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ABSTRACT

The United States Training and Employment Service General Aptitude Test Batrery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

June 1970

U.S. Training and
Employment Service
Technical Report
S-223 R

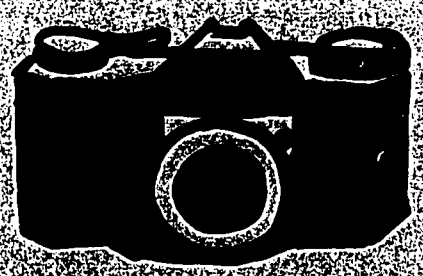
Development of USTES

APTITUDE TEST
BATTERY FOR

PHOTOGRAPHER, LITHOGRAPHIC

(print. & pub.)
972.382

U.S. DEPARTMENT OF LABOR
Manpower Administration



Technical Report on Development of USTES Aptitude Test Battery

For . . . .

Photographer, Lithographic (print. & pub.) 972.382

S-223R

(Developed in Cooperation with the
Wisconsin State Employment Service)

U.S. Department of Labor
Manpower Administration

June 1970

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come tc be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study #2370

Development of USTES Aptitude Test Battery

For
Photographer, Lithographic (print. & pub.) 972.382-010

S-223R

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Photographer, Lithographic (print. & pub.) 972.382-010. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
N-Numerical Aptitude	90
S-Spatial Aptitude	85
P-Form Perception	95
K-Motor Coordination	85

In addition, 6 correct responses on plates 1-6 of the AOH-R-R Pseudoisochromatic Plates have been established as a color discrimination norm.

Sample:

55 male workers employed as Lithographic Photographers in Wisconsin.

This study was conducted prior to the requirement of providing minority group information. Therefore, minority group status is unknown.

Criterion:

Supervisory ratings.

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .37 ($P/2 < .005$)

Effectiveness of Norms:

Only 67% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 82% would have been good workers. Thirty-three percent of the nontest-selected workers used in this study were poor workers; if the workers had been test-selected with the above norms, only 18% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	67%	82%
Poor Workers	33%	18%

SAMPLE DESCRIPTION

Size:

N = 55

Occupational Status:

Employed Workers.

Work Setting:

Workers were employed as Photographers by the following companies affiliated with the Graphic Arts Association in Wisconsin:

Name of Company	Location
Dosie and Johnson Company	Milwaukee
Inland Press, Inc.	Milwaukee
Kiesaw Litho Studio, Inc.	Milwaukee
W. A. Krueger Company	Milwaukee
The Krus Company	Milwaukee
Lithoplate Company	Milwaukee
Mandel - Multitone	Milwaukee
Milprint, Incorporated	Milwaukee
Milwaukee Graphic Plate Corp.	Milwaukee
Milwaukee Offset Service Corp.	Milwaukee
Moebus Printing Company	Milwaukee
Mueller Color Plate Company	Milwaukee
Phillip Litho Company	Milwaukee
O. L. Schilfforth Company	Milwaukee
E. F. Schmidt Company	Milwaukee
Strauss Printing Company	Madison
Tri-Color Offset Service, Inc.	Milwaukee
Western Printing Company	Racine

Employer Selection Requirements:

Education: None required. High school education with courses in chemistry, mathematics, and physics is preferred.

Previous Experience: None required.

Tests: None used

Other: Personal interview and check of references.

Principal Activities:

The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience:

All workers in the final sample had at least three years job experience. The formal apprenticeship training program is five years. Basic training is completed after two and one-half years of experience.

TABLE 2

Means (M), Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience.

	Mean	SD	Range	r
Age (years)	37.5	8.3	23-60	-.095
Education (years)	11.5	1.5	7-15	.335*
Experience (months)	176.9	108.4	36-420	-.034

*Significant at the .05 level.

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002A, and Plates 2-15 of the Dvorine Pseudo-isochromatic Plates were administered during the period November 1960 to May 1961.

CRITERION

The criterion data consisted of supervisory ratings of job proficiency made at approximately the same time as the tests were administered with a time interval of three to five weeks between the two ratings. The immediate supervisor rated each worker.

Rating Scale:

Form SP-21 "Descriptive Rating Scale" was used. The scale (see Appendix) consists of nine items covering different aspects of job performance. Each item has five alternative responses corresponding to different degrees of job proficiency.

Reliability:

A reliability coefficient of .93 was obtained between the initial ratings and the re-ratings, indicating a significant relationship. The final criterion score consists of the combined scores of the two ratings.

