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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

GLASS BLOWER, LABORATORY APPARATUS (inst. app.) 4-65.440

B-625 S-345

U. S. Employment Service
in Cooperation with
New Jersey State Employment Service

July 1965

GATB# 2556

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

GLASS BLOWER, LABORATORY APPARATUS (inst. & app.) 4-65.440

B-625 S-345

Summary

The General Aptitude Test Battery, B-1002A, was administered to a final sample of 50 students enrolled in a two year Glass Blowing Technology curriculum at Salem County Technical Institute, Penns Grove, New Jersey. The criterion consisted of Glass Blower Laboratory course grades. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data and their combined selective efficiency, the following norms were established.

GATB, B-1002 Aptitudes	Minimum Acceptable Scores
S-Spatial	95
P-Form Perception	95
M-Manual Dexterity	95

Effectiveness of Norms

The data in Table IV indicate that only 74 percent of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 84 percent would have been good workers. 26 percent of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 16 percent would have been poor workers.

TECHNICAL REPORT

I. Purpose

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 occupation of Glass Blower, Laboratory Apparatus 4-65.440.

II. Sample

The General Aptitude Test Battery, B-1002A, was administered to 50 students (49 male and 1 female) prior to their enrollment in a two-year Glass Blowing Technology curriculum at Salem County Technical Institute, Penns Grove, New Jersey.

The Scientific Glass Blowing Technology Course is a two-year program providing training in scientific glass blowing techniques. Students learn to design and fabricate laboratory apparatus from glass tubing and other shapes. The requirements for enrollment are: high school graduation; recommendation by high school principal; completion of high school courses in mathematics, including algebra and plane geometry; two years of laboratory science; must rank in upper two-thirds of graduation class.

TABLE I

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

N = 50	M	σ	Range	r
Age (years)	20.5	2.0	17-28	.122
Education (years)	13.2	.72	12-14	.265

III. Job Description

Job Title: Glass Blower, Laboratory Apparatus (inst. & app.) 4-65.440

Job Summary: Shapes, bends and joins together sections of glass tubing and connection using various glass-forming tools necessary for the manufacture of scientific laboratory apparatus.

Work Performed: Prepares for glass blowing operation by checking work area for necessary tools and inspecting blowing tube for working condition: Reads work order sheet to determine operation to be performed. Checks work order sheet to insure that tube sizes are in accordance with specifications. Determines method for glass blowing by visually observing glass tube and blueprint. Determines size of interchangeable tip to be used. Screws tip into bunsen burner with fingers. Lights bunsen burner, bottom burner, back burner and hand torch. Regulates flame from bunsen burner by rotating small knobs on burner. Regulates flame from bottom burner with foot pedal.

Places connections on glass tubing: Selects proper sized holder. Places pointed end of holder into end of connection not to be attached to glass tube. Determines spot on tube where connection will be made by reading blueprint. Preheats spot on glass tube at spot where connection will be made over bottom burner. Places connection and glass tube together, blowing into tube so that proper opening is maintained from tube to connection. Straightens connection to correct angle while glass is workable.

Places glass tube on rollers with connection, rotating directly above back burner flame to warm glass and eliminate the possibility of strain. Corrects small flaws and pin holes using tungsten pick while connection is still in a plastic state.

Performs bending operation: Reads blueprint to determine degree of angle to be made. Heats glass tube until it has reached a plastic state. Performs bending operation after removing from flame. Blows into blowing tube, during bending operation, to maintain proper sized opening at bend. Places bent tube on blueprint to determine if proper bend has been made. Makes mark with crayon on glass tube to designate spot where tube will be cut.

Attaches section of tube to piece of laboratory apparatus: Reads blueprint to determine spot and angle that glass tube will be attached to apparatus. Holds piece of apparatus over flame of bunsen burner. Directs flame at spot on apparatus where tube is to be connected. Blows into blowing tube so that small bubble appears. Breaks off bubble using tungsten carbide cutter. Reams hole that has been made in apparatus using tapered carbon. Heats end of glass tube to be attached and places end of tube to opening on apparatus. Attaches wood clamp between piece of apparatus and attached tube to be sure that proper alignment is maintained. Adjusts calipers to distance specified on blueprint and checks to make certain that end of the glass tube is at the exact distance from apparatus as specified.

Inserts narrow tube into wider and longer tube, cuts and attaches extension to narrow tube while closing wider tube over connection: Places narrow piece of tube over holder and twists it over a cork on holder to hold wider tube firmly over narrow tube. Visually observes open end of tubes to make certain they are in proper alignment. Lays piece on blueprint and marks spot where cut will be made with crayon. Places blowing tube into end of holder. Places holder on roller rest and guides spot to be cut into flame of bunsen burner. Removes excess glass from tube with forceps. Heats end of narrow piece of tube to be used as extension for narrow tube which is inserted in wider tube on holder. Heats end of tube on holder at same time. Places end of extension tube to end of inner narrow tube on holder. Visually observes to make certain there are no flaws in glass; that proper connection has been made; and that opening in narrow tube is maintained.

