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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 also included. (RC)

Technical Report on Development of USES Aptitude Test Battery

For

Key-Punch Operator (clerical) 213.582

S-180R74

Developed in cooperation with the
Alabama, Arkansas, California, Connecticut, Florida, Illinois, Indiana, Massachusetts, Michigan, Minnesota, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Texas and West Virginia State Employment Services

U. S. DEPARTMENT OF LABOR
Peter J. Brennan, Secretary

Manpower Administration
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Assistant Secretary for Manpower

October 1974

Development of USES Specific Aptitude Test Battery S-190874

For

Key-Punch Operator (clerical) 213.582

RESEARCH SUMMARY

This report describes the research which resulted in the development of the following Specific Aptitude Test Battery for use in selecting inexperienced or untrained individuals for training as Key-Punch Operators:

Aptitudes	Cutting Scores
G - General Learning Ability	75
Q - Clerical Aptitude	110
M - Manual Dexterity	75

Sample:
Four males and 349 females employed as Key-Punch Operators. The sample consisted of 148 minority group individuals of which 120 were Black, 18 were Spanish Surnamed, 5 were Oriental, 3 were American Indian and 1 was Polynesian. The rest of the sample consisted of nonminority group members. The geographic distribution is shown in Table 1.

TABLE 1

Geographic Distribution

	Minority	Non-minority	States
North	81	113	Connecticut, Illinois, Indiana Massachusetts, Michigan, Minnesota, New Jersey, New York, Ohio
South	52	79	Alabama, Arkansas, Florida, North Carolina, Texas, West Virginia
West	15	13	California, New Mexico, Oregon
Total	148	205	

Criterion:
Supervisory ratings. Criterion data were collected during 1973.

Design:
Concurrent (test and criterion data were collected at approximately the same time).

Concurrent Validity:
Phi coefficient for total sample = .23 ($P/2 < .0005$)
Phi coefficient for the Black subsample = .20 ($P/2 < .025$)
Phi coefficient for nonminority subsample = .23 ($P/2 < .0005$)

Effectiveness of Battery for Total Sample:
For the total sample, 61% of the nontest-selected individuals in this study were in the high criterion group; if they had been test-selected 71% would have been in the high criterion group. 39% of the nontest-selected individuals in this study were in the low criterion group; if they had been test-selected 29% would have been in the low criterion group. The effectiveness of the battery is shown in Table 2.

TABLE 2

Effectiveness of Battery for Total Sample

	Without Tests	With Tests
High Criterion Group	61%	71%
Low Criterion Group	39%	29%

Comparison of Minority and Nonminority Groups:
No differential validity for this battery was found. The difference between the phi coefficients for Black and nonminority groups is not statistically significant (CR = -.23). The battery is fair to Blacks, since the proportion of Blacks who met the cutting scores approximated the proportion who were in the high criterion group; 49% of the Blacks met the cutting scores and 58% were in the high criterion group.

JOB ANALYSIS

A job analysis was performed by observation of the workers' performance on the job and in consultation with the workers' supervisors. On the basis of the job analysis, the job description shown in Appendix 4 was prepared which was used to (1) select an experimental sample of workers who were performing the job duties; (2) choose an appropriate criterion or measure of job performance; (3) determine which aptitudes are critical, important, or irrelevant to job performance (see Tables 3 and 6); and (4) provide information on the applicability of the test battery resulting from this research.

TABLE 3

Qualitative Analysis
Based on the job analysis, the aptitudes indicated appear to be critical or important to the work performed

Aptitude	Rationale
G - General Learning Ability	Required to follow instructions so that correct format is followed in preparing program cards and reading the data.
Q - Clerical Perception	Required in quickly and accurately perceiving coded and uncoded data to be keypunched.
K - Motor Coordination	Required to coordinate eyes and hands quickly and accurately in making precise movements while operating the key-punch or key-tape machine.
F - Finger Dexterity	Required to move fingers quickly and accurately to manipulate keys on keyboard.
M - Manual Dexterity	Required to move hands swiftly and accurately while operating the key-punch or key-tape machine, to handle source data, and boxes of cards, and to load and unload card hopper.

