Technical Research Report 1138

VALIDATION OF EXPERIMENTAL ELECTRONICS SELECTION BATTERY

U. S. ARMY PERSONNEL RESEARCH OFFICE

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VALIDATION OF EXPERIMENTAL ELECTRONICS SELECTION BATTERY

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PREFACE

Technological advancements have led to increased speed, mobility, and destructive power of military operations. To permit commanders to make tactical decisions consistent with rapid change and succession of events, information on military operations must be processed and used more effectively than ever before. To meet this need, the Army is developing automated systems for the receipt, processing, storage, retrieval, and display of different types and vast amounts of military data. Since the effective operation and maintenance of these and other electronic systems depend ultimately on human components, the need for research information leading to improved selection, assignment, and on-the-job performance of personnel for the increasing number of electronic systems jobs is paramount.

One objective of the Electronics Task (now COMMAND SYSTEMS Task) was to develop instruments and procedures to improve the selection and assignment of electronics personnel through differential identification of aptitudes for MOS of high and low levels of complexity. The present publication summarizes research accomplished under Subtask c, "Validation of Experimental Electronics Selection Battery for the Differential Classification of Individuals for High vs. Low Level Electronics MOS", FY 1964 Work Program (Army R&D Project Number 2J024701A723, "Human Performance in Military Systems").

This portion of the research program is responsive to requirements of USCONARC and DCSPER as well as to requirements to contribute to achievement of Department of the Army R&D Project Number 2J024701A722, "Selection and Behavioral Evaluation".

USAPRO Technical Research Reports and Technical Research Notes are intended for sponsors of R&D tasks and other research and military agencies. Any findings ready for implementation at the time of publication are presented in the latter part of the Brief. Upon completion of a major phase of the task, formal recommendations for official action normally are conveyed to appropriate military agencies by briefing or Disposition Form.

VALIDATION OF EXPERIMENTAL ELECTRONICS SELECTION BATTERY

BRIEF

Requirement:

To develop measures for improving assignment of personnel to electronics jobs through differential identification of aptitudes for MOS of high and low complexity.

Procedure:

Experimental measures developed through successive stages were evaluated in terms of differential prediction of success in training and on-job performance in electronics (high complexity) MOS and electrical (low complexity) MOS. Composites involving the most effective predictors were compared with operational aptitude area composites in terms of prediction and independence of other aptitude areas.

Findings:

Three measures were found to yield good differentiation between electronics and electrical aptitude. Two of these measures are obtained from a single experimental instrument, the Personal Inventory for Electronics. A third measure, designated RME, was made up of radio, mathematics, and electronics information items derived from the experimental tests.

Composites involving one or more of these measures offered promise of improving selection for electronics jobs and were as effective as Aptitude Area EL for electrical jobs.

Two composites, one for electronics and one for electrical MOS, offered the possibility of reducing overlap between the electronics-electrical job area and other aptitude areas, but only if both composites were introduced.

Utilization of Findings

Current development and analysis of measures for differential classification is directed toward a comprehensive revision of the Army Classification Battery and aptitude area composites programmed for implementation in 1966. Basic to this revision is a large-scale analysis of operational and newly developed tests for differential validity across a broad sampling of MOS. The three most effective tests of the experimental Electronics Selection Battery--the two measures based on the Personal Inventory for Electronics and the RME--will be included in this analysis with the objective of expanding coverage of aptitudes for technological job areas.

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VALIDATION OF EXPERIMENTAL ELECTRONICS SELECTION BATTERY

SHORTAGE OF PERSONNEL FOR ELECTRONICS SYSTEMS

Accelerated use of electronic systems and equipment has created a spiraling demand for skilled electronics technicians both within and outside the Department of Defense. The Army as a major user or such personnel is confronted with the double-barreled problem of an increasing number of jobs requiring electronics skills and a high rate of turnover of personnel already trained and working in these jobs. The result has been a continuing requirement for means of selecting personnel who have the aptitude and ability to complete an electronics training program and perform satisfactorily in highly critical electronics positions.

