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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 signicant 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)

Development of USES Aptitude Test Battery for Automobile-Service-Station Mechanic

(auto. ser.) 620.381

U.S. DEPARTMENT OF LABOR
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BUREAU OF EMPLOYMENT SECURITY
Washington, D.C. 20210

Technical Report on Development of USES Aptitude Test Battery

For .....

Automobile-Service-Station Mechanic (auto. ser.) 620.381

S-380

U. S. Employment Service
in Cooperation with
Pennsylvania State Employment Service

August 1966

DEVELOPMENT OF USES APTITUDE TEST BATTERY

For

AUTOMOBILE-SERVICE-STATION MECHANIC 620.381
S-380

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Automobile-Service-Station Mechanic 620.381. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB, B-1002 Scores
S - Spatial Aptitude	90
P - Form Perception	80
F - Finger Dexterity	80

RESEARCH SUMMARY

Sample

54 male trainees in Manpower and Development Training courses (MDTA) at the Automotive Training Center of Spring Garden Institute, Philadelphia, Pennsylvania.

Criterion

Course grades

Design

Longitudinal (tests were administered at the beginning of training and criterion data were collected at the end of training).

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

Predictive Validity

Phi Coefficient = .45 (P/2 less than .005)

Effectiveness of Norms

Only 67% of the non-test-selected trainees used for this study were good trainees; if the trainees had been test-selected with the above norms, 86% would have been good trainees. 33% of the non-test-selected trainees used for this study were poor trainees; if the trainees had been test-selected with the above norms, only 14% 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	67%	86%
Poor Trainees	33%	14%

SAMPLE DESCRIPTION

Size

N = 54

Status

Trainees

Setting

Trainees were enrolled at the Automotive Training Center of Spring Garden Institute, Philadelphia, Pennsylvania.

School Selection Requirements

Education: None

Previous Experience: None

Tests: None

Other: Personal interview to determine if trainees have criminal record, are in good health, are able to converse with public, have knowledge of basic arithmetic and possess a Pennsylvania driver's license.

Principal Activities

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

Minimum Experience

All members of the sample were trainees.

Course Outline

Island Service	40 hrs.
Tires	32 hrs.
Batteries	16 hrs.
Body Appearance and Windshield Wiper Service	8 hrs.
Lubrication	40 hrs.
Shock Absorbers and Springs	16 hrs.
Cooling Systems	16 hrs.
Exhaust Systems	16 hrs.
Brake Systems	112 hrs.
Lighting Systems	24 hrs.
Engine Tune-Up	260 hrs.
Customer Relations Service and Selling	20 hrs.
Total	600 hrs.

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)	27.9	8.9	17 - 53	-.013
Education (years)	10.8	1.4	7 - 14	-.159

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002, Form A, were administered prior to the beginning of training.

CRITERION

The criterion data consisted of course grades which were assigned point values.

Reliability

Since only one grade was obtained, no measure of criterion reliability is available.

Criterion Score Distribution:

Possible Range:	11-55	Mean:	41.8
Actual Range:	21-54	Standard Deviation:	8.1

Criterion Dichotomy

The criterion distribution was dichotomized into low and high groups by placing 33% of the sample in the low criterion 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 22.

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 M, 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 Aptitude M. A relatively high mean score with employed workers may indicate that some sample pre-selection has taken place. 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	**Must use judgment to recognize defective equipment and analyze engine performance.**
P - Form Perception	**Must be able to perceive detail in auto parts and accessories.**
Q - Clerical Perception	**Must be able to read charts and instructions accurately and check various meters.**
F - Finger Dexterity	**Necessary in tune-up work but also significant in checking battery, fan belt installation or adjustment and other similar types of repair work.**
M - Manual Dexterity	**Necessary in all phases of auto repair work.**

TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlation with the Criterion (r) for the Aptitudes of the GATB