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B were administered during 1973.

CRITERION

The immediate supervisor rated each worker. The ratings were obtained by means of personal visits of State test development analysts who explained the rating procedure to the supervisors. Two ratings were obtained from each supervisor with an interval of two weeks between the ratings. Since sample members' test scores are confidential, supervisors were not aware of the individual's test performance at the time the ratings were completed.

A descriptive rating scale was used. The scale (see Appendix 3) consists of 6 items. Five of these items cover different aspects of job performance. The sixth item is a global item on the Key-Punch Operator's "all-around" ability. Each item has five alternatives corresponding to different degrees of job proficiency. For the purpose of scoring the items, weights of 1 to 5 were assigned to the responses. The total score on the rating scale is the sum of the weights for the six items. The possible range for each rating is 6-30.

A review of the job description indicated that the subjects covered by the rating scale were directly related to important aspects of job performance:

A. Amount of work: Key-Punch Operator must quickly key-punch data on cards or tape.

B. Quality of work: Key-Punch Operator must key-punch data in a prescribed manner and in accordance with written or oral instructions.

C. Accuracy of work: Key-Punch Operator must key-punch data with a minimum of error.

D. Amount of knowledge: Key-Punch Operator must know the operation of the machine in order to move switches and depress keys correctly and in the proper sequence.

E. Variety of job duties: Key-Punch Operator must be able to follow instructions as well as load the machine with cards or magnetic tape and properly operate the machine to quickly and accurately key-punch data.

F. "All-around" ability: Key-punch Operator's value to the employer involves a combination of the aspects of job performance listed above.

A reliability coefficient of .88 was obtained between the initial ratings and the re-ratings, indicating a significant relationship. Therefore, the final criterion score consists of the combined scores of the two ratings. The possible range for the final criterion is 12-60. The actual range is 21-60 The mean is 44.1 and the standard deviation 8.9. The relationship between the criterion and age, education and job experience is shown in Table 4.

TABLE 4

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

Total Sample

	Mean	SD	r
Age (years)	39.9	10.1	-.147
Education (years)	12.2	.9	.062
Experience (months on current job)	45.3	53.3	.040

About one-third of the workers are considered to be marginal workers; therefore, the criterion distribution was dichotomized so as to include as close as possible to one-third of the sample in the low criterion group and the remainder in the high criterion group. The criterion cutting score was set at 41 which places 39% in the low criterion group and 61% in the high criterion group. It was not possible to place precisely one-third of the workers in the low criterion group because of the nature of the criterion distribution.

SAMPLE

The sample consisted of four males and 340 females employed as Key-Punch Operators with various organizations in Alabama, Arkansas, California, Connecticut, Florida, Illinois, Indiana, Massachusetts, Michigan, Minnesota, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Texas and West Virginia (see Appendix 2). A total of 148 were minority group members (120 Blacks, 19 Spanish Surnamed, 6 Orientals, 3 American Indians, and 1 Polynesian). Means and standard deviations for age, education and experience are shown in Table 4. A pre-employment test (State merit examination or an aptitude test) had been given to a small proportion of the sample. The remainder of the sample was not test-selected. All workers had been employed at least four months in jobs with duties similar to those found in the job description in Appendix 4. Descriptive statistics for subgroups are shown in Appendix 1.

STATISTICAL RESULTS

TABLE 5

Statistical Results for Total Sample

N=353

Aptitude	Mean	SD	r
G - General Learning Ability	90.7	14.7	.248**
V - Verbal Aptitude	94.7	12.5	.163**
N - Numerical Aptitude	93.4	15.0	.270**
S - Spatial Aptitude	91.5	16.9	.161**
P - Form Perception	106.4	20.5	.172**
Q - Clerical Perception	118.3	16.2	.190**
K - Motor Coordination	111.2	13.0	.062
F - Finger Dexterity	96.2	21.2	.096
M - Manual Dexterity	94.2	19.4	.080

**Significant at the .01 level

Table 6 summarizes the qualitative analyses and statistical results shown in Tables 3 and 5 and shows the aptitudes considered for inclusion in the battery. Aptitudes K, F and M as well as aptitudes with significant correlations were considered for inclusion in the battery because Aptitudes F and M were rated as critical on the basis of the job analysis and aptitude K was rated important on the basis of the job analyses and this aptitude had a relatively high mean score.

