASVAB composites: Business & Clerical; and Health, Social, & Technology. Reliability coefficients for these two composites were calculated using the formulae in Wherry and Gaylord (1943), based on data on the reliabilities and intercorrelations of the subtests.

The subtest alternate form estimates in Table 29 are generally similar to the KR 20 reliabilities in Table 28. It should be noted that the alternate form reliability coefficients of Auto and Shop Information for females in 11th and 12th grades exceed the internal consistency reliability estimates. This is usually an indication of a multifactor test. In this case, the value of the KR 20 coefficient should be viewed as an underestimate. The same is true for Mechanical Comprehension. This is not observed for male subjects.

The composites are quite reliable, as the coefficients ranged from .88 to .94 across grade groups (see Table 30). Youth Population reliabilities were slightly higher, .93 to .95. This increase in reliability is prinicipally due to greater score variability. Coefficients were generally lowest for the two-year college group: .88 to .93, due to restricted variability. Table 23 (Chapter 2) shows that the standard deviations for this group are generally below 9.0, compared to 10.0 for the Youth Population. Separate coefficients for each gender are in the *Counselor's Manual for ASVAB-14*, Appendix D.

Standard Errors Of Measurement And Differences

Any test score is but an estimate of the individual's true score; that is, each test score contains both the person's true score and an error component. Because of measurement error, an individual in one instance could test higher than his or her true score and in another instance could score lower. The ideal situation would be to test the individual an infinite number of times to obtain the individual's true score (the central score) and a measure of deviation of these scores. Since this is impossible, an alternative method is used to estimate the influence of error in a test score.

This estimate is the Standard Error of Measurement (SEM) and is based on the reliability and variance of the test. The more reliable the test is, the smaller is its SEM, and the more precisely the test measures. The SEM estimates the standard deviation of the distribution of errors of measurement. It is the standard deviation of the expected distribution of observed scores around the individual's true score. The SEM is an indication of the variability in observed scores from true score.

For the ASVAB, the SEM is used to construct the composite score confidence bands, which correspond to plus or minus one SEM from the observed composite score. This band represents a reasonable range within which the true score should fall. In 68 percent of the cases, this ±1 SEM confidence band should include the individual's true test score. The SEM for each composite for all groups are shown in Table 31.

TABLE 31. Standard Errors of Measurement of ASVAB Composites (Standard Scores)

Composite	Grade 11-12	Two-Year College	Youth Population
Standard Errors for Males			
Academic Ability	2.4	2.7	a
Verbal	2.5	2.4	a
Math	2.6	2.5	a
Mechanical & Crafts	2.6	2.6	a
Business & Clerical	2.4	2.4	a
Electronics & Electrical	2.4	2.4	a
Health, Social, & Technology	2.3	2.3	a
Standard Errors for Females			
Academic Ability	2.4	2.7	a
Verbal	2.4	2.4	a
Math	2.7	2.7	a
Mechanical & Crafts	2.8	2.5	a
Business & Clerical	2.5	2.4	a
Electronics & Electrical	2.5	2.5	a
Health, Social, & Technology	2.5	2.3	a
Standard Errors for Combined Samples			
Academic Ability	2.4	2.7	2.7
Verbal	2.4	2.4	2.4
Math	2.7	2.5	2.5
Mechanical & Crafts	2.9	2.7	2.7
Business & Clerical	2.3	2.4	2.4
Electronics & Electrical	2.5	2.4	2.5
Health, Social, & Technology	2.3	2.2	2.2

[a]Not computed for the Youth Population.

In a similar fashion a Standard Error of Difference (SED) can be constructed to give a probability estimate of the difference between two test scores. The SED is based on the SEM of any two tests.

The SEM and the SED of the composites are computed by the following formulae:

$$SEM = S_x \sqrt{1 - r_{xx}}$$

where S_x = the standard deviation of scores,

r_{xx} = the test reliability of alternate forms,

and

$$SED = \sqrt{SEM_1^2 + SEM_2^2}$$

where SEM = the Standard Error of Measurement.

Differences between composites with one or more subtests in common are affected only by the subtests which are different and not by those which are common to the composites. For example, the Business and Clerical (BC) and the Health, Social, and Technology (HST) composites both contain the Verbal score:

$$BC = \underline{VE} + CS + MK \text{ and } HST = \underline{VE} + AR + MC.$$

Therefore,

$$SED_{BC-HST} = \sqrt{SEM^2_{CS+MK} + SEM^2_{AR+MC}}$$

When computing the SED for a pair of composites, the SEM^2 must be computed for the combination of subtests that is unique for each composite. The SED between pairs of Occupational Composites and pairs of Academic Composites for 11th and 12th grade students are shown in Table 32. Note that the SEDs tend to be 1.5 to 2 times larger than the SEMs; i.e., 3.6 to 5.1 standard score points for the SEDs versus 2.2 to 2.9 standard score points for the SEMs.

TABLE 32. Standard Errors of Differences Between Academic Composites for Grades 11-12 (Standard Scores)

Composite	Verbal	Math	AA
Standard Errors for Males			
Verbal	2.5[a]		
Math	3.6	2.6	
Academic Ability	5.0	4.4	2.4
Standard Errors for Females			
Verbal	2.4[a]		
Math	3.6	2.7	
Academic Ability	5.1	4.3	2.4
Standard Errors for Combined Samples			
Verbal	2.4[a]		
Math	3.6	2.7	
Academic Ability	5.1	4.3	2.4

[a]Standard Errors of Measurement are in the diagonal.

An example of how to compare an individual's Occupational Composite score is shown in Figure 1. The percentile score bands, which include one SEM on either side of the observed percentile score for each composite, are shown in the figure. The true score for each composite falls within the bar (indicated by brackets) about 68 percent of the time. If the bars do not overlap, or only slightly overlap, then the true scores on the individual composites are probably different. Nonoverlapping bars indicate that the observed percentile scores differ by about 5 standard score points (or about 2 SEMs, which are about 2.5 standard score points each). This difference is equal to one, or slightly more than one SED. Therefore, a reasonable interpretation is that the true scores are probably different for composites with nonoverlapping bars; this interpretation can be expected to be correct about 68 percent of the time.

Examples of Percentile Scores for 11th Grade Males

Standard Score	Occupational Composites MC	BC	EE	HST
38	16	26	12	22
39	20	29	13	23
40	22	[32]	17	25
41	25	35	19	[27]
42	[28]	•38•	22	32
43	31	42	25	34
44	33	[44]	29	•38•
45	•38•	47	[31]	43
46	39	50	34	44
47	43	54	•38•	[47]
48	[46]	58	40	49
49	50	62	[46]	51
50	54	65	50	55
51	59	69	53	59

••Indicates the 38th percentile score.

[ ] Indicates the scores that are ± one SEM around the 38th percentile.

FIGURE 1. Sample Confidence Bands (± One SEM Around the Target Score) Built around the 38th Percentile Score for 11th Grade Males.

The remaining SEMs and SEDs are reported in standard score units in Tables 33 through 37. Overall, no grade differences were found at the first decimal place for grades 11-12 for either SEM or SED. Sex differences were quite small, ranging from 0 to .2 standard score units.

In summary, the reliability of ASVAB 14 composites is quite good (around .93 for 11th and 12th grade students). Further, the Standard Error of Measurement is only about 2.5 points or about one-quarter of a standard deviation. As a consequence, the counselor may have confidence that the ASVAB composite scores are generally reasonable reflections of students' aptitude levels.

TABLE 33. Standard Errors of Differences Between Academic Composites for Two-Year Colleges (Standard Scores)

Composite	Verbal	Math	AA
	Standard Errors for Males		
Verbal	2.4[a]		
Math	3.5	2.5	
Academic Ability	5.1	4.5	2.7
	Standard Errors for Females		
Verbal	2.4[a]		
Math	3.6	2.7	
Academic Ability	5.2	4.5	2.7
	Standard Errors for Combined Samples		
Verbal	2.4[a]		
Math	3.5	2.5	
Academic Ability	5.2	4.4	2.7

[a]Standard Errors of Measurement are in the diagonal.

TABLE 34. Standard Errors of Differences Between Academic Composites for the Youth Population (Standard Scores)

Composite	Verbal	Math	AA
Verbal	2.4[a]		
Math	3.5	2.5	
Academic Ability	5.2	4.8	2.7

[a]Standard Errors of Measurement are in the diagonal.

TABLE 35. Standard Errors of Differences Between Occupational Composites for Grades 11-12 (Standard Scores)

Composites	MC	BC	EE	HST
	Standard Errors for Males			
Mechanical & Crafts	2.6*			
Business & Clerical	3.5	2.4		
Electronics & Electrical	4.3	3.9	2.4	
Health, Social, & Technology	4.3	4.3	3.9	2.3
	Standard Errors for Females			
Mechanical & Crafts	2.8*			
Business & Clerical	3.7	2.5		
Electronics & Electrical	4.4	4.0	2.5	
Health, Social, & Technology	4.3	4.5	4.1	2.5
	Standard Errors for Combined Samples			
Mechanical & Crafts	2.9*			
Business & Clerical	3.5	2.3		
Electronics & Electrical	4.3	3.9	2.5	
Health, Social, & Technology	4.3	4.3	3.9	2.3

*Standard Errors of Measurement are in the diagonal.

TABLE 36. Standard Errors of Differences Between Occupational Composites for Two-Year Colleges (Standard Scores)

Composites	MC	BC	EE	HST
	Standard Errors for Males			
Mechanical & Crafts	2.6*			
Business & Clerical	3.6	2.4		
Electronics & Electrical	4.3	3.9	2.4	
Health, Social, & Technology	4.4	4.3	3.9	2.3
	Standard Errors for Females			
Mechanical & Crafts	2.5*			
Business & Clerical	3.5	2.4		
Electronics & Electrical	4.4	4.0	2.5	
Health, Social, & Technology	4.3	4.4	4.1	2.3
	Standard Errors for Combined Samples			
Mechanical & Crafts	2.7*			
Business & Clerical	3.6	2.4		
Electronics & Electrical	4.4	3.9	2.4	
Health, Social, & Technology	4.4	4.3	3.9	2.2

*Standard Errors of Measurement are in the diagonal.

TABLE 37. Combined Standard Errors of Differences Between Occupational Composites for the Youth Population (Standard Scores)

Composites	MC	BC	EE	HST
Mechanical & Crafts	2.7[a]			
Business & Clerical	3.6	2.4		
Electronics & Electrical	4.2	3.9	2.5	
Health, Social, & Technology	4.5	4.2	4.0	2.2

[a]Standard Errors of Measurement are in the diagonal.

Validation of a test is concerned with determining the degree to which the test provides information relevant to the intended use of the test. There are three generally acknowledged categories of validity: content, construct, and criterion-related. Content validity is somewhat subjective. It is built into a test through choice of appropriate items (Anastasi, 1982). These items should representatively sample the behavior of concern and be as free as possible from irrelevant influences.

Moderately high correlations between a new test and similar earlier tests is evidence that the new test measures about the same general area of behavior, or construct, as other similar tests (Anastasi, 1982). Because construct validity is more theoretical in nature, it is usually not proven in a single study. Instead, acceptance of construct validity is based on an accumulation of research results (e.g., comparisons with other tests, factor reference studies).

To obtain criterion-related validity, performance on the test is checked against an appropriate criterion (Anastasi, 1982). In vocational aptitude and selection testing, which are the main purposes of ASVAB-14, criterion-related validity and content validity are intertwined. For example, job or training performance is frequently used as a measure of success (criterion-related validity) to correlate with scores on the ASVAB, while the items on many of the ASVAB-14 subtests are drawn from the job content domain (content validity) of the aptitude being assessed (e.g., Auto & Shop Information).

The discussion of the validity of ASVAB-14 will be presented in two parts. The first part will present evidence of construct validity by showing the relationship between ASVAB-14 and: (a) previous versions of the ASVAB, and (b) frequently used civilian aptitude/achievement batteries. Part 2 will present the results of predictive validation research to demonstrate the criterion-related validity of ASVAB-14. Part 2 will also review two recent developments that permit the generalization of ASVAB-14 predictive results to civilian occupations.

