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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)

March 1967 United States Employment Service Technical Report S-37R

Development of USES Aptitude Test Battery for

Pharmacist

(profess. & kin.) 074.181

U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION
BUREAU OF EMPLOYMENT SECURITY
Washington, D.C. 20210

Technical Report on Development of USES Aptitude Test Battery

For . . . . . .

Pharmacist (profess. & kin.) 074.181

S-37R

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

Revised-March 1967

FOREWORD

The United States 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.

Frank H. Cassell

Frank H. Cassell, Director
U. S. Employment Service

GATB Study #2631

DEVELOPMENT OF USES APTITUDE TEST BATTERY

For

Pharmacist (profess. & kin.) 074.181

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Pharmacist 074.181. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB B-1002 Scores
G - General Learning Ability	110
N - Numerical Aptitude	120
Q - Clerical Perception	115

RESEARCH SUMMARY

Sample:

64 senior Pharmacy students, 57 male and 7 female, at Ferris State College, Big Rapids, Michigan.

Criterion:

Grade-point averages earned in core curriculum courses leading to Bachelor of Science Degree in Pharmacy.

Design:

Concurrent (tests were administered at the beginning of the course and criterion data were collected one month after testing). Minimum aptitude requirements were determined on the basis of a course analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .42 ($p/2 < .0005$)

Effectiveness of Norms:

Only 67% of the non-test-selected students in the sample used for this study were good students; if the students had been test-selected with the S-37 norms, 80% would have been good students. 33% of the non-test-selected students used for this study were poor students; if the students had been test-selected with the S-37 norms, only 20% would have been poor students. The effectiveness of the norms is shown graphically in Table I:

TABLE I

Effectiveness of Norms

	Without Tests	With Tests
Good Students	67%	80%
Poor Students	33%	20%

SAMPLE DESCRIPTION

Size: N = 64

Occupational Status: 1966 senior Pharmacy students.

Educational Institution: Ferris State College, Big Rapids, Michigan

Course Selection Requirements:

Education: High School graduation; completion of 15 units of credit with a minimum grade-point average of 2.0, including one year each of algebra and geometry. Preferred to have preparation in basic high school sciences.

Previous Experience: None

Tests: None

Other: Personal attributes of orderliness and leadership desirable.

TABLE II

Mean, Standard Deviation (SD), Range, and Pearson Product-Moment Correlation with the Core Curriculum Grade-Point Average Criterion (r) for Age

	Mean	Sigma	Range	r
Age (years)	23.5	0.9	22-27	-.210

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B, were administered on May 18 and May 19, 1966.

CRITERION

Two criteria were obtained: (1) Total grade-point averages for all courses leading to a B.S. degree in Pharmacy (Total GPA); (2) grade-point average for the five-yearPharmacy (Core) curriculum. (Core GPA) The correlation between the two criteria was .94. The final criterion consisted of core curriculum grade-point averages.

Criterion Distribution:

Range:	2.00-3.74
Mean:	2.52
Standard Deviation:	0.4

Criterion Dichotomy: Ferris State College does not grant a B.S. degree to any student with less then a 2.0 average. All 64 students included in the sample graduated. Therefore, there was no true point of demarcation between "good students" and "poor students." For the purpose of this study, the point of dichotomy was arbitrarily set so as to place 33% of the sample in the low criterion group. Students in the high criterion group were designated as "good students" and those in the low group as "poor students". The criterion critical score was 2.22.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were considered for tryout in the norms on the basis of a qualitative analysis of the courses studied and a statistical analysis

of test and criterion data. Aptitudes G, V, N, and Q were considered for inclusion in the norms because the qualitative analysis indicated they were important in the course study. In addition, Aptitudes G, N, and Q had high means and Aptitudes G, V, and N had low standard deviations. A relatively low standard deviation with a trainee sample in a concurrent study indicates that some sample selection has occurred before or during the course and this may depress the correlation between the aptitude and the criterion. A relatively high mean score may also indicate some sample pre-selection. There were no significant correlations between the aptitudes and the criterion. Tables III, IV, and V show the results of the qualitative and statistical analyses.

TABLE III

Qualitative Analysis

Based on the course analysis, the following aptitudes appear to be important for successful completion of the Pharmacy course.

Aptitude	Rationale
G - Intelligence	Necessary to understand, learn, and complete technical course work involved.
V - Verbal Ability	Necessary to understand technical and pharmaceutical terms; to complete course work.
N - Numerical Ability	Necessary in study of mathematics, chemistry, physics, accounting management, and pharmaceutical calculations and analysis.

