DAT

DIFFERENTIAL APTITUDE TESTS

For Personnel and Career Assessment

Technical Manual

THE PSYCHOLOGICAL CORPORATION®
Harcourt Brace & Company
SAN ANTONIO
Orlando • Boston • New York • Chicago • San Francisco • Atlanta • Dallas
San Diego • Philadelphia • Austin • Fort Worth • Toronto • London

DAT

DIFFERENTIAL APTITUDE TESTS

For Personnel and Career Assessment

Technical Manual

TABLE OF CONTENTS

LIST OF TABLES

1. INTRODUCTION

The Differential Aptitude Tests (DAT) is an eight-test battery designed to measure an individual's ability to learn or to succeed in a number of different areas, such as mechanical reasoning, verbal reasoning, numerical reasoning, and space relations. Since the first edition was published in 1947, the DAT has been widely used for educational placement and vocational counseling of students in Grades 8 through 12. In addition to this scholastic emphasis, the DAT has been used extensively for occupationally oriented assessment of adults and post-secondary students.

The Differential Aptitude Tests for Personnel and Career Assessment (DAT for PCA) was published in order to enhance the use of the DAT to assess adults, including applicants for employment, candidates for employment-related training, career and vocational counselees, and college, technical school, and adult education students. The DAT for PCA is the first printed short form of the DAT ever published. Essentially an abbreviated version of the DAT Form V, the DAT for PCA uses the same high quality test items to measure the same DAT aptitudes.

BACKGROUND

In addition to the DAT for PCA, there have been five editions of the DAT to date. The test was first published in 1947 (Forms A & B); revisions appeared in 1962 (Forms L & M), 1972 (Forms S & T), 1980 (Forms V & W) , and 1990 (Forms C & D). Each of these revisions has been directed primarily at improving and updating the content of the tests as well as the normative information.

In 1987, a Computerized Adaptive Edition of the DAT was published, making the DAT available as computer software for IBM or Apple II compatible personal computers. This edition is a completely self-contained, automated DAT test administration, scoring, and report preparation system. It uses adaptive testing technology to tailor the choice of test items to the examinee's ability and, in the process, reduces the length of most of the DAT tests to half of their traditional number of items.

RATIONALE FOR DEVELOPING THE DAT FOR PCA

The rationale for developing the DAT for PCA was to offer a version of the battery that would encourage and facilitate use of the DAT in adult assessment applications. As has been the case with each DAT revision, the essential nature of the aptitudes measured by the DAT for PCA remains the same. However, the DAT for PCA differs from previous editions in several significant ways. Namely, the following innovations were introduced:

* Shortening of the tests,
* Repackaging of the tests, and
* Enhancing the ease of local scoring.

Shortening of Tests

The DAT for PCA is a shortened version of DAT Form V. Compared to the parent long form, seven of the eight DAT for PCA tests have been shortened by about one third. Only the already brief, highly speeded Clerical Speed and Accuracy Test (CSA) remains at its full length. The effect of shortening the DAT has been to reduce administration time substantially, both at the test and the battery level. None of the DAT for PCA tests has a time limit exceeding 20 minutes; the overall battery time limit has been reduced by about one hour. Table 1.1 lists the test length in number of items and the administration time for both the DAT for PCA and DAT Form V/W.

TABLE 1.1

Test Length and Administration Time for the DAT for PCA and DAT Form V/W

Test	# of Items		Admin. Time[a]	
	PCA	V/W	PCA	V/W
Verbal Reasoning	30	50	20	30
Numerical Ability	25	40	20	30
Abstract Reasoning	30	45	15	20
Mechanical Reasoning	45	70	20	30
Space Relations	35	60	15	25
Spelling	55	90	6	10
Language Usage	30	50	12	20
Clerical Speed and Accuracy	100	100	6	6

[a] Administration time measured in minutes.

Repackaging of Tests

The DAT for PCA and all accompanying materials have been redesigned specifically for administration to adults. In addition, the way in which the DAT tests are packaged has changed with the DAT for PCA: all eight DAT for PCA tests are available either in separate test booklets, or in booklets containing the most frequently used combinations of DAT tests. These combinations include:

* General Cognitive Ability Tests (including Verbal Reasoning and Numerical Ability)
* Perceptual Abilities Tests (including Abstract Reasoning, Mechanical Reasoning, and Space Relations), and
* Language and Clerical Tests (including Spelling, Language Usage, and Clerical Speed and Accuracy).

This repackaging makes it easier for users to administer one, several, or all eight tests to adult populations. In addition, the combination booklets of General Cognitive Ability and Perceptual Ability provide an easy alternative to those users who wish to measure two of the three factors that make up the U.S. Department of Labor's General Aptitude Test Battery (GATB).

Enhancing Ease of Local Scoring

The DAT for PCA answer documents are designed specifically for local scoring by the user; both hand-scorable and Ready-Score (TM) self-scoring mark transfer answer sheets are available in configurations that parallel the separate and combined test booklets. These changes make it easier for users to custom tailor their applications of the DAT for PCA as well as facilitate the immediate gathering of test results.

2. APTITUDE MEASUREMENT: A PHILOSOPHICAL PERSPECTIVE

A clear definition of the term "aptitude" is essential to understanding the philosophy that underlies the DAT. Warren's Dictionary of Psychology (1934) defines aptitude as:

> **APTITUDE.** A condition or set of characteristics regarded as symptomatic of an individual's ability to acquire with training some (usually specified) knowledge, skill, or set of responses ...

This definition implies that aptitudes result from a complex interaction of heredity and environment, and can be considered developed abilities. The entire concept can be summarized as a capacity to learn, given appropriate training and environmental input.

Using this definition of aptitude, the philosophical basis of the DAT involves the premise that human intelligence or mental ability is made up of many different aptitudes, and that these aptitudes must be measured from several points of view. As a result, the DAT is constructed to provide a rich profile of information about an individual's relative aptitudes in many areas of mental activity.

THE APTITUDES

As with the first edition of the DAT, the DAT for PCA includes tests that assess eight important aptitudes:

* Verbal Reasoning
* Numerical Ability
* Abstract Reasoning
* Clerical Speed and Accuracy
* Mechanical Reasoning
* Space Relations
* Spelling
* Language Usage

When all eight tests are administered together, the eight resulting scores are highly useful for broad-spectrum applications, such as career guidance or vocational rehabilitation counseling. For more focused assessment applications, such as personnel selection or adult literacy examinations, the DAT for PCA tests may be administered singly or in combinations of two or more.

The content of each of the eight DAT for PCA tests, their practical applications, and sets of commonly administered test combinations are described below.

Verbal Reasoning

The Verbal Reasoning (VR) test is a measure of ability to understand concepts framed in words. Rather than focusing on simple fluency or vocabulary recognition, the VR test is aimed at the evaluation of the ability to think constructively, to find commonalities among apparently different concepts, and to manipulate ideas on an abstract level. The VR test consists of analogies. The analogy form of test item is especially appropriate for the measurement of reasoning ability. The type of analogy item used in this test is double-ended in which both the first and last terms are missing. The examinee must choose from five alternative pairs the one pair that best completes the analogy. This type of item provides a measure of reasoning that is relatively complex without being tricky or esoteric. At the same time, the content of the items can be varied such that words may come from many different subject areas. Thus, the items sample both the examinee's knowledge as well as his or her ability to abstract and generalize relationships inherent in that knowledge.

VR may be expected to predict success in fields that require the understanding of complex verbal relationships and skill in manipulating verbal concepts. Academic success in most fields would be included in this category, as would success in many occupations, such as business, law, education, journalism, and the sciences.

Numerical Ability

The Numerical Ability (NA) Test is designed to test understanding of numerical relationships and facility in handling numerical concepts. The NA problems are framed in the item type usually called "arithmetic computation" rather than in what is usually called "arithmetic reasoning." This was prompted by the desire to avoid the language elements of the usual arithmetic reasoning problem, in which reading ability may play a significant role. The computation form has the advantage of being a relatively pure measure of numerical ability.

The NA test has been devised to require intelligent handling of a variety of mathematical concepts. For example, in problem 29 of DAT Form T, the answer 54 lbs, 32 oz. is scored as wrong even though it is the correct sum arithmetically; only 56 lbs. is accepted. The former response is not correct for it shows a failure to perceive the relationship between pounds and ounces.

NA is important to the prediction of success in such fields as mathematics, physics, chemistry, engineering, and other curricula in which quantitative thinking is essential. NA is required in varying degrees in occupations such as laboratory assistant, bookkeeper, statistician, and shipping clerk; in carpentry, toolmaking and other crafts, as well as in professions related to the physical sciences.

Abstract Reasoning

The Abstract Reasoning (AR) Test is a nonverbal measure of reasoning ability. It involves the ability to perceive relationships in abstract figure patterns — generalization and education of principles from non-language designs. Each AR problem requires the perception of an operating principle in a series of changing diagrams. In each instance, the examinee must discover the principle(s) governing the changes of the diagrams and give evidence of this understanding by designating the diagram that should follow logically.

In constructing the AR test, considerable care was taken to prevent visual acuity or any visual discrimination factor from contaminating the measurements obtained. The designs used have been selected so that all drawings are large and clear, and differences between successive diagrams are obvious. In each case the task is to generalize the changes into operating principles — thinking with abstract symbols. Complexity is obtained from increasing conceptual difficulty. The differences are apparent; discerning why the patterns differ is the intellectual exercise.

The AR score will be relevant when the job or curriculum requires perception of relationships among things rather than among words or numbers. Examples include such fields as mathematics, computer programming, drafting, and automobile repair. The AR test supplements information about general intelligence obtained by the VR and NA tests, and may be as properly grouped with the Space Relations and Mechanical Reasoning tests. Since the ability to reason with words is not the same as the ability to reason with abstract figures, AR cannot be substituted for VR. However, it can serve as a check on the VR score in cases of known or suspected language handicap. For example, if an examinee with a foreign background scores low on the VR test but high on the AR test, the validity of the VR score should be questioned and reexamined for that individual.

Clerical Speed and Accuracy

The Clerical Speed and Accuracy (CSA) Test is intended to measure speed of response in a simple perceptual task. The examinee must first select the combination that is marked in the test booklet, then bear it in mind while seeking the same combination in a group of similar combinations on a separate answer sheet, and, having found the identical combination, fill in its answer space. The test does not call for reasoning skills; rather, the emphasis is on speed of perception, momentary retention, and speed of response.

The ability to do routine work of the kind that the CSA test exemplifies is important in filing, coding, keypunching, stock room work, and similar occupations. In addition, high scores on the CSA test may be desirable for jobs involving technical and scientific data.

