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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)

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

WRAPPER-LAYER AND EXAMINER, SOFT WORK 6-12.341

WRAPPER LAYER 6-12.351

S-20
(Formerly D-229)

U. S. Employment Service in
Cooperation with
Florida and Pennsylvania State Employment Services

U. S. DEPARTMENT OF LABOR
Bureau of Employment Security
Washington 25, D. C.
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STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR WRAPPER-LAYER AND EXAMINER, SOFT WORK 6-12.341 WRAPPER LAYER 6-12.351

S-20

Summary

The General Aptitude Test Battery was administered in November 1950 to 18 women employed as Wrapper-Layer and Examiner, Soft Work at the Budd Cigar Company, Quincy, Florida, and to 31 women employed in October 1948 as Wrapper Layers at the Phillipsburg Plant of the General Cigar Company, Phillipsburg, Pennsylvania. The criteria used were supervisory ratings. The following aptitudes were found to be significant for these jobs: Spatial Aptitude (S), Form Perception (P), Finger Dexterity (F), and Manual Dexterity (M).

GATB Norms for Wrapper-Layer and Examiner, Soft Work 6-12.341 and Wrapper Layer 6-12.351 - B-229 - S-20

Table I shows for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Wrapper-Layer and Examiner, Soft Work 6-12.341 and Wrapper Layer 6-12.351.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for S-20

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
S	CB-1-F CB-1-H	80	S	Part 8	75
P	CB-1-A CB-1-L	85	P	Part 5 Part 7	85
F	CB-1-O CB-1-P	90	F	Part 11 Part 12	85
M	CB-1-M CB-1-N	85	M	Part 9 Part 10	80

Effectiveness of Norms

The data in Table IV indicate that 7 of the 10 poor workers, or 70 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 70 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 24 of the 27 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 occupations of Wrapper-Layer and Examiner, Soft Work 6-12.341 and Wrapper Layer 6-12.351.

II. Sample

This study is based on two samples of Wrapper Layers, one employed by the Budd Cigar Company of Quincy, Florida, and the other employed by the General Cigar Company of Phillipsburg, Pennsylvania. The Budd Cigar Company sample consists of 15 women employed as Wrapper-Layer and Examiner, Soft Work. The sample was selected by the Personnel Manager of the plant and his Foremen who had been instructed to select a group which would include good, average, and marginal workers. There were no stated entrance requirements except that only women are hired for this job and there seems to be a preference for women who are young and have long, flexible fingers.

The General Cigar Company sample consists of 31 women. Applicants for this job have generally been accepted for employment on the recommendation of the local Employment Service Interviewer who selects the applicants in terms of the job specification supplied by the company. There are no stated requirements with respect to age, education, and experience. The original sample consists of 40 Wrapper Layers who were considered successful. However, when trainees were eliminated from the sample as well as those experienced workers who obviously did not understand how to complete some of the tests in the GATB, the resulting number in the sample was 31.

Table II shows the means, standard deviations, and ranges of the age, education, and experience for both samples, and for the total sample.

TABLE II

Means (M), Standard Deviations (σ), and Ranges of Age, Education, and Experience

Wrapper-Layer and Examiner, Soft Work 6-12.341
Wrapper Layer 6-12.351

	M	σ	Range
Budd Cigar Company (N = 15)			
*Age (years)	27.8	6.9	17-42
Education (years)	9.4	1.8	8-12
Experience (months)	49.9	32.7	2-120
*(N = 14)			
General Cigar Company (N = 31)			
Age (years)	20.3	2.4	18-28
Education (years)	10.8	1.5	8-12
Experience (months)	6.2	1.9	3-9
Total Sample (N = 46)			
**Age (years)	22.6	5.5	17-42
Education (years)	10.4	1.7	8-12
Experience (months)	20.4	27.7	2-120
**(N = 45)			

The mean age in both samples seems to substantiate the belief that the companies prefer younger workers although there is no such stated requirement. The General Cigar Company sample is particularly young. Age does seem to be operating as a selection factor.

The two samples differ most in respect to experience. The General Cigar Company sample is influenced in this respect because of the fact that it was a new plant in a non-manufacturing area and so would necessarily not be able to hire experienced workers.

The report on the General Cigar Company sample indicated that this plant was located in an agricultural area where there is little opportunity for industrial employment; that there was an adequate supply of young women with some high school education from whom to select. Therefore, that the labor market was a determining factor as to the age and education of the sample.