The shortage of personnel for electronics positions has been aggravated by several conditions limiting assignment of input: Two-year inductees from selective Service--at least 50 percent of total Army input--are excluded from training courses lasting 20 weeks or longer, including most electronics MOS courses. To qualify for electronics training, three-year enlistees must have had a high-school education or GED equivalent or have completed specified mathematics and science courses. From the reduced pool, men are selected for training from those who during initial classification attain a qualifying score on the Electronics Aptitude Area. Of those assigned to training in electronics MOS, 15 to 30 percent do not satisfactorily complete the course.

Both DCSPER and USCONARC have requested that intensive research be conducted to develop means of identifying a larger number of personnel who can successfully complete the training courses for electronics MOS and subsequently perform satisfactorily in electronics jobs. In response to this request, the U. S. Army Personnel Research Office attacked the problem in a series of integrated research studies.

THE RESEARCH PROGRAM

The Electronics Aptitude Area (EL), a composite of scores in the Mechanical Aptitude Test and the Electronics Information Test of the Army Classification Battery (ACB), is used to determine qualification for assignment to both electronics and electrical MOS. Early studies in the research program gave grounds for the conclusion that EL was effective over the broad spectrum of jobs in the area but did not provide a basis for selecting men with the capacity to acquire requisite skills for the more complex electronics MOS. Consequently, men capable of performing the more complex jobs may be assigned to jobs which could be performed just as well by men of lesser capability in the area. Shortages of electronics personnel could be somewhat alleviated if means of greater differentiation within the job area could be made available.

The following approaches were formulated as offering the greatest potential for improved classification in the electronics-electrical domain:

- Development of new measures having greater sensitivity to factors found to be differentially related to success in electronics courses as opposed to success in the less complex electrical-mechanical courses.

- Addition of new and improved tests to tap those aptitude, ability, personality, and experiential factors related to success in electronics assignments but not presently measured in the Army Classification Battery.

- Development of more sensitive and reliable criteria of on-job performance to enable a more valid and meaningful evaluation of predictors.

To implement these research plans, an experimental Electronics Selection Battery of 15 tests was developed. Included in the battery were measures of information, reasoning ability, and personality, as well as background data (Figure 1). The present study was conducted to evaluate the experimental tests of the selection battery, in conjunction with operational measures of the Army Classification Battery, as differential selection devices for training in electronics and electrical MOS.

HOW THE BATTERY WAS EVALUATED

The experimental battery was administered during 1959 to approximately 4000 men assigned to Army school training for electronics and electrical MOS and to 1,500 men already serving in electronics or electrical MOS in Europe and at NIKE installations in the Sixth Air Defense Region, CONUS. ACB test scores and relevant biographical data were obtained for both groups from Army records. From among the school trainees 963 met the research requirements--age, first enlistment, and appropriate MOS. Complete data were available on 726 men on the job. A further division placed 605 in electronics MOS and 1084 in electrical MOS. The MOS represented in each sample are shown in Figure 2.

Tests and combinations of tests were evaluated on the basis of how well the scores predicted success in training as shown by final course grade, and success on the job as evidenced by supervisor and peer ratings.

To provide an evaluation of job performance against which to judge the effectiveness of the tests, a new rating form was developed. The form was designed to first focus the rater's attention on each element of performance and each personal quality deemed important to job success, and then to lead the rater to integrate his specific judgments into a single evaluation of the ratee's overall value to his organization.