Mechanical Reasoning

The Mechanical Reasoning (MR) Test is a specially constructed version of the Bennett Mechanical Comprehension Test. It was devised to parallel closely, and be slightly easier than, the regular series of Bennett Mechanical Comprehension Tests. The MR test measures the ability to understand basic mechanical principles of machinery, tools, and motion. Each item consists of a pictorially presented mechanical situation and a simply worded question. Items represent simple principles that involve reasoning rather than special knowledge.

The person who excels in this area typically finds it easy to learn the principles of operation and repair of complex devices. The score is affected by the previous experience of the subject, but not to a degree that introduces serious difficulties in interpretation. Formal training in physics produces an increase in score of only a few points.

The MR test is useful in making decisions as to the suitability of the examinee for those occupations and curricula that require an appreciation of the principles of commonly encountered physical forces. Occupations such as those of carpenter, mechanic, maintenance person, and assembler (to name a few) require the kind of understanding this test measures.

Space Relations

The Space Relations (SR) Test measures the ability to visualize a three-dimensional object from a two-dimensional pattern, and to visualize how this object would look if rotated in space. Each

problem shows one pattern, followed by four three-dimensional figures. Examinees are to choose the one figure that can be made from the pattern.

As in the AR test, the patterns and other drawings are large and clear; no premium is placed on visual discrimination. Perception of differences is very easy; the task is concerned solely with judgments of how the objects would look if constructed and rotated. Minute differences in size do not determine the answers. An examinee's answers will be correct if he or she has the ability to imagine the constructed object and its appearance after rotations.

The SR test is a measure of ability to deal with concrete materials through visualization. There are many careers that require the ability to imagine how an object would look if made from a given pattern, or how a specified object would appear if rotated in a given way. This ability to manipulate things mentally and to create a structure in one's mind from a plan is what the SR test is designed to evaluate. It is an ability needed in such fields as drafting, clothing design, architecture, art, die-making, decorating, carpentry, and dentistry.

Spelling and Language Usage

The Spelling (SP) Test measures how well examinees can spell common English words. The examinee is presented with a list of words, and is required to determine which are correctly spelled and which are misspelled. The misspelled words reflect plausible and commonly made spelling errors.

The Language Usage (LU) Test is intended to measure the ability to detect errors in grammar, punctuation, and capitalization. The items reflect the principles of present-day formal writing, and the ability measured by the test is highly predictive of success in a variety of academic courses.

The two tests, SP and LU, are more nearly achievement tests than any of the other DAT tests. The chief reason for their inclusion in the DAT is that they represent basic skills that are necessary in many career and academic pursuits. Separate scores are reported for the two tests, even though there are few instances when one of these abilities is needed without the other. Taken together, SP and LU provide a good estimate of the ability to distinguish correct from incorrect English usage. This ability is necessary in stenography and other aspects of business correspondence, in journalism, in proofreading, in advertising — wherever the written language is stock in trade. Individuals with high VR scores and low SP and LU scores can probably be helped by remedial training.

TEST COMBINATIONS

Although each of the DAT tests is intended to make a unique contribution to the understanding of the individual, it may often be advantageous to consider subgroups of two or more scores together. For example, VR and NA measure those functions that are associated with general cognitive ability — that is, scholastic aptitude, or "intelligence." This combination reflects an ability to learn in either an occupational or scholastic setting, and especially the ability to learn from books and manuals, trainers, teachers, or mentors.

The MR, SR and AR tests all measure components of perceptual ability, or the ability to recognize everyday physical forces and principles, to visualize concrete objects and manipulate those visualizations, as well as reasoning and learning potential of a non-verbal nature. These abilities are particularly important in dealing with things, rather than with people or words. The MR, SR and AR tests are well suited for assessment in most skilled trade occupations.

The CSA, SP, and LU tests are a kind of commercial language group — they represent a group of skills necessary to perform various types of office work. In combination, these tests may be useful for selecting clerical and secretarial candidates.

The VR, SP, and LU tests place a heavy emphasis on use of the English language. Administering these tests may give a misleading picture of the abilities of adults having limited English language facilities. Two tests, AR and SR, are entirely non-verbal (except for directions). The remaining tests place only a small emphasis on reading and verbal skills: NA, MR, and CSA. Of these three tests, the CSA test does not require use of the English language. DAT tests that require the least English language reading proficiency should be used for assessing adults with limited English skills.

3. TEST DEVELOPMENT

The DAT for PCA is a shortened version of the DAT Form V. In-depth historical, test development, and test revision information for Form V may be found in the DAT Form V Administrator's Manual, available from The Psychological Corporation.

CRITERIA FOR ITEM SELECTION

With the exception of the Clerical Speed and Accuracy (CSA) Test, DAT Form V tests were used as item banks for the selection of the DAT for PCA items. The CSA test is an already brief, highly speeded test that does not require shortening; hence, only seven DAT tests were shortened. In developing the DAT for PCA, the following criteria were used to guide item selection:

* Maintenance of test reliability
* Setting appropriate test difficulty level
* Enhancing cultural transparency of items
* Enhancing gender neutrality of items

Maintenance of Test Reliability

The development of the DAT for PCA began with a theoretical analysis of the psychometric effect of shortening each of the seven DAT tests on test reliability. The reliability of shorter versions of the DAT tests can be estimated theoretically by applying the Spearman-Brown formula to the known values of each of the tests' internal consistency reliability coefficients.[1] Using this formula, it was determined how much the original DAT tests could be shortened while still maintaining acceptable reliability coefficients. Table 3.1 lists the observed reliability coefficients for seven of the Form V tests, and the Spearman-Brown projected reliabilities of those tests shortened by 40 percent. These reliability estimates demonstrate that the DAT tests can be shortened without substantially reducing test reliability.

1) The Spearman Brown formula is as follows:

$$r_{nn} = \frac{nr_{tt}}{1+(n-1)r_{tt}}$$

In this formula, r_{nn} is the estimated coefficient, r_{tt} is the obtained coefficient, and n is the number of times the test is lengthened or shortened.

TABLE 3.1

Observed Reliability Coefficients[a] for DAT Form V Tests and Projected Reliability Coefficients[b] for DAT for PCA

Test	Form V (Observed)	DAT for PCA (Projected)
Verbal Reasoning	.94	.90
Numerical Ability	.92	.88
Abstract Reasoning	.94	.90
Mechanical Reasoning	.94	.90
Space Relations	.95	.92
Spelling	.96	.93
Language Usage	.92	.87

[a] Internal Consistency reliabilities as measured by Kudor-Richardson Formula #20.
[b] Reliabilities projected from Form V observed reliabilities using the Spearman-Brown formula.

Setting Appropriate Test Difficulty Level

The item selection process must result in overall test difficulty levels that are appropriate for the intended population: adults and students in post-secondary training programs. The "target difficulty" is the average proportion of correct responses to a test's items in the intended population, corrected for the number of response alternatives. Table 3.2 gives the target difficulty selection criteria of items for the seven tests of the DAT for PCA.

TABLE 3.2

Target Difficulty Criteria for the Seven DAT for PCA Tests

Test	Response Alternatives[a]	Target Difficulty[b]
Verbal Reasoning	5	.60
Numerical Ability	5	.60
Abstract Reasoning	5	.60
Mechanical Reasoning	3	.67
Space Relations	4	.62
Spelling	2	.75
Language Usage	5	.60

[a] These are the number of alternatives from which the examinee may choose on each item.

[b] Target difficulty is the average proportion of correct responses to a test's items.

Enhancing Cultural Transparency of Items

Previous experience with the use of the DAT outside of the United States had shown that a number of items were not appropriate for use in other English-speaking countries. For example, some DAT items had to be revised or replaced for use in Canada, Australia, and Great Britain, due to differences in language usage, spelling conventions, systems of measurement, and cultural referents. In developing the DAT for PCA, care was taken to emphasize cultural transparency in item selection by avoiding items that would not be usable in English-speaking countries other than the U.S.

Enhancing Gender Neutrality of Items

Some gender differences exist in the overall difficulty levels of the DAT tests. For example, females' average scores are higher than males' on the SP and LU tests; males' averages are higher than females' on the MR and SR tests. In assembling the DAT for PCA, care was taken to avoid increasing known gender differences, and to reduce them where possible.

TEST ASSEMBLY

The seven tests of the DAT for PCA were assembled by selecting subsets of items from DAT using the four aforementioned criteria. Two different but overlapping sets of data were used in the assembly of the DAT for PCA: one for assembly, and another for subsequent analyses. The first data set consisted of item analysis statistics, particularly item difficulty and discriminating power, for students in Grade 12 of the 1982 Form V standardization sample; these data were available for males and females, separately and combined. The second set of data consisted of a spaced sample of 1512 males in the standardization sample, spanning grades 10 through 12.

The Grade 12 male and female data set were used as the statistical basis for selecting Form V items for the DAT for PCA. This sample was chosen because it was considered the best approximation to an adult population: twelfth grade sample members are closest in age to an adult population, and little growth is expected in DAT scores after adolescence.

The Grade 10-12 males' item response data set was used to evaluate the psychometric properties of the shortened DAT version, including reliability, summary statistical properties, factorial structure, and correlations between long and short versions of the DAT tests. This sample was chosen because it was largely independent of the sample used for item selection, thus minimizing capitalization on chance in the estimation of the tests' psychometric properties.

4. EQUIVALENCE OF DAT FOR PCA TO DAT FORM V

This section presents both rational and empirical support for equivalence between the DAT for PCA and DAT Form V, and the method used to establish equivalent scores.

RATIONAL AND EMPIRICAL SUPPORT

To support the interchangeability of the DAT for PCA and the DAT Form V, the content specifications of the battery were left unchanged, and all seven new tests were assembled out of test items from the corresponding tests of DAT Form V. As a consequence, the DAT for PCA may logically be considered to be measuring the same aptitudes as DAT Form V, as well as other forms of the DAT.

Following assembly of the DAT for PCA, correlation coefficients were computed between raw scores on the DAT for PCA and those of DAT Form V. A coefficient was obtained for each of the seven tests; none was needed for the unchanged CSA test. The data source for the correlational analyses was the combined Grades 10, 11, and 12 males' item response data from the 1982 standardization of Form V. To compute the correlations, each DAT test was scored twice. First, the Form V raw score was computed; then, the DAT for PCA raw score was computed by ignoring responses to the Form V items not used in the short form. The resulting correlations are presented in Table 4.1.