Q- Clerical Perception	Necessary in filing and checking prescriptions, statements, and invoices.
F - Finger Dexterity	Necessary in performing assays, in manipulating of drugs and equipment in drug preparation.

TABLE IVA

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with the Criteria of Core GPA (r_1) and Total GPA (r_2) for the Aptitudes of the GATB

Aptitude	Mean	SD	Range	r_1	r_2
G - General Learning Ability	126.7	9.3	106-150	.215	.173
V - Verbal Aptitude	114.8	9.8	96-143	.128	.100
N - Numerical Aptitude	128.7	10.9	105-149	.157	.166
S - Spatial Aptitude	118.7	14.1	81-150	.032	.043
P - Form Perception	123.9	15.3	95-160	.175	.135
Q - Clerical Perception	127.4	16.0	97-183	.111	.070
K - Motor Coordination	119.1	13.1	91-149	-.058	-.030
F - Finger Dexterity	109.5	16.9	75-151	-.129	-.082
M - Manual Dexterity	123.4	16.4	87-159	-.016	.072

TABLE IVB

Correlations with Core GPA's Corrected for Restriction in Spread of Talent (r_3) and Total GPA's Corrected for Restriction in Spread of Talent (r_4) for the Aptitudes of the GATB

Aptitude	r_3	r_4
G - General Learning Ability	.352**	.427**
V - Verbal Aptitude	.202	.256*
N - Numerical Aptitude	.295*	.280*
S - Spatial Aptitude	-.061	.045
P - Form Perception	.175	.226
Q - Clerical Perception	.087	.138
K - Motor Coordination	-.046	-.088
F - Finger Dexterity	-.097	-.152
M - Manual Dexterity	.088	-.020

TABLE V

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 Deviation	x	x	x				x		
Significant Correlation with Criterion									
Aptitudes to be Considered for Trial Norms	G	V	N			Q			

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of aptitudes G, V, N, and Q, at trial cutting scores, were able to differentiate between the 67% of the sample considered good students and the 33% of the sample considered poor students. Trial cutting scores at five point intervals approximately one standard deviation below the mean are tried because this will eliminate about 1/3 of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about 1/3 of the sample; for four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about 1/3 of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of G-110, N-120, and Q-115 provided the highest degree of differentiation. The validity of these norms is shown in Table VI.

TABLE VI

Concurrent Validity of New S-37R Test Norms, G-110, N-120, and Q-115

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Students	7	36	43
Poor Students	12	9	21
Total	19	45	64

Phi Coefficient (Ø) = .42 Chi Square = 11.290
Significance Level = p/2 $<$ .0005

TABLE VII

Validity of Prior S-37 Test Norms of G-110, for this Sample

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Students	1	42	43
Poor Students	7	14	21
Total	8	56	64

Phi Coefficient (Ø) = .44 Chi Square = 12.390
Significance Level = p/2 $<$ .0005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for retaining the occupation studied in OAP-2, which is shown in Section II of the Manual for the General Aptitude Test Battery. A Phi Coefficient of .36 is obtained with the OAP-2 norms of G-115, N-115, and Q-105.

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

Means (M) and Standard Deviations (SD) for the B-1002 Aptitudes of the GATB for Various Samples of Pharmacists

Aptitude	1948 Utah (N=101)		1950 Tennessee (N=127)		1951 Florida (N=62)		1966 Michigan (N=64)	
	M	SD	M	SD	M	SD	M	SD
G - General Learning Ability	124	12	119	11	121	11	127	9
V - Verbal Aptitude	118	13	111	14	119	14	115	10
N - Numerical Aptitude	130	14	119	12	118	12	129	11
S - Spatial Aptitude	120	17	115	18	115	14	119	14
P - Form Perception	118	13	116	16	116	14	124	15
Q - Clerical Perception	111	15	111	15	110	14	127	16
K(T) - Motor Coordination	117	15	115	17	115	14	119	13
F - Finger Dexterity	-	-	99	17	-	-	110	17
M - Manual Dexterity	-	-	106	18	-	-	123	16

(Parts M, N. O, and P were not administered to the Utah and Florida Samples.)

Required Courses: Courses necessary for graduation from Ferris State College with a Bachelor's Degree in Pharmacy.