TABLE 6

Summary of Qualitative and Quantitative Data for Total Sample

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
"Critical" on Basis of Job Analysis						Y		X	X
"Important" on Basis of Job Analysis	X						X		
"Irrelevant" on Basis of Job Analysis									
Relatively High Mean					X	X	X		
Relatively Low Standard Deviation	X	X							
Significant Correlation with Criterion	X	X	X	X	X	X			
Aptitudes Considered for Inclusion in the Battery	G	V	N	S	P	Q	K	F	M

The information in Table 6 indicates that the following aptitudes should be considered for inclusion in the battery: G, V, N, S, P, Q, K, F and M. The objective is to develop a battery of 2, 3 or 4 aptitudes with cutting scores set at five point intervals at the point (a) where about the same percent will meet the cutting scores as the percent placed in the high criterion group and (b) which will maximize the relationship between the battery and the criterion. The cutting scores are set at approximately one standard deviation below the mean aptitude scores of the sample, with deviations above or below these points to achieve the objectives indicated above.

The following battery resulted:

Aptitudes	Cutting Scores
G - General Learning Ability	75
Q - Clerical Aptitude	110
M - Manual Dexterity	75

VALIDITY OF THE BATTERY

TABLE 7
Validity of Battery for Total Sample

	Below Cutting Scores	Meeting Cutting Scores	Total
High Criterion Group	69	148	217
Low Criterion Group	75	61	136
Total	144	209	353

Phi coefficient = .23
Significance level = P/2 < .0005

TABLE 7a
Validity of Battery for Black Subsample

	Below Cutting Scores	Meeting Cutting Scores	Total
High Criterion Group	29	40	69
Low Criterion Group	32	19	51
Total	61	59	120

Phi coefficient = .20
Significance level = P/2 < .025

TABLE 7b
Validity of Battery for Nonminority Subsample

	Below Cutting Scores	Meeting Cutting Scores	Total
High Criterion Group	33	97	130
Low Criterion Group	36	39	75
Total	69	136	205

Phi coefficient = .23
Significance level = P/2 < .0005

OCCUPATIONAL APTITUDE PATTERN

This occupation was incorporated into OAP-29 in Section II of the 1979 edition of the Manual for the USES General Aptitude Test Battery with a "double asterisk" (**), because the battery did not contain the same aptitudes as included in OAP-29 but a significant phi coefficient was obtained between the criterion and the OAP-29 cutting scores of V-90, Q-100 and K-90. A phi coefficient of .12 (P/2 < .025) was obtained.

APPLICABILITY OF BATTERY

The aptitude test battery may be used in the selection of inexperienced applicants for the job described in Appendix A.

APPENDIX 1.

Descriptive Statistics for Black and Nonminority Subgroups

	Black (N=120)			Nonminority (N=205)		
Variable	Mean	SD	Range	Mean	SD	Range
Aptitude G	93.0	11.0	54-114	96.1	14.2	59-139
Aptitude V	88.0	9.8	72-119	90.1	13.0	65-145
Aptitude N	85.4	13.2	54-120	88.6	15.6	52-140
Aptitude S	96.1	13.8	61-127	94.3	17.7	51-143
Aptitude P	100.1	17.9	55-140	100.7	21.6	61-178
Aptitude Q	114.1	15.1	72-152	121.3	16.3	75-170
Aptitude K	113.5	15.7	72-155	109.1	16.6	56-157
Aptitude F	95.0	21.9	50-145	97.1	21.3	21-150
Aptitude M	94.3	19.0	24-146	93.3	19.9	24-151
Criterion	42.5	7.6	26-60	45.0	9.6	21-60
Age	29.4	8.9	18-55	30.9	11.1	17-64
Education	12.3	.9	10-15	12.1	.9	8-16
Experience (present job)	47.0	54.1	1-265	45.0	53.6	1-253