TABLE 4.1

Part-Whole Correlations of DAT Form V and DAT for PCA

Test	r_{pw}
Verbal Reasoning	.98
Numerical Ability	.97
Abstract Reasoning	.98
Mechanical Reasoning	.98
Space Relations	.96
Spelling	.97
Language Usage	.97

The correlations presented in Table 4.1 are part-whole correlations, since the constituent test items of the DAT for PCA are completely contained in the longer Form V. Part-whole correlations are known to overstate the relationship between independently measured variables, and cannot be interpreted as alternate form correlations. They can, however, be used to support the equivalence of a short form to a longer one, since examinees are expected to respond the same way to the same items regardless of the form. As table 4.1 indicates, raw scores on DAT for PCA correlated very highly with DAT Form V raw scores.

EQUIVALENT RAW SCORES

For the convenience of users of the DAT who might wish to adopt the DAT for PCA, a table of equivalence between DAT for PCA and DAT Forms V and W is presented (see Table 4.2). For every possible raw score on the DAT for PCA, this table contains equivalent raw scores on DAT Forms V and W. The data contained in this table was prepared by performing equipercentile equating of the respective tests of both forms. The equating analyses used the Form V and DAT for PCA scores computed in the 1982 standardization sample of high school males in Grades 10 through 12. For three of the DAT tests — VR, MR, and SP — there were no actual scores in the portion of the score distribution below the chance level; when this occurred, regression methods were used to extrapolate equivalent scores. Table 4.2 presents these raw score equivalents for each test separately. Equivalent raw scores for DAT Forms A through T are published in test manuals for the previous editions of the DAT.

TABLE 4.2

Raw Score Equivalencies between DAT Form V and DAT for PCA By Subtest*

Verbal Reasoning		Numerical Ability		Verbal + Numerical		Abstract Reasoning		Mechanical Reasoning		Space Relations		Spelling		Language Usage	
PCA	V/W	PCA	V/W	PCA	V/W	PCA	V/W	PCA	V/W	PCA	V/W	PCA	V/W	PCA	V/W
30	49	25	39-40	55	88	30	44	45	69	35	59	55	89	30	48
29	47	24	38	54	87	29	43	44	68	34	55	54	86	29	46
28	45	23	37	53	86	28	41	43	66	33	51	53	84	28	43
27	43	22	35	52	84	27	40	42	64	32	47	52	80	27	41
26	41	21	34	51	81	26	38	41	62	31	45	51	78	26	39
25	40	20	32	50	80	25	37	40	61	30	43	50	76	25	37
24	38	19	31	49	78	24	35	39	59	29	41	49	73	24	35
23	36	18	29	48	77	23	34	38	58	28	39	48	71	23	33
22	35	17	28	47	75	22	33	37	56	27	36	47	69	22	32
21	33	16	26	46	74	21	32	36	55	26	35	46	67	21	30
20	32	15	25	45	72	20	31	35	53	25	34	45	65	20	28
19	30	14	23	44	70	19	30	34	51	24	32	44	64	19	27
18	29	13	21	43	69	18	28	33	50	23	30	43	62	18	25
17	27	12	19	42	67	17	27	32	48	22	29	42	60	17	23
16	25	11	18	41	65	16	26	31	47	21	27	41	58	16	22
15	24	10	16	40	64	15	25	30	45	20	26	40	57	15	21
14	22	9	15	39	62	14	23	29	43	19	25	39	55	14	19
13	21	8	13	38	60	13	22	28	42	18	23	38	54	13	18
12	20	7	12	37	59	12	21	27	41	17	22	37	52	12	16
11	18	6	10	36	57	11	20	26	39	16	21	36	51	11	15
10	16	5	9	35	56	10	19	25	37	15	20	35	50	10	14
9	15	4	7	34	54	9	16	24	35	14	19	34	48	9	13
8	13	3	5-6	33	53	8	15	23	34	13	18	33	46	8	13
7	12	2	4	32	51	7	12	22	32	12	17	32	45	7	10
6	11	1	3	31	50	6	10	21	31	11	15	31	43	6	9
5	9			30	48	5	9	20	30	10	14	30	42	5	8
4	8			29	46	4	7	19	28	9	13	29	41	4	6
3	7			28	45	3	6	18	27	8	12	28	40	3	5
2	5			27	43	2	4	17	26	7	11	27	38	2	3
1	3			26	41	1	2	16	25	6	8	26	37	1	2
				25	40			15	24	5	7	25	36		
				24	38			14	21	4	6	24	35		

TABLE 4.2 ***continued***

Verbal Reasoning		Numerical Ability		Verbal + Numerical		Abstract Reasoning		Mechanical Reasoning		Space Relations		Spelling		Language Usage	
PCA	V/W	PCA	V/W	PCA	V/W	PCA	V/W	PCA	V/W	PCA	V/W	PCA	V/W	PCA	V/W
				23	37			13	19	3	5	23	33		
				22	35			12	19	2	4	22	32		
				21	34			11	18	1	3	21	29		
				20	32			10	16			20	27		
				19	31			9	13			19	25		
				18	29			8	12			18	23		
				17	28			7	10			17	22		
				16	26			6	9			16	20		
				15	25			5	7			15	19		
				14	23			4	6			14	18		
				13	22			3	4			13	17		
				12	20			2	3			12	14		
				11	19			1	1			11	12		
				10	17							10	10		
				9	16							9	9		
				8	14							8	7		
				7	13							7	6		
				6	12							6	5		
				5	10							5	4		
				4	8							4	3		
				3	6							3	2		
				2	5							2	2		
				1	3							1	1		

* The raw score distributions are based on the total number of items answered correctly. Raw scores on Clerical Speed and Accuracy are directly equivalent on all forms of the DAT including the DAT for PCA.

5. NORMS AND PROFILES

DESCRIPTION OF THE NORMS

For consistency with previous versions of the DAT, the norms for the DAT for PCA are expressed both as percentiles and as stanines. Norms are reported for each possible raw score on the eight separate tests and also on the combined VR and NA tests for males, females, and both sexes combined (see Tables 5.1, 5.2, and 5.3).

TABLE 5.1

Percentile and Stanine Norms for Males*

Stanine	%ile	VR	NA	VR + NA	AR	MR	SR	SP	LU	CSA
9	99	30	25	55	30	44-45	35	55	30	88-100
9	97	—	—	53-54	29	43	—	—	29	76-87
8	95	29	24	52	—	42	34	53-54	28	68-75
8	90	28	23	49-51	28	—	33	—	26-27	61-67
7	85	27	21-22	47-48	27	40-41	—	52	25	58-60
7	80	25-26	—	45-46	—	—	32	51	24	55-57
6	75	24	20	43-44	—	39	31	50	—	53-54
6	70	23	19	41-42	26	38	30	49	22-23	52
6	65	22	18	39-40	25	—	29	48	—	50-51
6	60	20-21	17	37-38	—	37	28	47	21	49
5	55	19	16	35-36	24	36	27	45-46	20	47-48
5	50	18	15	33-34	23	35	25-26	43-44	19	45-46
5	45	17	14	31-32	22	—	24	42	—	44
5	40	15-16	13	29-30	21	33-34	22-23	40-41	18	43
4	35	14	12	27-28	20	—	21	39	17	41-42
4	30	12-13	11	25-26	19	31-32	19-20	37-38	15-16	40
4	25	11	10	22-24	18	30	17-18	35-36	14	38-39
3	20	10	9	20-21	16-17	28-29	15-16	33-34	13	36-37
3	15	9	7-8	17-19	13-15	26-27	13-14	31-32	12	34-35
2	10	6-8	6	14-16	9-12	24-25	12	28-30	9-11	31-33
2	5	5	5	11-13	7-8	20-23	10-11	24-27	7-8	26-30
1	3	4	3-4	9-10	5-6	17-19	8-9	22-23	5-6	20-25
1	1	0-3	0-2	0-8	0-4	0-16	0-7	0-21	0-4	0-19

* Norms are based on a nationally representative sample of over 5,250 male students tested in fall semester of the 12th grade.

TABLE 5.2

Percentile and Stanine Norms for Females*

Stanine	%ile	VR	NA	VR+NA	AR	MR	SR	SP	LU	CSA
9	99	30	25	54-55	30	42-45	35	55	30	96-100
9	97	29	—	52-53	29	40-41	34	—	29	80-93
8	95	28	23-24	51	—	38-39	33	54	—	73-79
8	90	27	—	48-50	28	36-37	32	—	28	66-72
7	85	—	21-22	46-47	27	35	31	53	26-27	63-65
7	80	25-26	—	45	—	34	30	—	—	60-62
6	75	24	20	43-44	26	33	29	52	25	58-59
6	70	23	19	41-42	25	32	28	—	—	56-57
6	65	22	18	39-40	—	31	27	51	24	55
6	60	20-21	17	37-38	24	—	26	50	23	53-54
5	55	19	16	35-36	—	30	25	49	22	52
5	50	18	15	33-34	23	29	23-24	—	—	50-51
5	45	17	14	31-32	22	27-28	22	48	21	49
5	40	15-16	13	29-30	21	—	20-21	47	20	47-48
4	35	14	—	27-28	19-20	26	19	46	19	45-46
4	30	12-13	11-12	25-26	—	25	18	44-45	—	44
4	25	11	—	23-24	18	24	16-17	43	18	42-43
3	20	10	10	21-22	15-17	23	14-15	41-42	16-17	40-41
3	15	9	8-9	18-20	14	21-22	12-13	38-40	15	39
2	10	6-8	7	15-17	10-13	19-20	11	34-37	13-14	35-38
2	5	5	5-6	12-14	7-9	16-18	9-10	31-33	10-12	31-34
1	3	4	4	10-11	5-6	15	7-8	26-30	8-9	27-30
1	1	0-3	0-3	0-9	0-4	0-14	0-6	0-25	0-7	0-26

* Norms are based on a nationally representative sample of over 5,750 female students tested in fall semester of the 12th grade.