Test	Aptitude or Ability Measured	Test Time (Minutes)
Mathematics	Arithmetic, Algebra, Geom. and Trig., Graph Reading	75
General Science and Radio	Science and Radio Information	35
Object Completion	Gestalt Perception	12
Letter Combination	Reasoning	6
Figure Analogies	Reasoning	40
Verbal Analogies	Reasoning	30
Dial Reading	Carefulness	15
Table Reading 1	Carefulness	12
Table Reading 2	Carefulness	10
Directional Plotting	Carefulness	20
Spatial Visualization	Spatial Visualization	35
Data Flow Analysis	Reasoning (System analysis)	25
Following Directions	Memory and Reasoning	20
Personal Inventory for Electronics	Personality, Background, Interests	120
General Electrical Information Test	Electrical and Electronic Information	45

Figure 1. Tests of the Experimental Electronics Selection Battery

MOS	Title	School Samples: High Complexity Electronics	School Samples: Low Complexity Electrical	On-Job Samples: High Complexity Electronics	On-Job Samples: Low Complexity Electrical
223	Air Def. Missile Electronics Mechanic (Nike-Ajax)			HJ	
224	Air Def. Missile Fire Control Mechanic (Nike-Ajax)			HJ	
225	Air Def. Missile Electronics Mechanic (Nike-Herc)			HJ	
226	Air Def. Missile Fire Control Mechanic (Nike-Herc)			HJ	
241	Doppler Repairman (Corporal)			HJ	
242	Computer Repairman (Corporal)			HJ	
243	Radar Repairman (Corporal)			HJ	
244	Internal Guidance Repairman (Corporal)			HJ	
251	Launcher Control Repairman (Nike)			HJ	
252	Acquisition Radar Repairman (Nike)			HJ	
253	Track Radar Repairman (Nike)			HJ	
254	Internal Guidance Repairman (Nike)			HJ	
281	Microwave Radio Repairman			HJ	
282	Radar Repairman	HS		HJ	
284	Electronic Naviation Equipment Repairman			HJ	
294	Field Carrier Equipment Repairman	HS		HJ	
296	Field Radio Repairman	HS		HJ	
312	Armor Communications Specialist			HJ	
293	Radio Relay and Carrier Operator		LS		LJ
310	Field Communications Crewman				LJ
321	Lineman		LS		LJ
323	Telephone Installer Repairman		LS		LJ

Figure 2. MOS School and On-the-Job Samples Used in the Analysis

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Both the electronics MOS school sample and the electrical MOS school sample were divided into equivalent halves so that one half of each could be used to identify the most promising tests and composites, and the remaining half could serve as an independent sample in which to determine the effectiveness of tests and composites previously identified. This cross-validation type of analysis was not planned for the smaller job performance samples. Rather, men in the school samples were to be followed up, and ratings of their job performance obtained after they had been working in an MOS for six months. While the resulting follow-up samples proved to be of inadequate size, they were useful in providing supplementary indication of the relative effectiveness of measures identified as promising.

In the present evaluation, focus was on developing selectors of increased effectiveness for the MOS of concern. At the same time, the effect that introducing new tests into the ACB and concomitant changes in the aptitude area composites would have on the total effectiveness of the battery for differential classification had to be given consideration. Any new test or composite which increased the amount of overlap among the aptitude areas would be of dubious overall value. For example, an improved selector for electronics MOS which was an equally good selector for several other groups of related MOS would not be expected to increase the differentiation among an individual's potentials that is now afforded by the ACB.

Testing time beyond that allowed for the ACB had to be kept to a minimum. Three experimental tests which were found to be highly effective as differential selectors would have increased total administration time for the ACB beyond acceptable limits. These tests were therefore subjected to item analysis, that is, each item was evaluated for effectiveness in predicting success in training and job performance. The best items were then assembled to form a new measure which was no longer than one average length test. The test was labeled RME to signify that it contained radio, mathematics, and electrical items, and its effectiveness was estimated along with that of the other experimental and operational tests.

RESULTS AND THEIR IMPLICATIONS

The analysis gave clear basis for the conclusion that there are ability and personal factors related to success in electronics MOS which are distinct and distinguishable from those related to success in electrical MOS. Factors associated with performance in electronics MOS were delineated and measured to a greater degree by the tests in the present study, both experimental and operational, than were factors associated with performance in electrical MOS.