APPENDIX 2

COMPANIES CONTRIBUTING SAMPLES

Computer Science Corporation, Huntsville, Alabama
Hayes International Corporation, Birmingham, Alabama
Scott Paper Company, Mobile, Alabama
Employment Security Commission, Little Rock, Arkansas
Continental Carpet, City of Commerce, California
Cordura, Inc., Los Angeles, California
Crocker National Bank, Los Angeles, California
Major L. A. Company, City of Commerce, California
Metropolitan Water, District of Southern California, Los Angeles, California
Monrovia Nursery, Azusa, California
Unitax Corporation, Whittier, California
United California Bank, Arcadia, California
Pitney-Bowes, Stamford, Connecticut
Travelers Insurance Company, Hartford, Connecticut
Department of Commerce, Tallahassee, Florida
Department of Motor Vehicles, Tallahassee, Florida
Chicago Metropolitan Mutual Assurance Company, Chicago, Illinois
Libby, McNeill and Libby, Chicago, Illinois
Prudential Life Insurance Company, Chicago, Illinois
Indiana Employment Security Division, Indianapolis, Indiana
John Hancock Mutual Life Insurance Company, Boston, Massachusetts
Massachusetts Division of Employment Security, Boston, Massachusetts
Kelly Girl Services, Inc., Southfield, Michigan
Uniroyal, Inc., Allen Park, Michigan
The St. Paul Fire and Marine Insurance Companies, St. Paul, Minnesota
Prudential Insurance Company of America, Newark, New Jersey
Albuquerque Public Schools, Albuquerque, New Mexico
Bernalillo County Medical Center, Albuquerque, New Mexico
ESC of New Mexico, Albuquerque, New Mexico
Department of Motor Vehicles, Albany, New York
New York State Department of Taxation and Finance, Albany, New York
State Insurance Fund, New York, New York
Data Processing of the South, Charlotte, North Carolina
Columbia Gas System Service Corporation, Columbus, Ohio
General Motors Corporation, Fisher Body Division, Columbus, Ohio
Nationwide Insurance, Columbus, Ohio
First National Bank of Oregon, Portland, Oregon
Blue Cross-Blue Shield of Texas, Dallas, Texas
Exxon USA, Houston, Texas
Craig Motor Service Company, Inc., Clarksburg, West Virginia
Union Carbide Corporation, Clarksburg, West Virginia
Wheeling-Pittsburg Steel Corporation, Wheeling, West Virginia

U.S. DEPARTMENT OF LABOR • MANPOWER ADMINISTRATION

DESCRIPTIVE RATING SCALE

SCORE _____

RATING SCALE FOR _____

D.O.T. Title and Code

Directions: Please read the "Suggestions to Raters" and then fill in the items which follow. In making your ratings, only one box should be checked for each question.

SUGGESTIONS TO RATERS

We are asking you to rate the job performance of the people who work for you. These ratings will serve as a "yardstick" against which we can compare the test scores in this study. The ratings must give a true picture of each worker or this study will have very little value. You should try to give the most accurate ratings possible for each worker.

These ratings are strictly confidential and won't affect your workers in any way. Neither the ratings nor test scores of any workers will be shown to anybody in your company. We are interested only in "testing the tests." Ratings are needed only for those workers who are in the test study.

Workers who have not completed their training period, or who have not been on the job or under your supervision long enough for you to know how well they can perform this work should not be rated. Please inform the test technician about this if you are asked to rate any such workers.

Complete the last question only if the worker is no longer on the job.

In making ratings, don't let general impressions or some outstanding trait affect your judgment. Try to forget your personal feelings about the worker. Rate only on the work performed. Here are some more points which might help you:

1. Please read all directions and the rating scale thoroughly before rating.

2. For each question compare your workers with "workers-in-general" in this job. That is, compare your workers with other workers on this job that you have known. This is very important in small plants where there are only a few workers. We want the ratings to be based on the same standard in all the plants.

3. A suggested method is to rate all workers on one question at a time. The questions ask about different abilities of the workers. A worker may be good in one ability and poor in another: for example, a very slow worker may be accurate. So rate all workers on the first question, then rate all workers on the second question, and so on.

4. Practice and experience usually improve a worker's skill. However, one worker with six months' experience may be a better worker than another with six years' experience. Don't rate one worker as poorer than another merely because of a lesser amount of experience.