TABLE 5.3

Percentile and Stanine Norms for Combined Sex*

Stanine	%ile	VR	NA	VR + NA	AR	MR	SR	SP	LU	CSA
9	99	30	25	54-55	30	44-45	35	55	30	91-100
9	97	—	—	53	29	43	34	—	29	78-90
8	95	28-29	23-24	51-52	—	42	—	54	28	71-77
8	90	27	—	48-50	28	40-41	33	53	27	64-70
7	85	—	21-22	46-47	27	39	32	—	26	60-63
7	80	25-26	—	45	—	38	31	52	25	58-59
6	75	24	20	43-44	26	36-37	30	51	—	56-57
6	70	23	19	41-42	—	—	29	50	24	54-55
6	65	22	18	39-40	25	35	28	—	23	52-53
6	60	20-21	17	37-38	—	34	27	49	22	51
5	55	19	16	35-36	24	33	25-26	48	21	50
5	50	18	15	33-34	23	32	24	47	—	48-49
5	45	17	14	31-32	22	31	23	46	20	46-47
5	40	15-16	13	29-30	21	30	22	44-45	19	45
4	35	14	—	27-28	20	28-29	20-21	43	18	43-44
4	30	12-13	11-12	25-26	19	27	19	41-42	17	42
4	25	11	10	23-24	18	26	17-18	38-40	16	40-41
3	20	10	9	20-22	16-17	25	15-16	36-37	15	38-39
3	15	9	8	17-19	13-15	23-24	13-14	34-35	13-14	36-37
2	10	7-8	7	15-16	10-12	20-22	11-12	30-33	11-12	33-35
2	5	6	5-6	12-14	7-9	17-19	9-10	26-29	8-10	29-32
1	3	5-4	4	10-11	5-6	15-16	7-8	23-25	6-7	24-28
1	1	0-3	0-3	0-9	0-4	0-14	0-6	0-22	0-5	0-23

* Norms are based on a nationally representative sample of over 11,000 male and female students tested in fall semester of the 12th grade.

Source of Normative Data

The DAT for PCA norms are the norms obtained for twelfth-grade high school students in the 1982 DAT Form V U.S. standardization sample. These norms are presented as score equivalents for the DAT for PCA. The examinee samples were determined by drawing a representative sample of U.S. school districts, and then of students within each participating district. Details of the sampling and norms development are reported in the DAT Administrator's Handbook for Forms V/W, available from The Psychological Corporation.

For many purposes, these national norms for twelfth-graders should be adequate for assessing adults as well. There is relatively little growth in the abilities assessed by the DAT after age 18, so norms for high school seniors should approximate the norms that would be obtained if a similarly representative sample of young adults was tested. In some circumstances, however, it may be preferable to interpret DAT for PCA performance with respect to a reference group that is more similar to the examinee group of interest. When this is the case, the test user should make arrangements to develop local norms, describing the distribution of DAT for PCA test scores in a specific examinee population.

Separate Norms by Sex

The norms for the DAT for PCA are reported in two different ways: both sexes combined, and separately by sex. Norms are reported separately by sex in order to encourage sex-fair interpretation of the test results. Although males and females perform about the same on three tests of the DAT, the two sexes typically score differently on the other tests. In particular, females tend to score higher than males on the SP, LU, and CSA tests; males achieve higher average scores on the MR and SRtests. Any sex differences that are found in raw scores on a test will be retained in combined-sex norms. In these instances, using combined-sex norms can result in either an exaggerated or an unduly discouraging picture of an examinee's ability. By

contrast, using separate norms for interpreting the scores of males and females will equate the distributions of percentile scores that are reported for each sex, effectively eliminating sex differences in the scores reported to examinees. For information on using the combined and sex-differentiated norms in a vocational counseling setting, see the DAT Administrator's Handbook for Forms V/W.

Norms for VR + NA

In addition to the eight separate tests, norms for the composite of VR and NA are included in the norms tables for the DAT for PCA. VR + NA, the sum of raw scores on the VR and NA tests, is a measure of general cognitive ability, and has been shown to be highly correlated with a number of other measures of general ability or intelligence. In addition, VR + NA has been useful as a general measure of academic ability or as an indicator of general ability to benefit from training programs, and may be useful in the selection of candidates for positions in industry, business, and government.

READING THE NORMS TABLES

The norms tables contain both percentiles and stanines corresponding to raw scores for the eight tests. The following paragraphs describe how to read both percentiles and stanines from the tables.

Percentiles

Percentile norms have been devised to encourage realistic interpretation of the test scores. All of the tests are highly reliable; however, it is important for the user to recognize that some component of any test score is error. Therefore, all scores have been converted to 23 designated percentile values. This method was chosen to avoid the appearance of exaggerated precision.

The procedure for converting raw scores to percentiles is to find the raw score for the specific test in the appropriate table according to sex (combined, males, or females). The corresponding percentile will be found in the same row as the raw score, at the left side of the page. Percentiles for all tests, and for the VR and NA combination, can be found in this fashion.

Although the percentiles appear as precise points in the norms tables, each number actually represents a zone of ability. These zones have been constructed so that the indicated percentiles represent the midpoint of each zone. For example, assume an examinee attains a raw score of 24 on VR. This examinee is at the 75th percentile according to the norms table. This figure actually represents a band including percentile values between 73 and 77, which means that this examinee scored higher than 72 percent of the normative group, while at least 22 percent of the group scored higher than this examinee.[1]

Stanines

Stanine equivalents of raw scores may be found by referring to the stanine column in Tables 5.1, 5.2., and 5.3. The stanine equivalents may be convenient for some purposes, but these nine broad categories do not allow the type of distinctions that may be made with percentiles. The tabulation on the following page shows the percent of the normative reference group assigned to each stanine. To obtain the stanine for a given raw score, locate the score on the appropriate line of Tables 5.1–5.3 and read the corresponding stanine at the left side of the page.

Stanine	Portion of Group
1	Lowest 4 percent
2	Next 7 percent
3	Next 12 percent
4	Next 17 percent
5	Middle 20 percent
6	Next 17 percent
7	Next 12 percent
8	Next 7 percent
9	Highest 4 percent

INTERPRETATION OF INDIVIDUAL PROFILES

The interpretation of an individual's DAT for PCA performance may be approached in two ways: norm-referenced and within-person comparison.

1) The zones of percentiles become narrower toward the extremes of the distribution. Thus, a percentile of 5 includes 4 through 7; 3 includes 2 and 3; 1 represents the first percentile only. Likewise, the 95th percentile includes 93 through 96; 97 includes 97 and 98; 99 represents only the 99th percentile. The remaining percentile designations are the midpoints of bands that are five percentiles wide.

Norm-Referenced Comparison

Norm-referenced comparisons involve comparing the performance of an examinee to the performance of others. Each examinee's DAT for PCA score is taken separately and evaluated relative to the scores of an appropriate normative sample, such as the national standardization sample.

Norm-referenced comparisons can be made for any or all of the tests. In cases of focused assessment (e.g., personnel selection), only one or a few tests may be of interest. For personnel selection applications, specific DAT for PCA tests are administered according to their expected relationship to success in a specified job. Cut-off scores are determined in relation to a locally developed normative group, such as successful employees holding the same job.

Table 5.4 lists summary statistics of DAT scores for a number of different occupational groups. These data were collected on all forms of the DAT and may be used for comparison purposes.

Within-Person Comparison

Within-person comparison involves comparing examinees' performance on each test of the battery with each examinee's own performance on the other tests of the battery. This type of comparison is typically used in broad-spectrum applications, especially career counseling. In within-person comparison, all of the DAT for PCA test scores are analyzed, giving a profile of relative strengths and weaknesses for the examinee. This profile can then be compared to typical profiles of aptitudes needed in various occupational groups. In this way, an examinee may learn the "goodness of fit" between their own aptitude profile and the profile that is required to perform well within a given occupation. The DAT Form V/W Administrator's Manual provides more information for the computation of profiles; the DAT Form V/W Counselor's Manual provides in-depth profile requirements for a number of occupational groups.

TABLE 5.4

Summary Statistics for Specific Occupational Groups

Occupational Group	Form	N	Actual Scores Mean	SD	Equivalent Means V	PCA
Verbal Reasoning						
Corn farmers	A	50	22.5	—	27	17
EEG technician trainees	L	65	30.0	—	30	19
Plumbing apprentices	L/M	51	26.0	8.1	26	16
Administrative personnel in electronics company	V	115	34.4	9.2	34	21
Engineering personnel in electronics company	V	67	38.7	7.5	39	24
Machine packagers	V	45	22.9	9.9	23	14
Newspaper editors	V	165	45.0	5.8	45	28
Newspaper reporters	V	224	44.0	5.9	44	28
Programmer trainees	V	50	40.0	7.4	40	25
Technical personnel in electronics company	V	82	34.4	8.3	34	21
Administrative personnel	PCA	78	22.3	6.4	35	22
Clerical personnel	PCA	63	15.6	6.4	25	16
Electricians in consumer products company	PCA	26	20.7	6.1	33	21
Insurance appraisers	PCA	17	20.1	5.5	33	20
Managerial personnel	PCA	63	27.5	2.3	44	28
Mechanics in consumer products company	PCA	40	19.9	6.2	32	20

TABLE 5.4 *continued*

Occupational Group	Form	N	Actual Scores Mean	SD	Equivalent Means V	PCA
Verbal Reasoning *continued*						
Pipefitters in consumer products company	PCA	21	18.3	5.6	29	18
Skilled tradesmen	PCA	77	18.6	6.5	30	19
Numerical Ability						
Air traffic controller trainees	A	811	22.2	—	28	17
Corn farmers	A	50	22.5	—	28	17
Heavy vehicle driver trainees in state assistance program	B	112	6.8	2.1	12	7
Heavy vehicle driver trainees in state assistance program	B	126	5.8	1.8	11	6
Plumbing apprentices	L/M	51	20.0	7.4	19	12
Refinery plant operators	T	337	23.0	7.9	23	14
Administrative personnel in electronics company	V	115	23.4	9.0	23	14
Applicants to consumer products company	V	236	21.6	9.3	22	13
Engineering personnel in electronics company	V	67	31.2	6.8	31	19
Machine packagers	V	45	15.2	7.7	15	9
Technical personnel in electronics company	V	82	23.7	7.9	24	15
Administrative personnel	PCA	78	15.1	5.6	25	15
Clerical personnel	PCA	63	10.5	5.1	18	11
Electricians in consumer products company	PCA	26	15.3	5.0	25	15
Insurance appraisers	PCA	17	12.2	6	19	12
Managerial personnel	PCA	63	19.1	3.9	31	19
Mechanics in consumer products company	PCA	40	13.0	4.9	21	13
Pipefitters in consumer products company	PCA	21	12.5	4.5	20	12
Skilled tradesmen	PCA	77	11.6	5.4	19	12
Verbal Reasoning + Numerical Ability						
Machine packagers	V	45	38.1	15.4	38	24
Production applicants	V*	4489	30.9	12.3	31	19
Abstract Reasoning						
Air traffic control trainees	A	812	34.4	—	33	22
Clerical workers	A	61	19.8	12.0	25	15
Corn farmers	A	50	21.0	—	26	16
Engineering Freshmen	A	616	42.1	3.8	40	27
Freshman psychology students	A	48	31.8	10.6	31	20