Part 1: Relationship Of ASVAB-14 To Other Tests

Relationship Of ASVAB Forms 5 And 14

Truss, Hiatt, and Sims (1982) analyzed subtest and composite relationships between ASVAB Forms 5, 6, and 7 and ASVAB Forms 8, 9, 10, and 14. A sample of 2,025 Service applicants took both ASVAB-8a (the reference test of Forms 8 through 14) and ASVAB Forms 6 or 7 (both parallel to ASVAB-5). The correlations between ASVAB-8a subtests and like-named ASVAB-5 subtests are presented in Table 38, while Table 39 presents the correlations between ASVAB-14 composites and the most related ASVAB-5 composites. Subtest correlations were .78 and above, indicating the comparability of like-named subtests in these two forms of the ASVAB. Academic composites for Forms 5 and 14 correlated .92 to .94. The Mechanical & Crafts composite was highly related (.91) to the ASVAB-5 Trade Technical composite. The Form 14 Business & Clerical composite correlated .77 with its most related Form 5 composite, Perceptual/Speed.

As noted earlier, Sims and Hiatt (1983) compared the factor structures of ASVAB Forms 5, 6, and 7 with Forms 8, 9, and 10 (recall that ASVAB-14 is parallel to ASVAB Forms 8, 9, and 10 and in fact contains the same test items as does ASVAB-9a). They found the factor structures to be very similar (see Table 8). These results indicate that validity data collected on ASVAB-5 can be generalized to ASVAB-14 for the majority of subtests and composites (See Part 2, D and E).

ASVAB-14 Versus Civilian Aptitude Batteries

Streicher and Friedman (1983) compared ASVAB Form 14 with three widely-used civilian aptitude and achievement batteries.

Two of the three civilian tests used in this study were the California Achievement Tests (CAT), Form 19C, and the Differential Aptitude Test (DAT), Form V. A math-science vocabulary test from an earlier CAT version (Form X) was added to permit comparison in that content area. The third commercial test consisted of eight subtests from the Flanagan Industrial Tests (FIT) and two subtests from the Flanagan Aptitude Classification Tests (FACT). This combination of subtests was chosen to meet testing time limitations in schools and to permit appropriate comparisons between test batteries.

TABLE 38. Correlations Between ASVAB-8a Subtests and Like-Named ASVAB-5 Subtests

Subtest	Correlation Coefficient
General Science	.81
Arithmetic Reasoning	.86
Word Knowledge	.87
Paragraph Comprehension	a
Numerical Operations	.78
Coding Speed	a
Auto & Shop Information[b]	.83
Mathematics Knowledge	.84
Mechanical Comprehension	.81
Electronics Information	.78

[a]No comparable subtest exists in ASVAB 5.
[b]The Auto & Shop subtest in ASVAB-8a has no like-named subtest in ASVAB-5 but is most like the Auto Information subtest (AI).

TABLE 39. Correlations Between ASVAB-14 Composites and ASVAB-5 Composites

ASVAB-14 Composites	ASVAB-5 Composites	Correlation Coefficient
Verbal	Verbal	.94
Math	Math	.94
Academic Ability	Academic Ability	.92
Mechanical & Crafts	Trade Technology	.91
Business & Clerical	Perceptual Speed	.77
Electronics & Electrical	Trade Technology	.88
Health, Social, & Technology	[a]	—

[a]No corresponding composite.
Note: These correlations are based on a sample of 2,025 Service applicants who took both forms of the ASVAB.

Because of the targeted audience of the commercial tests, the final sample varied across tests. The CAT sample (n = 1,681) consisted primarily of 10th grade students. The DAT sample (n = 1,338) was predominantly from the 10th and the 11th grades. The Flanagan sample (n = 1,029) was mostly from the 11th and the 12th grades.

Correlations were computed between each of the subtests and composites of the ASVAB and each of the subtests of the CAT, DAT and FIT/FACT. Correlations were also computed between each of the commercial battery subtests and the high school composites as well as the ASVAB Armed Forces Qualification Test (AFQT), the composite score used to track the quality of Service accessions (AFQT = AR + WK + PC + ½ NO). These correlations are presented in Tables 40 to 42.

Table 40. ASVAB-14 and CAT Correlation Coefficients*

	ASVAB Subtests											ASVAB Composites						
CAT Subtests	GS	AR	WK	PC	NO	CS	AS	MK	MC	EI	AFQT	AA	VBL	MTH	MC	BC	EE	HST
Reading Vocabulary-RV	.70	.65	.81	.70	.39	.31	.27	.65	.48	.39	.79	.79	.81	.69	.56	.72	.73	.75
Reading Comprehension-RC	.70	.66	.79	.74	.41	.35	.30	.66	.50	.39	.79	.80	.82	.70	.58	.75	.73	.76
Spelling	.41	.49	.53	.47	.37	.36	.04	.52	.23	.17	.58	.56	.52	.53	.29	.59	.49	.48
Language Mechanics-LM	.47	.57	.59	.55	.42	.39	.07	.62	.33	.22	.65	.64	.59	.63	.37	.67	.58	.58
Language Expression-LE	.60	.64	.72	.68	.42	.37	.19	.66	.41	.32	.75	.75	.73	.68	.49	.72	.67	.69
Mathematics Computation-MC	.51	.70	.55	.57	.48	.39	.15	.75	.39	.28	.71	.70	.60	.77	.48	.72	.69	.65
Mathematics Concepts and Applications-MCA	.62	.80	.67	.67	.49	.40	.26	.83	.52	.37	.81	.82	.73	.86	.61	.80	.80	.78
Reference Skills	.55	.63	.64	.64	.46	.44	.17	.64	.41	.31	.72	.71	.68	.67	.47	.73	.65	.66
Total Reading (RV + RC)	.73	.69	.83	.73	.42	.35	.30	.69	.52	.41	.83	.84	.86	.73	.60	.77	.77	.79
Total Language (LM + LE)	.58	.65	.71	.67	.45	.41	.15	.69	.41	.30	.80	.75	.73	.71	.47	.75	.69	.69
Total Math (MC + MCA)	.59	.79	.66	.65	.51	.42	.22	.83	.48	.35	.76	.80	.70	.86	.58	.79	.78	.75

*Based on 1,681 students.

Table 41. ASVAB-14 and DAT Correlation Coefficients*

DAT Subtests	GS	AR	WK	PC	NO	CS	AS	MK	MC	EI	AFQT	AA	VBL	MTH	MC	BC	EE	HST
	ASVAB Subtests												ASVAB Composites					
Verbal Reasoning-VR	.72	.75	.78	.72	.23	.22	.47	.73	.61	.48	.78	.82	.80	.78	.69	.75	.79	.81
Numerical Ability-NA	.64	.79	.67	.66	.41	.35	.40	.78	.57	.42	.80	.79	.71	.82	.65	.78	.77	.77
Abstract Reasoning-AR	.58	.65	.62	.62	.30	.28	.39	.66	.57	.40	.69	.69	.66	.69	.60	.68	.67	.70
Clerical Speed & Accuracy-CSA	.03	.10	.04	.07	.35	.43	−.03	.13	.03	−.01	.16	.08	.06	.12	.03	.26	.08	.07
Mechanical Reasoning-MR	.66	.62	.63	.60	.20	.12	.63	.58	.73	.59	.65	.68	.69	.63	.76	.58	.72	.75
Space Relations-SR	.61	.66	59	.59	.16	.19	.49	.67	.66	.50	.66	.68	.65	.70	.69	.63	.72	.73
Spelling-S	.53	.54	.60	.57	.32	.36	.27	.54	.39	.35	.64	.62	.61	.57	.46	.65	.58	.58
Language Usage-LU	.68	.67	.76	.72	.20	.26	.39	.67	.55	.48	.76	.78	.78	.71	.62	.73	.74	.75
VR + NA	.73	.82	.78	.74	.33	.30	.47	.80	.63	.49	.84	.86	.81	.85	.72	.81	.84	.84

*Based on 1,338 students.

ASVAB-14 and CAT

Where the two batteries have counterparts, cross battery subtest correlations were substantial, ranging from .70 to .83 (see Table 40). ASVAB subtests with no direct counterparts had low to moderate correlations with CAT subtests. The ASVAB AFQT composite score correlated .71 and above with all of the CAT subtests except Spelling (.58) and Language Mechanics (.65). The CAT composite of Total Reading correlates .86 with Verbal, Total Language correlates .75 with both Academic Ability and Business and Clerical, and Total Math correlates .86 with ASVAB Math.

ASVAB-14 and DAT

The correlations reported are those for the combined 10th through 12th grade sample (see Table 41). The magnitude of the DAT-ASVAB correlation coefficients varied in a predictable way. The highest correlations were in the areas of Word Knowledge/Verbal Reasoning (.78), Arithmetic Reasoning/Numerical Ability (.79), and Mechanical Comprehension/Mechanical Reasoning (.74).

Although the DAT does not have a science subtest, the ASVAB General Science subtest correlated .72 with Verbal Reasoning and .66 with Mechanical Reasoning of the DAT. Paragraph Comprehension, which also has no direct counterpart on the DAT, correlated .72 with the Language Usage and with the Verbal Reasoning subtests of the DAT.

The ASVAB AQFT correlated, moderate to high, with all DAT subtest scores except Clerical Speed and Accuracy which correlated moderately (.43) with CS. Excluding this subtest, AFQT correlations ranged from .[illegible] to .80 with a median of .68 with DAT subtests. The ASVAB composites (except Mechanical) correlate in the .80s with the DAT sum of Verbal Reasoning and Numerical Ability.

ASVAB-14 and FIT/FACT

Overall, correlations between the ASVAB and the Flanagan subtests were much lower than those between the CAT and the DAT subtests. Only three correlations exceeded .60. The correlations with the ASVAB AFQT composite score and with the ASVAB composites were in the moderate range. These correlations appear to be lower than expected because of low variances on the FIT/FACT subtests.

Of the three commercial tests used in this study, the CAT and the DAT batteries show moderate to strong correlations with the ASVAB. The ASVAB AFQT score also generally correlates highly with CAT and DAT subtests. However, the correlations between the Flanagan subtests and the ASVAB tend to be moderate to low; similar correlations were found for the AFQT-Flanagan comparison. The implications of these findings are that ASVAB-14 measures the same verbal and math domains as CAT, and the same verbal, quantitative, and mechanical areas as DAT.

ASVAB-5 Versus Civilian Aptitude Batteries

The current high school ASVAB is a direct descendant of ASVAB-5. ASVAB-5 has been compared to both the General Aptitude Test Battery (GATB) and the DAT (Kettner, 1977). A sample of 1232 students in grades 10 through 12, equally distributed by sex, was administered ASVAB-5 and either the DAT or the GATB. Averaged intercorrelations are presented in Tables 43 and 44. Factor analytic-derived structures for the subtests are presented in Table 45.

Table 43 presents data that show intercorrelations between ASVAB-5 and the GATB subtests. These correlations are averages across grade and sex. Moderately high correlations were obtained between GATB Arithmetic Reasoning and ASVAB AR (.74) and MK (.73), and between GATB Vocabulary and ASVAB WK (.73). Moderate-to-high relationships were also found between GATB Computation and ASVAB NO (.68) and MK (.66), between GATB Dimensional Space and ASVAB SP (.67) and MC (.59), and between GATB Name Comparison and ASVAB NO (.56). These relationships are important in generalizing predictive validity data collected on GATB to ASVAB (see Part 2, E).

Table 44 presents average intercorrelations between ASVAB-5 and DAT subtests. These relationships are very similar to those shown in Table 41 between ASVAB-14 and DAT subtests. Verbal Reasoning of DAT correlated .79 with ASVAB-5 WK (compared to .78 with ASVAB-14 WK). Numerical Ability of DAT correlated .81 with ASVAB-5 AR (compared to .79 with ASVAB-14 AR). Also, MC of ASVAB-5 correlated .67 with Mechanical Reasoning (MR) of DAT (compared to .73 between ASVAB-14 MC and DAT MR), and .64 with Space Relations (SR) of DAT (the same as between ASVAB-14 MC and DAT SR). The similar patterns of correlations of DAT with both ASVAB-5 and ASVAB-14 subtests reinforce the comparability of like-named subtests from these two forms of ASVAB.

