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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 and a personnel evaluation form are also included. (AG)

Development of USES Aptitude Test Battery for Automobile-Body Repairman

(auto. ser.) 807.381

U.S. DEPARTMENT OF LABOR
W. Willard Wirtz, Secretary
MANPOWER ADMINISTRATION
BUREAU OF EMPLOYMENT SECURITY
Washington, D.C. 20210

Technical Report on Development of USES Aptitude Test Battery

For .....

Automobile-Body Repairman (auto. ser.) 807.381

S-313

U. S. Employment Service
in Cooperation with
Minnesota and New Jersey State Employment Services

December 1966

FOREWORD

The United States 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 to 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.

Frank H. Cassell, Director
U. S. Employment Service

GATB Study #2519
~~2629~~
3765

DEVELOPMENT OF USES APTITUDE TEST BATTERY

For

Automobile-Body Repairman (auto. ser.) 807.381

S-313

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Automobile-Body Repairman (auto. ser.) 807.381. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB, B-1002 Scores
S - Spatial Aptitude	85
P - Form Perception	90
M - Manual Dexterity	90

RESEARCH SUMMARY - VALIDATION SAMPLE

Sample:
56 male MDTA trainees enrolled in a training course for automobile-body repairmen in Minnesota.

Criterion:
Instructor's ratings

Design:
Longitudinal (tests were administered at the beginning of the training course, and criterion data were collected after completion of the training course).

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

Predictive Validity:
Phi Coefficient = .55 ($P/2 < .0005$)

Effectiveness of Norms:
Only 64% of the non-test-selected trainees used for this study

were good trainees; if the trainees had been test-selected with the S-313 norms, 85% would have been good trainees. 36% of the non-test-selected trainees used for this study were poor trainees; if the trainees had been test-selected with the S-313 norms, only 15% would have been poor trainees. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Trainees	64%	85%
Poor Trainees	36%	15%

VALIDATION SAMPLE DESCRIPTION

Size: N = 56

Occupational Status: Trainees

Training Setting: Trainees were enrolled at either the Minneapolis Area Vocational-Technical School, (Minneapolis, Minnesota) or the St. Paul Area Vocational-Technical School, (St. Paul, Minnesota).

School Enrollment Requirements:

Education: No requirement

Previous Experience: No requirement

Tests: No tests used.

Principal Activities: The job duties of the occupation and the subjects contained in the course of study are shown in the Appendix.

Minimum Experience: None of the trainees had had previous experience as automobile-body repairmen.

TABLE 2

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

	Mean	SD	Range	r
Age (years)	28.6	7.5	18-51	-.026
Education (years)	10.4	1.7	6-14	-.019

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B were administered during 1963 and 1964.

CRITERION

The criterion data consisted of independent ratings and reratings made by instructors on the "Descriptive Rating Scale," with the exception of one set of rank order reratings. All ratings were converted to standard scores.

Rating Scale: An adaptation of the form SP-21 "Descriptive Rating Scale" was used. The scale (see Appendix) consists of eight items covering different aspects of job performance, with five alternatives for each item. The alternatives indicate the different degrees of job proficiency.

Reliability: The correlation coefficient between the two sets of ratings is .84 indicating satisfactory reliability. The final criterion score consisted of the combined standard scores of the two sets of ratings.

Criterion Score Distribution:

Actual Range:	62-134
Mean:	100.2
Standard Deviation:	19.3

Criterion Dichotomy: The criterion distribution was dichotomized into high and low groups by placing 36% of the sample in the low group to correspond with the percentage of trainees considered unsatisfactory or marginal. Trainees in the high criterion group were designated as "good trainees" and those in the low group as "poor trainees." The criterion critical score was 95.

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. Aptitude S which does not have a high correlation with the criterion was considered for inclusion in the norms because the qualitative analysis indicated that it was important for the job duties and the sample had a relatively high mean score on this aptitude. 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 performed.)

Aptitude	Rationale
G - General Learning Ability	Required to learn and understand principles of auto-body repair and proper use of tools and materials. Must be able to determine extent of damage to automobiles, estimate labor and material costs of repairs, and to plan and carry out repair work in most practical manner.
S - Spatial Aptitude	Required to visualize relationship of various body parts with the whole body and the desired contour of section to be repaired.
P - Form Perception	Required to detect minor blemishes or dents in body and to fill in or hammer out and paint damaged sections so that they conform with surrounding automobile body surfaces.
M - Manual Dexterity	Required to round out or fill in damaged body sections and repair upholstery using such hand tools as hammers, wrenches, files, welding torch, and sewing needles.