TABLE 5.4 *continued*

Occupational Group	Form	N	Actual Scores Mean	SD	Equivalent Means V	PCA
Abstract Reasoning *continued*						
Phone installers	A	430	32.0	8.0	31	20
Utility executives	A	208	28.3	10.4	30	19
Draftsmen	B	20	28.2	13.1	30	19
Junior Programmers	S/T	132	42.1	6.5	38	26
Phone company technicians	S/T	134	37.9	8.0	33	22
Administrative personnel in electronics company	V	115	31.6	7.7	32	21
Applicants to consumer products company	V	236	31.6	7.5	32	21
Engineering personnel in electronics company	V	67	37.3	5.6	37	25
Machine packagers	V	45	22.3	10.7	22	13
Marker makers in clothing company	V	167	22.2	9.6	22	13
Production applicants	V*	4489	29.1	10.1	29	18
Programmer trainees	V	50	38.2	5.3	38	26
Skilled applicants	V	746	33.3	7.2	33	22
Technical personnel in electronics company	V	82	33.7	5.6	34	23
Theme park new hires	V	654	31.7	8.7	32	21
Administrative personnel	PCA	78	19.7	6.7	31	20
Insurance appraisers	PCA	17	21.5	6.1	33	22
Electricians in consumer products company	PCA	26	21.5	5.0	33	22
Managerial personnel	PCA	63	22.4	4.3	33	22
Mechanics in consumer products company	PCA	40	18.3	6.6	28	18
Pipefitters in consumer products company	PCA	21	18.2	6.5	28	18
Skilled tradesmen	PCA	77	16.6	7.3	27	17
Clerical personnel	PCA	63	16.2	6.9	26	16
Mechanical Reasoning						
Air traffic control trainees	A	593	43.2	—	55	36
Civil engineer students, final year	A	60	32.9	10.6	48	32
Corn farmers	A	50	53.0	—	61	40
Electrical engineering students, final year	A	60	35.3	10.5	49	32
Engineering freshmen	A	616	53.4	8.2	61	40
Mechanical engineering students, final year	A	60	45.3	10.6	57	37
Beginner aircraft mechanics	A/B	92	44.5	11.2	56	37
Factory foremen	A/B	56	40.7	12.5	54	35
Riveters assistants	A/B	180	39.6	12.6	53	35
Draftsmen	B	20	44.9	11.7	57	37

TABLE 5.4 *continued*

Occupational Group	Form	N	Actual Scores Mean	SD	Equivalent Means V	PCA
Mechanical Reasoning *continued*						
Plumbing apprentices	L/M	51	44.7	10.5	49	32
Equipment technicians	S/T	134	56.1	9.6	58	38
Applicants to consumer products company	V	236	50.0	11.8	50	33
Engineering personnel in electronics company	V	67	55.0	8.3	55	36
Machine packagers	V	45	40.5	10.8	41	27
Skilled applicants	V	746	58.8	7.4	59	39
Technical personnel in electronics company	V	82	49.0	11.9	49	32
Unskilled applicants	V*	4893	48.9	11.4	49	32
Administrative personnel	PCA	78	30.8	6.6	47	31
Clerical personnel	PCA	63	26.8	7.3	41	27
Electricians in consumer products company	PCA	26	38.4	3.8	58	38
Insurance Appraisers	PCA	17	37.4	3.0	56	37
Managerial personnel	PCA	63	36.4	4.8	55	36
Mechanics in consumer products company	PCA	40	38.2	4.8	58	38
Pipefitters in consumer products company	PCA	21	35.7	5.7	55	36
Skilled tradesmen	PCA	77	37.3	4.5	56	37
Space Relations						
Air traffic control trainees	A	623	63.0	—	39	28
Civil engineering students, final year	A	60	36.7	16.1	26	20
Corn farmers	A	50	43.0	—	29	22
Electrical engineering students, final year	A	60	37.4	17.3	26	20
Engineering students, first year	A	616	74.6	14.2	47	32
Mechanical engineering students, final year	A	60	58.5	62.5	35	26
Medical students	A	150	62.0	15.8	36	27
Naval aviation cadets	A	125	75.3	13.9	47	32
Draftsmen	B	20	49.8	24.8	32	24
Plumbing apprentices	L/M	51	31.6	13.3	32	24
Dental hygiene students, second year	S/T	70	39.2	9.6	39	28
Dental hygiene students, third year	S/T	70	42.9	10.2	43	30
Refinery and plant operators, new hires	T	339	33.9	10.3	34	25
Skilled tradesmen	T	79	27.3	9.9	26	20
Machine packagers	V	45	24.3	11.0	24	18
Administrative personnel	PCA	78	21.8	7.5	29	22

TABLE 5.4 *continued*

Occupational Group	Form	N	Actual Scores Mean	SD	Equivalent Means V	PCA
Space Relations *continued*						
Clerical personnel	PCA	63	19.3	7.3	25	19
Electricians in consumer products company	PCA	26	25.9	6.2	35	26
Insurance appraisers	PCA	17	25.0	6.2	34	25
Managerial personnel	PCA	63	25.9	5.8	35	26
Mechanics in consumer products company	PCA	40	24.1	6.9	32	24
Pipefitters in consumer products company	PCA	21	21.5	7.0	29	22
Skilled tradesmen	PCA	77	24.4	7.4	32	24
Spelling						
Administrative personnel	PCA	78	51.7	4.0	80	52
Clerical personnel	PCA	63	46.3	8.0	67	46
Managerial personnel	PCA	63	52.6	3.3	84	53
Skilled tradesmen	PCA	77	41.9	9.4	60	42
Language Usage						
Air traffic control trainees	A	458	37.2	—	37	25
Administrative personnel	PCA	78	25.5	3.9	39	26
Clerical personnel	PCA	63	20.1	5.3	28	20
Managerial personnel	PCA	63	26.8	2.4	41	27
Skilled tradesmen	PCA	77	19.7	5.2	28	20
Clerical Speed and Accuracy						
Administrative personnel	PCA	78	46.4	9.3	46	46
Clerical personnel	PCA	63	44.8	9.9	45	45
Managerial personnel	PCA	63	49.9	8.5	50	50
Skilled tradesmen	PCA	77	39.7	8.6	40	40

* Experimental test composed of Form V items and the length of DAT for PCA tests.

6. RELIABILITY

Reliability refers to the accuracy and precision of test scores, and is one indication of the confidence one may place in test scores. Reliability may be examined by determining the internal consistency of a scale, the stability of test scores over time, or the consistency of scores between alternate forms of a test. The Kuder-Richardson procedure yields an estimate of internal consistency reliability.[1] Table 6.1 contains Kuder-Richardson Formula #20 (KR#20) reliability coefficients, raw score means, standard deviations, and standard errors of measurement for the seven DAT for PCA tests. The KR#20 reliability coefficients were computed from the item response data collected in the 1982 national standardization of DAT Forms V and W. For these analyses, the Grade 10 through 12 male subsample data were used; only the DAT for PCA items were scored.

TABLE 6.1

Reliability of Seven DAT for PCA Tests

Test	r_{tt}[a]	Mean	SD	SEM
Verbal Reasoning	.91	15.7	7.7	2.3
Numerical Ability	.88	13.9	6.0	2.1
Abstract Reasoning	.91	20.0	7.2	2.2
Mechanical Reasoning	.91	32.5	8.5	2.6
Space Relations	.93	22.0	9.0	2.4
Spelling	.94	38.8	11.0	2.9
Language Usage	.89	17.0	7.0	2.3

[a] Internal consistency reliability computed using Kuder-Richardson Formula #20

Another statistic frequently used in estimating a test's precision is the standard error of measurement (see SEM in Table 6.1). The standard error of measurement gives an indication of test reliability expressed in raw score units. Since no test is perfectly accurate, scores obtained by an examinee on any test will vary from administration to administration. As a result, any obtained score is considered an estimate of the examinee's "true" score. The standard error of measurement is a statistical measure of how close an obtained raw score is to this theoretical true score. The standard error of measurement is typically used to create a "confidence interval" around the obtained score within which the true score has a high probability of falling. For example, suppose an examinee with a raw score of 20 on the VR test were tested repeatedly. With a standard error of measurement of about 2 raw score points, the chances are two out of three that his/her true score falls between 18 and 22.

Note that KR#20 reliability coefficients are not reported for the CSA test in Table 6.1. Since this test is highly speeded, internal consistency measures of reliability are not appropriate. For the CSA test, alternate-form reliability coefficients were computed during the development of DAT Forms V/W. As detailed in the DAT Form V/W Administrator's Handbook, two independent samples were used for this analysis. Grade 8 and Grade 10 data were obtained from public schools in two suburban communities of New York State. All students were given Parts I and II of the Form V CSA test, followed immediately by Part II of the Form W CSA test. The results of this study are reprinted in Table 6.2.

---

1) The KR#20 formula is as follows:

$$r_{tt} = \left(\frac{n}{n-1}\right)\frac{SD_t^2 - \Sigma\, pq}{SD_t^2}$$

In this formula, r_{tt} is the reliability coefficient of the whole test, n is the number of items in the test, and SD_t the standard deviation of total scores on the test. Σ pq is found by tabulating the proportion of persons who pass (p) and the proportion who do not pass (q) each item.

TABLE 6.2

Alternate-Form Reliability Coefficients for the Clerical Speed and Accuracy Test, Forms V and W[a], by Sex.

Sex	N	Corr. r [b]	Corr. r_{vw} [c]	Form V Mean	Form V SD	Form W Mean	Form W SD
Males	96	.97	.78	45.3	9.4	49.2	8.2
Females	89	.96	.90	48.4	8.6	52.2	9.9

Note: The data were collected in two suburban communities in New York.

[a] Form V administered first, followed immediately by Form W.
[b] Reliability coefficient estimated from r_{vw} after correction for variability of norms group.
[c] Obtained coefficient of correlation between Forms V and W.

7. VALIDITY

Three broad categories of evidence are typically recognized for examining the issue of test validity: content validity, criterion-related validity, and construct validity evidence. The focus of this chapter is on two of these categories: criterion-related and construct validity evidence.

CRITERION-RELATED VALIDITY

One of the primary reasons tests are used is to help enable organizations, selection specialists, trainers, teachers, or other individuals make an educated guess about an examinee's potential for future success. For example, selection tests are used to hire or promote those individuals who are most likely to be productive employees. The rationale behind selection tests is this: the "better" an individual performs on the test, the "better" this individual will perform as an employee. How sound and appropriate is this inference? In other words, how valid is the inference that the high-scoring individual will be a high-performing employee?