The results discussed in Part 1 of this chapter were the construct validity of ASVAB. This includes the similarity of key ASVAB subtests across Forms 5 and 14, and the similarity with key subtests of the CAT, DAT, and GATB.

The ASVAB composites cover all of the same aptitude areas as do the CAT and DAT with the exception of spelling, language use, and spacial perception. ASVAB-14 subtests cover much of the area measured by GATB written subtests except for the Tool and Form Matching and Mark Making. The construct validity of ASVAB is therefore strongly indicated by its similarity to these frequently used commercial aptitude measures.

Table 42. ASVAB-14 and FIT/FACT Correlation Coefficients*

FIT/FACT Subtests	ASVAB Subtests											ASVAB Composites						
	GS	AR	WK	PC	NO	CS	AS	MK	MC	EI	AFQT	AA	VBL	MTH	MC	BC	EE	HST
Arithmetic	.35	.48	.35	.37	.49	.52	.07	.51	.26	.23	.53	.47	.40	.52	.32	.59	.46	.44
Electronics	.38	.36	.32	.30	.08	.04	.43	.30	.43	.49	.34	.38	.37	.35	.53	.27	.46	.44
Expression	.41	.34	.46	.40	.31	.36	.01	.43	.16	.16	.47	.44	.47	.41	.21	.52	.40	.37
Judgment and Comprehension	.46	.46	.51	.50	.21	.25	.08	.48	.30	.29	.53	.54	.55	.50	.34	.51	.50	.50
Reasoning	.52	.67	.55	.58	.30	.29	.17	.70	.44	.35	[illegible]	.69	.62	.73	.50	.64	.67	.66
Mechanics	.40	.28	.31	.21	−.03	−.06	.65	.18	.51	.50	.25	.31	.34	.25	.60	.16	.42	.42
Scales	.41	.52	.43	.40	.34	.41	.26	.49	.41	.35	.54	.53	.46	.54	.47	.53	.53	.53
Tables	.30	.44	.36	.42	.47	.55	−.01	.45	.20	.18	.53	.46	.41	.47	.25	.59	.41	.41
Vocabulary	.48	.45	.56	.48	.12	.15	.21	.47	.35	.33	.52	.55	.57	.49	.41	.47	.52	.53
Coding	.30	.33	.31	.41	36	.38	−.15	.41	.17	.16	.44	.38	.39	.40	.15	.48	.36	.34

*Based on 1,029 students.

Table 43. Average Intercorrelations* Between ASVAB-5 and GATB Subtests

ASVAB-5 Subtests	GATB Subtests							
	NC	CO	DS	VO	TM	AR	FM	MM
GI	.16	.19	.19	.34	.12	.26	.12	.01
NO	.56	.68	.37	.42	.50	.53	.42	.40
AD	.34	.31	.30	.15	.44	.19	.31	.40
WK	.31	.44	.35	.73	.20	.61	.22	.04
AR	.40	.44	.51	.59	.28	.74	.41	.08
SP	.30	.40	.67	.37	.29	.48	.44	.12
MK	.44	.66	.49	.64	.36	.73	.45	.14
EI	.16	.51	.50	.42	.20	.40	.24	.01
MC	.20	.32	.59	.41	.17	.50	.35	−.04
GS	.23	.33	.45	.60	.19	.49	.21	.02
GB	.20	.31	.37	.54	.19	.43	.19	−.01
SI	.23	.26	.47	.36	.29	.40	.34	.08
AI	.09	.16	.42	.23	.13	.21	.25	−.02

*Coefficients reported are the average of 11th and 12th grade male and female students. The total sample was 616.

ASVAB-5 Subtests:

General Information (GI)
Numerical Operations (NO)
Attention to Detail (AD)
Word Knowledge (WK)
Arithmetic Reasoning (AR)
Space Perception (SP)
Math Knowledge (MK)
Electronics Information (EI)
Mechanical Comprehension (MC)
General Science (GS)
General Biological Science (GB)
Shop Information (SI)
Automotive Information (AI)

GATB Subtests:

Name Comparison (NC)
Computation (CO)
Dimensional Space (DS)
Vocabulary (VO)
Tool Matching (TM)
Arithmetic Reasoning (AR)
Form Matching (FM)
Mark Making (MM)

Table 44. Average Intercorrelations* Between ASVAB-5 and DAT Subtests

ASVAB-5 Subtests	DAT Subtests							
	VR	NA	AR	CS	MR	SR	SG	LU
GI	.48	.37	.31	.09	.33	.26	.27	.44
NO	.43	.62	.47	.53	.31	.31	.47	.42
AD	.15	.23	.24	.43	.08	.17	.19	.18
WK	.79	.59	.47	.19	.53	.45	.58	.75
AR	.75	.81	.66	.27	.57	.59	.42	.66
SP	.53	.49	.58	.16	.55	.77	.23	.43
MK	.73	.87	.69	.28	.56	.59	.54	.69
EI	.60	.45	.45	.08	.55	.49	.33	.49
MC	.61	.55	.55	.12	.67	.64	.31	.51
GS	.67	.54	.49	.14	.51	.49	.39	.59
GB	.59	.46	.43	.04	.41	.40	.38	.54
SI	.38	.28	.29	.09	.42	.40	.24	.31
AI	.31	.19	.21	-.03	.36	.30	.12	.22

*Coefficients reported are the average of 11th and 12th grade male and female students. The total sample was 616.

ASVAB-5 Subtests:

General Information (GI)
Numerical Operations (NO)
Attention to Detail (AD)
Word Knowledge (WK)
Arithmetic Reasoning (AR)
Space Perception (SP)
Math Knowledge (MK)
Electronics Information (EI)
Mechanical Comprehension (MC)
General Science (GS)
General Biological Science (GB)
Shop Information (SI)
Automotive Information (AI)

DAT Subtests:

Verbal Reasoning (VR)
Numerical Ability (NA)
Abstract Reasoning (AR)
Clerical Speed and Accuracy (CS)
Mechanical Reasoning (MR)
Space Relations (SR)
Spelling (SG)
Language Usage (LU)

Table 45. Aptitudes Measured in Common by ASVAB-5, DAT, and GATB

ASVAB-5 Subtest	DAT Counterpart	GATB Counterpart
Numerical Operations	Numerical Ability	Computation/Arithmetic Reasoning
Word Knowledge	Verbal Reasoning/Language	Vocabulary
Space Perception	Space Relations	Dimensional Space
Arithmetic Reasoning/Math Knowledge	Numerical Ability	Computation/Arithmetic Reasoning
Mechanical Comprehension	Mechanical Reasoning	—

Part 2: Predictive Validity

Service Validity Data

Validity studies on ASVAB-14 and its parallel forms (i.e., ASVAB Forms 8, 9, 10) demonstrate that the ASVAB has the ability to predict performance in both military and civilian settings. In a study of the validity of ASVAB-14 composites, Maier and Truss (1984) investigated the validity of the Academic and the Occupational Composites for predicting performance in Marine Corps military training courses. Marine Corps enlistees were administered ASVAB Forms 8, 9, or 10; their ASVAB scores were later correlated with their scores in training school. Sample sizes ranged from 256 to 1,880 for different training courses. The correlations, corrected for range restriction using a multivariate procedure (Mifflin & Verna, 1977), are presented in Table 46. The validities for predicting performance in related occupational groups ranged from .64 to .69. The mean validity of the occupational groups was .67.

TABLE 46. Validity of ASVAB-14 Composites; Correlations[a] Between ASVAB Composite Scores and Final School Grade in Marine Corps Training Courses

		Composites						
			Occupational				Academic	
Occupational Group[b]	Number of Courses	MC	BC	EE	HST	AA	VBL	MTH
Mechanical & Crafts	9	.64	.57	.63	.63	.60	.59	.57
Business & Clerical	9	.52	.67	.63	.62	.65	.59	.64
Electronics & Electrical	3	.63	.63	.69	.67	.66	.63	.67
Health, Social, & Technology	2	.60	.66	.66	.66	.66	.65	.63

[a]Correlation coefficients corrected for range restrictions and then averaged across courses.

[b]Mechanical & Crafts include, for example, auto, aviation, engineering equipment, and refrigerator mechanics.

Business & Clerical include, for example, administrative, finance, personnel, stock, travel clerks, and communication operators.

Electronics & Electrical include, for example, electrical and electronics repair, and field radio operators.

Health, Social & Technology include, for example, cooks and ordinance specialists.

A comprehensive investigation based upon 64,907 enlisted Army accessions in Fiscal Years 1981 and 1982 examined the validity of the high school composites on a combined criterion of training success and a written job performance test. All the Army accessions had taken one form of ASVAB 8, 9, or 10. The results of this validation research are presented in Table 47. When there is an obvious relation between the Army Occupational Group and a matching high school composite (e.g., in the Clerical, Electronics, General Motor Maintenance, or Skill Technical areas), the matching high school composite has the highest validity coefficient. Overall, the average validity coefficient on the combined criterion of training success and job performance was .47 (McLaughlin, Rossmeissl, Wise, Brandt, & Wing, 1984).

TABLE 47. Validities[a] of ASVAB-14 Occupational Composites for a Combined Army Training and Job Performance Criterion

Army Occupational Group	Sample Size	Composite			
		MC	BC	EE	HST
Clerical	10,368	.47	.54	.53	.53
Combat	14,266	.43	.40	.43	.44
Electronics	5,533	.47	.43	.47	.47
Field Artillery	5,602	.49	.44	.48	.49
General Maintenance	2,571	.47	.43	.46	.47
Motor Maintenance	7,073	.49	.42	.46	.47
Operators/Food	8,704	.48	.43	.47	.48
Surveillance/Communications	3.729	.48	.44	.48	.49
Skilled Technical	7,061	.54	.56	.57	.58
Average Validity	—	.48	.45	.48	.49

[a]Correlation coefficients corrected for range restrictions.

Subgroup Validity Comparisons

Male-Female Comparisons

Data from the Air Force Human Resources Laboratory provide information on a comparison between males and females with regard to ASVAB validity. The data presented in Table 48 were based on 73 Service technical training courses. All samples contained at least 100 trainees, including at least 50 women. The criteria were end-of-course grades. Median validities on each composite were comparable for males and females.

TABLE 48. ASVAB-14 Occupational Composite Validities for Male and Female Graduates of Armed Services Technical Training Schools

				Validity Coefficients[b]			
			Median	Uncorrected		Corrected[c]	
		No. of	Sample				
Composite	Sex	Crs[a]	Size	Range	Median	Range	Median
Mechanical	M	13	930	.23-.51	.46	.21-.65	.56
& Crafts	F	13	82	.03-.47	.35	.19-.72	.57
Business	M	20	375	.19-.57	.38	.25-.84	.56
& Clerical	F	20	96	.04-.53	.31	−.08-.89	.58
Electronics	M	12	557	−.07-.50	.44	.06-.70	.54
& Electrical	F	11	71	−.06-.54	.30	.04-.83	.52
Health, Social,	M	26	348	.12-.54	.37	.14-.80	.58
& Technology	F	25	104	.07-.55	.37	.05-.76	.65

[a]Number of courses (Crs) by Service are: Air Force—39; Army—26; Marine Corps—4; and Navy—4. Appropriate composite is based on highest correlation with course selector composite.
[b]Correlations of composite scores with end-of-course grades. Grades for some courses have low variance (standard deviations less than 5.0). Therefore, the absolute validity for these is underestimated; however, the relative validity for males and females can be compared.
[c]Validities corrected using a multivariate procedure refined by Lawley in Mifflin and Verna (1977).

Race Comparisons

Correlations of training grades with military composite scores computed separately for Blacks and Whites are available from Service validation studies. Uncorrected validity coefficients were reported by Wilbourn, Valentine, and Ree (1984) for Air Force courses with at least 25 Blacks (median sample size for combined races was over 400). These coefficients were subsequently corrected for range restriction. Median validities by race are shown in Table 49 for Occupational Composite groups. Corrected validities across racial samples were similar in three of the four groups, with the median validity being appreciably lower for Blacks than Whites in only the Mechanical & Crafts group.