Criterion Score Distribution:

Possible Range:	18-90
Actual Range:	31-87
Mean:	61.1
Standard Deviation:	12.2

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 33% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers." The criterion critical score is 55.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitudes S andP which do not have high correlations with the criterion, were considered for inclusion in the norms because the qualitative analysis indicated that the aptitudes might be important for the job duties and the sample had relatively high mean scores on these aptitudes. Tables 3, 4, and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performance)

Aptitudes	Rationale
G - General Learning Ability	Required to learn proper methods and procedures for using a camera and developing negatives and prints, and in making determinations of job requirements.
N - Numerical Aptitude	Required to compute proper camera settings and exposure time taking into consideration lens speed, distance and amount of light.
S - Spatial Aptitude	Required to determine colors to be maintained and withheld, to repair damage to copy, to set lamps at proper angles and distance, and to check balance of illumination, centering, size, and focus of image.
P - Form Perception	Required to detect errors or faults of negative by comparing with original copy and to observe film development for density and image formation.
M - Motor Coordination	Required to mix chemicals, wash and hang film to dry, mount films, position copy and clean boards and glass.

On the basis of the job analysis data, V-Verbal Aptitude is considered irrelevant for performing the duties of this job.

TABLE 4

Means (M), Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N=55

	Mean	SD	Range	r
G - General Learning Ability	108.2	12.5	80-140	.288*
V - Verbal Aptitude	104.8	12.2	74-137	.061
N - Numerical Aptitude	101.5	13.4	75-134	.311*
S - Spatial Aptitude	114.2	17.7	78-170	.233
P - Form Perception	104.6	16.9	70-153	.059
Q - Clerical Perception	102.2	12.3	75-132	.152
K - Motor Coordination	102.3	17.0	74-148	.273*
F - Finger Dexterity	94.8	20.9	6-140	.187
M - Manual Dexterity	97.4	19.9	40-149	.247
Dvorine Pseudoisochromatic Plates	13.2	2.6	8-14	.112

*Significant at the .05 level.

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes G	V	N	S	P	Q	K	F	M
Job Analysis Data Important	X		X	X	X				X
Irrelevant		X							
Relatively High Mean	X	X		X	X				
Relatively Low Standard Dev.	X	X	X			X			
Significant Correlation With Criterion	X		X				X		
Aptitudes to be Considered for Trial Norms	G		N	S	P		K		

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of aptitudes G, N, S, P, and K at trial cutting scores were able to differentiate between the 67% of the sample considered to be good workers and the 33% of the sample considered to be poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For four aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample; for two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of thesample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of N-90, S-85, P-95, and K-85 provided optimum differentiation for the occupation of Photographer, Lithographic (print. & pub.) 972.382-010. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .37 (statistically significant at the .005 level).

TABLE 6

Concurrent Validity of Test Norms
N-90, S-85, P-95, and K-85

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	10	29	39
Poor Workers	11	5	16
Total	21	34	55

Phi Coefficient = .37 Chi Square (X^2_y) = 7.5

Significance Level = P/2 $<$.005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-7 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A Phi Coefficient of .33 is obtained with the OAP-7 norms of G-105, S-95, and P-100.

SP-21

A-P-P-E-N-D-I-X

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

Score____

RATING SCALE FOR _____
D. O. T. Title and Code

Directions: Please read Form SP-20, "Suggestions to Raters", and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

Name of Worker (print) _____
(Last) (First)

Sex: Male____ Female____

Company Job Title: _____

How often do you see this worker in a work situation?

☐ See him at work all the time.

☐ See him at work several times a day.

☐ See him at work several times a week.

☐ Seldom see him in work situation.

How long have you worked with him?

☐ Under one month.

☐ One to two months.

☐ Three to five months.

☐ Six months or more.

A. How much work can he get done? (Worker's <u>ability</u> to make efficient use of his time and to work at high speed.)

☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.

☐ 2. Capable of low work output. Can perform at a slow pace.

☐ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.

☐ 4. Capable of high work output. Can perform at a fast pace.

☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

☐ 1. Performance is inferior and almost never meets minimum quality standards.

☐ 2. The grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.

☐ 3. Performance is acceptable but usually not superior in quality.

☐ 4. Performance is usually superior in quality.

☐ 5. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

☐ 1. Makes very many mistakes. Work needs constant checking.

☐ 2. Makes frequent mistakes. Work needs more checking than is desirable.

☐ 3. Makes mistakes occasionally. Work needs only normal checking.

☐ 4. Makes few mistakes. Work seldom needs checking.

☐ 5. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.

☐ 2. Has little knowledge. Knows enough to "get by."

☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.

☐ 4. Has broad knowledge. Knows enough to do good work.

☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

☐ 1. Has great difficulty doing his job. Not at all suited to this kind of work.

☐ 2. Usually has some difficulty doing his job. Not too well suited to this kind of work.

☐ 3. Does his job without too much difficulty. Fairly well suited to this kind of work.

☐ 4. Usually does his job without difficulty. Well suited to this kind of work.