Three of the experimental measures emerged as having good potential for differentiating between abilities required for electronics as contrasted to electrical MOS. Two of these measures are obtained by applying different scoring keys--a high complexity key and a low complexity key--to a single instrument, the Personal Inventory for Electronics. A third measure, the RME, also was an effective predictor of training success in electronics MOS.

The Personal Inventory for Electronics measures formed the basis for two composites which appeared to have good possibilities for providing the differentiation sought in the present study. The high complexity score combined with the Arithmetic Reasoning and Electronics Information Tests of the ACB was a better predictor of school and job success in Electronics MOS than was the EL Aptitude Area. The low complexity score, double weighted, plus the Automotive Information Test of the ACB, was as effective as EL for electrical MOS and had the added advantage of being a better predictor of school and on-job success in electrical MOS than in electronics MOS. With respect to overlap with operational aptitude areas, when both these composites were included the general effect was to lower the relationship between selectors for the electronics-electrical domain and other aptitude areas. The total effect in terms of differential classification to all occupational areas remains to be determined.

The cognitive test made up of radio, mathematics, and electrical-electronics subject matter (RME), in combination with the high complexity score of the Personal Inventory, was also a promising selector for electronics MOS. This combination showed the least overlap with operational aptitude areas of any electronics composite evaluated.

In summary, the present study has provided evidence that better differentiation can be obtained between potential for success in electronics jobs and aptitudes and abilities required for less exacting jobs in the electrical job area. More satisfactory tests of potential in electronics than in electrical MOS were attained. Extension of research to delineate and measure factors more independently associated with performance in electrical jobs could be expected to improve prediction of success in that area.

Some tests developed in the present study, particularly the two measures based on the Personal Inventory for Electronics, warrant consideration either for inclusion in much their present form or as experimental instruments for further evaluation as a part of the total classification battery. Results on the effectiveness of various elements of the experimental battery suggest that further integration of content could capitalize on the best aspects of individual measures to produce a superior selector for electronics assignments.

Continuing research to improve and maintain the effectiveness of the ACB is designed to maximize the differential value of all tests in determining assignments to training. The total effort is directed toward inclusion of separate measures, each highly effective in selecting men for one set of related MOS and less effective in measuring their qualification for other MOS. In the present study, overlap between the experimental composites and operational aptitude areas was estimated on the basis of relationships among scores on the various composites. These estimates are at best approximations of overlap that would occur in predicted performance in the many different groups of Army MOS. The overall contribution these newly developed measures could make to differential classification as part of the aptitude area system could not be appraised in a study concentrating on--and limited to--selection for electronics and electrical Army jobs. Their effectiveness as part of the total battery will be appraised in an across-the-board differential validity analysis of operational and newly developed tests designed to provide the basis for a major revision of the Army Classification Battery and reconstitution of the aptitude area composites. Such a major revision, responsive to consistent trends in the Army's job structure and incorporating new developments in testing, is scheduled for operational implementation in 1966.

CONSTRUCTION AND VALIDATION OF THE EXPERIMENTAL ELECTRONICS SELECTION BATTERY

TECHNICAL SUPPLEMENT

TECHNICAL SUPPLEMENT

The test development program focused on identifying personnel having the aptitude and ability to complete training and perform successfully in electronics as distinguished from electrical MOS. Several research studies were integral to the research program which culminated in development of the experimental battery.

PRIOR APRO STUDIES

The ACB vs Success in Army School Courses

The initial study reevaluated tests of the Army Classification Battery and aptitude area composites as predictors of success in several electronics and electrical maintenance Army school courses (Helme and White, 1958). Operational aptitude area composites and two-test weighted composites predesignated as logical alternatives were validated against school criteria. The Electronics Aptitude Area (EL) was the most effective composite for predicting success in the electronics courses. None of the other predesignated composites provided any increment in prediction. For the electrical maintenance courses, the General Maintenance Aptitude Area (GM) resulted as the most effective predictor.