5. Rate the workers according to the work they have done over a period of several weeks or months. Don't rate just on the basis of one "good" day, or one "bad" day or some single incident. Think in terms of each worker's usual or typical performance.

6. Rate only the abilities listed on the rating sheet. Do not let factors such as cooperativeness, ability to get along with others, promptness and honesty influence your ratings. Although these aspects of a worker are important, they are of no value for this study as a "yardstick" against which to compare aptitude test scores.

MA 7-66
Apr. 1973

NAME OF WORKER (Print) (Last) (First)

SEX: MALE_____ FEMALE_____

Company Job Title: _____

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

- ☐ All the time.
- ☐ Several times a day.
- ☐ Several times a week.
- ☐ Seldom.

How long have you worked with this worker?

- ☐ Under one month.
- ☐ One to two months.
- ☐ Three to five months.
- ☐ Six months or more.

A. How much can this worker get done? (Worker's ability to make efficient use of time and to work at high speed.) (If it is possible to rate only the quantity of work which a person can do on this job as adequate or inadequate, use #2 to indicate "inadequate" and #4 to indicate "adequate.")

- ☐ 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 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 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. 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 the 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.

MA 7-66
Apr. 1973

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

☐ 1. Has very limited knowledge. Does not know enough to do the 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 the job thoroughly.

E. How large a variety of job duties can the worker perform efficiently? (Worker's ability to handle several different operations.)

☐ 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.

F. Considering all the factors already rated, and only these factors, how good is this worker? (Worker's all-around ability to do the job.)

☐ 1. Performance usually not acceptable.

☐ 2. Performance somewhat inferior.

☐ 3. A fairly proficient worker.

☐ 4. Performance usually superior.

☐ 5. An unusually competent worker.

Complete the following ONLY if the worker is no longer on the job.

G. What do you think is the reason this person left the job? (It is not necessary to show the official reason if you feel that there is another reason, as this form will not be shown to anybody in the company.)

☐ 1. Fired because of inability to do the job.

☐ 2. Quit, and I feel that it was because of difficulty doing the job.

☐ 3. Fired or laid off for reasons other than ability to do the job (i.e., absenteeism, reduction in force).

☐ 4. Quit, and I feel the reason for quitting was not related to ability to do the job.

☐ 5. Quit or was promoted or reassigned because the worker had learned the job well and wanted to advance.

RATED BY	TITLE	DATE

COMPANY OR ORGANIZATION	LOCATION (City, State, ZIP Code)

APPENDIX 4

S-190R76

JOB DESCRIPTION

Job Title: Key-Punch Operator (clerical) 213.582

Job Summary: Operates alphabetical and numerical key-punch or key-tape machine by rapidly and accurately punching coded and uncoded data onto tabulating cards or magnetic tape. Places cards to be punched into card hopper or loads magnetic tape, manipulates keys on keyboard to record data onto cards or magnetic tape, and removes completed cards or magnetic tape.

Work Performed: Obtains source data to be recorded on cards or tape from supervisor or central point and places source data on reading board.

Picks up blank cards from box and places them in card hopper or loads magnetic tape in key-tape machine. Turns on main line switch to activate machine.

*Follows oral or written instructions on the correct format to use in punching program cards on key-punch machine or entering program in program memory using established codes on key-tape machine. Secures program card to key-punch machine.

Moves switches and depresses keys to select automatic or manual duplication and skipping and selects alphabetic or numeric punching when appropriate.

*Records coded and uncoded data onto tabulating cards or magnetic tape following written information on source data by depressing keys corresponding to numbers or symbols on machine keyboard.

Picks up completed cards or magnetic tape and removes them from card stacker or key-tape machine.

Carries completed work in batches or in boxes back to supervisor or to central point where it can be picked up for verifying.

May verify punch cards or proofread typed copy produced from the magnetic tape, making corrections to the tape as necessary.

*These job duties were designated as critical job duties. These duties are critical since they must be performed competently if the job is to be performed in a satisfactory manner. Key-Punch Operators spend about 80% of their working hours every day performing these job duties.