This same factor may be true also for the Florida sample.

III. Job Description

Job Title: Wrapper-Layer and Examiner, Soft Work 6-12.341
Wrapper Layer 6-12.351

The job description for the Budd Cigar Company sample follows:

Job Summary: Lays wrapper tobacco leaf on cigar-making machine and operates machine which rolls leaves around filler bunch to make the cigar. Examines cigars as they come from machine, discarding those with flaws and placing the balance in tray.

Work Performed: Picks up wrapper leaf from pile and places leaf on die of soft-work-cigar making machine in such a manner as to obtain maximum cuts per leaf. Smoothes wrapper leaf on die with both hands.

Presses foot treadle which causes back of machine to revolve at same time the leaf is cut to correct shape and automatically rolled around the filler.

Removes balance of leaf from the die of machine and repeats the process using remnant of leaf as long as full wrapper can be obtained. (This is usually only twice.)

Inspects cigars as they come from the machine, picking out those with flaws and placing the balance in tray. Works in conjunction with Bunch Maker.

The job description for the General Cigar Company sample follows:

Work Performed: Worker sits at work table, picks up a tobacco leaf-half from a pile on table surface; using thumb heel and fingers of both hands positions leaf vein side down on a trimming die, simultaneously depressing foot pedal to start machine causing suction to hold leaf on die while turret revolves simultaneously actuating a roller which crosses die thus cutting leaf to proper shape.

Cut leaf is picked up by suction carrier which transports cut leaf into machine to be rolled around a bunch or filler for the cigarillo.

Picks up original leaf-half using thumbs and fingers of both hands and repositions leaf on trimming die to secure another cut and continues this process until maximum number of cuts have been secured.

Stacks finished cigarillos in a tray at end of work table exercising visual inspection as cigars are placed by hand in tray.

Performance Requirements

Responsibility - Responsible for keeping machine and work stations clean.

Job Knowledge - Worker must learn the difference between upper and lower sides of tobacco leaves since operator must place proper side on surface of die.

Mental Application - Must exercise judgment as how to cut stock economically so as to get maximum number of cuts from tobacco leaf.

Dexterity and Accuracy - Must be able to use quick deft movements of hands and fingers in positioning tobacco leaves on the die. Considerable skill must be developed in smoothing cigar leaf over die. Must be able to learn to coordinate and time work movements in unison with another operator who works under similar conditions, but on the opposite side of the machine, and in order that both persons work duties may be performed in keeping with the speed of the machine.

IV. Experimental Battery

All the tests in the General Aptitude Test Battery, B-1001, were administered to the sample group.

V. Criteria

The criterion for the Budd Cigar Company was a supervisory rating assigned by the Personnel Manager and the foreman for each one in the sample. The raters stated that the ratings primarily reflected production records, and that the ratings of the workers were not forced into the high-average-low groups since they were selected to represent these groups. (The Florida report stated "Considerable confidence is given to the ratings since a previous study (Informational Report submitted on March 15, 1950) indicated that the ratings did reflect actual production.") The raters submitted their ratings twice with a time interval of about two months between the ratings. The employees were rated as to job proficiency in the three categories of good, average, and poor. After two months had elapsed, the raters again rated all their employees including the sample group into the three categories. The raters were not told at the first rating session that another rating would be made, and they did not have a record of the first ratings. Even though nearly all the employees in the occupation of Wrapper-Layer and Examiner, Soft Work and Bunch Maker, Machine were rated at the second session and the employees in this study were unidentified in the first, they received practically the same rating. The second rating was the one selected by the Florida Agency as the final criterion.

The criterion for the General Cigar Company consisted of the overall rating of the Plant Superintendent. A qualitative rating was obtained from two supervisors from each group. However each supervisor could not rate all the employees, so an overall rating was obtained from the Plant Manager. This rating coincided with the supervisors' ratings with only a few minor variations within the breakdowns of high, middle and low. It was, therefore, decided to use the ratings of the Plant Manager alone. Raters were cautioned to consider only quantity and quality.

Weekly production records were obtained for the period beginning July 1 to September 30. Production records and absentee records were combined to break down production into an hourly rate for correlation for aptitude scores. The correlations were somewhat lower than those between supervisory ratings and test scores. Production records were not supplied for two workers in the experimental sample. Also, they were quantitative in nature and did not take into consideration quality of work which seems to be important in these jobs. It was therefore decided to discard these ratings in favor of the supervisory ratings.