On the basis of these results, research effort concentrated on differentiating between jobs requiring complex electronics abilities and those requiring electrical-mechanical abilities. Implicit in this approach was the need for new measures having a greater sensitivity to those personal characteristics and abilities which are differentially related to success in the two categories of courses.

The Army Classification Battery and Job Success

Graduates of the same five electronics courses and two electrical maintenance courses used in the study described above formed a separate sample for evaluation of selected ACB composites as predictors of on-the-job success (Sharp, Helme, and White, 1958). The criterion of success was derived from supervisor and associate performance ratings. The EL aptitude area was the best predictor for four of the five electronics jobs. Neither the EL nor the General Maintenance (GM) aptitude area had satisfactory validity for the one other electronics job. For one electrical job, the Motor Maintenance Aptitude Area (MM) was superior to both EL and GM, a logical alternative selector. None of the three composites was satisfactory for predicting success in the other electrical job. Final course grade was found to be no better predictor than the more valid of the aptitude areas. Finally, and perhaps more important, the general level of prediction was lower than the level usually found in studies involving job success criteria, an indication of the need for improved tests to tap those factors related to job performance which were not being adequately measured by the ACB and for more sensitive and reliable criteria against which to evaluate such tests.

Factors Important to Electronics Success

Concomitantly with the foregoing studies, a comprehensive analysis of the skills, knowledge, interest, and personal factors important to training and on-job success in electronics was undertaken (Goldstein, 1958). This analysis covered past research, training methods, training facilities, the nature of the job demands, and reenlistment behavior. While much information was obtained from a review of related research, the survey emphasized information obtained in conferences with cognizant personnel in other research organizations and visits to Army electronics schools and Army Nike sites. The conclusion was reached that success in an electronics assignment is related to aptitude and ability factors in addition to those measured by the ACB, to specific information in electronics areas acquired prior to Army service, and to personality, background, and experiential factors. Development of information tests, new personality tests, and noncognitive tests seemed to offer the greatest promise for improving the selection of personnel for electronics jobs.

EXPERIMENTAL ELECTRONICS SELECTION INSTRUMENTS

An experimental Electronics Selection Battery (ESB) was specifically oriented toward measuring characteristics necessary to success in electronics work and toward differentiating between potentialities for the more complex electronics jobs and electrical repair and maintenance jobs (Goldberg and Castelnovo, 1960). In selecting, adapting, and constructing tests for the battery, careful consideration was given to tests being used by the various military services for selection of electronics personnel. Where promising, items and even complete tests from these sources were included in the ESB. Additional items and tests were constructed specifically for the ESB. The resultant battery was made up of 15 tests--three information measures, five reasoning ability measures, six noncognitive ability measures, and one personality background measure. On a pilot run, the tests were found to have an appropriate range of difficulty, and the test scores to have acceptable spread. Below is a brief description of each of the tests:

<u>Information Measures</u>

<u>Mathematics Test</u>. An 80-item test ordered into four 20-item sections as follows: Arithmetic, Algebra, Geometry and Trigonometry, and Graph Reading. This was the first test in the battery and 75 minutes were allowed for completion.

General Science and Radio Information Test. A 70-item test--50 general science items and 20 radio information items. This was the second test in the battery and had a time limit of 35 minutes.

General Electrical Information Test. A 62-item test based on the type of information which could be gained from practical experience, popular electrical and electronics journals, and high school courses. This was the fifteenth test in the battery and had a time limit of 45 minutes.

Reasoning Ability Measures

Letter Combinations Test. A 30-item test in which the examinee is asked to choose from four groups of letters the one group which is somehow different from the other three. This was the fourth test in the battery and had a time limit of 6 minutes.

Figure Analogies Test. A 72-item test in which the examinee's understanding of relationships among geometric figures is measured. This was the fifth test in the battery and had a time limit of 40 minutes.

