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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

BIOLOGIST (profess. & kin.) 0-35.22

B-562

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

September 1963

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 Biologist 0-35.22.

II. Sample

During March and April, 1960, the GATB, B-1002A, was administered to a sample of 50 male students majoring in Biology at two colleges in Pennsylvania; 32 students at the University of Scranton, Scranton, Pennsylvania and 18 students at King's College, Wilkes-Barre, Pennsylvania.

Students entering both colleges are required to have completed the following courses in high school: four credits in English, two credits in a foreign language, two credits in Algebra, one credit in Geometry, General Science, Biology, Chemistry and Physics, and two or three credits in Social Studies. In addition, entering freshmen are required to take the College Entrance Examination Board Scholastic Aptitude Tests, the Nelson-Denny Reading Tests and the Cooperative English Grammar Tests. For the degree of Bachelor of Science in Biology, a minimum of 60 semester hours are required in Science and Mathematics. Of this number, a minimum of 40 semester hours are required in the major sequence; a major sequence includes courses of Biology and Chemistry for a Biology major. All students in the sample have been granted the degree of Bachelor of Science in Biology.

TABLE I

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

N = 50	M	σ	Range	r
Age (years)	21.3	1.2	19-26	.024

III. Job Description

Job Title: Biologist (profess. & kin.) 0-35.22

Job Summary: Studies the origin, development, anatomy, functions, distribution, and other basic principles of plants and animals and the relationship between plant and animal life, usually specializing in research centering around a particular plant, animal, or aspect of biology.

Pertinent Courses of Study:

General Biology - A comprehensive study of representatives of the major plant and animal phyla from the standpoint of structure, function, development and relationship. General biological principles, such as the nature and origin of life, the organization of living beings, and the problems of heredity, development and evolution.

Comparative Vertebrate Anatomy - The gross anatomy and phylogeny of the organ systems in the vertebrate organism, with special emphasis given to mammals including the shark, turtle, pigeon and cat.

Embryology - Early stages of development with reproduction, gametogenesis, fertilization, cleavage and the processes of morphogenesis treated from the comparative viewpoint. The development of organs and organ systems as it occurs in frogs, chicks and pigs.

Histology - The microscopic structure and functioning relations of vertebrate tissue and organ systems, with emphasis on the mammal.

General Botany - An introduction to the basic biological principles as illustrated by plants, and a survey of the plant kingdom.

Bacteriology - The structure, function, growth, reproduction and relationships of bacteria, yeasts and molds; includes a brief survey of the pathogens together with an introduction to the principle of immunology.

Physiology - The basic physiological processes and principles underlying the functioning of the animal organisms; includes the physics and chemistry of protoplasm, enzymes, irritability, excitation, conduction, contractibility and intergradation.

General Physics - The study of mechanics, heat and sound, electricity and optics.

General Chemistry - The fundamental principles of chemistry and brief descriptive studies of the more important elements and their compounds.

Introductory Organic Chemistry - The first principles of organic chemistry.

Mathematics - Plane trigonometry, emphasizing analytical and graphical aspects, quadratic equations, theory of equations, mathematical inductions, binomial theorems, exponential and logarithmic functions, and complex numbers.

IV. Experimental Battery

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

V. Criterion

The final criterion consisted of the individual's grade point-average (GPA) for all completed courses in Biology, Chemistry, Mathematics and Physics. (These courses are described in Section III of this report.) To increase the range of final criterion scores, the GPA's for the sample were arranged in rank order and converted to linear scores; these linear scores had a range of 6-94 with a mean of 50.02 and a standard deviation of 18.78.

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 study scientific facts and concepts which are needed for an understanding of the structure, function, development and relationship of living organisms; and to draw conclusions or generalizations from accumulated facts.

Verbal Aptitude (V) - required to understand written statements or facts concerning biological science; and to express oneself precisely in describing and analyzing biological functions or principles.

Numerical Aptitude (N) - required to understand basic principles in the study of chemistry and physics; and to acquire knowledge for the development and presentation of statistical data in biological research.

Spatial Aptitude (S) - required to visualize depth and width in microscopic examinations, as in cytology; and to visualize the relative positions of muscles, etc., in anatomy.

Form Perception (P) - required to identify and observe minute differences in varieties of species and minute differences in the structures of insects.

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	125.3	11.2	.489**
V-Verbal Aptitude	120.0	12.4	.366**
N-Numerical Aptitude	120.9	11.1	.368**
S-Spatial Aptitude	121.0	15.8	.368**
P-Form Perception	116.8	15.3	-.069
Q-Clerical Perception	123.2	13.6	.092
K-Motor Coordination	125.3	18.7	-.047
F-Finger Dexterity	100.9	14.9	-.165
M-Manual Dexterity	111.9	21.5	-.011

**Significant at the .01 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	X	X					
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 N-110, S-105 and Q-110 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 34 percent of the sample in the low criterion group because this percent was considered to be the unsatisfactory or marginal workers.

Table IV shows the relationship between test norms consisting of Aptitudes N, S, and Q with critical scores of 110, 105 and 110 respectively, and the dichotomized criterion for Biologist 0-35.22
Workers 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 Biologists 0-35.22
(N-110, S-105, Q-110)

N = 50	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Students	6	27	33
Poor Students	12	5	17
Total	18	32	50

Phi Coefficient = .517
χ^2 = 13.350
P/2 < .0005

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 N, S and Q with minimum scores of 110, 105 and 110 , respectively, have been established as B-1002 norms for Biologist 0-35.22.
The equivalent B-1001 norms consist of N-110, S-110 and Q-110.

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 35 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.

GATB # 2467

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

Biologist 0-35.22

B- 562

Summary

The General Aptitude Test Battery, B-1002A, was administered to a sample of 50 male students majoring in Biology at two colleges in Pennsylvania; King's College in Wilkes-Barre and the University of Scranton in Scranton, Pennsylvania. The criterion consisted of grade-point average. On the basis of mean scores, standard deviations, correlations with the criteria, job analysis data, and their combined selective efficiency, Aptitudes N-Numerical Aptitude, S-Spatial Aptitude and Q-Clerical Perception were selected for inclusion in the final test norms.

GATB Norms for Biologist 0-35.22, B-562.

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
N	CB-1-D CB-1-I	110	N	Part 2 Part 6	110
S	CB-1-F CB-1-H	110	S	Part 3	105
Q	Part B	110	Q	Part 1	110

Effectiveness of Norms

The data in Table IV indicate that only 66 percent of the non-test-selected students used for this study were good; if the workers had been test-selected with the above norms, 84 percent would have been good. Thirty-four percent of the non-test-selected used for this study were poor; if the workers had been test-selected with the above norms, only 16 percent would have been poor students.