TABLE 4

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 56

Aptitude	Mean	SD	Range	r
G - General Learning Ability	96.3	15.3	55-133	.087
V - Verbal Aptitude	93.3	15.0	65-137	-.030
N - Numerical Aptitude	89.7	15.0	50-122	.104
S - Spatial Aptitude	110.2	17.1	71-153	.129
P - Form Perception	96.9	15.9	59-132	.353**
Q - Clerical Perception	95.7	15.5	56-139	.274*
K - Motor Coordination	88.7	20.2	41-140	.194
F - Finger Dexterity	104.6	19.9	56-147	.172
M - Manual Dexterity	103.6	19.9	51-142	.291*

*Significant at the .05 level
**Significant at the .01 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
Irrelevant						X			
Relatively High Mean				X				X	X
Relatively Low Standard Dev.									
Significant Correlation with Criterion					X	X			X
Aptitudes to be Considered for Trial Norms				S	P				M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of aptitudes S, P, and M at trial cutting scores were able to differentiate between the 64% of the sample considered good trainees and the 36% of the sample considered poor trainees. 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 two-apti-

tude trial norms, minimum cutting scores slightly higher than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of S-85, P-90, and M-90 provided the highest degree of differentiation. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .55 (statistically significant at the .0005 level).

TABLE 6

Predictive Validity of Test Norms
S-85, P-90, M-90

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Trainees	7	29	36
Poor Trainees	15	5	20
Total	22	34	56

Phi Coefficient (ϕ) = .55
Significance Level = $P/2 < .0005$

Chi Square (X^2) = 16.32

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study did not meet the requirements for incorporating the occupation studied into any of the 36 OAP's included in Section II of the Manual for the General Aptitude Test Battery. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.

GATB Study ~~#2629~~ 3765 S-313

Automobile-Body Repairman (auto. ser.) 807.381

Check Study #1 Research Summary

Sample:
63 male MDTA trainees enrolled in a course for automobile-body repairmen in New Jersey.

TABLE 7

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and the Aptitudes of the GATB - Cross-Validation Sample #1

Age, Education & Aptitudes	Mean	SD	Range	r
Age (years)	26.9	9.5	18- 57	-.258*
Education (years)	10.3	1.7	6- 14	.085
G - General Learning Ability	91.2	14.0	67-124	.165
V - Verbal Aptitude	91.8	12.7	66-121	.066
N - Numerical Aptitude	89.3	16.5	55-127	.035
S - Spatial Aptitude	99.7	17.9	71-140	.326**
P - Form Perception	96.6	22.1	51-142	.322**
Q - Clerical Perception	98.2	16.0	68-143	.068
K - Motor Coordination	96.8	20.8	49-148	.025
F - Finger Dexterity	92.3	21.3	45-149	.256*
M - Manual Dexterity	104.0	21.5	62-159	.234

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

Criterion:
Instructor's ratings

Design:
Longitudinal (tests were administered at the beginning of the training course, and criterion data was collected at the completion of the training course).

Principal Activities:
The job duties and the course of study are comparable to those shown in the Appendix for the validation sample.

Predictive Validity:
Phi Coefficient = .34 ($P/2 < .005$)

TABLE 8

Predictive Validity of Test Norms
S-85, P-90, M-90

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	17	24	41
Poor Workers	17	5	22
Total	34	29	63

Phi Coefficient (ϕ) = .34 Chi Square (X^2) = 7.43
Significance Level = $P/2 < .005$

Effectiveness of Norms:

Only 65% of the non-test-selected trainees in this sample were good trainees; if the trainees had been test-selected with the S-313 norms, 83% would have been good trainees. 35% of the non-test-selected trainees in this sample were poor trainees; if the trainees had been test-selected with the S-313 norms, only 17% would have been poor trainees. The effectiveness of the norms when applied to this independent sample is shown graphically in Table 9:

TABLE 9

Effectiveness of S-313 Norms on Check Study Sample #1

	Without Tests	With Tests
Good Trainees	65%	83%
Poor Trainees	35%	17%

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

RATING TRAINEES

DESCRIPTIVE RATING SCALE

(For Aptitude Test Development Studies)

Score_____

RATING SCALE FOR_____
(DOT Title and Code for Training Course)

Directions: Please read "RATING TRAINEES - SUGGESTIONS TO RATERS" and then complete this rating scale. In making your ratings, only one box should be checked for each question.

