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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

INDUSTRIAL TECHNOLOGY - TECHNICAL INSTITUTE TRAINING O-68.

B-603 or S-323

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

November 1964

GATB #2528

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

INDUSTRIAL TECHNOLOGY - TECHNICAL INSTITUTE TRAINING O-68.

B-603 or S-323

Summary

The General Aptitude Test Battery, B-1002B, was administered to a final sample of 52 male students enrolled in the two-year Industrial Technology curriculum at the Erie County Technical Institute, Buffalo, New York. This training was established under Title VIII of the National Defense Education Act of 1958. The criterion consisted of grade-point averages. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes G-Intelligence, V-Verbal Aptitude and N-Numerical Aptitude were selected for inclusion in the final test norms.

GATB Norms for Industrial Technology - Technical Institute Training O-68, ~~B-603~~ S-323

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
G	CB-1- H CB-1- I CB-1- J	110	G	Part 3 Part 4 Part 6	105
V	CB-1- J	95	V	Part 4	95
N	CB-1- D CB-1- I	120	N	Part 2 Part 6	115

Effectiveness of Norms

The data in Table IV indicate that only 67 percent of the non-test-selected students used for this study were good students; if the students had been test-selected with the above norms, 77 percent would have been good students. 33 percent of the non-test-selected students used for this study were poor students; if the students had been test-selected with the above norms, only 23 percent would have been poor students.

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 in screening applicants for referral to a training curriculum in Industrial Technology. (These norms may be particularly useful in screening applicants for training established under Title VIII of the National Defense Education Act of 1958.)

II. Sample

The General Aptitude Test Battery, B-1002B, was administered in March 1962 and July 1963 to 60 senior male students enrolled in a two-year Industrial Technology curriculum at the Erie County Technical Institute, Buffalo, New York. This training was established under Title VIII of the National Defense Education Act of 1958. Eight students were eliminated from the sample due to the collection of incomplete criterion data. Therefore, the final sample consisted of 52 male students who successfully completed the two-year course of study.

Graduates of the two-year curriculum in Industrial Technology at the Erie County Technical Institute are awarded the Degree of Associate in Applied Science. The requirements for enrollment are: high school graduation; recommendation by high school principal; good high school background in mathematics and either physics or chemistry; evidence that the student is physically qualified for the curriculum; acceptance through formal application; qualifying on admission interview and tests.

TABLE I

Mean (M), Standard Deviation (σ), Range, and Pearson Product-Moment Correlation with the Criterion (r) for Age

N = 52	M	σ	Range	r
Age (years)	20.7	1.5	19-27	.151

III. Course Description

Title of Course Curriculum: Industrial Technology

Summary: The Industrial Technology curriculum at the Erie County Technical Institute requires two years of instruction. Students spend three quarters of each year in classes and laboratories at the Institute and are employed in industry for the remaining portion of the year. The curriculum provides for basic training in the application of inspection, time and motion study, production planning, materials handling, plant layout, statistical quality control, and cost control to a modern manufacturing enterprise.

Technical Curriculum: The following courses comprise the core of technical subjects in Industrial Technology.

Mechanical Drawing: Fundamental mechanical drafting practice in the use of instruments, lettering, orthographic projection, sketching and blueprint interpretation. Theory and interpretation of dimensions, auxiliary views, sections, detail and assembly drawings.

Machine Tools: The use of ferrous and nonferrous materials; types and machinability of steel; use of bench and layout tools; purpose and operation of drill presses, lathes, planers and shapers. Purpose and use of milling machines, grinders, turret lathes, thread grinders; use of carbide cutting tools.

Physics: A study of the physical principles of heat, properties of matter, mechanics, principles of sound, electricity, light and modern physics.

Time and Motion Study: Basic laws of motion economy; operational and process analysis; methods improvement; stop watch time studies. Use of standard data methods; application in plant operations.

Manufacturing Analysis: Practicability of product design; production methods; equipment; manufacturing process. Preparation of operation sheets.

Manufacturing Processes: Theory of manufacturing methods, processes, tools and equipment including forging, die casting, welding, press work and production machining.

Chemistry: A general course covering laws; equations, properties, oxidation and reduction, electro-chemistry and industrial processes.

Manufacturing Accounting: Basic principles of accounting for assets, liabilities and net worth. Analysis of financial actions leading to preparation and interpretation of financial statements. Unit cost determination.

Production Control: Basic concepts, principles, objectives and functions of production control. Planning and scheduling of various types of production.

Jig and Fixture Design: Principles and practice in applying motion economy to the design of jigs and fixtures in manufacturing processes.

Supervisory Training: Methods of handling management problems, setting policy, personnel problems, etc.

Industrial Analysis: Field visits to various plants. Preparation and discussion of reports.

Plant Layout: Principles of plant layout in production needs. Application of materials handling devices. Preparation of plant layout using templates and 3-D scale models.

Materials: A study of ferrous and nonferrous metals; production of steel; iron carbon diagrams; heat treating; foundry practices; relationship of metallurgy to production processes and quality control.

Precision Measurement: Theory and use of precision measurement instruments. Inspection of parts using comparators, sine bars, optical flats, air gages, dial indicators and gage blocks.