As do other types of validity evidence, criterion-related validity evidence addresses the question of the validity of the inference that high-scoring individuals will be successful on some criterion of interest. Criterion-related validity is an empirical — or statistical — approach to gathering validity evidence. By collecting test scores and criterion scores, such as job performance scores, grades in a training course, or scores on other tests, one can statistically determine how much confidence may be placed in using test scores to predict success on the criterion of interest. Typically, correlation coefficients between criterion measures and scores on the test serve as indices of criterion-related validity. At the end of this chapter, Table 7.1 presents a compilation of criterion-related validity coefficients collected for the DAT for PCA and other forms of the DAT.

CONSTRUCT VALIDITY

Construct validity evidence relies upon both statistical and logical means to justify the use of tests. Construct validation demonstrates two points:

(a) that the construct measured by the test (e.g., verbal reasoning or numerical ability) is required for success on the criterion of interest, and

(b) that the specific test under consideration is a good measure of the theoretical construct or trait.

Evidence of construct validity is gathered by collecting criterion-related validity evidence, content validity evidence, information about test development procedures, and information about the overlap of the test under consideration with other tests. Evidence for construct validity can be shown through convergent, divergent, and factorial validity. Convergent validity is shown when a test correlates with other tests or variables that purport to measure the same trait or construct. Alternatively, divergent validity is shown when a test does not correlate highly with tests or variables that measure different traits or constructs. Factorial validity evidence is gathered when a factor analysis shows a clustering of variables that are thought to be common to a group of tests or other measures of a trait. Convergent and divergent validity are usually shown by correlating a test with other tests, and factor analysis further analyses these intercorrelations in terms of their commonalities.

Evidence of the construct validity of the DAT for PCA can be examined by noting the known relationship of other forms of the DAT to three kinds of tests:

* other multiple aptitude batteries,
* nationally standardized college admissions tests, and
* general ability and intelligence tests.

Relationship With Other Multiple Aptitude Batteries

The DAT is one of the three most widely used multiple aptitude test batteries in the United States. The other two batteries are the General Aptitude Test Battery (GATB), developed by the U.S. Department of Labor's U.S. Employment Service, and the Armed Services Vocational Aptitude Battery (ASVAB), developed by the Department of Defense. The relationship of the DAT to each of these batteries has long been a subject of investigation. DAT correlations with GATB were evaluated as early as 1948, and reported in the GATB manual. The Department of Defense has conducted studies of the interrelationships among ASVAB and DAT, and among GATB and ASVAB. The results of a select few of these studies involving the DAT are highlighted below.

The General Aptitude Test Battery (GATB):

The GATB has been widely used in personnel assessment by state employment services, who also offer the GATB as a screening device for prospective employers. In cooperation with state agencies, the U.S. Employment Service has conducted hundreds of criterion-related GATB validity studies over the last forty years.

The GATB includes twelve tests; from these, nine factors are reported. In contrast with the DAT, all of the GATB tests are brief and speeded. The nine factors are:

G: General Intelligence
V: Verbal Aptitude
N: Numerical Ability
S: Spatial Ability
P: Form Perception
Q: Clerical Perception
K: Motor Coordination
F: Finger Dexterity
M: Manual Dexterity

The first factor, G (General Intelligence) includes scores on three tests that are included in other GATB factors (Vocabulary, Arithmetic Reasoning, and Spatial Perception); consequently, scores on G overlap with scores on factors V, N, and S. The first six GATB scores are composites of scores on printed tests of cognitive abilities. The last three factors, K, F, and M, are derived from physical tests of motor function.

Table 7.2 contains the intercorrelations of the eight DAT tests with six GATB scores obtained in a 1986 study in Canada. The subjects included male and female high school and community college students. This study used all eight DAT tests, but only tests of cognitive abilities from the GATB.

The pattern of DAT-GATB correlations in Table 7.2 is highly similar to DAT-GATB correlations obtained from a sample of male high school seniors in 1948, despite the fact that the two tables' data were obtained almost forty years apart, in different countries, and using different forms of both test batteries (for 1948 correlations, see the Third Edition Manual for the DAT). The similarity of these correlational patterns provides evidence that the interrelationships of DAT and GATB tests are consistent across time and place.

The pattern of correlations in Table 7.2 shows the following relationships:

1) Overall, the DAT battery is highly related to the six GATB cognitive factors,

2) All of the DAT tests, except the Clerical Speed and Accuracy Test, were highly correlated with the GATB's General Intelligence Factor,

3) Each of the DAT tests has its highest correlation with the appropriate GATB factor, and

4) The DAT's Clerical Speed and Accuracy test correlated fairly highly with all of GATB"s perceptual tests, as well as the motor tests.

The Armed Services Vocational Aptitude Battery (ASVAB):

The ASVAB is used in personnel selection, high school counseling, and two major Department of Defense testing programs. For personnel selection, the ASVAB is used by all four U.S. military services to establish applicants' qualifications for enlistment, and for placement in military technical specialties. The ASVAB, like the GATB, has been extensively studied to determine its job-related predictive validity; virtually all such studies to date have involved military occupations.

The ASVAB Form 14 contains the following 10 tests:

GS: General Science
AR: Arithmetic Reasoning
WK: Word Knowledge
PC: Paragraph Comprehension
NO: Numerical Operations
CS: Coding Speed
AS: Automotive and Shop Information
MK: Mathematics Knowledge
MC: Mechanical Comprehension
EI: Electronics Information

TABLE 7.2

DAT-GATB Intercorrelation Matrix

	VR	NA	VR + NA	AR	CSA	MR	SR	SP	LU	G	V	N	S	P
NA	.73													
VR + NA	—	—												
AR	.63	.70	.71											
CSA	.41	.44	.46	.35										
MR	.68	.63	.71	.69	.27									
SR	.68	.67	.72	.70	.38	.72								
SP	.68	.57	.68	.44	.40	.35	.40							
LU	.81	.66	.80	.51	.44	.55	.53	.75						
G	.78	.72	.81	.64	.48	.62	.64	.70	.80					
V	.76	.64	.76	.58	.46	.57	.55	.68	.81	.94				
N	.52	.62	.61	.43	.48	.29	.33	.64	.58	.66	.54			
S	.53	.58	.59	.63	.42	.58	.68	.40	.45	.70	.57	.41		
P	.19	.23	.22	.24	.36	.19	.27	.24	.19	.37	.28	.35	.49	
Q	.40	.42	.44	.39	.61	.21	.29	.50	.39	.57	.51	.62	.46	.49

DAT Tests

VR = Verbal Reasoning
NA = Numerical Ability
VR + NA = Verbal Reasoning/Numerical Ability Composite
AR = Abstract Reasoning
CSA = Clerical Speed and Accuracy
MR = Mechanical Reasoning
SR = Space Relations
SP = Spelling
LU = Language Usage

GATB Tests

G = General Learning Ability
V = Verbal Aptitude
N = Numerical Aptitude
S = Spatial Aptitude
P = Form Perception
Q = Clerical Perception

Of the ten ASVAB-14 tests, eight are essentially power tests, and two are highly speeded: Numerical Operations and Coding Speed. Of the eight power tests, three involve a reasoning task — Arithmetic Reasoning, Paragraph Comprehension, and Mechanical Comprehension; the other five are tests of acquired information or knowledge: General Science, Word Knowledge, Automotive and Shop Information, Mathematics Knowledge, and Electronics Information. The only ASVAB test with a direct counterpart DAT test is the Mechanical Comprehension test, which is highly similar in item content to DAT Mechanical Reasoning. ASVAB's two tests of quantitative aptitude, Arithmetic Reasoning and Mathematics Knowledge, are both similar to school achievement tests in mathematics. Paragraph Comprehension is similar to a reading achievement test.

Table 7.3 contains a complete matrix of intercorrelations between the tests of the DAT and ASVAB-14. Also included in the table are correlations of two composite measures of general cognitive ability: the VR + NA composite of DAT, and the Armed Forces Qualification Test (AFQT) composite of ASVAB tests AR, WK, PC, and NO. The data in Table 7.3 were obtained in a Department of Defense study of 1338 high school students in grades 10 through 12, reported in the Technical Supplement to the ASVAB Counselor's Manual.

TABLE 7.3

DAT-ASVAB Intercorrelation Matrix

	VR	NA	VR + NA	AR	CSA	MR	SR	SP	LU	GS	ARITH	WK	PC	NO	CS	AS	MK	MC
NA	.75																	
VR + NA	—	—																
AR	.69	.75																
CSA	.11	.22	—	.17														
MR	.62	.55	—	.58	.08													
SR	.66	.62	—	.61	.09	.71												
SP	.56	.56	—	.46	.19	.50	.48											
LU	.76	.67	—	.62	.11	.64	.64	.73										
GS	.72	.64	.73	.58	.05	.66	.61	.53	.68									
ARITH	.75	.79	.82	.65	.10	.62	.66	.54	.67	.72								
WK	.78	.67	.78	.62	.04	.63	.59	.60	.76	.82	.73							
PC	.72	.66	.74	.62	.07	.60	.59	.57	.72	.72	.71	.80						
NO	.23	.41	.33	.30	.35	.21	.27	.36	.28	.27	.35	.28	.29					
CS	.22	.35	.30	.28	.42	.12	.19	.36	.26	.16	.26	.20	.26	.58				
AS	.47	.40	.47	.39	-.03	.63	.50	.27	.39	.60	.52	.57	.49	.15	.04			
MK	.73	.78	.80	.66	.13	.58	.67	.54	.68	.67	.80	.68	.69	.34	.27	.45		
MC	.61	.57	.63	.57	.03	.73	.66	.39	.55	.66	.65	.63	.62	.21	.14	.66	.63	
EI	.48	.42	.49	.40	-.01	.59	.50	.35	.48	.59	.53	.57	.52	.14	.07	.66	.50	.68
AFQT	.78	.80	.84	.69	.16	.65	.66	.64	.76	—	—	—	—	—	—	—	—	—

DAT Test

VR = Verbal Reasoning
NA = Numerical Ability
VR + NA = Verbal Reasoning/Numerical Ability Composite
AR = Abstract Reasoning
CSA = Clerical Speed and Accuracy
MR = Mechanical Reasoning
SR = Space Relations
SP = Spelling
LU = Language Usage

ASVAB Test

GS = General Science
ARITH = Arithmetic Reasoning
WK = Word Knowledge
PC = Paragraph Comprehension
NO = Numerical Operations
CS = Coding Speed
AS = Auto and Shop Information
MK = Mathematics Knowledge
MC = Mechanical Comprehension
EI = Electronics Information

Data provided by Malcolm Ree, N = 1338. VR + NA and AFQT correlations were obtained from the Technical Supplement to the Counselor's Manual.