☐ 5. Does his job with great ease. Exceptionally well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

☐ 1. Cannot perform different operations adequately.

☐ 2. Can perform a limited number of different operations efficiently.

☐ 3. Can perform several different operations with reasonable efficiency.

☐ 4. Can perform many different operations efficiently.

☐ 5. Can perform an unusually large variety of different operations efficiently.

G. How resourceful is he when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 1. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. How many practical suggestions does he make for doing things in better ways? (Worker's ability to improve work methods.)

☐ 1. Sticks strictly with the routine. Contributes nothing in the way of practical suggestions.

☐ 2. Slow to see new ways to improve methods. Contributes few practical suggestions.

☐ 3. Neither quick nor slow to see new ways to improve methods. Contributes some practical suggestions.

☐ 4. Quick to see new ways to improve methods. Contributes more than his share of practical suggestions.

☐ 5. Extremely alert to see new ways to improve methods. Contributes an unusually large number of practical suggestions.

I. Considering all the factors already rated, and <u>only</u> these factors, how acceptable is his work? (Worker's "all-around" ability to do his job.)

☐ 1. Would be better off without him. Performance usually not acceptable.

☐ 2. Of limited value to the organization. Performance somewhat inferior.

☐ 3. A fairly proficient worker. Performance generally acceptable.

☐ 4. A valuable worker. Performance usually superior.

☐ 5. An unusually competent worker. Performance almost always top notch.

FACT SHEET

Job Title

Photographer, Lithographic (print. & pub.) 972.382-010

Job Summary

Makes line, half-tone and contiuous tone negatives and black and white photo prints using photo-mechanical and commercial film for the reproduction of original copy.

Work Performed

Studies job order and copy such as large charts, commercial art in one or more colors, photographs, color transparencies and printed or mimeographed matter. Interprets job requirements,taking into consideration nature of copy, to make the following determinations: ratio of reduction and enlargement to exact scale; colors to be used in order to regulate intensity of color and/or light; type of film to be used in order to regulate in time for each sub-division of the job (the factors entering into this decision are dependent on the type of original copy, lens speed, film sensitivity, level, and kind of illumination); equipment to be used to photograph or print the job (i.e., type of camera and printer,etc); kind of screen to be used; range of tones in the copy (compares tones with a gray scale; proper screen distance according to line size of screen and degree of enlargement necessary; and computations for varying diaphragm openings for combination line and half-tone work. Performs the following sequence of steps essential to the separation of basic colors from full color original subjects; mixes chemicals used in contact room or camera room; repairs any minor damage to copy, cleans copy board glass, and positions copy; sets arc lamps at proper angles and distances, checks for balance illumination of copy and improvises diffusers and/or reflectors, if necessary; examines image on ground glass in order to check centering, size and focus, and readjusts, if necessary; makes camera settings according to previous calculations and selects proper diaphragm stops, and filters, if needed; sets screen in holder between the lens and film, sets screen distance indicator and checks for proper distance and alignment by the use of wedges, scales, and micrometers; mounts film on the vacuum back or stay-flat back and puts back into exposure position; exposes film or glass and develops for the proper time and temperature, using the developer recommended for the type of film used; uses a magnifying glass to make constant examinations during film development and watches for density and image formation, in order to determine the necessity of changing developing time to control the density and formation of the image (pre-exposes, modifying exposures proportionately, if necessary); fixes, washes, and hangs film to dry

Places glass in rack; chemically reduces or intensifies areas according to the needed correction (may also do this mechanically by employing scrapers, needles, pens, or brushes); checks negatives on light table for proper size and inclusion of all data by comparing the negative with the original copy in order to detect errors of faults; selects and constructs special function stops, properly adjusts screen distance and determines the multiple exposures required; uses filters to strengthen, reduce, or eliminate specific colors in the copy, dodges section of copy requiring more or less illumination, and makes test negatives as necessary; shoots multiple exposures for superimposing both half-tone and line into one piece finished negatives or positives and does general contact work for both color and stripping departments; makes half-tone negatives by the conventional, circular, contact, or special screen processes; makes line and half-tone projection enlargements; to eliminate moire, screens already screened originals, either matching the rulings of the original or using the out-of-focus methods; makes positives from line or half-tone negatives; makes color separation for jobs requiring the reproduction of full color copy and may then make half-tone positives by cameras or contact printer; may make brown (Van Dyke-Ozachrome) and black prints for color proofing.

Effectiveness of Norms

Only 67% of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the S-223R norms, 82% would have been good workers. Thirty-three percent of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the S-223R norms, only 18% would have been poor workers.

Applicability of S-223R Norms

The aptitude test battery is applicable to jobs which include a majority of duties described above.

GPO 898.737

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