TABLE 49. Air Force Composite Validities by Race for Occupational Composite Groups

Occupational Composite	Race	Number of Courses	Sample Size Range	Sample Size Median	Validity Coefficient Uncorrected Range	Uncorrected Median	Corrected Range	Corrected Median
MC	B	4	49-350	126	.14-.38	.23	.28-.63	.51
(Mechanical)	W	5	267-1930	1080	.24-.51	.45	.38-.77	.64
BC	B	7	30-630	37	.21-.72	.49	.51-.99	.82
(AFQT)	W	7	66-1135	107	.28-.57	.49	.57-.86	.78
EE	B	6	25-85	27	.25-.49	.33	.59-.78	.74
(Electronics)	W	6	208-454	303	.41-.56	.45	.78-.87	.80
HST	B	8	53-772	125	.15-.41	.33	.34-.84	.70
(General)	W	8	192-3809	407	.35-.57	.44	.61-.87	.73

Note: Mechanical = 2AS + MC + GS
AFQT = AR + WK + PC + 1/2NO
Electronics = GS + AR + MK + EI
General = AR + (WK + PC)

Regression Equation Analyses

Differential predictive validity exists when the regression of a selection test score on a measure of job or training performance is different among subpopulation groups (Bock & Moore, 1984). To determine if differential validity exists, the regression line is estimated. It is usually satisfactory to assume a straight-line relationship between the criterion and predictor scores, in which case, the regression lines can be fitted by estimating the least squares solution for each of the groups. If the deviations of the criterion scores from the regression line within each group are normally distributed and have the same variance in all of the groups, methods are usually available for testing the hypothesis that the regression lines are homogeneous from one group to another. The test has two component hypotheses: H1—equality of slopes between groups—and, given that H1 is accepted, H2—equality of intercepts between groups.

In the case of two groups, schematic regression lines are shown in Figure 2 representing the three possible outcomes of these tests of hypotheses—namely, accept H1 and H2, accept H1 and reject H2, and reject H1 and H2. Panel A of Figure 2 represents two homogenous regressions (regression lines collinear—the length of each line represents the sample range of the criterion scores; on average, Group 2 in this panel has lower scores on the predictor tests than does Group 1, but it also has correspondingly lower average scores on the criterion). For predictive purposes, the tests are functioning in the same manner in both groups, the same regression line can be assumed in each group, and group membership of the applicant can be ignored during selection.

In Panel B, the extent to which criterion scores depend upon predictor scores is the same for each group, but the level of performance is uniformly higher in Group 2 (i.e., the regression lines are parallel but not coincident). If the Group 1 line were used to predict performance for Group 2, Group 2 criterion scores would be underpredicted. The condition represented in Panel B would occur when job performance depends upon two factors, one related to the predictor tests and the other one not. Deficiency in design of the validation study can also produce the result shown in Panel B. For example, selection may be influenced by some unknown factor that depends on group membership but is unrelated to predictor scores within groups. Suppose that selection is not done "blind" and that the person responsible for selection is permitted to use discretionary judgment in borderline cases. If these judgments were based on other information about the ability of Group 2 members, so that in effect they were being screened more stringently than Group 1, the ultimate performance of Group 2 would be higher at given selection scores. This would be especially likely to happen if there were many more Blacks than Whites in the school, and the person doing the selection was attempting to better balance the racial composition of the team. Rigorous controls in carrying out a validation study, especially in the selection of applicants without regard to group membership, are critical.

Finally, Panel C predicts a situation in which the selection test is not related to the performance measure to the same extent in both groups. This result, which typically occurs when the groups differ in their average predictor scores, is symptomatic of technical shortcomings of the predictor tests. The tests may not have a uniform distribution of item difficulty, and may be less reliable at lower score ranges than at higher. This is especially a problem in multiple choice tests where the effects of guessing produce less reliable scores in the low range. The resulting nonuniform attenuation of the predictor-criteria correlation can lead to regression lines such as shown in Panel C. The greater measurement error in Group 1 has reduced the slope of the regression line relative to that of Group 2 as shown in Panel C.

Another reason for the effect shown in Panel C, and one more difficult to correct, is that the dimension measured by the test actually changes as the items increase or decrease in difficulty. It may be that the person constructing the test, in trying to devise more difficult items, added additional dimensions to the task that the items present. If these dimensions are relevant to criterion performance, the validity of the tests will increase as the item difficulty increases. In this case, scores in the lower ranges of the predictor will be less valid than those in the higher ranges, with the result that the regression lines will appear as in Panel C. It is even possible that a test may be multidimensional throughout its range, and that some of these dimensions are predictors in one of the groups but not in the other. This would also tend to produce different slopes of the regression lines.

In the interpretation of validity studies, it is of course not just the statistical significance of deviations from homogeneous regression that must be considered, but also the actual sizes of the deviations and the practical effect of possibly ignoring them in favor of a simpler selection rule. When the validation studies are done in very large samples, even minor departures from the assumption of homogeneous regression will be significant. But when the actual effects of the heterogeneity on the types of correct and incorrect classification are calculated, it might be found that the effects are too small to be of practical importance.

The Armed Services have carried out numerous studies of the possible differential validity of their selection/classification tests. Some of the first studies were carried out by Guinn, Tupes, and Alley (1970a, 1970b) using Airman Qualifying Examinations. Studies involving previous ASVAB forms are discussed in Bock & Moore (1984). Findings to be covered here concern current ASVAB forms.

Sex Groups

Prediction of Air Force technical training grades from ASVAB military selector composites for female and male enlistees was examined by Fast and Martin (1984). Training courses consisted of 14 general, 11 mechanical, 7 electronic, and 7 administrative (clerical) specialities. Statistical tests of sex bias at the .05 probability level were carried out for slope (interaction) and intercept (level) differences. Slope differences were significant in only two courses; in both courses the slope was smaller for females than for males. Intercept differences by sex were significant in seven courses including the two with slope bias. Grades of females were overpredicted in a total of six courses including two general, two administrative, one electronics, and one mechanical, and were underpredicted in one mechanical course.

Prediction of Army Skill Qualification Test (SQT) scores from selector composites for female and male enlistees was investigated by Hanser and Grafton (1983). The SQT scores are designed to serve as criterion-referenced tests of job proficiency. Separate SQTs are developed for each skill level within a Military Occupational Specialty (MOS). Scorable units in a SQT include written tasks and hands-on performance tasks. Data in this study were SQT scores in four large noncombat MOSs and composite scores based on ASVAB Forms 6 and 7. Sex comparisons of regression lines were made for ASVAB Forms 6 and 7 composites and estimated ASVAB Forms 8, 9, and 10 composites. For ASVAB Forms 6 and 7, slopes were greater for females than for males in two MOSs: Telecommunications Operator and Military Police. For ASVAB Forms 8, 9, and 10, the only slope difference favored females in the Military Police. With ASVAB Forms 6 and 7 composites, female SQT scores were underpredicted for Drivers and Cooks but were overpredicted for those with below average ASVAB selector scores in the other two MOSs. Composite sex level differences levels were smaller for ASVAB Forms 8, 9, and 10. As with ASVAB Forms 6 and 7, SQT scores of females with below average Forms 8, 9, and 10 scores were overpredicted in the Military Police MOS.

Regression lines predicting Marine Corps training grades from ASVAB-14 occupational composites were compared for sex and race samples by Maier and Truss (1984). Courses included 9 Mechanical & Crafts (MC), 8 Business & Clerical (BC), 3 Electronics & Electrical (EE), and 2 Health, Social, & Technology (HST), and samples ranged from 256 to 1,843 trainees. Significant interaction (slope) differences due to sex, race, or education were found in only three courses. Female grades were underpredicted in five courses,

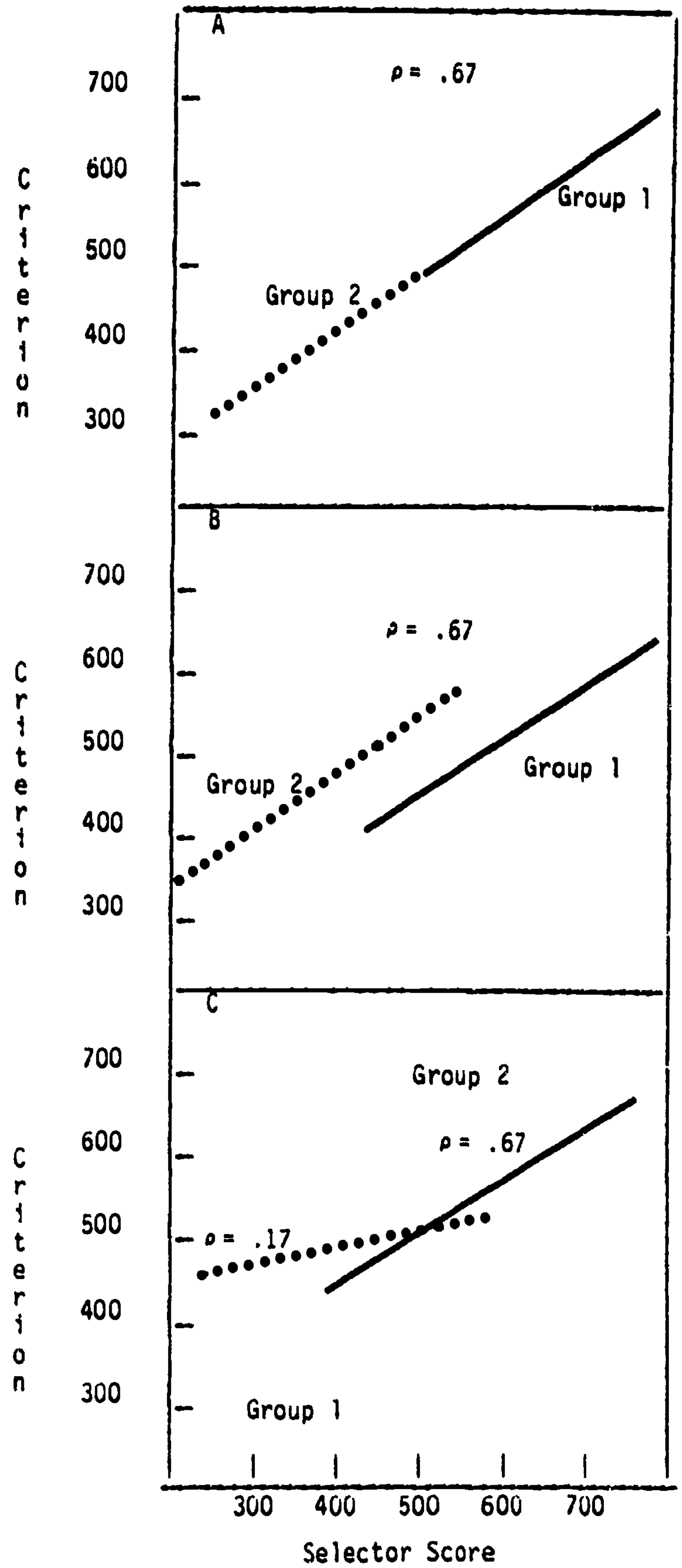

Figure 2. Schematic Selector vs. Criterion Regression Lines for two Groups.
A: No differential validity; B: Selection bias favoring group 1;
C: Differential validity. (Bock and Moore, 1984).

including both courses that used HST as their predictor, and were overpredicted in one MC course.

In summary, sex differences were insignificant in the majority of occupational training samples for which regression lines were compared. Slope differences were infrequent. Intercept level differences were significant in about one fourth of the groups, but female criterion scores were under- or overpredicted with equal frequency. Consistent sex differences were not found for any one type of ASVAB composite.

Race Groups

Prediction of Army SQT scores from ASVAB composites by race for males was examined by Hanser and Grafton (1983). Slopes were essentially parallel. In nearly all groups, SQT scores of Blacks were overpredicted by ASVAB selector composites. In comparisons of Occupational Composites with Marine Corps specialties, Maier and Truss (1984) found that Black performance was overpredicted in three groups, including two MC groups, and underpredicted in two groups.