Table 7.4 presents the results of a factor analysis of the ASVAB-DAT data reported in Table 7.5. All tests of the DAT were used; ASVAB-14 subtests included were General Science (SC), Arithmetic Reasoning (AR), Word Knowledge (WK), Paragraph Comprehension (PC), Numerical Operations (NO), Coding Speed (CS), Auto & Shop Information (AS), Mathematics Knowledge (MK), Mechanical Comprehension, (MC), and Electronics Information (EI). The factor analysis used the principal axes method and varimax rotation; four factors were extracted.

TABLE 7.4

DAT-ASVAB Factor Loading Matrix

	Factor 1	Factor 2	Factor 3	Factor 4
ASVAB Tests				
General Science	.45	.55	.47	.06
Arithmetic Reasoning	.67	.44	.32	.18
Word Knowledge	.47	.48	.59	.08
Paragraph Comp.	.49	.42	.51	.13
Numerical Operations	.16	.18	.12	.68
Coding Speed	.11	.01	.14	.79
Auto and Shop Info.	.19	.80	-.12	.01
Mathematics Knowledge	.69	.37	.31	.20
Mechanical Comp.	.42	.74	.16	.07
Electronics Information	.21	.72	.23	.01
DAT Tests				
Verbal Reasoning	.66	.35	.47	.08
Numerical Ability	.78	.26	.27	.31
Abstract Reasoning	.66	.31	.25	.21
Mechanical Reasoning	.39	.65	.31	.07
Space Relations	.53	.49	.26	.13
Spelling	.30	.19	.63	.31
Language Usage	.47	.30	.70	.15
Clerical Speed and Acc.	.08	-.04	.01	.52

Factor 1 = General Reasoning
Factor 2 = Mechanical Operations and Principles
Factor 3 = Verbal Achievement
Factor 4 = Clerical Speed

The pattern of DAT-ASVAB correlations and factor loadings in Tables 7.3 and 7.4 show the following relationships:

1) Overall, the DAT battery is highly related to ASVAB,

2) With the exception of the highly speeded Clerical Speed and Accuracy test, all of the DAT's tests were moderately to highly correlated with all of the ASVAB's power tests,

3) The DAT's Clerical Speed and Accuracy was correlated only with ASVAB's two speeded tests, Numerical Operations and Coding Speed,

4) The DAT's VR + NA composite was very highly related to ASVAB's scholastically-oriented tests — General Science, Arithmetic Reasoning, Word Knowledge, Paragraph Comprehension, and Mathematics Knowledge, and

5) The DAT's Verbal Reasoning, Numerical Ability, Mechanical Reasoning, and Language Usage tests each had their highest correlations with ASVAB tests with similar content — respectively with Word Knowledge; Arithmetic Reasoning and Math Knowledge; Mechanical Comprehension; and Word Knowledge and Paragraph Comprehension.

Relationship with College Admissions Tests

Two test programs are of great importance in college admissions programs: the Scholastic Aptitude Test (SAT) of the College Entrance Examination Board, and the American College Testing Program's ACT. Previous research with the DAT has established a high degree of correlation among certain DAT tests and scores on these two college admissions tests. In particular, the DAT Verbal Reasoning and Numerical Ability tests, and the VR + NA composite have been found to be highly predictive of SAT and ACT scores. For example, the DAT Form V/W VR + NA composite has demonstrated correlations in the range of .38 to .79 with SAT scores and .68 to .94 with ACT scores. The DAT Form V/W Technical Supplement, published in 1984, contains correlations of DAT scores with ACT and SAT scores from a number of studies involving DAT Forms S/T and V/W.

Relationship with General Ability and Intelligence Tests

Although the DAT was developed explicitly to counter the practice of reporting test performance in terms of a single, global ability score, it has long been known that scores on some of the separate DAT tests are highly correlated with scores on a variety of general ability or intelligence tests. Early studies examining the relationship between the DAT VR + NA composite and several well-known scholastic aptitude or intelligence tests recorded correlation coefficients in the range .66 to .92, while more recent examinations reveal correlations ranging from .38 to .94 for males and .47 to .87 for females. For more information about studies that have assessed these relationships, see the Fifth Edition Manual for the DAT Forms S/T and the DAT Form V/W Technical Supplement.

TABLE 7.1

Selected Criterion-Related Validity Studies of the DAT

Test Form	Group	N	Test	r	Mean	SD	Criterion	Sample Composition
A	Industrial workers in a large organization in Italy, graduates of a program to train skilled workers	84	VR	.49	22.8	12.0	Supervisor rating following 1-year training program of combined classroom performance, job performance and suitability for permanent employment	Males, average age 23 years
			NA	.32	10.4	6.4		
			AR	.49	18.1	13.2		
			CSA	.38	47.3	10.9		
			MR	.53	34.1	13.8		
			SR	.49	38.2	20.3		
A	First-line foremen for an aircraft manufacturer	99	VR	.25	—	—	Summary rating by immediate supervisor of overall supervisory effectiveness	Males, average education 11 years, 6 months to 11 years supervisory tenure
			AR	.26	—	—		
			SR	.26	—	—		
			LU	.27	—	—		
A	Enlisted men in the Non-Commissioned Officers Academy in a four-week academic and technical training program	34	VR	.77	27.7	—	Final rank in officer training program	Enlisted males, less than a year of military training
			AR	.68	—	—		
			SP	.52	—	—		
			LU	.52	—	—		
	Passed Training	16	VR	—	36.9	7.3		
			AR	—	37.4	5.6		
			SP	—	61.0	6.2		
			LU	—	35.3	8.6		
	Failed Training	18	VR	—	19.6	8.2		
			AR	—	27.3	12.4		
			SP	—	31.2	21.8		
			LU	—	20.5	12.1		
A	Farmers in farming training program	50	NA	.36	22.5	—	Instructor rating of performance	Males, average age 33 years, 11 years education, farm management 6.5 years, in training 2.5 years

TABLE 7.1 *continued*

Test Form	Group	N	Test	r	Mean	SD	Criterion	Sample Composition
A	Engineering students, University of Minnesota, tested prior to starting program	434	NA	.43	33.7	4.3	Honor point ratio in first year of engineering program, including math, chemistry, and drawing grades	Males and females.
A	Air traffic controller trainees, in eight-week basic training	124	NA AR SR	.41 .54 .42	— — —	— — —	Grade average of academic and laboratory-simulated air traffic control performance	Males with prior military experience
A	Phone installer and repairer employees for Bell Telephone, in five geographic areas	430	AR	.44	32.0	8.0	Highest level of job proficiency attained during training	Males, 211 White, 219 Black, high school graduate, average age 21 years
A	Low to high level promotable executives of large public utility	208	AR	.38	28.3	10.4	Supervisor rating of overall performance	Males, age range 22 to 62 years
A	Clerical employees in an insurance company	61	AR	.24	19.8	11.8	Supervisor rating of overall job performance	Females, 39 white, 33 Black, recent high school graduates
A	University freshmen in engineering program	510	AR MR SR	.21 .42 .49	42.1 53.4 74.6	3.8 8.2 14.2	Grade in graphics course	
A	Foremen in a large manufacturing plant of household items	56	MR	.40	40.7	12.5	Supervisor rating of overall job performance using paired comparison of employees	Males, average age 46, 12th grade education, 22 years tenure
A	Riveter assistants in an aircraft corporation	180	MR	.34	39.6	12.6	Instructor rating following 5-day riveter training	Males, age 17-39, 6-15 years education

TABLE 7.1 *continued*

Test Form	Group	N	Test	r	Mean	SD	Criterion	Sample Composition
A	Tool and die machinist apprentices in an aircraft corporation	47	MR	.39	—	—	Instructor overall rating of employees in a 4-year training program	Male high school graduates, ages 18-21, most in first two years of program
A	Beginner mechanics in an aircraft corporation	92	MR	.38	44.5	11.2	Instructor overall rating following a 5-day training in assembly and installation of parts	Males, average age 26, average 11th grade education
A	Naval aviation cadets in Naval Air Training program	108	SR CSA	.35 .20	75.4 63.1	13.9 11.2	Pre-flight ground school final grade	Males
A	Technical school students with 2 years high school typing	61	CSA	.54	68.0	—	Typewriting speed	Females
A/B	High school students in first year of shorthand class	126	SP	.59	—	—	Course grade	Females
B	Freshman engineering students at Iowa State University, using a 15-minute time limit	667	MR SR	.31 .31	47.3 50.1	9.1 17.1	Engineering graphics grade, first quarter.	All areas, e.g., electrical, chemical, aerospace, mechanical, architectural
B	Heavy vehicle operators in New York employment program	107	NA	.30	6.8	2.1	Training proficiency test score	Males, 39 White, 38 Black, 30 Hispanic non-high school graduate, low socio-economic status, average age 35
B	Draftsmen in a large manufacturing company	20	SR	.49	49.8	24.8	Supervisor ranking of job proficiency	19 Males, 1 Female, 3 months to 24 years job experience, 11-14 years education

TABLE 7.1 *continued*

Test Form	Group	N	Test	r	Mean	SD	Criterion	Sample Composition
B	Draftsman applicants, no previous drafting experience, manufacturing company	35	SR SR	.52 .35	51.8	25.9	Drawing grade in training Mathematics grade in training	20 Males, 5 Females, 12-15 years education
L	Post-secondary students in business programs, e.g., marketing, secretarial science, business administration	53 32	CSA CSA	.42 .39	55.1 55.8	10.8 13.1	Third quarter GPA in business program	Females
T	Refinery and plant operators in large oil company, tested first day of employment	316	NA SR	.46 .29	23.0 33.9	8.0 10.3	Test performance in training	275 Males, 38 Females 83 Black, 30 Hispanic, 200 White
T	Stock clerks, currently employed						Performance rating of accuracy and efficiency; controlled for age	147 Males, 16 Females modal age 34-37, modal tenure more than 5 years
	Total Group	167	CSA	.27	44.2	17.0		
	White	120	CSA	.24	44.6	17.4		
	Black	22	CSA	.50	42.4	16.6		
	Hispanic	18	CSA	.33	44.9	17.1		
V	Computer programming trainees in business applications, employed in a major financial services corporation	48	VR AR VR AR	.46 .48 .60 .46	40.0 38.3 40.0 38.3	7.4 5.4 7.4 5.4	Training class quiz average Overall performance rating	Males and Females
V	Machine packagers in a large manufacturer of consumer products	45	VR NA AR MR SR	.30 .47 .33 .44 .30	22.9 15.2 22.3 40.5 24.3	9.9 7.7 10.7 10.8 11.0	Supervisor rating of attention to detail job dimension Supervisor rating of overall performance	36 Females, 9 Males, 32 White, 10 Black, 3 Hispanic, average tenure 11 years

