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LEVEL II

Research Memorandum 70-2

**USE OF THE ARMY CLASSIFICATION BATTERY
FOR COUNSELING AND ASSIGNMENT
TO NON-ARMY TRAINING**

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FOR COUNSELING AND ASSIGNMENT TO NON-ARMY TRAINING

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**USE OF THE ARMY CLASSIFICATION BATTERY
FOR COUNSELING AND ASSIGNMENT TO NON-ARMY TRAINING**

Project TRANSITION is a unique and ambitious program of cooperation among the Armed Forces, industry and labor, and a number of federal agencies. The goal is to provide soon-to-be veterans with job training and thereby help them find productive futures as civilians¹. The project, established by the Department of Defense in 1968, is administered in the Army through the General Educational Development program in Army Education Centers.

Four basic services are offered to men and women being separated from the service: counseling, training, education, and job referral. Enlisted members with six months or less of active duty remaining prior to separation or retirement are eligible for TRANSITION assistance. The TRANSITION cycle begins with an orientation session explaining the program. Individuals then complete a Career Plans Questionnaire indicating their background, future plans, and aspirations. Those requesting TRANSITION services are scheduled for individual counseling sessions. Graduates of the training courses are not guaranteed job placement, nor are they obligated to seek employment with the company that provides the training. But since industry (and the government agencies) normally provides training in skills for which it has job requirements, those who successfully complete a course are usually offered employment.

In the Army, implementation of Project TRANSITION focused attention on the proper referral of applicants for TRANSITION training. At the time, the Behavior and Systems Research Laboratory (BESRL) advanced the position that a suitable aptitude area of selection, based on Army Classification Battery tests, could be suggested for each type of TRANSITION training without the necessity for additional prior empirical research. The Department of Defense (DOD) and other interested industry and agency representatives concurred on the acceptability of the ACB and other Form 20 data for trainee screening². However, in order to provide an empirical base for the use of the Army tests in Project TRANSITION, DOD requested BESRL to undertake a small-scale one-time study. The study was conducted on students in the IBM Office Equipment Repair Course. The present Research Memorandum is a report of the comparability study of ACB tests and the tests used routinely with civilian applicants for the course.

¹ Maurer, CPT Richard C., USN. Project TRANSITION--Bridge to the Future. Army Digest. 24, 10, October 1969.

² Memorandum from OSD (M&RA) to Dir, USABESRL, dated 13 March 1968.
Subject: Equivalence Testing of Army and IBM Tests. (Appendix A)

BESRL's position was based on extrapolation from experience with the operational Army classification and assignment system and the effective differential validity of the Army aptitude area scores demonstrated over time in a wide variety of Army training programs. Examples of aptitude area composites and cutting scores suggested by BESRL for certain TRANSITION courses are shown in Table 1.

Table 1

APTITUDE AREA COMPOSITES AND SUGGESTED CUTTING SCORES FOR
SELECTED TRANSITION COURSES

Course	Aptitude Area	Component Tests	Suggested Cutting Score
IBM Office Equipment Repair	General Maintenance (GM)	PA, SM	100
Television Repair	Electronic (EL)	ELI, MA	100
Postal Clerk Training	Clerical (CL) <u>or</u>	ACS, VE	90
	General Technical (GT)	VE, AR	100
Correction Officer Training	General Technical (GT)	VE, AR	100

In the case of the Postal Clerk and Correction Officer training courses, the concern of the training agency was that, even if training were completed successfully, the Post Office Department, the Federal Bureau of Prisons, and the Civil Service Commission would require TRANSITION graduates to take the same tests as are administered to untrained applicants for employment. So strong was the conviction that these graduates would be suitable that efforts were made to have the Civil Service Commission and the federal agencies to agree to accept them without additional testing.

COMPARABILITY STUDY

The study requested by the Assistant Secretary of Defense (Manpower and Reserve Affairs) was to take the form of a comparison of the ACB tests and tests routinely used as selection instruments for jobs in one of the occupational areas for which TRANSITION training is provided. The Office Equipment Repair Course offered by the International Business Machines Corporation (IBM) was selected as a test case for comparing the effectiveness of ACB tests and the selection instruments used by the training agency.

It was the intention of IBM to use the ACB measures only as a pre-screen and to screen additionally, first on an evaluative interview of potential as IBM field representative, and then on several IBM paper-and-pencil tests. The tests are described in Table 2. However, before the data analysis was completed, the BESRL position that the Army tests have a direct value for predicting IBM TRANSITION training outcome was accepted by IBM³.