The reported slight overprediction of minority performance is consistent with a number of other investigations. The overall consensus from a number of studies and expert reviews of the ASVAB is that the latter is a valid predictor of successful completion of training. Eitelberg, Laurence, Waters, and Perelman (1984) discuss the generally equitable prediction of success for majority and minorities over a wide range of military occupations. Morever, the Defense Advisory Committee on Military Personnel Testing (an independent panel of nationally recognized psychometricians) reviewed the ASVAB and concluded: "The evidence clearly reveals that the ASVAB has substantial operational value for purposes of predicting training criteria in a wide range of military specialties. There is also substantial evidence that the tests provide reasonable predictions for minority as well as majority group applicants, and do not systematically underestimate the performance of minority group members" (p.2).

Eitelberg et al. hold that there is some indication of a possible statistical bias against women in the technical areas of ASVAB, but conclude that differences are due to previous experiences of the two sexes and "not necessarily a weakness of the ASVAB" (p. 113). Jensen (1985) cautions that composite scores based on the Auto and Shop Information and/or the Electronics Information subtests should be interpreted in light of an examinee's exposure to auto mechanics and to shop and physics courses.

ASVAB-5 Validity Data

The previous high school test, ASVAB-5 and its parallel forms, ASVAB-6 and ASVAB-7, were subjected to validity analyses. Swanson (1979) studied the relationship between ASVAB scores and performance in Navy training schools. The sample consisted of 32,354 students. For schools having final grades as the criterion, the median uncorrected and corrected validities of the ASVAB selector composite were .43 and .73, respectively. For schools having a days-to-completion criterion, the corresponding validities were −.21 and −.36.

Berger, Berger, and Gupta (1977) correlated final course grades with ASVAB-5 scores. Students were either in the 12th grade and had taken the ASVAB in the 11th grade, or were enrolled in postsecondary courses and had taken the ASVAB in the 12th grade. Overall, Berger et al. found that (uncorrected) validities for ASVAB composite scores were in the moderate range, .3 to .5. Studies by Larson and Arenson (1979) and Kettner and Streeter (1979) also found significant correlations between ASVAB-5 and civilian school performance. Results of these studies are presented in Table 50.

Overall, research on ASVAB-5 demonstrates that the validity of the test for predicting civilian training performance is in the moderate to high range and for predicting military training performance is in the high range. As shown in an earlier section, there is also a strong relationship between ASVAB Forms 5 and 14; therefore, the results from research on ASVAB-5 can be generalized to ASVAB-14.

[1]Biennial Report of the Defense Advisory Committee on Military Personnel Testing, Washington, DC: Office of the Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics), June 1983.

TABLE 50. ASVAB-5 Academic Composite Validities (Uncorrected) for Course Grades by Type of Institution

Institution	No of Courses	Sample Size		Validity Coefficients	
		Range	Median	Range	Median
High School	16	91-520	346		
Academic Ability				.31-[illegible]	.45
Verbal				.33-.52	.42
Math				.34-.62	.45
Post Secondary	16	92-437	241		
Academic Ability				.19-.51	.36
Verbal				.17-.44	.29
Math				.19-.48	.42
Two-Year College	41	50-338	80		
Academic Ability				.08-.64	.41
Verbal				-.02-.61	.38
Math				.21-.59	.40

Validity Generalization (From Hunter, 1983a and 1983b)

Over the past ten years there has been some change in how validity is viewed. Previously, it was widely held that validity could only be demonstrated by conducting a validation study for every test-job combination. This was extended to the point of believing that a validation study should be conducted at every location at which the test was to be used, in order to be able to predict performance in a given job.

However, it is now argued that validity does not vary to a significant degree across job settings, organizations or time. In fact, even large differences in job content may produce only small differences in validity. The new evidence indicates both that task differences between job families within an occupational area may have little or no effect on test validities and also that differences in test validities among entirely different jobs may be small.

The procedure used to demonstrate this new approach is called "validity generalization." The basic premise underlying validity generalization is that validity coefficients from near-identical or similar tasks (or test batteries) can be compared and averaged across time and setting to achieve an overall statement of prediction. This new knowledge has made it possible to compute validity coefficients for families of jobs rather than just for specific jobs. Consequently, the validity of jobs not yet studied, but which are located within a job family for which validity data are known, can be determined.

Such consistency of validity also makes it possible to determine the validity of one test from empirical data on the validity of a psychometrically equivalent test. In the case of ASVAB, validity generalization makes it possible to predict performance on civilian jobs from knowledge gained from the study of the validity of the ASVAB in predicting military job performance.

The principal researchers behind the concept of validity generalization are Schmidt and Hunter (Schmidt and Hunter, 1977; Hunter, Schmidt, and Jackson, 1982). Schmidt and Hunter have shown that most of the variation in results from earlier validation studies came from the design and conduct of the studies themselves, rather than from actual differences in validity coefficients per se. The key problem in these studies was simply sampling error; that is, deviations from true population parameters due to sampling, usually from the use of small samples. (It should be noted that the sample size in a validation study is usually determined by the available workers rather than by a selection of the optimum size desired. Consequently, sample size is typically smaller than deemed necessary or even hoped for.) Lent, Aurback, and Levin (1971) found that the average sample size in validation studies has been only 68. For sample sizes that small, the observed correlations between test scores and job performance can be expected to vary widely from the true population value. Therefore, the validity variations seen across studies have been more artifactual than true. These across-study variations have created a false impression of instability with regard to validity.

Schmidt and Hunter developed validity generalization formulae that partitioned the observed variance in validity across studies into two parts: one part due to sampling error and other artifacts, and a second part due to real variation in population correlations. Other analytic formulae were subsequently developed (see Hunter, Schmidt, and Pearlman, 1982 for a review). These researchers interpreted their results to indicate that if a specific test can be used to predict performance for a given job, then there is virtually no variation in validity across settings beyond that due to sampling error.

The concept of validity generalization is particularly meaningful to the Services in that they have a unique data base of validation studies. The Services have been conducting validation studies for over 30 years. Moreover, the typical sample size in these Service studies has been over 500. These large sample sizes make it possible to compare validity coefficients for the job across time and across test batteries. Hunter (1983a and 1983b) has shown that the results of these military comparisons are comparable to those reported in civilian validity generalization studies, again leading to the conclusions that validity does not vary across time and that *validity is uniform across psychometrically equivalent tests.*

Because the ASVAB can be shown to be psychometrically equivalent to other batteries, the concept of equal validities across equivalent tests dramatically increases the power of the ASVAB. For example, Hunter (1983a) has shown that the Vocabulary subtest of the General Aptitude Test Battery (GATB) is psychometrically equivalent to the Word Knowledge subtest of the ASVAB. Consequently, the validity of the ASVAB Word Knowledge subtest can be determined from empirical data gathered on the GATB. Similar links can be made for other ASVAB subtests.

Hunter reanalyzed data that Ghiselli (1966, 1973) had compiled over a 25-year period; Ghiselli had averaged validity coefficients across many test types and across many job families. The resulting reanalyzed validities are shown in Table 51. In general, the data show that, when job complexity decreases, the validity of measures of general cognitive ability tests goes down, while the validity of measures of general psychomotor ability in general, goes up. These trends are expected.

The general cognitive ability measure of the reanalyzed Ghiselli data is psychometrically equivalent to a composite of two of the ASVAB subtests: Arithmetic Reasoning (AR) and Word Knowledge (WK). Therefore, AR and WK should be measuring the same aptitude as measured by Ghiselli's General Cognitive Ability (Schmidt & Hunter, 1975). Accordingly, the validity coefficient values in the cognitive ability column in Table 51 represent a comparable measure of validity for the ASVAB for each job family. However, Hunter (1983b) performed an extensive psychometric analysis of the ASVAB and concluded that the ASVAB actually improves on the validities presented in Table 51. This improvement is due primarily to the fact that the ASVAB contains measures of technical aptitude in the forms of the Mechanical Comprehension (MC) and Electronics Information (EI) subtests.

Table 51. A Reanalysis of Ghiselli's 1973 Data for Mean Validities for Nine Job Families

Job Family	Measures of General Cognitive Ability	Meaures of General Psychomotor Ability
Manager	.53	.29
Clerk	.54	.29
Salesman	.61	.29
Protective Professions Worker	.42	.26
Service Worker	.48	.27
Trades and Crafts Worker	.46	.34
Elementary Worker	.37	.40
Vehicle Operator	.28	.44
Sales Clerk	.27	.17

Note: Mean validities have been corrected for criterion unreliability and for range restriction using mean figures for each predictor from Hunter (1980) and King, Hunter, and Schmidt (1980).

The ASVAB also provides two measures (AR and MK) of quantitative aptitude rather than one. Consequently, the composite of these two subtests will have higher reliability and validity than either test alone. The same can be said for verbal aptitude in that the ASVAB has two measures (WK and GS) which in combination produce a 4 percent higher validity for general cognitive ability than in the Ghiselli data.

The other ASVAB subtests also seem to improve on the measure of general cognitive ability. For instance, adding technical aptitude subtests to quantitative and verbal aptitude composites improved average validities from .578 to .602 (Sims and Hiatt. 1981; Thorndike, 1957; Maier and Grafton, 1981; Maier and Fuchs, 1972; and Maier and Truss, 1983). This new composite would have an average validity 8.3 percent higher than the measures of General Cognitive Ability composite in the Ghiselli table. Consequently, the ASVAB can be expected to have higher validity for civilian jobs than the general ability measure analyzed by Ghiselli. Hunter (19[illegible]3) has concluded that the ASVAB predicts job performance in all known military and related civilian occupations.

Military-Civilian Occupational Crosswalk Project

One feature of ASVAB-14 that will prove extremely valuable to counselors is the information gathered from a recent project. This project involved determining the equivalency between civilian and military occupations in detail. Military occupations and civilian occupations listed in the U.S. Department of Labor *Dictionary of Occupational Titles* (DOT) were crosscoded based on (1) tasks performed, (2) machines or tools used, and (3) output or results achieved. This crosscoding was done by experienced civilian job analysts.

The results of this project were assembled into a *Military Career Guide* (MCG)(U.S. Department of Defense, 1984b). The MCG is designed as a career counseling resource for students, parents, and counselors. It provides narrative descriptions of duties, work environment, training provided, and other characteristics for more than 130 military enlisted occupations.

The description of each occupation in the MCG contains information about comparable military occupational specialties from the Army, Navy, Air Force, Marine Corps, and Coast Guard. Because some specialties are not found in all of the Services, not all Services are represented in each occupation. The descriptions are necessarily general in nature. The MCG is intended to be a resource for exploration that covers the full range of enlisted force occupations across all Services. More detailed information about the nature and availability of a military occupational specialty in a particular Service can be obtained from the Service's education specialists or recuiters.

Each of the occupational descriptions in the MCG contains 11 sections that characterize the numerous military specialties represented by that occupation. The occupations have been organized in clusters similar to the *Occupational Outlook Handbook* published by the U.S. Department of Labor.

The MCG lists both the clusters of common occupations found in the Crosswalk Project and the ASVAB-14 composite which best predicts success in the occupation. A counselor will be able to tie ASVAB scores to specific civilian and military occupations and thereby help guide students into those work areas in which they have the greatest likelihood of success.

These two sources, the concept of Validity Generalization and the Military-Civilian Occupational Crosswalk Project, provide analytic support for the predictive validity of ASVAB-14 for civilian occupations.

Utility of the ASVAB

A final consideration concerns the military aspects of the ASVAB. Some believe that the ASVAB is a test to be used only for those contemplating a career in the military. Although that is certainly an appropriate use of the ASVAB, it should be emphasized that the ASVAB can also provide valuable career information for all individuals in the age brackets for which the test was designed. As shown, the ASVAB has been validated in military and civilian settings. Validity generalization techniques allow the validity of the ASVAB to be extended to settings other than those for which validation studies have been successfully completed. Therefore, the information in the MCG will enable counselors and students to relate ASVAB scores to both military and civilian occupations.

