

VALIDITY OF A LEARNING ABILITY TEST

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The first problem as in the building of any test was to construct the test items. The kind of a test desired affects the nature of the test items. A short, omnibus type of learning ability test similar to the *Otis Self-Administering Tests of Mental Ability* was desired. Furthermore, a test which could be used later as a part of a clerical battery of tests must be short. The multiple choice form of test item was selected to be used throughout the test.

Sixty multiple choice items were constructed from twenty-three areas of knowledge, some of which are closely related. All test devices commonly used in mental tests were included if they could be adapted to the multiple choice form. These data are given in Table I.

The test of sixty items was given to a limited number of cases and the items of the Experimental Edition were arranged in order of difficulty. Three items were used as samples, seven were eliminated, and fifty items were included in the test used in this study.

The number and per cent of errors for each item were determined for the following categories: 1. Upper fourth on the test, all students making scores of 36 and above; 2. Lower fourth on the test, all students making scores of 26 and below; 3. Middle half on the test, all students making scores between 29 and 35; 4. High school students; 5. College students; 6. All students. As a result of this count for 685 students, items were rearranged in order of difficulty. These data have been presented in Table II.

TABLE I
Source of Material for Learning Ability Test

AREAS	ITEM	N
1 Arithmetic	2-5-12-21-23-26-30-33-42	9
2 Analogy	1-7-36	3
3 Biology	1-8-16-25	4
4 Religion	3	1
5 Chemistry	4*-44	1
6 English	6-20	2
7 Vocabulary	14-31-38-43-45 ¹	4
8 Geography	9-17-32-39-40-50	6
9 Music	10	1
10 General Information	11-37	2
11 Use of Information	11	1
12 Astronomy	13-24	2
13 Literature	15-26	2
14 Art	18-41	2
15 History	19	1
16 Reasoning	22	1
17 Physics	27	1
18 Sports	29	1
19 Statistics	34	1
20 Civics	35	1
21 Agriculture	36	1
22 Higher Mathematics	46-47	2
23 Number Series	48-49	2

*To be omitted from revised test

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TABLE II
Percentage of Error for Learning Ability Test

ITEM	DIFFERENCE			TOTAL ERRORS	MIDDLE HALF	HIGH SCHOOL	COLLEGE	NEW ORDER IN TERMS OF DIFFICULTY
	UPPER 4TH	LOWER 4TH	IN UPPER- LOWER					
1	15	30	15	20	30	17	21	18
2	1.8	15	13	7	3	10	5	5
3	4.3	17	12	9	9	9	9	6
4	0	1.4	1.4	0.8	0	1	0.4	X
5	1.8	11	9.2	7	7	9	5.9	4
6	9.3	43	33.7	22	16	27	19	19
7	5.6	49	43.4	22	21	24	22	20
8	0	5.6	5.6	1	1	0	2.2	1
9	2.5	61	58.5	25	20	30	23	25
10	3.7	44	40.3	20	19	21	19	17
11	10	34	24	23	27	15	26	21
12	5.6	36	30.4	17	12	20	16	16
13	.6	24	23.4	10	8	12	9	7
14	.6	43	42.4	16	7	24	12	13
15	25	63	38	47	52	51	46	36
16	.6	30	29.4	14	15	10	15	11
17	2.5	46	45.5	25	25	34	21	24
18	0	11	11	4	4	3	4	2
19	.6	17	16.4	6	2	11	3	3
20	5.0	20	15	10	8	8	11	9
21	.6	38	37.4	16	15	17	15	15
22	12	59	47	39	49	36	40	29
23	14	54	40	35	38	42	33	28
24	3.7	26	22.3	12	12	12	11	10
25	3.1	34	30.9	15	12	20	13	12
26	7.5	27	19.5	16	14	14	16	14
27	3.1	19	15.9	10	10	12	9	8
28	18	70	52	41	40	48	38	31
29	25	65	40	44	38	54	39	32
30	7.5	51	43.5	25	26	18	28	23
31	30	72	42	47	43	52	45	35
32	32	60	28	47	50	51	46	37
33	42	80	38	62	65	62	62	39
34	69	92	23	82	81	95	77	45
35	18	49	31	33	34	34	33	28
36	14	38	24	24	22	29	22	22
37	23	39	16	35	31	53	27	27
38	41	75	34	63	75	51	68	40
39	24	60	36	40	37	46	37	30
40	41	47	6	45	50	45	46	24
41	30	82	52	59	62	66	56	38
42	26	65	39	45	54	37	49	33
43	76	81	5	65	92	51	66	48
44	72	89	17	83	86	79	84	47
45	83	85	2	85	85	89	85	X
46	44	87	43	70	78	70	70	42
47	40	80	40	67	76	64	66	41
48	63	83	20	78	87	66	81	44
49	65	85	20	75	74	77	74	43
50	78	82	6	81	82	81	81	45

The difference between the percentages of error between the upper and lower fourths for each item was calculated. Two items which failed to have a percentage difference of 5% were eliminated before coefficients of reliability and validity were established. The greatest difference in the percentage of error between the upper and lower fourths was 58.5, the average difference in percentage was 28.9, while the average percentage of error was 36.0. Only five items besides the two eliminated had a difference of less than 10 per cent. The assumption of the item analysis was that the total test measured learning ability; then each item should be missed more frequently by those in the lower fourth than those in the upper fourth if the item has value.