The equivalence study design provided for the prescreening of Project TRANSITION applicants for IBM training, using a General Maintenance Aptitude score of 100 as a preliminary standard. IBM would make the final selection on the basis of an interview and scores on its own selection tests. IBM test scores and course grades for all individuals who started training (including those who failed or who dropped out for non-academic reasons) were to be used to determine the validity coefficients of the ACB tests for comparison with those of the IBM tests⁴.

SAMPLES

Army Sample. The 278 men in the Army sample were tested with the ACB and the IBM selection at Fort Dix, New Jersey. Armed Forces Qualification Test (AFQT) scores were obtained from Army records. This sample was used in correlational analysis of the two sets of tests.

IBM Sample. The IBM sample consisted of 73 civilian trainees in the Office Equipment Repair course at Endicott, New York. The men were tested on six ACB tests: Verbal (VE), Arithmetic Reasoning (AR), Pattern Analysis (PA), Mechanical Aptitude (MA), Shop Mechanics (SM), and Electronics Information (ELI). Final course grades were obtained on each of five aspects of training performance: laboratory performance, subject knowledge, attitude, key punch technical, and key punch personal. Total criterion score was not computed. IBM selection test data were not available for this sample. No direct comparison of ACB and IBM test validity could therefore be made.

RESULTS

CORRELATION STUDY IN THE ARMY SAMPLE

Correlation data is presented in the form of a 12 x 17 matrix of the AFQT, the eleven ACB tests, and the five IBM selection tests (Table 3). AFQT, a test of general learning ability, was included in the matrix as a reference test. AFQT contains four item types: Word Knowledge, Tool Knowledge, Arithmetic Reasoning, and Pattern Analysis. For ease of comparison, AFQT is listed with the three ACB tests of general ability: Verbal, Arithmetic Reasoning, and the General Information Test (GIT). These are followed by ACB

³ LTR. IBM Corporation to OSD (M&RA), dated 24 June 1968. (Appendix B)

⁴ Memorandum: From Dir, BESRL to OSD (M&RA), dated 1 March 1968. Subject: Determining the Comparability of IBM and ACB Tests. (Appendix C)

Table 2

SCREENING TESTS USED BY IEM

Name of Test	No. of Items	Time Limit	Description
Survey of Mechanical Insight (SMI) (California Test Bureau)	35 three-choice items	25 (35) minutes	Measures the ability to predict the resultant motion of various parts of a mechanism when a given part is operated. Measures the aptitude to solve the types of mechanical problems involved in jobs requiring the operation, maintenance, repair, or design of various types of machinery.
Aptitude for Field Engineering (AFE)	20 each of three types of five-choice items	45 minutes	Number series, figure series, and computer-orientated arithmetic reasoning problems.
Office Products CE Aptitude Test (CE)	CE-1: 45 items	45 minutes	Mechanical and electrical principles, identification of parts and tools, knowledge of functions of parts and tools.
	CE-2: 15 items	15 minutes	Electronics principles, identification of parts, symbols, knowledge of functions.
	CE-3: 56 items	25 minutes	Figure series, and number series.

Table 3

CORRELATION* OF ARMY AND IBM SELECTION TESTS*
(N = 278)

	AFQT	Army Tests											IBM Tests				
		Army Classification Battery											SMI	AFE	CE-1	CE-2	CE-3
		VE	AR	GIT	ACS	ARC	PA	SM	MA	ELI	AI	CI					
1. AFQT		65	71	66	37	34	71	46	62	51	48	44	65	69	66	14	60
2. VE	65		62	66	46	35	39	13	37	35	12	40	33	64	41	13	55
3. AR	71	62		54	52	38	53	21	47	36	21	40	44	76	52	21	62
4. GIT	66	66	54		36	34	46	32	54	42	36	47	49	59	55	16	53
5. ACS	37	46	52	36		46	35	11	28	26	07	40	18	53	29	17	52
6. ARC	34	35	38	34	46		36	15	34	20	09	28	35	50	29	14	46
7. PA	71	39	53	46	35	36		42	56	45	43	25	61	53	53	11	51
8. SM	46	13	21	32	11	15	42		49	49	61	28	40	21	51	14	17
9. MA	62	37	47	54	28	34	56	49		56	51	33	66	47	59	14	42
10. ELI	51	35	36	42	26	20	45	49	56		49	32	55	33	59	24	26
1. AI	48	12	21	36	07	09	43	61	51	49		19	46	18	56	07	14
2. CI	44	40	40	47	40	28	25	28	33	32	19		25	42	32	17	37

*Decimals omitted

*Army Sample

tests of specific aptitudes, knowledge, and information. Data on the ACB Pattern Analysis (PA) and Shop Mechanics tests, components of the General Maintenance Aptitude Area suggested by BESRL as the selector for IBM training, are listed on adjacent rows.