Performs cutting and flaring operation: Marks spot to be cut with crayon while tube is on blueprint. Heats glass tube over bunsen burner. Removes excess piece of glass with forceps. Blows into blowing tube until bubble forms approximately double in diameter size as glass tube. Breaks off bubble using edge of tungsten carbide cutter. Uses tapered iron tool to produce a flared, even edge at end of tube if specified in blueprint.

Course Description: A two year program providing training in scientific glassblowing techniques. Students learn to design and fabricate laboratory apparatus from glass tubing and other shapes using blast torches, glass cutters, gas and oxygen burners, glass lathes, and annealing ovens.

Course Material of Scientific Glassblowing: Student is oriented to shop rules, vocabulary, safety, employment and history of Scientific Glassblowing. The student is introduced to the various equipment, e.g., power tools and laboratory equipment, and glass tubing. Preliminary operations of glass blowing are taught, such as sealing and bending operations, then making simple glassware items; fundamental sealing, tocling and lathe operations are introduced.

The remainder of the course is devoted to making various types of apparatus graduated in degree of difficulty, ranging from adapters, represented by such things as aeriation tubes, thermometer wells and holders to extraction apparatus, e.g., soxhlet extractor body, which is a device for corrosion testing dye-fastness and the extracting of oils from porous materials.

IV. Experimental Battery

All the tests of the GATB, B-1002A, were administered to the sample group.

V. Criterion

The criterion data were collected in 1965 and consisted of laboratory grades in Glass-Blowing courses averaged over the first three semesters of the two-year curriculum. The distribution of the criterion scores ranged from 9-45, with a mean score of 28.1 and a standard deviation of 6.8.

VI Qualitative and Quantitative Analyses

A. Qualitative Analysis

On the basis of the job analysis data, the following aptitudes were rated "important" for success in this occupation:

Intelligence (G) - required to plan work and decide best method for performing each operation; to read and interpret blueprints; to solve problems which occur when changing from one operation to another.

Spatial Aptitude (S) - required to read blueprints; to visualize shapes to be produced; to judge correct angles when bending and shaping glass.

Form Perception (P) - required to visually inspect for flaws in glass and to be sure that proper connections have been made.

Finger Dexterity (F) - required to accomplish fine manipulations with various glass-forming tools.

Manual Dexterity (M) - required to handle equipment and various tools to shape and bend products according to specifications.

B. Quantitative Analysis:

TABLE II

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 50

Aptitudes	M	σ	r
G-Intelligence	108.6	11.8	-.075
V-Verbal Aptitude	99.4	10.3	-.248
N-Numerical Aptitude	106.7	10.5	.018
S-Spatial Aptitude	115.1	16.2	.307*
P-Form Perception	112.2	11.6	.358*
Q-Clerical Perception	102.1	10.9	-.109
K-Motor Coordination	103.9	13.6	.004
F-Finger Dexterity	102.7	17.9	.191
M-Manual Dexterity	114.7	20.1	.216

*Significant at the .05 level

C. Selection of Test Norms:

TABLE III

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 Sigma		X	X		X	X			
Significant Correlation with Criterion				X	X				
Aptitudes to be Considered for Trial Norms				S	P				M

Trial norms consisting of various combinations of Aptitudes S, P and M with appropriate cutting scores were evaluated against the criterion by means of the Phi Coefficient technique. A comparison of the results showed that B-1002 norms consisting of S-95, P-95 and M-95 had the best selective efficiency.

VII. Predictive Validity of Norms

The validity of the norms was determined by computing a Phi Coefficient between the test norms and the criterion and applying the Chi Square test. The criterion was dichotomized by placing 26 percent of the sample in the low criterion group because this percent was considered to be the unsatisfactory or marginal students.

Table IV shows the relationship between test norms consisting of Aptitudes S, P and M each with a critical score of 95 and the dichotomized criterion for Glass Blower, Laboratory Apparatus 4-65.440. Students in the high criterion group have been designated as "good students" and those in the low criterion group as "poor students."

TABLE IV

Predictive Validity of Test Norms for Glass Blower, Laboratory Apparatus 4-65.440 (S-95, P-95, M-95)

N = 50	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Students	6	31	37
Poor Students	7	6	13
Total	13	37	50

Phi Coefficient = .376

$\chi^2 = 7.050$

$P/2 < .005$

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

VIII. Conclusions

On the basis of the results of this study, Aptitudes S, P and M each with a minimum score of 95, have been established as B-1002 norms for Glass Blower, Laboratory Apparatus 4-65.440. The equivalent B-1001 norms consist of S-100, P-95 and M-100.

IX. 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 Guide to the Use of the General Aptitude Test Battery, January 1962. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.