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Frankel, M.R. & McWilliams, H.A. (1981). *The profile of American youth: Technical sampling report.* Chicago, IL: National Opinion Research Center.

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Kass, R.A., Mitchell, K.J., Grafton, F.C., & Wing, H. (1982). *Factor structure of the Armed Services Vocational Aptitude Battery (ASVAB), forms 8, 9, and 10: 1981 Army applicant sample* (Technical Report 581). Alexandria, VA: United States Army Research Institute for the Behavorial and Social Sciences.

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Maier, M.H. & Grafton, F.C. (1981). *Aptitude composites for ASVAB 8, 9, and 10* (Research Report 1308). Alexandria, VA: United States Army Research Institute for the Behavorial and Social Sciences.

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This report describes the calibration of ASVAB forms 8, 9, and 10 to the Armed Forces Qualification Test 7a (AFQT-7a), the reference test used to tie current versions of the ASVAB back to the World War II reference population.

Sims, W.H. & Maier, M.H. (1983) *The appropriateness for military applications of the ASVAB subtests and score scale in the new 1980 reference population* (CNA 83-3102). Alexandria, VA: Center for Naval Analyses.

This report examines whether any of the ASVAB form 8, 9, and 10 subtests are inappropriate for inclusion in the 1980 reference population developed from administering the ASVAB to a nationally representative sample (i.e., the American Youth project). Power subtest scores were found to be stable, but speed subtest scores were not. Report recommends that the speeded test results be studied more thoroughly and that the use of these test scores be delayed until the issue is resolved.

Stoloff, P.H. (1983). *A factor analysis of ASVAB form 8a in the 1980 DoD reference population* (CNA 83-3135). Alexandria, VA: Center for Naval Analyses.

ASVAB form 8a was factor analyzed. Four factors (Verbal, Speed, Math, and Technical) were found.

Swanson, L.C. (1979). *Armed Services Vocational Aptitude Battery, forms 6 and 7: Validation against school performance in 99 Navy enlisted schools-July 1976 through February 1978* (NPRDC TR 80-1). San Diego, CA: Navy Personnel Research and Development Center.

Final school grades and days-to-completion were used to validate ASVAB scores.

Truss, A.R., Hiatt, C.M. & Sims, W.H. (1982). *An analysis of correlations between the Armed Services Vocational Aptitude Battery (ASVAB) forms 5/6/7 and forms 8/9/10* (CNA 82-3095/11). Alexandria, VA: Center for Naval Analyses.

Service applicants (n = 2,025) were administered both ASVAB-8 and ASVAB-6 or 7. This report presents the correlations between like-named subtests and composites from these two ASVAB forms.

Wegner, T.G. & Ree, M.J. (1984). *Armed Services Vocational Aptitude Battery: Correcting the speeded subtests for the 1980 youth population* (AFHRL-TR-85-14). Brooks AFB, TX: Air Force Human Resources Laboratory, Manpower and Personnel Division.

This study addressed the concerns of Sims and Maier (1983) and determined that the discrepant behavior of the speeded subtests was due to the use of an inappropriate answer sheet in the normative study. A correction was developed and applied.

APPENDIX A

Item Taxonomies

The following domain specifications outline the content assessed by ASVAB items. ASVAB Form 8a was used for initial guidance in explicating the ten content areas. In most cases, however, there are too few items in the Form 8a subtests to comprehensively delineate any single domain. The content specifications are designed to adequately represent the diverse content of each of the knowledge/skill areas incorporated into the ASVAB. All items are multiple choice and all have four answer choices except for Coding Speed, which has five.

General Science (GS)

The General Science domain was specified with the aid of current texts for junior and senior high school science courses. The textbooks surveyed included *Focus on Physical Science* by C.H. Heimler and J. Prece and *Elements of Biological Sciences* by W.T. Keeton. The General Science items cover the areas of life science, physical science, and earth science; the approximate weighting of these areas is 45%, 45%, and 10%, respectively.

The life science area includes items dealing generally with the plant and animal kingdoms and with human nutrition and health. It also includes the areas of human genetics, ecology, and cell structures and processes. The physical science area includes such topics as measurement, force and work, energy, basic electricity, magnetism, and light and sound. It also includes the classification of matter into elements and compounds, the characteristics of solids, liquids, and gases, and simple solutions and chemical reactions. The earth science area includes geology, meteorology, and astronomy.

Arithmetic Reasoning (AR)

The Arithmetic Reasoning domain consists of items that require the recognition and application of basic mathematical processes and operations in problems encountered in everyday life. The items emphasize the processes or operations required for solution rather than computational complexity. Six basic process/operation areas are covered. Items involve one or more of these areas in their solution.

The first area involves the recognition and application of the four basic arithmetic operations: addition, subtraction, multiplication, and division. The algebraic forms and illustrative examples are listed below (a and b are integers, decimals, or fractions—x is the unknown value).

$a + b = x$	If a 10' and 15' extension cord are connected together, how far will they reach?
$a - b = x$	If 5' is cut from a 10' board, how much will be left?
$ab = x$	If four 6' hoses are connected, how long will they reach?
$a/b = x$	If 12 apples are split evenly among 4 children, how many will each get?

The second area involves a rearrangement of the basic operations and thus requires some manipulation to find the answer. The algebraic forms and simple examples are given below.

$a + x = b$	If you connect a 15' extension cord to another cord and find it will reach 25', how long is the other cord?
$a - x = b$	If you cut 5' from a board and find you have 5' left, how long was the original board?
$ax = b$	If four hoses of equal length connected together reach 24', how long is each hose?
$a/x = b$	If 12 apples are split evenly among a group of children and each child gets 3 apples, how many children are in the group?

The third area assesses skill in dealing with percentages. Three basic forms for these items and examples are given below.

a% of b = x	If 20% of Bill's $150.00 check is taken away for taxes, how much tax does he pay?
x% of b = a	If $30.00 of Bill's $150.00 check goes to taxes, what percent of his check is this?
a% of x = b	If Bill pays 20% of his salary to taxes and he pays $30.00 in taxes, how much was his original check?

The fourth area assesses skill in solving "rate" problems and other problems involving equivalent-fractions operations. The general form and example is:

a/b = x/c	If 3 women can produce 6 widgets in 4 hours, how many widgets can they produce in 8 hours?

The fifth area assesses skill in converting simple units of time and distance.

The sixth area requires determination of perimeters, areas, and volumes of circles/balls, squares/cubes, rectangles, and triangles.

Word Knowledge (WK)

The Word Knowledge subtest assesses knowledge through synonyms and contains two types of item stems. Most of the item stems are of the form "______ most nearly means. . . ." Approximately 40 percent of the stems, however, are complete sentences containing the key word in context. The key or stem words are for the most part selected from the Lorge-Thorndike word frequency lists.

Paragraph Comprehension (PC)

The Paragraph Comprehension items are designed to assess an examinee's ability to understand what is read. Six facets of the comprehension domain are covered. These six facets are 1) the ability to recall literal detail, b) the ability to paraphrase or summarize a passage, c) the ability to recognize main ideas, d) the ability to make inferences regarding material in the passage, e) the ability to apply the material in the passage to other material, and f) the ability to recognize and understand sequential, cause/effect and comparative relationships. Some items measure one of these abilities; most measure more than one.

Passages vary in length from about one to five paragraphs, of from about 30 to 120 words, excluding stem and alternatives. Each passage is used for from one to five questions. Most paragraph content is nonfiction but both fiction and nonfiction paragraphs are used in assessing each facet of the domain. The specific content of the paragraphs is selected to minimize the effects of examinee's prior experiences so that examinees must understand the information presented in the paragraph in order to know the correct answer.

Numerical Operations (NO)

This is a speeded test requiring rapid and accurate computation of simple two number problems presented thusly: 2 + 3 =. All numbers are one or two digit whole numbers and addition, subtraction, multiplication, and division are equally represented.

The item option alternatives contain the correct answer and three incorrect alternatives. Incorrect item option alternatives are combinations of the incorrect applications of operations to the two numbers in the root question.

Coding Speed (CS)

This a speeded test requiring rapid and accurate matching of four digit numbers with single words from a key. Coding Speed items are developed by utilizing a dictionary for selection of common usage words consisting of three to ten letters each.

A table of random numbers from 0-9 was generated to determine the code number sequence for each word. A second random number table was developed to determine placement of the correct response using numbers 1-5. Number one is used for correct answer A; number two = B; number three = C; number four = D; and number five = E. Placement of the words in each test is determined at random.

Automotive & Shop Information (AS)

The Automotive Information domain was developed with the aid of three basic texts in automobile mechanics used in vocational-technical schools (*Auto Mechanics* by H.E. Ellinger, *Auto Mechanics Fundamentals* by M.W. Stockel, and the *Automotive Encyclopedia* by W.K. Toboldt and L. Johnson). A preliminary domain was established by examining the tables of contents of these texts and determining target representations of the subareas as percentages of pages devoted to each subarea in the texts. The subareas are listed below.

Subarea

Basic Engine Construction and Operation
Basic Engine Mechanical Components
(valves, pistons, bearing, etc.)
Engine Lubrication Systems
Engine Cooling Systems
Fuel and Fuel Systems
Batteries
Starters
Charging Systems
Ignition Systems
Engine Testing and Service
Clutches
Standard Transmissions
Automatic Transmissions
Differentials and Rear Axles
Brake Systems
Tires
Suspensions
Steering Systems
Accessories
(radio, heater, interior lighting, etc.)
Body Repair

The Shop Information domain is divided into three areas: tools, materials, and design and layout. Specific topics within these areas were developed by surveying texts used in shop instruction. These texts were *Tools and How to Use Them* by Jackson and Day, *Cabinetmaking and Millwork* by Feirer, *Modern Metalworking* by Walker, and *Machineshop Operations and Setups* by Lascoe, Nelson, and Porter. *The Complete Guide to Home Repair, Maintenance, and Improvement* by Hufnagel and the *Complete Do-It-Yourself Manual* edited by Day, Daniels, Martin, and Scharff were also reviewed. Major topics identified within each of the three main areas are shown below.

Tools (functions, proper usage, safety)
- Measuring
- Cutting
- Shaping
- Fastening
- Welding
- Grinding/Sanding
- Digging
- Construction
- Plumbing
- Electrical

Materials (advantages, limitations, available forms, special considerations)
- Metal
- Wood (and Wood Composition)
- Glass
- Plastic
- Glues/Adhesives
- Fasteners
- Abrasives

Design and Layout
- Templates
- Patterns and Forms
- Blueprint Reading
- Design Considerations

Mathematics Knowledge (MK)

The Mathematics Knowledge domain involves the application of mathematical principles. A brief outline of the concepts included in this content area, and their approximate representations in the item pool, are shown below.

Concepts	Representation
Conversions of common fractions, decimals, and percents. Simplification of fractions, improper fractions, and reciprocals.	10%
Least common denominator, greatest common factor, and smallest common multiple.	10%
Prime numbers and factorials.	5%
Analytic geometry: equations for common geometric figures. Plane/solid geometry: Perimeter, area, volume: 2- and 3-dimensional figures.	20%
Exponents, roots, and powers: simple operations. Polynomials: simple operations, factoring, roots.	15%
Linear equations: slope, and intercept. Cartesian (rectangular) coordinate system.	5%
Transforming verbal problems into algebraic symbols.	5%
Equation solving: substitution of constants into equations, using the distributive law, basic operations.	30%

Mechanical Comprehension (MC)

Mechanical Comprehension items assess the ability to apply mechanical principles to simple devices in order to determine an aspect of their operation. Explication of the mechanical comprehension domain begins with the six simple machines. From these, a list of common compound machines and a short list of structural components were added. Finally, a list of basic mechanical concepts was created. These lists, presented below, form the preliminary definition of the domain. Items are developed by chosing one or more list elements and combining them into a single problem. Most items contain pictorial or graphic representation of the problem.