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

Sex: Male_____ Female_____

A. How much aptitude or facility does he have for the vocational training? (Trainee's adeptness or knack for performing the work easily and well.)

☐ 1. Has great difficulty doing the work. Not at all suited for the training.

☐ 2. Usually has some difficulty doing the work. Not too well suited for the training.

☐ 3. Does the work without too much difficulty. Fairly well suited for the training.

☐ 4. Usually does the work without difficulty. Well suited for the training.

☐ 5. Does the work with great ease. Exceptionally well suited for the training.

B. How much ability does he have for maintaining adequate production in the vocational activity for which he was trained?

☐ 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.

C. How good was the quality of his work during the vocational training?

☐ 1. Performance was inferior and almost never met minimum quality standards.

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

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

☐ 4. Performance was usually superior in quality.

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

D. How quickly did he learn the instructional units of the vocational training?

- ☐ 1. Learned the work very slowly. Needed careful and repeated instructions.
- ☐ 2. Learned the work somewhat slower than most.
- ☐ 3. Learned most of the work in the usual amount of time.
- ☐ 4. Learned most of the work quickly.
- ☐ 5. Learned all of the work very rapidly. Needed only the minimum amount of training or instructions for even the difficult aspects.

E. How much ability does he have for using the equipment of the vocational training?

- ☐ 1. Has very limited ability. Cannot use the equipment adequately.
- ☐ 2. Has little ability. Can use the equipment to "get by."
- ☐ 3. Has a moderate amount of ability. Can use the equipment to do fair work.
- ☐ 4. Has high ability. Can use the equipment to do good work.
- ☐ 5. Has very high ability. Can use the equipment to do excellent work.

F. How large a variety of job duties can he perform efficiently?

- ☐ 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 in coping with work situations that are different or out of the ordinary?

☐ 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. Considering all the factors already rated, and only these factors, how acceptable was his performance during vocational training?

☐ 1. Performance was unsatisfactory.

☐ 2. Performance was not completely satisfactory.

☐ 3. Performance was satisfactory.

☐ 4. Performance was good.

☐ 5. Performance was outstanding.

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FACT SHEET

Job Title: Automobile-Body Repairman (auto. ser.) 807.381

Job Summary (Validation Sample): Repairs damaged automobile bodies by restoring original contours of body metal, replacing irreparable body parts, and performing other related automotive repair services.

Work Performed: Repairs damaged bodies and fenders: Examines damaged vehicle to determine extent of damage, and decides on most practical methods of repair. Hammers bumps and dents in the metal to release strains and stresses and to restore contours of the damaged areas. Uses bumping and dinging hammers, dolly blocks, spoons, and air hammer. Heats solder to a plastic state and applies it to damaged areas. Adds new metal to small or inaccessible dents that cannot be hammered and to other areas that require building up to their original thicknesses and contours. Smooths and paddles plastic solder with wooden stick until surface contour conforms to adjacent area. Using electric arc or acetylene welding equipment, welds breaks and tears in body metal; or trims breaks with shears. Shrinks areas that have become stretched by heating small spots of metal in the stretched area with a torch, upsetting (hammering the stretched metal into the heated areas), dinging (hammering the area smooth), and quenching the shrunken spot with a wet sponge. Files, sands, or grinds rough areas to a smooth finish, feeling surface by hand to locate small irregularities.

Replaces damaged parts: Removes badly damaged parts, such as fenders, bumpers and door panels by loosening or cutting bolts and, when necessary, prying loose any parts that have jammed against the body. Restores reparable parts to their original contours. Replaces irreparable parts from stock and reassembles them to the vehicle body.

May perform other automotive repairs: Repaints repaired and replaced parts or entire vehicle with brush or spray gun, matching existing color or customer's order. Repairs or replaces damaged upholstery and worn fabric tops. Replaces broken windshields and window glass. Estimates cost of repairs.

Course Content	Clock Hours
Welding	50
Use of tools - hand and power	35
Characteristics of metal	25
Principles of leading and other new techniques	50
Fender repair	100
Panel replacement, and repair	150
Major body repair	180
Adjusting doors, hood, cleaning and repairing upholstery	50
Preparing car for refinishing, priming, spraying with lacquer, enamel and acrylic paint, sanding, taping, rubbing	75

Course Content	Clock Hours
Hints for refinishing and matching colors	25
Estimating	15
Installing glass and repairing water leaks	25
	780

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