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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (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 is included. (AG)

FINAL REPORT

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

PANTOGRAPHER 979.782

S-109

U. S. Employment Service in
Cooperation with
North Carolina State Employment Service

U. S. DEPARTMENT OF LABOR

Washington , D. C.
August 1957

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR PANTOGRAPHER 979.782

S-109

Summary

The General Aptitude Test Battery, B-1001, was administered in January 1956 to a sample of 50 workers employed as Pantographer 979.782 at the Carolina Textile Engraving Company, Charlotte, North Carolina. The criterion consisted of broad category supervisory ratings. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data and their combined selective efficiency, aptitudes P-Form Perception, A-Aiming and F-Finger Dexterity were selected for inclusion in the test norms.

GATB Norms for Pantographer 979.782 - S-109

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Pantographer 979.782.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for S-109

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
P	CB-1-A CB-1-L	80	P	Part 5 Part 7	80
A	CB-1-C CB-1-K	70	K	Part 8	70
F	CB-1-O CB-1-P	75	F	Part 11 Part 12	70

Effectiveness of Norms

The data in Table IV indicate that 8 of the 12 poor workers, or 67 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 67 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 31 of the 35 workers who made qualifying test scores, or 89 percent, were good workers.

TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Pantographer 979.782.

II. Sample

The General Aptitude Test Battery, B-1001, was administered in January 1956 to a sample of 4 male and 46 female workers employed as Pantographer 979.782 by the Carolina Textile Engraving Company, Charlotte, North Carolina. Of the 50 workers who were tested, 14 were trainees. Ratings were obtained on the trainees after they had completed their training. A training period of six months was considered necessary for proficiency on the job. All of the workers in the sample were considered to be experienced workers.

Table II shows the means, standard deviations, ranges and Pearson product-moment correlations (corrected for broad categories) with the criterion for age, education, and experience.

TABLE II

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_{cr}$) for Age, Education and Experience
Pantographer 979.782
N = 50

	M	σ	Range	$_{cr}$
Age (years)	27.8	8.3	18-45	.048
Education (years)	8.8	2.0	5-12	.202
Experience (months)	30.0	23.3	9-103	.458**

** Significant at the .01 level

The data in Table II indicate that there is no significant relationship between age or education and the criterion. The significant correlation between experience and the criterion may indicate a bias on the part of the supervisors in favor of those workers with the most experience, or it may reflect a true relationship between job proficiency and length of experience. Since the criterion consists of subjective ratings, it was not feasible to correct the criterion statistically to nullify the influence of experience. The data indicate that the sample is suitable for test development purposes with respect to age, education and experience.

III. Job Description

Job Title: Pantographor 979.782

Job Summary: Transfers textile designs from zinc plates to coppor printing rollers using a Pantograph Machine. Traces tho lines indicated by a particular color in tho enlarged design etched on a flat zinc plate, using a stylet attached to the machine, simulatneously pressing a pedal to bring a series of diamond points (1 to 12 or more) in contact with a copper roller varnished with an acid resistant material. Repeats process for various colors shown on the sketch, tracing each color portion on a separate roller.

Work Performed: Sets tracing needle of Pantograph Machine in tracer and makes it fast by tightening a screw. Manually shifts carriage by hand to bring needle into position over starting point on plate. Takes hold of tracer on each side and presses needle point downward into line cut in plate. Depresses pedal which raises risers to press diamond points firmly against copper printing roll. Guides needle point through line of design cut on plate while holding pedal down, thus causing diamond point to trace pattern on copper printing roll. Occasionally inspects visually tracing on roll to see that design is correct according to design cut out on plate. Rectifies a wrong tracing by covering it over with paint, using a fine artist's brush. Clamps a ground plate to table alongside of design plate, using a clamp. Adjusts ground needle in ground arm and fastens it securely by turning a screw. Sets tracing needle point on a line of design on plate where ground is to start and sets ground needle point on ground plate. Moves the tracing needle across design between lines of pattern, causing ground needle to follow line on ground plate. Holds down pedal causing diamond points to trace ground in design on roll.

IV. Experimental Battery

All of the tests of the GATB, B-1001, were administered to the sample group.

V. Criterion

The criterion consisted of supervisory ratings in broad categories. Ratings were obtained on the 36 experienced workers in January 1956 and seven months later ratings were obtained on the 14 trainees and integrated with the ratings previously obtained for the 36 experienced workers. When supervisors rated the sample of 50, changes were made in the ratings of a few of the 36 workers when relative positions were considered for the entire sample. The workers were placed in three categories-- "A", "B" and "C": 18 workers were placed in the "A" group; 20 workers in the "B" group; and 12 workers in the "C" group. For computational purposes, the ratings were converted to quantitative values of 60, 48 and 37 for the "A", "B" and "C" groups, respectively.

