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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)

June 1970

U.S. Training and
Employment Service
Technical Report
S-307R



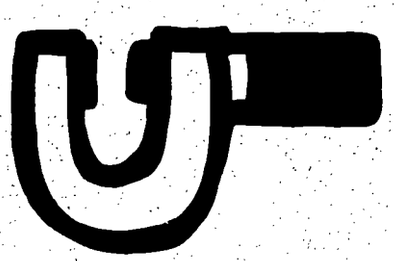
Development of USTES

# APTITUDE TEST BATTERY FOR

# DIE MAKER

(paper goods)
739.381

U.S. DEPARTMENT OF LABOR
Manpower Administration



Technical Report on Development of USTES Aptitude Test Battery

For . . . .

Die Maker (paper goods) 739.381

S-307R

(Developed in cooperation with Connecticut, Indiana, Minnesota, Texas and Wisconsin State Employment Services)

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.

GATB Study #2506

Development of USTES Aptitude Test Battery

For

Die Maker (paper goods) 739.381-022

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Die Maker (paper goods) 739.381-022. The following norms were established:

| GATB Aptitudes | Minimum Acceptable GATB Scores |
|---|---|
| N - Numerical Aptitude | 80 |
| S - Spatial Aptitude | 90 |
| M - Manual Dexterity | 90 |

Research Summary

Sample:

58 male workers employed as Die Makers in various member firms of the Folding Paper Box Association of America.

This study was conducted prior to the requirement of providing minority group information. Therefore, minority group status is unknown.

Criterion:

Supervisory ratings.

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 = .44 ($P/2 < .0005$)

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, 79% 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 21% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

| | Without Tests | With Tests |
|---|---|---|
| Good Workers | 66% | 79% |
| Poor Workers | 34% | 21% |

SAMPLE DESCRIPTION

Size:

N = 58

Occupational Status:

Employed Workers.

Work Setting:

Workers were employed at the following various member firms of the Folding Paper Box Association of America.

| State | Company |
|---|---|
| Connecticut | Warner Brothers Company |
| Indiana | Crown Paper Box Co., Indianapolis |
| Indiana | Indianapolis Paper Container Co., Indianapolis |
| Indiana | Paper Package Company, Indianapolis |
| Michigan | Consolidated Paper Co., Monroe |
| Michigan | KVP Sutherland Paper Co., Kalamazoo |
| Michigan | Michigan Carton Co., Battle Creek |
| Minnesota | Sigs Steel Die Makers, St. Paul |
| Minnesota | Waldorf Paper Products Co., St. Paul |

| State | Company |
|---|---|
| Texas | Houston Paper Co., Houston |
| Wisconsin | Cornell Paperboard Products Co., Milwaukee |
| Wisconsin | Forsberg Paper Box Co., Madison |
| Wisconsin | Green Bay Packaging Co., Green Bay |
| Wisconsin | Marathon Corporation. Menasha |
| Wisconsin | Milprint. Incorporated |
| Wisconsin | Paper Box & Specialty Co., Sheboygan |
| Wisconsin | A. Geo. Schultz Co., Milwaukee |

Employer Selection Requirements:

Education: None required.

Previous Experience: None required.

Tests: None used.

Other: None.

Principal Activities:

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

Minimum Experience:

All workers in the final sample had at least 12 months job experience.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience. N=58

| | Mean | SD | Range | r |
|---|---|---|---|---|
| Age (years) | 37.3 | 9.9 | 20-59 | -.011 |
| Education (years) | 10.9 | 1.7 | 6-14 | -.015 |
| Experience (months) | 133.4 | 94.7 | 12-528 | .176 |

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B, were administered during the period July 1962 to March 1964.

## CRITERION

The criterion data consisted of supervisory ratings of job proficiency made at approximately the same time as the tests were administered with a time interval of two to five weeks between the two ratings. The immediate supervisor rated each worker.

Rating Scale:

Form SP-21 "Descriptive Rating Scale" was used. The scale (see Appendix) consists of nine items covering different aspects of job performance. Each item has five alternative responses corresponding to different degrees of job proficiency.

Reliability:

A reliability coefficient of .89 was obtained between the initial ratings and the re-ratings, indicating a significant relationship. The final criterion score consists of the combined scores of the two ratings.

Criterion Score Distribution:

| | |
|---|---|
| Possible Range: | 18-90 |
| Actual Range: | 47-90 |
| Mean: | 67.8 |
| Standard Deviation: | 11.8 |

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 63.