TABLE 7.1 *continued*

Test Form	Group	N	Test	r	Mean	SD	Criterion	Sample Composition
V	Administrative, technical, and engineering employees of manufacturer of electronic components (15-minute test time limit)	267	VR	.24	35.5	8.7	Manager rating of analytic ability	180 Males, 84 Females, 115 Administrative, 82 Technical, and 67 Engineering employees
			VR	.30	35.5	8.7	Manager rating of quantitative ability	
			NA	.31	25.6	8.8		
			AR	.26	33.7	6.8		
V	Newspaper editors, 27 newspapers nationwide						Composite rating of writing headlines cutlines, editing copy, story selection, page layout, managing production flow	111 White Males, 54 White Females, mean age 37, 16 years education, 4.5 years as editor, 8 years company tenure
	Total Group	165	VR	.43	44.9	5.8		
	White Males	111	VR	.40	45.0	5.2		
	White Females	54	VR	.50	44.8	7.0		
V	Newspaper reporters, 27 newspapers nationwide						Composite rating of information gathering and analysis, generation of story ideas, and writing	137 White Males, 87 White Females, mean age 37, 16 years education, 6.5 years as reporter, 8.7 years company tenure
	Total Group	224	VR	.33	43.7	5.9		
	White Males	137	VR	.35	43.5	6.2		
	White Females	87	VR	.31	44.2	5.4		
PCA	Skilled tradesmen in manufacturer of consumer products	87	VR	.39	—	—	Manager ranking of mechanical performance	Total sample includes electricians, pipefitters, line, truck, and building mechanics. Average age 43 years, 20 years company tenure, 12.5 years in current job. Males, 83 White 3 Black, 1 Hispanic
			NA	.25				
			MR	.31				
	Electricians, Mechanics	66	VR	.43	—	—		
			NA	.29	—	—		
			MR	.36	—	—		
			SR	.18	—	—		
	Mechanics	40	VR	.35	—	—		
			NA	.29	—	—		
			MR	.35	—	—		
			SR	.27	—	—		
	Electricians	26	VR	.57	—	—		
			NA	.36	—	—		
			MR	.39	—	—		
			SR	.05	—	—		
	Pipefitters	21	SR	.32	—	—		
			AR	.41	—	—		

TABLE 7.1 *continued*

Test Form	Group	N	Test	r	Mean	SD	Criterion	Sample Composition
PCA (cont.)	Total Skilled Tradesmen	87	VR	.37	—	—	Manager ranking of ability to take initiative	
	Electricians, Mechanics	66	SR	.18	—	—		
	Mechanics	40	SR	.27	—	—		
	Electricians	26	SR	.05	—	—		
	Pipefitters	21	SR	.32	—	—		
			AR	.53	—	—		
	Pipefitters	21	AR	.47	—	—	Manager ranking of communication	
	Pipefitters	21	AR	.47	—	—	Manager ranking of planning and organizational ability	
	Total Skilled Tradesmen	87	VR	.37	—	—	Manager ranking of problem identification skill	
			NA	.30	—	—		
			MR	.35	—	—		
			SR	.24	—	—		
	Electricians, Mechanics	66	VR	.38	—	—		
			NA	.35	—	—		
			MR	.34	—	—		
			SR	.17	—	—		
	Mechanics	40	VR	.34	—	—		
			NA	.32	—	—		
			MR	.37	—	—		
			SR	.00	—	—		
	Electricians	26	VR	.44	—	—		
			NA	.45	—	—		
			MR	.31	—	—		
			SR	.46	—	—		
	Pipefitters	21	SR	.32	—	—		
			AR	.51	—	—		
	Total Skilled Tradesmen	87	VR	.28	—	—	Manager ranking of problem resolution skill	
			NA	.31	—	—		
			MR	.27	—	—		

TABLE 7.1 *continued*

Test Form	Group	N	Test	r	Mean	SD	Criterion	Sample Composition
PCA (cont.)	Electricians, Mechanics	66	VR	.33	—	—		
			NA	.35	—	—		
			MR	.29	—	—		
	Mechanics	40	VR	.31	—	—		
			NA	.40	—	—		
			MR	.27	—	—		
	Electricians	26	VR	.39	—	—		
			NA	.34	—	—		
			MR	.34	—	—		
	Pipefitters	21	AR	.39	—	—		
	Total Skilled Tradesmen	87	VR	.33	—	—	Manager ranking of overall performance	
			NA	.31	—	—		
			MR	.33	—	—		
			SR	.25	—	—		
	Electricians, Mechanics	66	VR	.38	—	—		
			NA	.35	—	—		
			MR	.39	—	—		
			SR	.22	—	—		
	Mechanics	40	VR	.37	—	—		
			NA	.40	—	—		
			MR	.39	—	—		
			SR	.19	—	—		
	Electricians	26	VR	.40	—	—		
			NA	.34	—	—		
			MR	.39	—	—		
			SR	.32	—	—		
	Pipefitters	21	SR	.24	—	—		
			AR	.44	—	—		
	Total Skilled Tradesmen	87	VR	.33	—	—	Manager ranking of overall performance potential	
			NA	.30	—	—		
			MR	.40	—	—		
			SR	.29	—	—		

TABLE 7.1 *continued*

Test Form	Group	N	Test	r	Mean	SD	Criterion	Sample Composition
PCA (cont.)	Electricians, Mechanics	66	VR	.36	—	—		
			NA	.33	—	—		
			MR	.44	—	—		
			SR	.24	—	—		
	Mechanics	40	VR	.28	—	—		
			NA	.34	—	—		
			MR	.43	—	—		
			SR	.12	—	—		
	Electricians	26	VR	.51	—	—		
			NA	.42	—	—		
			MR	.49	—	—		
			SR	.52	—	—		
	Pipefitters	21	SR	.37	—	—		
			AR	.49	—	—		
*	Computer operator trainees in a large northeastern utility	23	VR	.33	35.1	7.3	Supervisor and instructor rating of job performance	Mixed gender and racial sample
			NA	.43	19.9	8.1		
*	Marker makers for a clothing manufacturer	35	AR	.43	26.6	10.2	Supervisor ranking of overall performance	22 Males, 13 Females 23 White, 6 Hispanic 2 Black, 5 Oriental
*	Plumbing apprentices	50	MR	.39	44.7	10.5	Shop performance and test scores	
			SR	.28	31.6	13.3		
*	Sewing machine mechanics for a clothing manufacturer	167	AR	.24	22.2	9.6	Supervisor rating of mechanical job performance	145 Males, 12 Females 79 White, 74 Hispanic 7 Black, 3 Other modal age 30-39
*	Junior programmers in data services						Job performance rating	
	Males	94	AR	.23	42.4	6.0		
	Females	38	AR	.52	41.2	7.1		

*Test form not reported.

TABLE 7.1 *continued*

Test Form	Group	N	Test	r	Mean	SD	Criterion	Sample Composition
*	Equipment technicians in telephone company	134	AR CSA	.27 .44	37.9 56.1	8.0 9.6	Job performance rating	111 Males, 23 Females 84 White Males, 15 Hispanic Males, 12 Black Males
*	Toll collectors for Port of New York Authority						Supervisor's ranking	Females, employed at least 6 mo at job, correction for range restriction applied
	White	80	CSA	.32	63.1	11.8		
	Black	102	CSA	.03	62.2	8.0		
*	Mining technicians in a machinery maintenance department of a strip coal mine	62	MR	.27	—	—	Supervisory rating on knowledge of job operations	Mechanics, millwrights, electricians
*	Dental hygiene students in 3-year university program, tested prior to clinical training	70	SR	.55	39.2	9.6	Oral anatomy lab grade incl. completed drawings of teeth	Females, 19-23 years
			SR	.35	—	—	Dental therapy lab grade including actual dental work	
*	Students taking shorthand	124	SP LU	.44 .51	63.0 .25	— —	Course grade in shorthand	Junior class, high school students

*Test form not reported.

8. USES OF THE DAT FOR PCA IN ADULT ASSESSMENT

The DAT for PCA was designed and developed for adult assessment applications. In keeping with this focus, this chapter will address the following uses of the DAT for PCA:

* Employee Selection
* Career Counseling
* Ability to Benefit Determination

EMPLOYEE SELECTION

Many business, industrial and government concerns use testing as a component of their employee selection process. Typical selection test programs make use of cognitive ability tests, aptitude tests, manual dexterity tests, personality tests, basic skills tests, and work values tests, to name but a few. Tests are used to screen out unqualified candidates, to categorize prospective employees according to their probability of success on the job, or rank order a group of candidates according to merit.

The eight tests of the DAT for PCA are all cognitive tests; they can be highly useful, singly or in combinations, for employee selection purposes. The DAT for PCA tests have been used for selection in jobs spanning the occupational spectrum from unskilled laborers to professional and managerial positions.

Organizations may use the DAT for PCA in two different ways for employee selection purposes. The first way is to use one of the three partial battery booklets as a component of the selection procedure. The second way is to assemble a specific selection battery consisting of two or more of the eight DAT tests, chosen on the basis of the user's own test validity research. For example, the Verbal Reasoning and Numerical Ability tests are frequently used — singly or together — to assess general cognitive ability. The Abstract Reasoning test is often used when a non-verbal measure of cognitive ability is desired. The Mechanical Reasoning and Space Relations tests are often preferred for selection of candidates for jobs with mechanical aspects.

CAREER COUNSELING

Some organizations provide career counseling services to employees, either as part of a formal career development program, or in the course of outplacement counseling in connection with employment termination. In either case, the intention is to assist the employee in identifying and exploring career alternatives that are well matched with the employee's interests and abilities. In career development counseling, the primary intent may be to serve the best interests of the organization, as it identifies candidates for greater responsibility, or for reassignment within the organization. In outplacement counseling, the principal beneficiary is the employee.

The DAT was originally developed as a tool for career guidance counselors to use in assisting students and young adults with career exploration. In this application, the counselor seeks to identify career options with cognitive requirements that are well-suited to the counselee's measured aptitudes. For career exploration, administration of the entire battery of eight DAT for PCA tests is most appropriate. Since each individual can be expected to score higher on some kinds of tests than on others, identifying areas of relative strengths and weaknesses can be quite useful for career guidance purposes.

ABILITY TO BENEFIT DETERMINATION

Gauging an individual's ability to benefit from specific kinds of formal job training or post-secondary trade, technical, or vocational education can also be done on the basis of DAT for PCA scores. If the entire DAT for PCA battery has been administered, scores on specific tests can be used to evaluate an examinee's prospects for training success. If it is not desirable or feasible to administer the entire battery, the probability of training success can be estimated from scores on one or more DAT for PCA tests.