Aptitudes	Mean	SD	Range	r
G - General Learning Ability	89.5	10.8	67-113	.393**
V - Verbal Aptitude	88.7	11.4	68-127	.317*
N - Numerical Aptitude	86.4	13.9	56-121	.195
S - Spatial Aptitude	96.7	13.5	58-120	.389**
P - Form Perception	92.4	14.3	55-123	.338*
Q - Clerical Perception	95.1	11.3	78-128	.333*
K - Motor Coordination	91.9	17.1	47-126	.118
F - Finger Dexterity	86.0	16.2	43-123	.398**
M - Manual Dexterity	96.5	18.7	50-135	.195

* 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	X
Irrelevant									
Relatively High Mean				X		X			X
Relatively Low Standard Deviation	X	X		X		X			
Significant Correlation with Criterion	X	X		X	X	X		X	
Aptitudes to be Considered for Trial Norms	G	V		S	P	Q		F	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 various combinations of aptitudes G, V, S, P, Q, F and M at trial cutting scores were able to differentiate between the 67% of the sample considered good trainees and 33% of the sample considered poor trainees. Trial cutting scores at five point intervals approximately one standard deviation below the mean were tried because this will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample; 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. The Phi Coefficient was used as a basis for comparing trial norms. Norms of S-90, P-80 and F-80 provided the highest degree of differentiation. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .45 (statistically significant at the .005 level).

TABLE 6

Predictive Validity of Test Norms

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Trainees	11	25	36
Poor Trainees	14	4	18
Total	25	29	54

Phi Coefficient (ϕ) = .45 Chi Square (x^2) = 10.741
Significance Level = P/2 less than .005

DETERMINATION OF OCCUPATION APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-26 which is shown in Section II of the Manual for the General Aptitude Test Battery. A Phi Coefficient of .24 is obtained with the OAP-26 norms of S-85, P-90, F-85.

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FACT SHEET

Job Title

Automobile-Service-Station Mechanic (auto. ser.) 620.381

Job Summary

Performs minor engine tune-up, brake repair, wheel balancing, lubrication, and sells gasoline, oil, auto parts and accessories, and provides service to customers.

Work Performed

Performs Tune-Up: Checks, cleans and gaps spark plugs and ignition points, replaces where necessary; checks and when necessary replaces condenser and air filter. Checks distributor. Checks and adjusts carburetor; checks and adjusts timing and checks compression with meter or other devices. Checks generator, voltage regulator (or alternator), fuel pump, water pump, automatic choke and makes adjustments as necessary; checks battery and starter using testing devices and cleans battery cables when necessary. Checks engine idle and makes adjustments using gasoline analyzer or other testing equipment to check whether the mixture is too rich or too lean. Checks fuel filter and fuel line. Checks wires in electrical system. Checks fan belt and replaces where necessary.

Performs Brake Repair: Checks brake lining for wear; adjusts brakes or replaces brake linings, brake drums and wheel cylinders. Checks hydraulic brake system; installs proper amount of brake fluid, checks master cylinder for leaks; checks stop light switch and replaces when necessary. Bleeds hydraulic brake system in order to get desired amount of pressure to operate brakes properly. Checks parking brake and adjusts when necessary.

Performs Wheel Balancing: Operates a machine that shows whether automobile wheels are balanced, reads indicators which show location of unbalance and corrects unbalance by placing small counterweights onto the rim.

Performs Lubrication Service: Drives automobile (or truck) onto car lift; raises car lift; lubricates chassis according to prescribed procedure using lubrication gun; may follow lubrication chart to locate all points to be lubricated. Changes oil by draining crankcase and replaces oil with desired amount and quality. Checks oil filter and replaces when necessary. Sprays spring leaves with lubricant using spray gun. Checks muffler and exhaust systems; replaces muffler and installs new one when necessary. Checks tires for wear and informs customer if replacements are needed. Lowers car lift. Checks cooling system; cleans and flushes dirty cooling systems. Installs anti-freeze when necessary; checks water pump for proper operation.