## 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. Aptitudes G,N and M which do not have high correlations with the criterion, were considered for inclusion in the norms because the qualitative analysis indicated that the aptitudes might be important for the job duties and the sample had relatively high mean scores on aptitudes G and M and a relatively low standard deviation for aptitude N. 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)

| | |
|---|---|
| G - General Learning Ability | Required to learn proper methods of constructing dies and their lay out. |
| N - Numerical Ability | Required to calculate the number of dies to be fitted on each sheet, the size of the die blocks, and the amount of clearance needed for placement of rules. |
| S - Spatial Ability | Required to visualize the correct lay out of rules on the dies from the samples and specifications. |
| P - Form Perception | Required to check accuracy of the cutting and creasing of the dies against the specifications, using squares, dividers, rulers and compass. |
| M - Manual Dexterity | Required to operate hand and power tools, to fit and assemble rules, and to lock up die in chase. |

TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N=58

| | Mean | SD | Range | r |
|---|---|---|---|---|
| G - General Learning Ability | 103.4 | 15.7 | 77-141 | .187 |
| V - Verbal Aptitude | 98.5 | 15.6 | 75-136 | .071 |
| N - Numerical Aptitude | 97.6 | 14.9 | 63-135 | .185 |
| S - Spatial Aptitude | 112.8 | 18.6 | 79-159 | .267* |
| P - Form Perception | 100.3 | 16.7 | 63-138 | .042 |
| Q - Clerical Perception | 99.4 | 12.7 | 70-124 | .125 |
| K - Motor Coordination | 99.6 | 11.9 | 78-132 | .143 |
| F - Finger Dexterity | 98.6 | 15.6 | 58-133 | .052 |
| M - Manual Dexterity | 102.6 | 15.6 | 57-144 | .022 |

*Significant at the .05 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 Dev. | | | X | | | X | X | |
| Significant Correlation with Criterion | | | | X | | | | |
| Aptitudes to be Considered for Trial Norms | G | | N | S | | | | M |

DEVIATION 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, N, S 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 N-80, S-90 and M-90 provided optimum differentiation for the occupation of Die Maker (paper goods) 739.381-022. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .44 (statistically significant at the .0005 level).

TABLE 6

Concurrent Validity of Test Norms
(N-80, S-90 and M-90)

| | Nonqualifying Test Scores | Qualifying Test Scores | Total Total |
|---|---|---|---|
| Good Workers | 4 | 34 | 38 |
| Poor Workers | 11 | 9 | 20 |
| Total | 15 | 43 | 58 |

Phi Coefficient = .44 Chi Square ($X^2_\phi$) = 11.3

Signficance Level = $p/2 < .0005$

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-37 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A Phi Coefficient of .41 is obtained with the OAP-37 norms of N-80, S-95, and M-85.

SP-21

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

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

Score____

RATING SCALE FOR _____
D. O. T. Title and Code

Directions: Please read Form SP-20, "Suggestions to Raters", and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

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

Sex: Male_____ Female_____

Company Job Title: _____

How often do you see this worker in a work situation?

☐ See him at work all the time.

☐ See him at work several times a day.

☐ See him at work several times a week.

☐ Seldom see him in work situation.

How long have you worked with him?

☐ Under one month.

☐ One to two months.

☐ Three to five months.

☐ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

☐ 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.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

☐ 1. Performance is inferior and almost never meets minimum quality standards.

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

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

☐ 4. Performance is usually superior in quality.

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

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

☐ 1. Makes very many mistakes. Work needs constant checking.

☐ 2. Makes frequent mistakes. Work needs more checking than is desirable.

☐ 3. Makes mistakes occasionally. Work needs only normal checking.

☐ 4. Makes few mistakes. Work seldom needs checking.

☐ 5. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.

☐ 2. Has little knowledge. Knows enough to "get by."

☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.

☐ 4. Has broad knowledge. Knows enough to do good work.

☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

☐ 1. Has great difficulty doing his job. Not at all suited to this kind of work.

☐ 2. Usually has some difficulty doing his job. Not too well suited to this kind of work.

☐ 3. Does his job without too much difficulty. Fairly well suited to this kind of work.

☐ 4. Usually does his job without difficulty. Well suited to this kind of work.

☐ 5. Does his job with great ease. Exceptionally well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

☐ 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 when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 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. How many practical suggestions does he make for doing things in better ways? (Worker's ability to improve work methods.)