The reliability of the test by the even-odd method (.896) was stepped-up by the Spearman-Brown formula to $.820 \pm .0290$. By this formula the test would have to be twice as long to have a reliability of .90. While a higher reliability was desirable, a longer test was not. The coefficient of reliability and other data are given in Table III.

Coefficients of validity are given in Table IV. Variables, grade levels, and the number of cases are given for a more complete evaluation of the coefficients.

Percentile norms for grades 7 to 12, 11 and 12, college freshmen, and for all students combined were calculated. The choice of norms were provided for different grade and school levels. These data are given in Table V.

The mean, mode, and median were found to be almost identical, a desirable characteristic of a test other than diagnostic tests. The range of 36 points was considered as sufficient variability. These data are summarized in Table VI.

The test had most of the limitations that one would expect of a test which was too short to satisfy many test technicians. However, for a test of 48 items which requires only 19 minutes, the test is worth using as a simple device for measuring the relative learning ability of high school or college freshmen students. The final plan is to use the test of Learning Ability (19 minutes) a Clerical Speed Test (10 minutes) a Clerical Arithmetic Test (20 minutes) and a Spelling Test (10 minutes) as an Aptitude and Ability Test for prospective clerical workers and for clerical employees in private industry, schools, or Government service.

TABLE III

Coefficient of Reliability of Learning Ability Test

VARIABLE	r_{ee}	r_{mm}	PE_{rmm}	N
Even items (e)				
Odd items (o)	.896	.820	$\pm .0290$	200

TABLE IV
Coefficients of Validity for Learning Ability Test

VARIABLE	r_{12}	PE ₁	N	GRADES
A				
1. L. A. %ile				
2. Calif. Men. Mnt. Total Test-IQ	.723	± .0322	100	11,12
B				
1. L. A. %ile				
2. Otis %ile	.613	± .0421	100*	Col. Fresh.
C				
1. L. A. %ile				Col. Fresh.
2. Grade Average	.285	± .0619	100*	(year)
D				
1. Otis %ile				Col. Fresh.
2. Grade Average	.161	± .0657	100*	(year)
E				
1. L. A. %ile				
2. Otis %ile	.645	± .0550	51	10, 11, 12 (H. S.)
F				
1. L. A. %ile				
2. Grade Average	.428	± .0771	51	10, 11, 12 (H. S.)
G				
1. Otis %ile				
2. Grade Average	.572	± .0634	51	10, 11, 12 (H. S.)
H				
1. L. A. %ile				
2. Otis %ile	.781	± .0321	67	7, 8, 9 (Jr. H. S.)
I				
1. L. A. %ile				
2. Grade Average	.497	± .0628	67	7, 8, 9 (Jr. H. S.)
J				
1. Otis %ile				
2. Grade Average	.491	± .0624	67	7, 8, 9 (Jr. H. S.)

*Sampling of 402 cases

TABLE V

Percentile Norms for Learning Ability Test

SCORES	H. S. 7-12 N = 122	H. S. 11 & 12 N = 163	Col. F. N = 400	H. S. & Col. F. N = 685
46		99.9		99
45		99.6		99
44		99.3		99
43		98.7	99.9	99
42		98	99.5	99
41		97	98	98
40		95	98	97
39	99.3	93	96	96
38	99.5	90	98	93
37	99.1	89	90	91
36	96	85	85	87
35	95	80	79	83
34	93	74	71	75
33	90	71	64	70
32	88	63	58	64
31	86	58	51	59
30	83	49	44	52
29	77	39	35	43
28	72	34	29	38
27	66	32	23	32
26	58	27	18	27
25	53	23	14	23
24	48	19	11	19
23	45	14	8	16
22	40	10	5	12
21	35	7	4	10
20	28	5	2	8
19	23	5	1	6
18	22	4	0.7	5
17	17	4	.6	4
16	13	3	.6	3
15	9	2	.6	2
14	8	1.8	.6	2
13	4	0.6	.5	1.1
12	3		.5	0.8
11	1.9		.5	0.6
10	0.8		0.5	0.4
9			0.2	0.1

TABLE VI
Statistical Data

SCORES NOT GROUPED

75 %ile = 34.0

50 %ile = 29.7 or median

25 %ile = 25.5

Q = 4.25

Range = 36

Mean = 29.6

Mode 30.0

Median 29.7

GROUPED SCORES

Scores f

45-47— 1

42-44— 8

39-41— 34

36-38— 78

33-35—120

30-32—144

27-29—111

24-26— 77

21-23— 57

18-20— 25

15-17— 15

12-14— 12

9-11— 3

 N = 685