Electricity: Characteristics of electrical circuits; effect of inductance; resistance and capacitance in AC and DC circuits; fundamental AC and DC machines and controls.

Statistical Quality Control: The theory of control of attributes and variables. Practice in making and interpreting control charts.

The subjects in the Industrial Technology curriculum and the approximate number of classroom and laboratory hours in each studject are as follows:

Subject	Classroom Hours	Laboratory Hours
Mechanical Drawing	--	100
Machine Tools	--	120
Physics	70	---
Time and Motion Study	70	70
Manufacturing Analysis	40	20
Manufacturing Processes	50	---
Chemistry	50	20
Manufacturing Accounting	50	20
Production Control	40	20
Jig and Fixture Design	10	70
Supervisory Training	20	---
Industrial Analysis	--	50
Plant Layout	10	60
Materials	40	---
Precision Measurement	20	20
Electricity	40	20
Communication Skills	120	---
Mathematics	180	---
Sociology Health Education Coordinating Conference Economics Human Relations	120	---

Subject	Classroom Hours	Laboratory Hours
Labor Relations Seminar Statistical Quality Control	100	50

The course of study consists of approximately 1030 hours of classroom instruction and 640 hours of laboratory work.

NOTE: Since technical institute training curriculums usually prepare students for broad categories of technical work rather than for specific jobs, a specific Dictionary of Occupational Titles classification cannot be assigned to the Industrial Technology course curriculum. However, the following are titles of positions held by graduates of the Industrial Technology curriculum at the Erie County Technical Institute, Buffalo, New York:

Cost Estimator	Production Planner
Foreman	Production Scheduler
Inspector	Quality Control Analyst
Plant Layout Draftsman	Time Study Man

IV. Experimental Battery

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

V. Criterion

The criterion data collected consisted of "total" and "refined" grade-point averages. The total grade-point average consisted of the ratio between the total number of honor points earned and the total number of credit hours taken in the two-year course of instruction. Honor points assigned to each letter grade are: A = 4, B = 3, C = 2, D = 1, and F = 0. The refined grade-point average was the student's grade-point average for only the core of technical subjects in Industrial Technology (see section III of this report). Pearson product-moment correlations were computed between each of the GATB aptitudes and (1) total grade-point averages, and (2) refined grade-point averages. Neither of these criteria correlated significantly with any of the aptitudes. The refined grade-point averages were selected as the final criterion having a range of 1.91-3.71, a mean of 2.33 and a standard deviation of .37.

VI. Qualitative and Quantitative Analyses

A. Qualitative Analysis

On the basis of job analysis data, the following aptitudes measured by the GATB were rated "important"for success in this two-year training curriculum:

Intelligence (G) - required to learn and understand the principles and techniques of applied industrial planning, production and control, analyzing and evaluating data, and instituting methods and procedures.

Verbal Aptitude (V) - required in preparation of operation sheets, planning and scheduling production, and communicating orally and in writing.

Numerical Aptitude (N) - required in the making of precision measurements, recording of observations and interpretation of blueprints and other numerical information.

Spatial Aptitude (S) - required in mechanical drawing, design of tools and preparation of layouts, using three-dimensional scale models.

Clerical Perception (Q) - required in the perception of detail in arithmetic material, and in making and recording mathematical computations in accounting, time and motion study and quality control.

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 = 52

Aptitudes	M	σ	r
G-Intelligence	119.9	10.4	.108
V-Verbal Aptitude	106.9	8.7	.250
N-Numerical Aptitude	117.6	11.5	.157
S-Spatial Aptitude	122.1	16.3	-.226
P-Form Perception	120.4	17.8	-.038
Q-Clerical Perception	112.2	13.1	.182
K-Motor Coordination	111.2	14.4	.224
F-Finger Dexterity	110.6	17.0	-.057
M-Manual Dexterity	118.3	17.6	-.073

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									
Aptitudes to be Considered for Trial Norms	G	V	N	S		Q			

Trial norms consisting of various combinations of Aptitudes G, V, N, S and Q 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 G-105, V-95 and N-115 had the best selective efficiency.

VII. 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 33 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 G, V and N with critical scores of 105, 95 and 115, respectively, and the dichotomized criterion for the experimental sample of students. Individuals in the high criterion group have been designated as "good students" and those in the low criterion group as "poor students."

TABLE IV

Validity of Test Norms for
Industrial Technology
(G-105, V-95, N-115)

N = 52	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Students	8	27	35
Poor Students	9	8	17
Total	17	35	52

Phi Coefficient = .30
X^2 = 4.711
P/2 < .025

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 G, V and N with minimum scores of 105, 95, 115, respectively, have been established as B-1002 norms for selecting students for the two-year Industrial Technology curriculum described on pages 3-5 of this report. The equivalent B-1001 norms consist of G-110, V-95 and N-120.

IX. Determination of Occupational Aptitude Pattern

Since a specific (6 digit) Dictionary of Occupational Titles classification cannot be assigned to the two-year curriculum in Industrial Technology (see page 5 of this report), no OAP analysis was made on the data for this study.