☐ 1. Sticks strictly with the routine. Contributes nothing in the way of practical suggestions.

☐ 2. Slow to see new ways to improve methods. Contributes few practical suggestions.

☐ 3. Neither quick nor slow to see new ways to improve methods. Contributes some practical suggestions.

☐ 4. Quick to see new ways to improve methods. Contributes more than his share of practical suggestions.

☐ 5. Extremely alert to see new ways to improve methods. Contributes an unusually large number of practical suggestions.

I. Considering all the factors already rated, and only these factors, how acceptable is his work? (Worker's "all-around" ability to do his job.)

☐ 1. Would be better off without him. Performance usually not acceptable.

☐ 2. Of limited value to the organization. Performance somewhat inferior.

☐ 3. A fairly proficient worker. Performance generally acceptable.

☐ 4. A valuable worker. Performance usually superior.

☐ 5. An unusually competent worker. Performance almost always top notch.

FACT SHEET

Job Title: Die Maker (paper goods) 739.381-022

Job Summary: Constructs steel rule dies for scoring and cutting out paper carton blanks on cylinder or platen presses. Works from samples or specifications. Lays out design of die on plywood sheets and uses wood working tools to cut die blocks. Measures, cuts, shapes and assembles steel Cutting and Creasing Rules on die block. Locks up completed die in Chase using Quoins. Checks carbon impression of die on Litho sheet, for accuracy and makes necessary adjustments.

Work Performed: Studies samples and specifications to determine method of construction and procedures. Examines litho sheet to determine number of die panels to be constructed. Figures number of dies that can be fitted on each plywood sheet being sure that grain of paper stock and wood will run in same direction. Measures design of die and lays it out on wood panel to make block die using ruler, protractor, and compass. Lays out jig dies for paper doll and similar cut outs by cutting out sample with sharp knife and tracing outline onto ply wood panel using carbon paper.

Cuts plywood blocks to dimensions of layout design, using table saw, jig saw, and dril press. Measures and checks wooden blocks against specifications, allows clearance for placement of cutting and creasing rules, and pull from presses. Uses chisel and hammer to adapt wooden blocks and pull from presses. Uses chisel and hammer to adapt wooden blocks to design when cut cannot be made with power tools.

Selects proper size and type cutting and creasing rules required for paper stock, kind of press to be used for production, type of die to be constructed, and various cuts and scores needed. Measures and cuts rules and knives, using hand cutter, for assembling and fitting in position on wood block die or insertion in cut on plywood jig die. Removes metal burrs from cut edge of stock on grinding wheel to conserve space when stacked together. Places ends of knives in miterer to form miter joints to insure clean cuts in stock. Shapes steel rules to desired angle on hand-operated bending press, selects softer steel rules when bending is required. Inserts hand die in bending press or uses special die and pliers to hand form required shapes. Tempers all rules and knives which have been shaped on bending press by placing in small electric oven and regulating temperature to obtain desired hardness.

Fits and assembles on work table, proper cutting and creasing rules between wood block designs or in pre-cut grooves on jig dies. Uses wood mallet when necessary to pound rules into position. Glues small pieces of cork on sponge rubber to die blocks alongside rule to prevent paper stock from sticking to die during production.

Locks up completed die in steel chase to hold wooden blocks and cutting and creasing rules in position. Places lock-up quoins between die block and frame of chase. May insert lead slug between quoins and chase to insure proper stress on die. Uses lock-up key to expand quoin and lock die in position.

Makes sample cartons by placing litho sheet over completed die and uses scoring tool, hammer, and wood block to score and cut sample. Checks sample carton for accuracy against specification for correct size, clearance, and all construction detail. Uses squares, dividers rulers, and compass to check dimensions. May make die sheets for use in sampling room by obtaining carbon impressions from completed die.

Registers carbon paper impression of die, after it has been locked up on press by Make Ready Pressman, onto litho sheet to determine true position of cutting and creasing rules. Makes necessary correction to die until accurate impression is obtained. Adapts dies when possible with special knives or other devices which will cut litho sheets during production to simplify stripping of scrap. Maintains and stores dies for possible re-use. Posts and keeps records of dies available. Supervises Die Maker Helper in assisting in making large dies, locking up dies, storing and filing of dies, corking dies, and in making simple dies.

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 S-307R norms, 79% would have been good workers. 34% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-307 norms, only 21% would have been poor workers.

Applicability of S-307R Norms: The aptitude test battery is applicable to jobs which include a majority of duties described above.

GPO 898-740