Verbal Analogies Test. A 70-item test of ability to determine the relationships between things in which the examinee completes a four-word analogy. This was the sixth test in the battery and had a time limit of 30 minutes.

Data Flow Analysis Test. A 23-item test of the type of reasoning involved in systems analysis (trouble shooting). This was the twelfth test in the battery and had a time limit of 25 minutes.

Following Directions Test. A factorially complex 169-item test involving memory and reasoning under speeded conditions. This was the thirteenth test in the battery and had a time limit of 20 minutes.

Noncognitive Abilities Measures

Object Completion Test. A 30-item test of Gestalt perception involving the ability to recognize a pattern or object partially occluded in an irregular checkerboard ground. This was the third test in the battery and had a time limit of 12 minutes.

Dial Reading Test. A 57-item test of carefulness as measured by accuracy in reading printed dials. This was the seventh test in the battery and had a time limit of 15 minutes.

Table Reading 1. A 42-item test of carefulness involving the ability to read two parameter tables quickly and accurately. This test was the eighth in the battery and had a time limit of 12 minutes.

Table Reading 2. A 43-item test of carefulness involving the ability to select the appropriate table and then to read four parameters within the table quickly and accurately. This test was the ninth in the battery and had a time limit of 10 minutes.

Directional Plotting Test. A 47-item test designed to measure carefulness in reading a chart and determining direction under speed requirements. This was the tenth test in the battery and had a time limit of 20 minutes.

Spatial Visualization. A 44-item test requiring the subject to visualize three-dimensional forms from a verbal description in order to solve problems about these forms. This was the eleventh test in the battery and had a time limit of 36 minutes.

Personality and Background Measure

Personal Inventory for Electronics. A 425-item inventory including measures of conscientiousness, persistence, stability, attitudes toward schooling, work, authority, and information regarding background, activities, and interests. This was the fourteenth test in the battery. Approximately two hours were required to permit everyone to complete the inventory. An item analysis of the inventory resulted in two separate scoring keys. The electronics MOS key (PIE, high) included 69 items and the electrical MOS key (PIE, low), 71 items (Castelnovo and Cook, 1960).

VALIDATION OF THE ELECTRONICS SELECTION BATTERY

Criterion Measures

Final course grade was the criterion of training success. The criterion of job performance was a rating on overall value to the organization. An individual's rating was computed by adding the mean of the ratings made by his associates to the mean of ratings made by his supervisors and taking the average of the two. All men included in the sample were rated by at least two supervisors who had had opportunity to observe their work for no less than two months. Both associate and supervisor ratings were obtained on a specially constructed 15-point scale. An extensive survey of related research, examination of job descriptions, and interviews with electrical and electronics personnel at schools and in the field identified six performance factors and a number of personal qualities as important in evaluating proficiency of electronics and electrical maintenance personnel. A distillation of these factors was incorporated into a rating form which permitted separate ratings for the various performance factors and personal qualities. In addition, a section was provided where a ratee's overall value to an organization could be evaluated. This gave the rater a chance to integrate his evaluations on the preceding specific factors with all additional information he considered important and to express this as a single rating on a 15-point scale. The rating form was pretested with electronics personnel. No difficulty was experienced, and reactions to the form, format, and content were favorable. The reliability on the on-job performance ratings, determined by Ebel's method for intra-class correlation (Ebel, 1951) which is essentially an average intercorrelation, was a respectable .76 for the Electronics MOS (sample 6 in Table 1) and .71 for Electrical MOS (sample 7).

Table 1

BREAKOUT OF TOTAL SAMPLE INTO SUBSAMPLES

Subsample No.	Designation	N
1	Electronics School (Validation)	165
2	Electrical School (Validation)	318
4	Electronics School (Cross validation)	161
5	Electrical School (Cross validation)	319
6[a]	Electronic On-Job (Validation)	279
7[a]	Electrical On-Job (Validation)	447
8	Electronics Sample 1 + 4 (Follow-up)	49
9	Electrical Sample 2 + 5 (Follow-up)	108

[a]Samples also used for item analysis of Personal Inventory for Electronics.

