DOCUMENT RESUME

ED 060 121 TM 001 279

| | |
|---|---|
| TITLE | Sheet-metal Worker (any ind.) 804.281 -- Technical Report on Development of JSTES Aptitude Test Battery. |
| INSTITUTION | Manpower Administration (DOL), Washington, D.C. U.S. Training and Employment Service. |
| REPORT N | TR-S-82R |
| PUB DATE | Jun 70 |
| NOTE | 12p. |
| EDRS PRICE | MF-$0.65 HC-$3.29 |
| DESCRIPTORS | *Aptitude Tests; *Cutting Scores; Evaluation Criteria; Job Applicants; *Job Skills; Norms; Occupational Guidance; *Personnel Evaluation; Sheet Metal Work; *Sheet Metal Workers; Test Reliability; Test Validity |
| IDENTIFIERS | GATB; *General Aptitude Test Battery |

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)

S-82 R

June 1970

U.S. Training and
Employment Service
Technical Report
S-82 R



Development of USTES

# APTITUDE TEST BATTERY FOR

# SHEET-METAL WORKER

(any ind.)
804.281

U.S DEPARTMENT OF LABOR
Manpower Administration

Technical Report on Development of USTES Aptitude Test Battery

For . . . .

Sheet-Metal Worker (any ind.) 804.281

S-82R

(Developed in Cooperation with the
Florida State Employment Service)

2

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 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.

# Development of USTES Aptitude Test Battery

For

Sheet-Metal Worker (any ind.) 804.281-010

S-82R

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Sheet-Metal Worker (any ind.) 804.281-010. The following norms were established:

| GATB Aptitudes | Minimum Acceptable GATB Scores |
|---|---|
| S - Spatial Aptitude | 90 |
| Q - Clerical Perception | 80 |
| K - Motor Coordination | 75 |
| M - Manual Dexterity | 95 |

## Research Summary

**Sample:**

79 male apprentices enrolled in the Lindsey Hopkins Vocational School, Miami, Florida. This study was conducted prior to the requirement of providing minority group information. Therefore, minority group status is unknown.

**Criteria:**

Instructors ratings of classroom performance and course grades.

**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 = .51 ($P/2 < .0005$)

**Effectiveness of Norms:**



Only 66% 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-four percent of the nontest-selected workers used for 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 I

Effectiveness of Norms

| | Without Tests | With Tests |
|---|---|---|
| Good Workers | 66% | 82% |
| Poor Workers | 34% | 18% |

SAMPLE DESCRIPTION

Size:

N = 79

Occupational Status:

Apprentices enrolled in vocational school.

Work Setting:

Apprentices were enrolled in the Lindsey Hopkins Vocational School, Miami, Florida.

Employer Selection Requirements:

Education: None required.

Previous Experience: None required.

Tests: None used.

Other: Persons admitted must be between the ages of 18 and 22 except veterans and persons with previous experience in sheet-metal work.

Principal Activities:

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

Minimum Instruction:

All apprentices in the final sample had at least 112 hours instructions.

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) | 25.0 | 4.6 | 18-40 | -.089 |
| Education (years) | 10.4 | 1.8 | 6-14 | .373** |

**Significant at the .01 level.

## EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002A were administered during April 1955.

## CRITERION

The criterion data consisted of course grades. These letter grades ranged from E, for failing, through A+, for excellent, assigned by the instructor on the basis of all phases of classroom performance. The 79 apprentices were placed in three criterion groups as follows:

| Criterion Group | N | Letter Grade |
|---|---|---|
| Good | 28 | A+, A, B+, B |
| Average | 25 | B-, C+, C |
| Poor | 26 | C-, D+, D, D-, E |

For computational purposes, the three broad categories of good, average, and poor, were converted to quantitative values of 61, 50 and 39 respectively.

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 34% 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 50.

## 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. 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 for planning and laying out work from blueprints; noting changes and alterations to be made on the blueprints; and for making sketches and constructing templates. |
| N - Numerical Aptitude | Required for calculations of quantity, size and shape of items in connection with layout, fabrication, assembly and installation operations. |
| S - Spatial Aptitude | Required for three-dimensional visualization of objects to be made and for making visual comparisons from blueprints to objects they represent. |
| P - Form Perception | Required for accuracy in drawings and measurements; for comparing parts of objects; and for selecting proper tools, parts and materials. |
| K - Motor Coordination | Required for using scribe, dividers and center punch in layout work. |
| F - Finger Dexterity | For setting up and operating power machines and tools; and for using various hand tools and parts. |
| M - Manual Dexterity | Required in almost all phases of the work, particularly for skillful use of hands and arms in handling materials, parts and tools. |