Orientation - 1 quarter hour

Health and Physical Education - 3 quarter hours

Social Sciences

Introductory General Psychology - 3 quarter hours
Principles of American Government - 6 quarter hours

Mathematics

College Algebra - 4 quarter hours
Numerical Trigonometry - 3 quarter hours

Communication Skills - 9 quarter hours

Biologic and Basic Sciences

General Biology - 4 quarter hours
General Botany - 4 quarter hours
General Zoology - 4 quarter hours
Anatomy - 4 quarter hours
Physiology - 8 quarter hours
Bacteriology - 12 quarter hours
General Inorganic Chemistry - 10 quarter hours
Organic Chemistry - 15 quarter hours
Qualitative Analysis - 6 quarter hours
Quantitative Analysis - 5 quarter hours
Introductory Physics - 12 quarter hours
Biochemistry - 6 quarter hours
Public Health and Sanitation - 3 quarter hours
First Aid - 1 quarter hour

Economics, Law, Accounting

Principles of Ecomomics - 4 quarter hours
Principles of Accounting - 4 quarter hours
Elementary Business Law - 4 quarter hours

Pharmacy (Core Curriculum)

Orientation to Pharmacy - 2 quarter hours (lecture) No credit.

Designed to acquaint the student with the five major areas of the curriculum: Pharmacy, Pharmaceutical Chemistry, Pharmacy Administration, Pharmacognosy, and Pharmacology. Information

given about major pharmaceutical organizations, basic pharmaceutical literature, opportunities for pharmacy graduates, and the history of the pharmacy profession.

Introductory Pharmacy - 7 quarter hours (6 hours lecture, 3 hours laboratory)

This course enlarges on the material presented in Orientation to Pharmacy. In addition, it includes a study of elementary processes used in pharmacy; various systems of linear measure, weight, volume, household measurements and equivalents and their use in elementary pharmaceutical calculations; pharmaceutical terminology; pharmaceutical Latin; fundamental principles and processes involved in the manufacture of pharmaceutical preparations; advanced pharmaceutical calculations; and an introduction to types of pharmaceutical preparations.

Inorganic Pharmaceutical Chemistry - 3 quarter hours (lecture)

A study of drug preparations and tests, pharmacodynamics, outstanding incompatabilities and methods of stabilizing inorganic chemicals used in Pharmacy.

Drug Assay - 5 quarter hours (3 hours lecture, 6 hours laboratory)

Chemical assay of drugs of the United States Pharmacopoeia and National Formulary. Analyses are made on gravimetric, titrimetric, and instrumental procedures.

Pharmacognosy - 12 quarter hours (9 hours lecture, 9 hours laboratory)

Study of natural products of economic importance: fibers, plant exudates, tannins, volatile oils, perfumes and spices, with special

emphasis given to insecticides, rodenticides, herbicides, and other pesticides, poisonous and hayfever-causing plants.

Study of sources, methods of preparation, physical and chemical properties, evaluation, constituents and uses of drugs of biological origin (primarily plant origin), including the isolation of the active principles of biological origin. Discussion of plant growth substances and other natural products of pharmaceutical and technical importance. Study of drugs obtained from animals and microorganisms, discussion of toxic plants and animals, allergenic plants and substances.

Organic Pharmaceutical Chemistry - 12 quarter hours (10 hours lecture, 6 hours laboratory)

A study of the classifications, titles, chemical names, synonyms, trade names, structures, sources, properties, uses, and preparations of official and non-official medicinals in current use and under investigation. Special emphasis is placed on the relationship between chemical structure and physiological activity. Review of articles in current literature pertinent to the substances discussed.

Pharmaceutical Preparations - 12 quarter hours (9 hours lecture, 9 hours laboratory)

Study of official and non-official pharmaceutical preparations including methods of manufacture, properties and uses; doses; synonyms of official pharmaceutical preparations; continued study of pharmaceutical calculations, terminology and Latin.

Prescriptions - 12 quarter hours (9 hours lecture, 9 hours laboratory)

Training in the compounding of prescriptions of various types, such as pills, ointments, powders, etc. with special emphasis on accuracy,

cleanliness, technique, and speed. Discussion of new products and current problems in area of pharmacy.

Pharmacology - 12 quarter hours (9 hours lecture, 9 hours laboratory)
Study of action, mechanism of action, absorption, action in the body, excretion, toxicity and therapeutic uses of official and selected non-official drugs grouped according to their effect on physiological systems. Laboratory experiments are designed to show drug activity on excised organs and intact animals.

Pharmacy Seminar - 2 quarter hours (2 hours lecture)
Study of pharmaceutical and professional ethics as pertaining to the conduct, responsibilities, and obligations of the pharmacist as a member of the community health team. New and current products considered, emphasizing their importance in each of the five pharmacy areas.