VI. Statistical and Qualitative Analysis

Since both groups perform substantially the same work, and are similar in age, education, and experience, they have been combined into one total sample. The broad category ratings of each subsample were combined into one distribution of broad category ratings for the 46 workers in the total sample.

Table III shows the means, standard deviations, Pearson product-moment correlations (corrected for broad categories) with the criterion, and standard errors of correlation for the aptitudes of the General Aptitude Test Battery for the combined sample. The means and standard deviations of the aptitudes are comparable to general population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_{c}r$), and Standard Errors of Correlation ($\sigma_{c}r$) for the Aptitudes of the General Aptitude Test Battery

Wrapper-Layer and Examiner, Soft Work 6-12.341
Wrapper Layer 6-12.351
N = 46

Aptitudes	M	σ	$_{c}r$	$\sigma_{c}r$
G - Intelligence	93.1	14.3	.277	.136
V - Verbal Ability	87.4	11.0	-.031	.147
N - Numerical Ability	98.3	16.9	.314*	.133
S - Spatial Ability	94.4	16.2	.287	.135
P - Form Perception	104.7	16.2	.279	.136
Q - Clerical Perception	98.0	17.4	-.107	.146
A - Aiming	105.3	14.7	.055	.147
T - Motor Speed	99.7	15.1	.114	.146
F - Finger Dexterity	110.7	17.9	.286	.135
M - Manual Dexterity	94.4	17.4	.231	.140

*Significant at the .05 level.

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

Spatial Aptitude (S) and Form Perception (P) - are required in placing the tobacco wrapper leaf on the die of the machine in a manner which yields the maximum number of cuts per leaf and in inspecting the finished cigars to make certain that they are without flaws.

Finger Dexterity (F) and Manual Dexterity (M) - are necessary for quick, deft movements of hands and fingers in positioning the tobacco leaves on the die, and in smoothing the leaves over the die.

Aiming (A) and Motor Speed (T) - appear to be necessary for positioning the leaves on the die and keeping up with the speed of the machine.

Table III shows that the highest means were obtained for Aptitudes P, A, and F. All the standard deviations are below the general population norm of 20, with the sample showing the greatest homogeneity for Aptitude V. There is a significant correlation at the .05 level between Aptitude N and the criterion.

Aptitudes S, P, F, and M were selected for inclusion in the norms. These aptitudes appear to be most important from a job analysis standpoint and show good predictive efficiency when used in combination. Aptitudes P and F have two of the highest means for the sample.

Although Aiming and Motor Speed appear to be important for successful job performance, there was not sufficient evidence to warrant inclusion of these aptitudes in the test norms.

Cutting scores for Aptitudes S, P, and F were set one standard deviation below the mean and rounded to five point score levels. For Aptitude S, the cutting score was rounded to the nearest five point level to one sigma below the mean. For Aptitudes P and F, the cutting scores were rounded to the next lower adjacent five point level. For Aptitude M, the cutting score was set one half standard deviation below the mean and rounded to the nearest five point level. Cutting scores were set at these levels in order to maximize the selective efficiency of the norms. The resulting norms consist of S - 80, P - 85, F - 90, and M - 85.

In order to compute the tetrachoric correlation coefficient between the above norms and the criterion, and the Chi Square value, the criterion was dichotomized. Table IV shows the relationship between test norms consisting of Aptitudes S, P, F, and M with critical scores of 80, 85, 90, and 85, respectively, and the criterion. Workers in the high criterion group have been designated as "good workers" and those in the low group have been designated as "poor workers."

TABLE IV

Relationship Between Test Norms Consisting of Aptitudes S, P, F, and M with Minimum Scores of 80, 85, 90, and 85, Respectively and the Criterion

Wrapper-Layer and Examiner, Soft Work 6-12.341
Wrapper Layer 6-12.351
N = 46

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	12	24	36
Poor Workers	7	3	10
Total	19	27	46

r_{tet} = .55 X^2 = 2.959

$\sigma_{r_{tet}}$ = .26 $p/2 < .05$

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

VII. Conclusions

On the basis of all the considerations discussed above, it is recommended that Aptitudes S, P, F, and M with minimum scores of 80, 85, 90, and 85, respectively, be used as B-1001 norms for Wrapper-Layer and Examiner, Soft Work 6-12.341 and Wrapper Layer 6-12.351. Equivalent B-1002 norms consist of S - 75, P - 85, F - 85, and M - 80.