Sampling and Data Collection

Since it was not feasible to include an adequate sample of men from each of 95 MOS for which EL was the selector, a nucleus of MOS was identified which could be categorized by expert judgment according to the complexity of the electrical-electronic abilities required. Three such categories were delineated, high, intermediate, and low complexity. The intermediate category was subsequently abandoned because it contained too few individuals. Selection of the specific MOS to comprise the categories was based on several considerations, salient among them the likelihood of an acute shortage of qualified personnel for vital jobs, the perceived representativeness of an MOS for several similar MOS, and the estimated number of men in school and job assignments available for testing. The MOS included in the study are shown in Figure 2 of the basic report.

During the period from March through December 1959, the experimental battery was administered to approximately 4000 men about to undergo MOS training at Fort Monmouth, New Jersey, Fort Gordon, Georgia, and Fort Bliss, Texas. In June, October, and November 1959, the battery was administered to approximately 1500 men with electronics MOS assigned to Nike installations in the Sixth Air Defense Region or working in selected electronics MOS in Ordnance, Signal, Infantry, Armored and Artillery Branches in USAREUR. All personnel were in their first enlistment, and were less than 26 years of age. Concomitantly, Performance Evaluation Forms were administered to peers and supervisors for the on-job incumbents. Provision was made for obtaining final course grades for the school trainees to whom the tests were administered, as well as supervisory performance evaluations after the men had served six months on the job. Form 20 data were obtained for both school and on-job personnel.

All tests in the battery were administered to the training school samples. Only nine were administered to the on-job samples, because of time constraints. Since the on-job samples generally could not be made available for more than one day, the battery was pared down to six hours testing. In deciding which tests should be excluded for the on-job samples, the following factors were considered: (1) the extent to which a test appeared to be a measure of on-job achievement rather than a predictor, (2) the extent to which a test was judged to be a general intellectual functioning measure rather than a measure of specific job related abilities, (3) and the magnitude of the validity coefficients obtained for the same or similar tests for electronics jobs in the Air Force. The six tests omitted on this basis were: General Science and Radio Information, General Electrical Information, Dial Reading, Table Reading 2, Figure Analogies, and Verbal Analogies.

Statistical Analysis

Data were screened for completeness and compatibility with sampling requisites. This screening reduced the number of usable cases to 963 school personnel and 726 on-job personnel. Within each of these groups, separate samples were constituted for high level electronics MOS and lower-level electrical MOS. To provide for cross validation, the electronics and electrical school samples were each divided into two subsamples on the basis of a rank ordering on the EL aptitude area. Individuals were assigned to the subsamples on an alternate basis starting from the highest score. Finally two additional samples, one for Electronics the other for Electrical MOS, were composed of men in the school samples for whom on-job follow-up performance ratings were later received. The sample breakout is shown in Table 1.

The Personal Inventory for Electronics was item analyzed, using two on-job samples (6 and 7) in order to establish separate scoring keys for the electronics and electrical MOS. This procedure resulted in an electronics measure of 69 items and an electrical measure of 71 items. Items selected all had significant biserial r's ($P < .05$) and P values between .10 and .90.

Scores on each ESB and ACB measure were correlated (product moment) with school grade or performance rating as appropriate (Appendix Tables A-1 and A-2). The intercorrelations of all tests, both ACB and ESB, were computed. All validity coefficients were corrected for multivariate restriction in range (selection on all ACB tests) using a standard matrix of ACB tests values.1/ Test selection and compositing procedures were then applied considering both ACB and ESB tests but using subsamples 1, 2, 6, and 7 only, keeping the other subsamples for cross validation of the selected test composites. Heavy reliance was placed on correlation of sums techniques for compositing. That is, validity coefficients for composites of test scores were computed by substituting in the appropriate correlation of sums formula the validity coefficients of the tests in a given composite and their intercorrelations. This technique was supplemented by information obtained from computing the complete multiple regression and from application of the Wherry-Doolittle test selection procedure.