VI. Statistical and Qualitative Analysis

Table III shows the means, standard deviations, and Pearson product-moment correlations (corrected for broad categories) with the criterion for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general working population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_cr$) for the Aptitudes of the GATB

Pantographer 979.782
N = 50

Aptitudes	M	σ	$_cr$
G-Intelligence	83.5	12.8	.382**
V-Verbal Aptitude	81.2	11.0	.128
N-Numerical Aptitude	77.9	17.7	.414**
S-Spatial Aptitude	94.6	16.0	.255
P-Form Perception	97.1	21.2	.416**
Q-Clerical Perception	78.7	15.6	.470**
A-Aiming	93.8	19.4	.532**
T-Motor Speed	87.5	19.5	.352*
F-Finger Dexterity	99.7	18.6	.658**
M-Manual Dexterity	86.5	19.5	.385**

** Significant at the .01 level
* Significant at the .05 level

The statistical results were interpreted in the light of the job analysis data. The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation:

Form Perception (P) - required in comparing transferred design with pattern; in visually inspecting work to see that design is correct according to design cut on plate; also required for rectifying wrong tracing by covering it over with paint.

Aiming (A) - required in guiding needle point through line of design cut on plate to trace pattern on copper printing roll; also required for moving stylet to follow colored lines in etched pattern.

Finger Dexterity (F) and Manual Dexterity (M) - required in manually shifting carriage to bring needle into position over starting point on plate; in setting tracing needle of Pantograph Machine in tracer and fastening it by tightening a screw; also required in tracing pattern accurately by use of a stylet.

The highest mean scores in descending order of magnitude were obtained for Aptitudes F, P, S and A, respectively. All of the Aptitudes, except Aptitude P have standard deviations of less than 20. Aptitude V has the lowest standard deviation.

When N = 50, correlations of .361 and .279 are significant at the .01 level and the .05 level of confidence, respectively. Aptitudes G, N, P, Q, A, F and M correlate significantly with the criterion at the .01 level. Aptitude T correlates significantly with the criterion at the .05 level.

Aptitudes P, A, F and M were considered for inclusion in the test norms on the basis of the quantitative and qualitative factors cited above. All of these aptitudes appear to be important in terms of the job analysis data and show significant correlations with the criterion; in addition, Aptitudes P, A and F have relatively high mean scores.

Although Aptitudes G, N, Q and T showed significant correlations with the criterion and Aptitude S had a relatively high mean score, none of those aptitudes appeared to be important on the basis of the job analysis data. Therefore, Aptitudes G, N, Q, T and S were not given further consideration for inclusion in the test norms.

Several sets of norms, consisting of various combinations of Aptitudes P, A, F and M with appropriate cutting scores were selected for tryout. The relationship between each of these sets of trial norms and the dichotomized criterion was determined by means of the tetrachoric correlation technique. A comparison of the results showed that norms consisting of P-80, A-70 and F-75 had better selective efficiency than any other set of norms tried. The cutting scores for Aptitudes P, A and F are each within 10 points of one standard deviation below the sample mean.

VII. Concurrent Validity of Norms

For the purpose of computing the tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test, the criterion was dichotomized by placing those workers who were rated "A" and "B" into the high criterion group and those workers who were rated "C" into the low criterion group. This placed 12 of the 50 workers, or 24 percent of them, into the low criterion group.

Table IV shows the relationship between test norms consisting of Aptitudes P, A and F with critical scores of 80, 70 and 75, respectively, and the dichotomized criterion for Pantographer . Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Relationship between Test Norms Consisting of Aptitudes P, A and F with Critical Scores of 80, 70 and 75, Respectively, and the Criterion for Pantographer 979.782

N = 50

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	7	31	38
Poor Workers	8	4	12
Total	15	35	50

$r_{tet} = .70$ $\quad X^2 = 7.942$

$\sigma_{r_{tet}} = .26$ $\quad P/2 < .005$

The data in the above table indicate a significant relationship between the test norms and the criterion for this sample.

VIII. Conclusions

On the basis of mean scores, correlations with the criterion, job analysis data and their combined selective efficiency, Aptitudes P, A and F with minimum scores of 80, 70 and 75, respectively, are recommended as B-1001 norms for the occupation of Pantographer 979.782 . The equivalent B-1002 norms consist of P-80, K-70 and F-70.

IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupation include three aptitudes, only those occupational aptitude patterns which include the same three aptitudes with cutting scores that are within 10 points of the cutting scores established for the specific norms are considered for that occupation. Since none of the existing 22 occupational aptitude patterns includes Aptitudes P, A and F, the selective efficiency of any existing occupational aptitude pattern was not determined for this sample. However, the data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.