Pharmacy Accounting - 2 quarter hours (1 hour lecture, 3 hours laboratory)
Fundamental accounting principles applied to the pharmaceutical field; problems simulated to meet the everday needs of the pharmacist include mathematics of retailing, retail financial management, departmental accounting, methods of financing a retail pharmacy, and interpretation of financial statements.

Marketing of Drug Products - 3 quarter hours (3 hours lecture)
Study of current marketing methods, functions, distribution, price policies, competitive practices, price control, etc.

Retail Pharmacy Management - 8 quarter hours (6 hours lecture, 4 hours laboratory)
Study of pharmaceutical statistics, selecting a location, business

policies, types of proprietorship; financing, acquiring, and layout of a retail pharmacy; factors governing the selection, receiving, pricing, merchandising, and selling of goods; study of personnel problems, budgeting, competition, control, and departmentalization of retail pharmacies.

Pharmacy Law - 2 quarter hours (2 hours lecture)

Comprehensive study of the laws and/or regulations of the State of Michigan and the Federal Government which govern the activities within the pharmaceutical field, including those on poisons, narcotics, barbituates, negligence, training and licensure of pharmacists.

Electives - 31 quarter hours

These are the areas where the student has some latitude for selecting courses. Twelve quarter hours must be in the humanities, eight in the social sciences, and the remaining 11 in the area of the student's choice.

Accreditation

Ferris State College is an accredited member of the North Central Association of Colleges and Secondary Schools.

The School of Pharmacy of Ferris State College, Big Rapids, Michigan, is a member of the American Association of Colleges of Pharmacy and is accredited by the Michigan Board of Pharmacy and the American Council on Pharmaceutical Education, the national accrediting agency for colleges of Pharmacy. Graduation with the B.S. degree in Pharmacy satisfies the educational requirements for licensure as a Pharmacist in Michigan and all other states.

Entrance Requirements

Graduation from high school with a minimum of 15 units of credit, including

one year each of Algebra and Geometry, and a minimum grade-point average of 2.0.

Grading System

Ferris State College uses a grading system based on a four-point scale, with A = 4, Excellent; B = 3, Good; C = 2, Average; D = 1, Poor; and F = 0, Failed.

Graduation Requirements for Bachelor of Science Degree in Pharmacy

1. Complete all work of 5-year Pharmacy curriculum minimum of 258 quarter hours.
2. Maintain cumulative total honor point average of 2.0 and honor point average of not less than 2.0 for pharmaceutical subjects.
3. Satisfy minimum residence requirement of 3 academic years in Pharmacy.
4. Be recommended for degree by faculty of School of Pharmacy.

Registration Requirements as a Pharmacist with the State of Michigan

1. Must be a graduate of an accredited School of Pharmacy.
2. Must be a citizen of the United States.
3. Must be 21 years of age.
4. Must be of good moral character.
5. Must have had one year of apprenticeship, practical experience or internship in Pharmacy, 6 months of which may be earned after the second year of enrollment in the Pharmacy course, but at least six months must be earned after graduation. This internship must be served in a community or hospital pharmacy approved for intern training by the Board of Pharmacy.

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FACT SHEET

JOB TITLE: Pharmacist (profes. & kin.) 074.181

Job Summary: Working in a community pharmacy, a pharmacist prepares and/or orders previously prepared medicines and other pharmaceuticals and dispenses them in accordance with prescriptions prepared by physicians, dentists and veterinarians. Performs routine assays to determine identity, purity, and strength of drugs. Preserves drugs, medicines, biologicals and chemicals, mainly by proper storing. Maintains adequate stocks of drugs, chemicals, and other pharmaceutical supplies. Fills prescriptions, properly labeling them with instructions for use. Numbers prescription orders and places them in a permanent file for reference. Provides technical information to other health practitioners and gives information about health problems and sick room supplies to the public. Performs managerial duties related to buying, storing, and selling sick room supplies, sundries, tobacco, magazines, etc.; to personnel, accounting, advertising and displays.

Course Summary: Acquires theoretical and practical training in handing chemicals and drugs, including chemical synthesis of drugs or separation of drugs from natural sources; the topological and pharmacological (external and internal bodily effect of drugs) activity of drug use on man and animals; the formulation of drug products for various ways of administering drugs to man and animals; various aspects of drug product controls; and regulations regarding the dispensing of drugs to the public.

This course prepares students for positions in retail community pharmacy. By choosing certain electives, or by advanced training, the student may become qualified to work in specialty areas such as hospital pharmacy, manufacturing pharmacy, pharmacy sales-service, analysts in pharmaceutical production and control or in pharmaceutical research.

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GPO 925-533

March 1967 S-37R

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