Simple Machines	Basic Compound Machines	Complex Compound Machines
Lever	Belt/Chain	Bearing
Inclined Plane	Cam	Brake
Pulley	Cam Follower	Clutch
Screw	Crank	
Wedge	Gear	
Wheel and axle	Linkage	
	Piston/Cylinder	
	Pushrod	
	Ratchet	
	Shaft	
	Spring	

Structural Components

- Brace
- Truss

Mechanical Concepts

- Acceleration/Deceleration
- Centripetal/Centrifugal Force
- Compression
- Convection
- Diffusion
- Elasticity
- Expansion
- Fluid Dynamics
- Fluid Statics
- Force
- Friction
- Gravity
- Inertia
- Mass
- Momentum
- Pressure
- Speed
- Tension
- Velocity
- Weight
- Work

Electronics Information (EI)

The Electronics Information domain was developed using three texts in elementary electronics used by vocational schools (*Electricity and Electronics* by H.H. Gerrish & W.E. Dugger, *Basic Electronics* by B. Grob, and *Electricity and Basic Electronics* by S.R. Matt). A preliminary domain was established by examining the contents of these texts and establishing target representations of the subareas using the proportions of pages devoted to each subarea in the texts. The resulting domain outline, presented below, was used as a starting point for item development.

Subareas

Theory

- Physics of Electricity/Electronics
  - Electrons, Protons, & Charge
  - Magnetism
  - Conductors & Insulators
- Resistance
- DC Circuits
  - Basic Theory
  - Series
  - Parallel
  - Series-Parallel
  - Network
- Inductance
  - Basic Theory
  - Reactance
  - Circuits
- Capacitance
  - Basic Theory
  - Reactance
  - Circuits
- AC Circuits
  - Basic Theory
  - Resonance
  - Filters
- Vacuum Tubes
- Transistors & Diodes
- Integrated Circuits

Practice

- Batteries
- Generators
- Motors
- Power Supplies
- Amplifiers
- Oscillators
- Transmittors
- Receivers
- Logic Devices
- Meters
- Test Instruments
- Television

APPENDIX B

Norms

Table B-1. ASVAB-14 (A, B, & C) Academic Ability (AA) Composite Percentile Norms by Sex and Grade

Standard Score	Females Grade 11th	Females Grade 12th	Males Grade 11th	Males Grade 12th	Total Grade 11th	Total Grade 12th	Standard Score
25 and less	1	1	1	1	1	1	25 and less
26	1	1	1	1	1	1	26
27	1	1	3	1	1	1	27
28	1	1	4	2	3	2	28
29	1	2	4	2	3	2	29
30	2	3	7	3	4	3	30
31	3	4	8	4	6	4	31
32	5	5	9	6	7	5	32
33	7	7	11	7	9	7	33
34	11	9	13	9	12	9	34
35	13	10	17	10	15	10	35
36	14	12	18	10	16	11	36
37	18	13	21	13	19	13	37
38	21	17	25	15	23	16	38
39	22	19	28	19	25	19	39
40	25	22	30	21	27	21	40
41	28	26	32	23	30	25	41
42	32	29	35	26	33	27	42
43	35	31	37	28	36	29	43
44	38	34	39	29	39	32	44
45	44	38	42	32	43	35	45
46	46	41	46	35	46	38	46
47	52	44	50	39	51	41	47
48	56	48	54	42	55	45	48
49	58	50	55	44	56	47	49
50	63	57	59	48	61	53	50
51	66	62	63	54	64	58	51
52	72	67	66	58	69	62	52
53	77	72	70	61	74	67	53
54	81	76	75	67	78	71	54
55	83	81	78	70	81	75	55
56	84	81	80	72	82	77	56
57	87	84	83	76	85	80	57
58	90	86	86	80	88	83	58
59	91	89	88	85	90	87	59
60	93	92	91	88	92	90	60
61	94	94	94	92	94	93	61
62	97	97	97	94	97	95	62
63	98	98	98	95	98	97	63
64	99	99	99	98	99	99	64
65 and	99	99	99	99	99	99	65 and more

Note: AA = Sum of AR + VE Standard Scores reconverted to Standard Scores.

Table B-2. ASVAB-14 (A, B, & C) Verbal (VBL) Composite Percentile Norms by Sex and Grade

Standard Score	Females Grade 11th	Females Grade 12th	Males Grade 11th	Males Grade 12th	Total Grade 11th	Total Grade 12th	Standard Score
22 and less	1	1	1	1	1	1	22 and less
23	1	1	2	1	1	1	23
24	1	1	2	1	2	1	24
25	1	1	4	2	2	1	25
26	1	2	4	3	3	2	26
27	2	2	5	3	3	3	27
28	3	3	6	4	4	3	28
29	4	4	7	5	5	4	29
30	5	5	9	6	7	5	30
31	6	6	10	6	8	6	31
32	8	7	12	7	10	7	32
33	10	9	14	8	12	8	33
34	13	10	16	10	14	10	34
35	14	11	18	11	16	11	35
36	15	12	19	14	17	13	36
37	18	15	21	15	19	15	37
38	20	16	24	16	22	16	38
39	23	17	26	17	24	17	39
40	25	20	28	19	26	19	40
41	28	22	31	20	29	21	41
42	31	24	33	24	32	24	42
43	34	27	35	26	35	26	43
44	36	29	38	28	37	28	44
45	40	32	41	31	41	32	45
46	44	36	44	36	44	36	46
47	49	40	47	39	48	39	47
48	51	44	51	41	51	42	48
49	57	49	55	44	56	47	49
50	62	54	59	47	61	51	50
51	67	60	63	53	65	56	51
52	69	63	66	56	67	59	52
53	72	68	70	61	71	65	53
54	78	74	74	65	76	70	54
55	82	78	78	71	80	74	55
56	84	81	81	75	82	78	56
57	87	87	84	79	86	83	57
58	91	91	88	84	90	87	58
59	94	94	92	88	93	91	59
60	97	95	95	92	96	93	60
61	98	97	99	94	98	95	61
62	99	99	99	97	99	98	62
63 and more	99	99	99	99	99	99	63 and more

Note: VBL = Sum of GS + WK + PC Standard Scores reconverted to Standard Scores.

Table B-3. ASVAB-14 (A, B, & C) Math (MTH) Composite Percentile Norms by Sex and Grade

Standard Score	Females Grade 11th	Females Grade 12th	Males Grade 11th	Males Grade 12th	Total Grade 11th	Total Grade 12th	Standard Score
31 and less	1	1	1	1	1	1	31 and less
32	1	1	1	1	1	1	32
33	1	1	2	1	2	1	33
34	3	3	5	2	4	3	34
35	4	5	9	4	6	5	35
36	8	7	11	7	10	7	36
37	12	11	16	9	14	10	37
38	14	13	17	11	16	12	38
39	18	16	22	14	20	15	39
40	23	22	26	18	25	20	40
41	27	26	30	23	28	25	41
42	30	29	34	26	32	27	42
43	34	34	37	30	36	32	43
44	41	39	41	32	41	36	44
45	44	43	45	36	45	40	45
46	47	47	49	39	48	43	46
47	50	52	53	43	52	47	47
48	53	56	56	47	54	51	48
49	57	58	58	50	58	54	49
50	58	60	60	52	59	56	50
51	62	63	63	55	62	59	51
52	67	66	65	58	66	61	52
53	68	69	68	62	68	65	53
54	72	72	72	64	72	68	54
55	75	75	74	67	75	71	55
56	78	77	76	71	77	74	56
57	80	81	79	74	79	77	57
58	83	84	80	76	81	80	58
59	85	85	81	79	83	82	59
60	87	86	83	83	85	84	60
61	89	86	85	84	87	85	61
62	90	89	87	86	88	87	62
63	92	92	91	88	92	90	63
64	94	94	92	91	93	92	64
65	95	95	95	93	95	94	65
66	97	97	98	96	97	96	66
67	99	99	99	98	99	98	67
68 and more	99	99	99	99	99	99	68 and more

Note: MTH = Sum of AR + MK Standard Scores reconverted to Standard Scores.

Table B-4. ASVAB-14 (A, B, & C) Mechanical & Crafts (MC) Composite Percentile Norms by Sex and Grade

Standard Score	Females Grade 11th	Females Grade 12th	Males Grade 11th	Males Grade 12th	Total Grade 11th	Total Grade 12th	Standard Score
29 and less	1	1	1	1	1	1	29 and less
30	1	1	1	1	1	1	30
31	1	2	2	1	2	2	31
32	2	4	3	1	3	3	32
33	6	7	6	3	6	5	33
34	9	8	8	4	8	6	34
35	13	12	9	6	11	9	35
36	18	18	11	7	15	12	36
37	25	24	14	9	19	16	37
38	27	25	16	10	22	17	38
39	33	30	20	11	26	20	39
40	37	34	22	13	29	23	40
41	43	39	25	16	34	27	41
42	47	42	28	19	38	31	42
43	53	48	31	22	42	35	43
44	57	55	33	24	45	40	44
45	62	62	38	28	50	45	45
46	66	65	39	30	53	47	46
47	73	69	43	33	58	50	47
48	76	73	46	35	61	54	48
49	82	77	50	39	66	58	49
50	84	80	54	42	69	60	50
51	88	83	59	47	73	64	51
52	89	86	64	50	76	67	52
53	92	90	68	54	80	72	53
54	94	92	70	58	82	74	54
55	95	94	74	62	84	78	55
56	96	95	76	65	86	80	56
57	97	96	81	71	89	83	57
58	98	97	82	74	90	85	58
59	98	98	86	78	92	88	59
60	99	98	89	81	94	89	60
61	99	99	92	86	96	92	61
62	99	99	94	87	97	93	62
63	99	99	96	91	98	95	63
64	99	99	97	93	98	96	64
65	99	99	98	94	99	97	65
66	99	99	99	96	99	98	66
67	99	99	99	98	99	99	67
68 and more	99	99	99	99	99	99	68 and more

Note: MC = Sum of AR + AS + MC + EI Standard Scores reconverted to Standard Scores.

Table B-5. ASVAB-14 (A, B, & C) Business & Clerical (BC) Composite Percentile Norms by Sex and Grade

Standard Score	Females Grade 11th	Females Grade 12th	Males Grade 11th	Males Grade 12th	Total Grade 11th	Total Grade 12th	Standard Score
24 and less	1	1	1	1	1	1	24 and less
25	1	1	2	1	1	1	25
26	1	1	3	1	2	1	26
27	1	1	3	2	2	2	27
28	1	1	4	3	3	2	28
29	2	1	6	4	4	2	29
30	3	2	8	5	5	3	30
31	4	2	9	5	6	3	31
32	5	3	11	6	8	5	32
33	6	4	12	7	9	5	33
34	7	5	14	8	11	7	34
35	8	6	15	9	12	8	35
36	9	8	19	11	14	9	36
37	11	9	21	13	16	11	37
38	13	10	26	15	20	12	38
39	16	13	29	17	22	15	39
40	18	14	32	20	25	17	40
41	21	18	35	23	28	21	41
42	24	22	38	25	31	24	42
43	28	25	42	30	35	28	43
44	33	28	44	33	38	30	44
45	37	33	47	38	42	36	45
46	39	35	50	41	45	38	46
47	42	40	54	46	48	43	47
48	48	45	58	49	53	47	48
49	50	48	62	52	56	50	49
50	55	53	65	57	61	55	50
51	59	57	39	62	64	60	51
52	64	62	73	66	68	64	52
53	66	65	75	68	71	67	53
54	69	69	78	72	74	70	54
55	76	74	81	75	78	75	55
56	78	77	83	78	80	77	56
57	82	82	87	82	85	82	57
58	84	85	90	84	87	84	58
59	87	89	93	90	90	89	59
60	89	91	96	93	92	92	60
61	92	93	97	95	95	94	61
62	94	94	98	96	96	95	62
63	98	96	99	98	98	97	63
64	99	98	99	99	99	99	64
65 and more	99	99	99	99	99	99	65 and more

Note: BC = Sum of VE + CS + MK Standard Scores reconverted to Standard Scores.