None of the correlation coefficients was high enough that Army and IBM selection tests might be considered to be interchangeable or equivalent. The one possible exception is the correlation of $r = .76$ between the ACB Arithmetic Reasoning Test and the IBM Aptitude for Engineering Test (AFE). The AFQT and six of the eleven ACB tests--Verbal, Arithmetic Reasoning, General Information Test, Classification Inventory (CI), Army Clerical Speed, and Army Radio Code Aptitude--had their highest correlation with the AFE. The five IBM tests were most similar to AFQT (average $r, .55$). PA and SM were relatively independent of the IBM selection tests (PA average $r, .46$; SM, $.29$). Thus, the GM Aptitude Area and the IBM tests may not be measuring similar aptitudes. This aspect of equivalence, however, was no longer an issue by the time the study was completed (See Appendix B).

On the assumption that pairs of ACB and IBM tests with similar item content would be measuring the same or similar aptitudes and would therefore correlate higher than would dissimilar pairs, the tests paired as shown in Table 4 were examined. While from inspection of the content, only the ACB Pattern Analysis Test and the IBM Survey of Mechanical Insight appeared to have similar item content, the paired tests yielded the highest intercorrelations obtained across batteries.

Table 5 presents the means and standard deviations of the Army tests (AFQT and the ACB) and the five IBM selection tests. The Army tests are listed in the same order as in Table 3. The IBM tests are paired with the ACB tests with which they had the highest correlation. The descriptive statistics for the Army sample indicate that, except for the Classification Inventory, Army tests were one-fourth to one-half a standard deviation above Army population means--a result which might be expected from a Fort Dix input.

ACB PREDICTION IN THE IBM SAMPLE

The IBM sample data are presented as a 12 x 12 correlation matrix (Table 6) consisting of the six ACB tests (VE, AR, PA, SM, MA, ELI) considered relevant to prediction of the IBM course criteria, the GM aptitude area, and the five criterion parts: laboratory performance (LP), subject knowledge (SK), attitude (ATT), key punch, technical (KPT), and key punch, personal (KPP). The criterion parts were not further defined, nor were passing scores suggested. Mean and standard deviation are given for each variable where available.

ACB mean scores in the IBM sample ranged from 125.35 (MA) to 131.08 (ELI). Means were one and one-half to two standard deviations above Army population means. The standard deviations for the IBM group were small, with a range from 9.57 (ELI) to 16.85 (PA). There was only one GM aptitude area score below 100. Practically all the IBM trainees scored well above 100

Table 4

CORRELATION BETWEEN IBM AND ACB TESTS WITH SIMILAR CONTENT

IBM Test and Content Type	ACB Test	Correlation Coefficient
Survey of Mechanical Insight (SMI)	Mechanical Aptitude	.66
Aptitude for Field Engineering (AFE)		
Number Series	Arithmetic Reasoning	.76
Figure Series	Pattern Analysis	.53
Arithmetic Problems	Arithmetic Reasoning	.76
Office Products CE Aptitude Test		
CE-1: Mechanical-Electrical Principles	Mechanical Aptitude	.59
	Electronics Information	.59
CE-2: Electronics Principles	Electronics Information	.24*
CE-3: Figure Series	Pattern Analysis	.51
Number Series	Arithmetic Reasoning	.62

*Correlation between CE-2 and ACB tests ranged from .07 to .24.