Performs Road Services as Required: **Drives auto or tow truck to location of disabled vehicle. Diagnoses problem and attempts to remedy condition (fixing flats, replacing flat tire, installing chains, boosting battery power to start automobile, etc.); may tow vehicle to station if necessary.**

Sells Gasoline, Oil and Service: **Sells gasoline and delivers desired amount to customer's tank; checks quantity of oil in crankcase and informs customer if a supply is needed and sells desired amount; checks battery for proper amount of acid and installs distilled water when necessary. Checks proper level of water and anti-freeze in cooling system (during cold weather checks protection of anti-freeze using hydrometer and sells anti-freeze when amount in cooling system is too low to afford proper protection). Cleans windshield and checks windshield wipers; sells customer windshield wipers if necessary. May check tire air pressure and fills tire to proper pressure; notes condition of tires and attempts to sell replacements to customer if necessary. Writes up credit slips; receives money for cash sales and issues cash receipt when requested by customer. Uses cash register to record sale by depressing proper buttons on register to note type of sale and amount. Answers automotive questions and gives road and street directions.**

Performs Other Minor Repairs and Adjustments: **Sells miscellaneous auto accessories such as outside rear view mirrors, rust inhibitors, anti-freeze, tires, batteries, tire chains, etc. May repair and tune-up other combustion engines such as power lawn mowers, power snow blowers and outboard motors. Performs other duties as required.**

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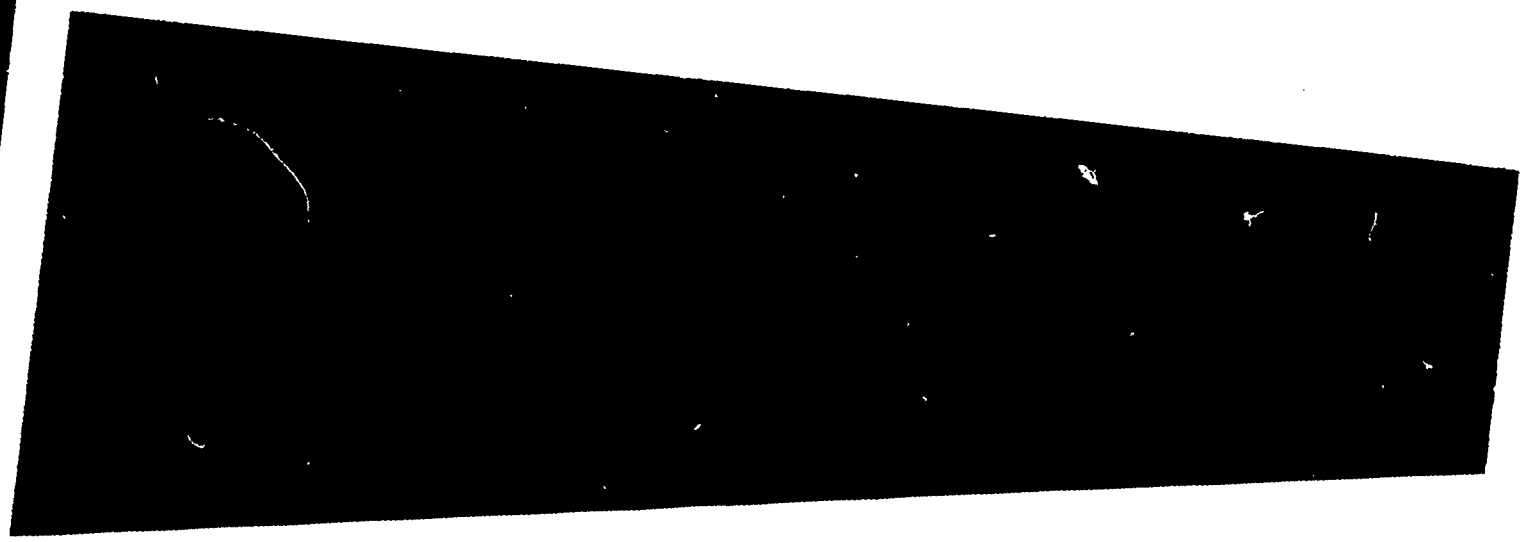


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