Table B-6. ASVAB-14 (A, B, & C) Electronic & Electrical (EE) Composite Percentile Norms by Sex and Grade

Standard Score	Females Grade 11th	Females Grade 12th	Males Grade 11th	Males Grade 12th	Total Grade 11th	Total Grade 12th	Standard Score
29 and less	1	1	1	1	1	1	29 and less
30	1	1	2	1	1	1	30
31	1	2	3	1	2	2	31
32	4	3	4	2	4	2	32
33	6	5	5	3	5	4	33
34	7	9	9	5	8	7	34
35	10	11	11	6	11	9	35
36	14	14	13	8	14	11	36
37	18	17	15	9	16	13	37
38	22	20	18	12	20	16	38
39	26	23	22	13	24	18	39
40	31	27	26	17	29	22	40
41	34	30	27	19	31	24	41
42	37	35	31	22	34	28	42
43	41	37	35	25	38	31	43
44	45	44	39	29	42	36	44
45	50	49	41	31	45	40	45
46	54	53	45	34	49	43	46
47	59	57	49	38	53	47	47
48	61	60	53	40	57	50	48
49	66	63	57	46	61	54	49
50	69	66	59	50	64	58	50
51	72	71	63	53	68	62	51
52	76	74	66	55	71	64	52
53	79	77	69	58	74	67	53
54	82	79	71	61	76	70	54
55	85	82	74	65	80	73	55
56	86	84	77	68	82	76	56
57	89	87	80	73	84	80	57
58	91	88	83	76	87	82	58
59	93	91	84	80	89	85	59
60	94	92	87	82	90	87	60
61	96	95	89	87	92	91	61
62	97	97	92	90	94	94	62
63	98	98	94	91	96	94	63
64	99	99	95	94	97	96	64
65	99	99	96	96	98	97	65
66	99	99	98	97	99	98	66
67	99	99	99	97	99	98	67
68 and more	99	99	99	99	99	99	68 and more

Note: EE = Sum of GS + AR + MK + EI Standard Scores reconverted to Standard Scores.

Table B-7. ASVAB-14 (A, B, & C) Health, Social, & Technology (HST) Composite Percentile Norms by Sex and Grade

Standard Score	Females Grade 11th	Females Grade 12th	Males Grade 11th	Males Grade 12th	Total Grade 11th	Total Grade 12th	Standard Score
26 and less	1	1	1	1	1	1	26 and less
27	1	1	2	1	1	1	27
28	1	1	3	1	2	1	28
29	1	1	3	1	2	1	29
30	2	2	5	3	4	3	30
31	3	3	6	3	5	3	31
32	5	4	7	4	6	4	32
33	7	7	10	6	9	6	33
34	9	8	12	7	11	8	34
35	13	11	15	9	14	10	35
36	17	14	18	10	17	12	36
37	18	15	20	10	19	13	37
38	21	18	22	13	21	15	38
39	25	23	23	15	24	19	39
40	27	24	25	16	26	20	40
41	32	29	27	19	30	24	41
42	35	33	32	23	34	28	42
43	40	36	34	24	37	29	43
44	44	39	38	27	41	33	44
45	50	43	43	32	46	37	45
46	52	46	44	35	48	40	46
47	57	52	47	38	52	45	47
48	61	57	49	39	55	48	48
49	67	61	51	44	59	52	49
50	71	67	55	47	63	57	50
51	74	70	59	50	66	60	51
52	79	73	62	55	70	64	52
53	81	78	65	61	73	69	53
54	83	80	70	62	77	71	54
55	87	83	75	65	81	74	55
56	89	86	78	68	84	77	56
57	91	88	81	72	86	80	57
58	94	91	85	75	89	83	58
59	96	93	87	80	91	87	59
60	97	94	90	83	93	89	60
61	97	97	93	88	95	93	61
62	97	99	95	93	96	96	62
63	98	99	96	94	97	96	63
64	99	99	98	95	99	97	64
65	99	99	99	96	99	98	65
66 and more	99	99	99	99	99	99	66 and more

Note: HST = Sum of AR + VE + MC Standard Scores reconverted to Standard Scores.

Table B-8. ASVAB-14 (A, B, & C) Composite Percentile Norms for the 1980 Youth Population

Standard Score	Composites VBL	MTH	AA	MC	BC	EE	HST	Standard Score
24 and less	1	1	1	1	1	1	1	24 and less
25	2	1	1	1	1	1	1	25
26	3	1	1	1	1	1	1	26
27	3	1	1	1	2	1	1	27
28	4	1	2	1	3	1	1	28
29	5	1	3	1	4	1	2	29
30	6	1	4	1	5	1	3	30
31	7	1	5	2	5	2	4	31
32	8	1	6	3	6	3	5	32
33	9	2	8	4	7	4	7	33
34	10	3	9	6	9	6	8	34
35	11	5	11	8	10	8	10	35
36	13	8	12	10	11	11	12	36
37	14	12	14	13	12	13	14	37
38	15	14	16	15	14	15	16	38
39	16	17	18	18	16	17	18	39
40	18	21	20	21	18	20	20	40
41	20	26	22	24	20	22	22	41
42	22	29	25	26	22	26	25	42
43	24	32	26	29	26	29	27	43
44	26	36	29	32	28	33	30	44
45	28	39	31	36	31	35	33	45
46	31	42	34	38	33	39	35	46
47	34	46	37	42	37	43	39	47
48	36	48	40	45	41	45	41	48
49	39	52	42	49	44	49	45	49
50	42	53	46	51	49	51	48	50
51	47	56	49	55	51	55	51	51
52	50	59	53	57	56	58	55	52
53	55	61	57	61	59	62	59	53
54	60	64	61	64	63	64	62	54
55	65	67	65	68	67	67	66	55
56	69	70	67	71	70	70	69	56
57	74	73	71	74	74	73	73	57
58	79	76	76	77	77	76	77	58
59	84	78	80	80	81	79	80	59
60	88	80	84	82	84	82	83	60
61	92	81	87	85	88	85	87	61
62	96	84	92	87	90	88	91	62
63	98	87	94	90	94	90	93	63
64	99	90	98	92	96	92	95	64
65	99	92	99	94	97	94	97	65
66	99	96	99	96	99	96	99	66
67	99	98	99	98	99	98	99	67
68 and more	99	99	99	99	99	99	99	68 and more

Table B-9. Academic Composite Percentile Norms for Students Attending 2-Year Colleges

Standard Score	Females VBL	Females MTH	Females AA	Males VBL	Males MTH	Males AA	Total VBL	Total MTH	Total AA	Standard Score
30 and less	1	1	1	1	1	1	1	1	1	30 and less
31	1	1	1	2	1	1	1	1	1	31
32	1	1	1	2	1	1	1	1	1	32
33	2	1	1	2	1	1	2	1	1	33
34	2	1	2	3	1	2	3	1	2	34
35	3	2	3	3	2	2	3	2	3	35
36	4	4	4	4	2	3	4	3	3	36
37	4	5	5	4	3	3	4	4	4	37
38	5	7	6	4	4	3	5	6	5	38
39	6	8	9	5	4	6	6	7	8	39
40	8	13	11	5	7	7	6	10	9	40
41	9	17	13	7	10	7	8	14	10	41
42	10	19	14	7	12	8	9	16	12	42
43	12	23	14	9	14	9	11	19	12	43
44	14	26	17	9	16	10	11	22	14	44
45	17	31	21	10	18	14	14	25	18	45
46	20	33	25	12	19	15	16	27	20	46
47	23	38	29	15	21	17	20	30	24	47
48	25	41	31	18	23	19	22	33	26	48
49	28	44	34	20	24	20	25	35	28	49
50	34	44	38	23	25	23	29	36	31	50
51	39	47	42	26	31	25	34	40	35	51
52	43	51	48	28	35	29	37	44	40	52
53	47	54	52	35	37	35	42	47	44	53
54	55	60	58	40	42	40	48	52	50	54
55	62	66	63	47	44	45	55	56	55	55
56	68	70	65	52	48	46	61	60	57	56
57	75	70	71	58	55	53	61	65	63	57
58	83	77	75	67	60	59	76	70	68	58
59	88	81	82	75	62	65	82	72	74	59
60	90	83	88	77	65	72	85	75	81	60
61	95	85	93	84	67	78	90	77	87	61
62	97	90	97	92	71	85	95	82	92	62
63	99	92	98	96	78	89	98	86	94	63
64	99	93	99	99	83	97	99	89	99	64
65	99	96	99	99	88	99	99	92	99	65
66	99	98	99	99	93	99	99	96	99	66
67	99	99	99	99	98	99	99	99	99	67
68 and more	99	99	99	99	99	99	99	99	99	68 and more

Table B-10. ASVAB-14 (A, B, & C) Occupational Composite Percentile Norms for 2-Year College Students

Standard Score	Females MC	Females BC	Females EE	Females HST	Males MC	Males BC	Males EE	Males HST	Standard Score
32 and less	1	1	1	1	1	1	1	1	32 and less
33	3	1	1	2	1	1	1	1	33
34	5	1	3	3	1	2	1	1	34
35	6	2	3	4	1	2	1	1	35
36	7	2	6	6	2	2	2	3	36
37	10	4	7	6	3	3	2	4	37
38	13	5	9	9	3	4	2	4	38
39	17	6	11	11	4	5	3	5	39
40	18	7	13	13	5	7	4	6	40
41	24	8	17	16	6	8	5	7	41
42	26	10	22	19	7	9	7	8	42
43	29	12	23	20	9	11	10	8	43
44	31	14	27	25	10	13	11	11	44
45	40	16	30	28	12	14	13	12	45
46	43	18	34	32	13	15	17	13	46
47	50	23	39	37	15	17	19	15	47
48	55	25	41	39	16	19	19	18	48
49	61	29	46	43	18	21	21	20	49
50	64	32	49	46	20	24	24	21	50
51	69	35	54	49	22	31	27	22	51
52	73	38	58	54	24	38	32	25	52
53	77	41	62	61	26	43	33	32	53
54	80	50	66	68	29	52	35	33	54
55	86	55	73	71	34	57	39	38	55
56	89	60	78	75	36	59	43	43	56
57	92	68	82	79	42	65	50	43	57
58	93	73	83	84	46	69	54	54	58
59	97	78	89	88	52	74	60	63	59
60	98	82	89	93	54	77	61	67	60
61	99	87	93	95	60	85	70	73	61
62	99	91	95	99	65	89	74	77	62
63	99	95	96	99	72	93	77	80	63
64	99	96	98	99	77	95	80	87	64
65	99	98	99	99	80	96	85	88	65
66	99	99	99	99	84	98	92	97	66
67	99	99	99	99	89	98	96	99	67
68	99	99	99	99	91	99	98	99	68
69	99	99	99	99	98	99	99	99	69
70 and more	99	99	99	99	99	99	99	99	70 and more

Table B-11. ASVAB-14 (A, B, & C) Occupational Composites Percentile Norms for 2-Year College Students (Combined)

Standard Score	Composites				Standard Score
	MC	BC	EE	HST	
32 and less	1	1	1	1	32 and less
33	2	1	1	2	33
34	3	2	2	2	34
35	4	2	2	3	35
36	5	2	4	4	36
37	7	3	5	5	37
38	9	4	6	7	38
39	11	5	7	8	39
40	13	7	9	10	40
41	16	8	11	12	41
42	18	10	15	14	42
43	20	12	17	15	43
44	22	14	20	18	44
45	27	15	22	21	45
46	30	17	26	24	46
47	35	20	30	27	47
48	38	22	32	30	48
49	42	26	35	33	49
50	45	29	38	35	50
51	49	33	42	37	51
52	52	38	47	41	52
53	55	42	50	48	53
54	58	50	52	53	54
55	63	56	58	56	55
56	66	60	63	61	56
57	70	67	68	66	57
58	73	71	70	71	58
59	77	76	76	77	59
60	79	80	77	81	60
61	82	86	83	85	61
62	84	90	86	89	62
63	87	94	87	91	63
64	90	96	90	94	64
65	91	97	93	94	65
66	93	99	96	99	66
67	95	99	98	99	67
68	96	99	99	99	68
69 and more	99	99	99	99	69 and more

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