Table 5

MEANS AND STANDARD DEVIATIONS
OF ARMY AND IBM SELECTION TESTS*

Mean		Standard Deviation	
Army Test	IBM Test	Army Test	IBM Test
AFQT 58.76		23.41	
VE 110.83		20.99	
AR 106.54	AFE 29.90 CE-3 28.19	20.46	AFE 12.38 CE-3 12.26
GIT 103.86		18.08	
ACS 104.49		18.43	
ARC 105.97		23.92	
PA 104.89		23.11	
SM 107.81		16.78	
MA 107.09	SMI 23.79 CE-1 18.96	17.92	SMI 7.67 CE-1 6.01
ELI 105.02	CE-1 18.96 CE-2 13.41	18.83	CE-1 6.01 CE-2 2.09
AI 106.48		18.54	
CI 95.07		22.79	

*Army Sample

Table 6

CORRELATION COEFFICIENTS^a, MEANS, AND STANDARD DEVIATIONS OF ARMY TESTS AND IBM CRITERION^{*}

	Correlation		Mean	Standard Deviation
	Army Classification Battery	IBM Criterion		
VE	VE		126.93	10.66
AR	49 AR		^b	^b
PA	18 51 PA		126.81	16.85
SM	36 34 40 SM		127.97	10.27
MA	39 52 41 49 MA		125.35	14.77
ELI	33 46 33 35 31 ELI		131.08	9.57
GM	34 50 80 87 54 41 GM		^b	^b
LP	09 22 32 32 26 26 38 LP		2.79	0.99
SK	14 28 41 30 31 29 41 SK		3.08	0.96
KPT	04 25 36 26 25 30 36 KPT	83 KPT	5.12	3.14
ATT	-11 09 23 35 27 27 34 ATT	56 50 54 ATT	3.47	0.72
KPP	-09 -06 15 25 16 12 24 KPP	62 53 75 61 KPP	7.06	1.86

^aDecimals omitted^bNot available^{*}IBM Sample

on the ACB tests. The few scores below 100 were almost all in the 93 to 99 range. One trainee had three scores below 100 (VE 117, AR 81, SM 122, PA 83, MA 83, ELI 122), and one trainee had all scores below 100 (VE 76, AR 74, SM 88, PA 57, MA 90, ELI 89). This was the one GM score below 100. It would be of interest to know whether these two trainees were graduated, whether or not they were employed by IBM, and how well they performed on the job.

The five criterion parts appear to consist of two clusters: A homogeneous cluster including laboratory performance, subject knowledge, and key punch, technical (intercorrelation .87) and a less homogeneous attitudinal cluster including attitude and key punch, personal (intercorrelation .61). The GM Aptitude Area predicted each of the criterion parts better on the average than did any of the six individual ACB tests. PA and SM were equally effective predictors of the IBM criteria, and performed better than the other ACB tests in this respect. GM predicted the technical criterion cluster more effectively (average correlation .38) than it predicted the attitudinal cluster (average correlation .29).

CONCLUSIONS

The highest correlation across the two selection batteries was found between the ACB and IBM tests considered similar in item content. However, the correlation coefficients (.24 to .76) were not high enough to establish the equivalence of the two sets of tests--a consideration which had ceased to be of great concern by the time the study was completed.

Empirical support for the BESRL hypothesis that ACB tests are suitable selection instruments for TRANSITION training was obtained. Use of the General Maintenance Aptitude Area as selector for the IBM Office Equipment Repair Course was considered warranted on the basis of the validity coefficient of about .40 in the sample studied. There were no counter-indications to the use of the ACB and aptitude areas in screening for TRANSITION training.

The recommended score of 100 seems appropriate. All except one person in the IBM sample would have been selected at this cutting score.

APPENDIX A

MEMO REGARDING
USE OF ARMY TESTS AS SELECTORS FOR
TRANSITION TRAINING

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D. C. 20301

MANPOWER
and
Reserve Affairs

13 March 1968

MEMORANDUM FOR: Dr. Julius E. Uhlaner
Director, U. S. Army Behavioral Science
Research Laboratory

SUBJECT: Equivalence Testing of Army and IBM Tests

Attached is a copy of a letter received from IBM regarding equivalence testing of Army and IBM tests.

It would seem to be most advantageous and economical to select one of the later dates from among those suggested by IBM. May I have an indication as to when Army would be able to conduct the proposed testing program so that I may respond to IBM?

I am in full accord with your desire to limit such studies to the minimum. It is expected that this research will be done on a one time only basis.

Other companies will be encouraged to rely on military classification tests whenever tests are appropriate for selecting trainees in Project TRANSITION. We recognize the need to convert military personnel jacket information to Project TRANSITION applications without empirical research in each instance.