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 79

| | Mean | SD | Range | r |
|---|---|---|---|---|
| G - General Learning Ability | 99.6 | 13.7 | 65-132 | .465** |
| V - Verbal Aptitude | 92.8 | 12.9 | 61-133 | .332** |
| N - Numerical Aptitude | 94.9 | 15.6 | 56-130 | .422** |
| S - Spatial Aptitude | 109.7 | 16.6 | 61-143 | .401** |
| P - Form Perception | 100.6 | 15.9 | 58-141 | .337** |
| Q - Clerical Perception | 96.0 | 13.5 | 69-143 | .373** |
| K - Motor Coordination | 99.0 | 18.7 | 47-140 | .326** |
| F - Finger Dexterity | 97.3 | 16.3 | 63-138 | .287** |
| M - Manual Dexterity | 115.9 | 19.3 | 78-163 | .286* |

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

TABLE 5

Summary of Qualitative and Quantitative Data

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

## 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, V, N, S, P, Q, K, F, and M at trial cutting scores were able to differentiate between the 66% of the sample considered to be good workers and the 34% 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 the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of S-90, Q-80, K-75 and M-95 provided optimum differentiation for the occupation of Sheet-Metal Worker (any ind.) 804.281-010. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .51 (statistically significant at the .0005 level).

TABLE 6

Concurrent Validity of Test Norms
S-90, Q-80, K-75, and M-95

| | Nonqualifying Test Scores | Qualifying Test Scores | Total |
|---|---|---|---|
| Good Workers | 6 | 46 | 52 |
| Poor Workers | 17 | 10 | 27 |
| Total | 23 | 56 | 79 |

Phi Coefficient = .51

Chi Square ($X^2_{xy}$) = 20.3

Significance Level = P/2 $<$ .0005

## DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-42 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A Phi Coefficient of .40 is obtained with the OAP-42 norms of S-90, P-85 and M-85.

FACT SHEET

Job Title

Sheet-Metal Worker (any ind.) 804.281-010

Job Summary

Fabricates, assembles, installs, and repairs sheet-metal articles and equipment by cutting, shaping, and fitting the parts with machine and hand tools.

Work Performed

Plans and lays out work: Studies blueprints and sketches of the article to be made; checks specified dimensions against actual dimensions at the point of installation, and selects material according to specifications; lays out required figures or patterns from blueprints, sketches, or templates, making measurements with rule, square, and dividers, locating reference points, and marking lines on stock with a scriber or chalk; may make patterns or templates.

Fabricates parts: Cuts sheet metal along scribed outline, using hand- or power-driven cutting tools such as power squaring shear, rotary shear, acetylene cutting torch, slitting shear, or power hacksaw; bends sheet metal along marked outlines to specified angles on a bending brake; uses beading machine to raise a bead on or near metal to reduce its flexibility; makes open lock seams with a seaming machine; pounds red-hot sections of sheet metal with wooden mallet on cast-iron molds of specified size and curvature to form concave sheet metal to specifications by using a roll-forming machine; may heat parts with a blowtorch before bending or forming; drills holes for bolts, rivets, and screws with punch press or portable hand drill.

Assembles units: Fastens sections of sheet-metal assemblies together by bolting, cementing, nailing, screwing, soldering, welding, or riveting parts according to specifications: closes lock seams by hammering them together.

Installs assemblies: Erects necessary scaffolding or hoisting equipment; carries assemblies or units to the point of installation; bolts or screws hangers, brackets, or reinforcements to the assemblies at points of attachment; fits assembly into place by bolting, cementing, nailing, riveting, screwing, soldering, or welding; may grind or file seams, joints, and rough surfaces of assemblies to a smooth finish by using such machines as portable buffing wheel and portable grinder, and such hand tools as file, chisel, and hammer.

## Effectiveness of Norms

Only 66% of the non test-selected workers used for this study were good workers; if the workers had been test-selected with the S-82R norms, 82% would have been good workers. Thirty-four percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-82R norms, only 18% would have been poor workers.

## Applicability of S-82R Norms

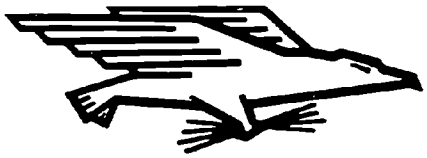
The aptitude test battery is applicable to jobs which include a majority of duties described above.



GPO 898-811

**U.S. DEPARTMENT OF LABOR**
MANPOWER ADMINISTRATION
WASHINGTON, D.C. 20210

OFFICIAL BUSINESS



POSTAGE AND FEES PAID
U.S. DEPARTMENT OF LABOR

THIRD CLASS MAIL