CHARLES A. ULLMANN
Research Psychologist

Enclosure

APPENDIX B

STATEMENT FROM
IBM ON DATA COLLECTION FOR
ACB-IBM TEST EQUIVALENCE STUDY

IBM

International Business Machines Corporation

112 East Post Road
White Plains, New York 10601
914/White Plains 9-1900

June 24, 1968

Dr. Charles A. Ullmann
Research Psychologist
Manpower and Reserve Affairs
Office of the Assistant Secretary of Defense
Washington, D. C. 20301

Dear Dr. Ullmann:

To bring you up to date on the status of the research we are doing in connection with Project Transition, data gathering has been completed for the part of the research in which Army tests were administered to IBM trainees at Endicott, New York. We are presently relating the scores to training outcomes and expect to complete our analysis in two weeks. Incidentally, of the 73 trainees tested, only one had a General Maintenance Aptitude Area Score of less than 100.

The testing of recruits with IBM tests at Fort Dix was completed also, but I understand from Mr. Tom Houston that it will not be possible to determine the Army test scores for these same recruits. Therefore, the correlation between IBM and Army tests cannot be determined.

For this reason Mr. Houston has offered to do the IBM testing with another sample of Army recruits and insure access to their Army test scores. In reviewing this research in light of Project Transition activity, we have concluded that it is not necessary at this point to test another sample of recruits. The Office Products Division has found in their Transition program that test scores of any kind have been of little use in selection. The pool of possible candidates has usually been too meager to tolerate any further screening.

-2-

As for the Field Engineering Division, we have run into a similar dearth of interested candidates and have not even assembled the first class of trainees. In the event we do get into a large scale screening situation, we feel that the direct validity of Army tests for IBM training outcomes will be more valuable than knowing the interrelation of IBM and Army tests.

W. E. DODD

/jo

cc: Mr. T. Houston
Dr. M. Maier

APPENDIX C

COMMUNICATION INCLUDING EQUIVALENCE
STUDY DESIGN

CRDBSRL DOL

1 March 1968

MEMORANDUM FOR: DR. CHARLES ULLMANN
OFFICE, SECRETARY OF DEFENSE (M&RA)
ROOM 3C 937, PENTAGON

SUBJECT: Determining the Comparability of IBM and ACB Tests

1. In response to your phone request to Dr. Maier of my staff, BESRL is prepared to conduct an equivalence study as outlined in the inclosure. We are presently inclined to absorb the effort as a pilot study within the present program since needed research resources do not appear excessive.

2. Should the requirement expand, as for example, in replication in other areas, it is highly likely that present resources would not be adequate. In such event, request should be made through OCRD channels with indication of the financial support that could be provided.

1 Incl
Equivalence Study Design

J. E. UHLANER
Director

EQUIVALENCE STUDY DESIGN

1. The following were agreements reached at the BESRL meeting with IBM representatives on 7 February 1968 concerning the screening of applicants for the IBM training courses conducted under Project Transition.

a. Army counselors will prescreen the applicants and use a GM aptitude area score of 100 as the preliminary standard.

b. IBM will make the final selection on the basis of an interview and scores on their own selection tests.

2. The following procedures are proposed to determine the comparability of the IBM and ACB tests.

a. Administration of ACB Tests

(1) Part of the ACB (VE, AR, PA, MA, SM and ELI) will be administered to trainees at the IBM training center at Philadelphia. These six tests will require about three hours administration time.

(2) BESRL plans to test as many trainees as possible during one day, but must determine how many trainees can be tested in any one room at the same time, and how many testing sessions can be run concurrently. BESRL plans to have two testing sessions, one in the morning and one in the afternoon; several groups can be tested during each session if space is available. If not all trainees can be tested, then those requiring the least amount of instruction should be tested.

(3) BESRL will administer the tests, but will need proctoring assistance from IBM, especially if two or more groups are tested simultaneously.

b. Administration of IBM Tests

The IBM selection tests will be administered to an Army input sample of about 200 men at Fort Dix. BESRL will require about 200 test booklets and answer sheets and an administrative manual from IBM. The test booklets will be returned to IBM.

c. Validity Analysis

BESRL will also need from IBM the test scores for the trainees on their selection tests and the course grades when they become available. These data will be used to determine the validity coefficients of the ACB tests for comparison with those of the IBM tests. Criterion data will be needed on all the individuals who started training, including those who failed or who dropped out for non-academic reasons.

3. BESRL will score the answer sheets and perform the statistical analyses. The results will be presented to ASD(M) as soon as they are available.