RESULTS

Initial Compositing

In addition to considerations of optimizing absolute and differential validity for both school and on-job performance, emphasis was placed on limiting the number of tests to be added to the ACB and the number of tests in a selector composite. In the event new measures were considered for incorporation in the ACB, they should be compatible with the basic structure of the aptitude area system, in which selectors are two-test composites, unit-weighted or unit and double-weighted. The prevailing structure was adopted after research had shown that there is little loss

1/ The standard matrix used for correction of restriction in range was based on full length scores on all current ACB tests administered in 1958 to an input sample stratified on AFQT to be representative of a World War II mobilization population (Katz, 1962).

in validity when unit-weighted two-test composites are used instead of beta-weighted two-, three-, or even ten-test composites, and that double-weighting the specific test in a composite approximates obtained beta weights (Karcher, Zeidner, and Brueckel, 1954).

The baseline for evaluating the effectiveness of any change in selector was the present Electronics Aptitude Area (Mechanical Aptitude Test plus Electronics Information Test, the latter double weighted) in terms of absolute validity, differential validity, and independence of other aptitude areas.

The more promising test composites are shown in Table 2. The most useful predictor of success in electronics MOS in both school and job samples was a composite of the Arithmetic Reasoning Test, the Electronics Information Test (both of the ACB), and the Personal Inventory for Electronics, high complexity measure. A composite of the Automotive Information Test and the Personal Inventory for Electronics, low complexity was selected for predicting success in electrical MOS. Double weighting the Personal Inventory for Electronics (low complexity) yielded an increase in differential validity and also a reduction in overlap with other aptitude areas. Table 3 shows the correlational relationship between these composites and existing ACB aptitude area composites in the school samples.

These results were a good indication that an improvement in the selection of personnel likely to succeed in electronics MOS and electrical MOS might be relized without major revamping of the ACB. Introduction of one new test--the Personal Inventory for Electronics--would provide measures predictive of success in the electronics-electrical domain at both high complexity and low complexity levels. These two measures, in combination with scores on other appropriate ACB tests, would provide more valid prediction of success in Electronics MOS and Electrical MOS, as well as better differentiation between the two, than does the current EL selector, or, in fact, any other operational aptitude area.

Because the new experimental composites included ACB tests which also form part of other aptitude area composites, correlation between the new composites and some operational composites was relatively high (Table 3). However, the average correlation of the new composite with the other seven aptitude areas was still less than that of EL with the same seven aptitude areas ($\bar{r}$ = .64 and .71 respectively using Fisher's z transformation for the computations).

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Table 2

MOST PROMISING COMPOSITES AND THEIR VALIDITY COEFFICIENTS

Most Promising Composites	Validity Coefficients			
	School		On-Job	
	Electronics MOS (N = 165)	Electrical MOS (N = 318)	Electronics MOS (N = 279)	Electrical MOS (N = 447)
MA + 2 ELI (current)	.71	.49	.30	.30
Math Total + ELI + PIE, high	.76	.52	.39	.29
Math Total + ELI	.77	.52	.34	.30
Math Total + PIE, high	.73	.48	.40	.25
Math Total + General Electrical	.77	.52	---	---
AR + ELI + PIE, high	.75	.53	.35	.30
Data Flow + PIE, low	.42	.56	.25	.32
Table Reading 2, PIE, low	.41	.58	---	---
AI + PIE, low	.40	.48	.32	.43
AI + 2 PIE, low	.36	.47	.30	.42
AR + ELI	.75	.52	.28	.31
AR + PIE, high	.70	.52	.35	.26
All Tests - Multiple R	.83	.67	.46	.51

Table 3

INTERCORRELATION OF SELECTED COMPOSITES AND
EXISTING ACB APTITUDE AREAS FOR SCHOOL SAMPLES

Selected Composites and Current Aptitude Areas	AI + 2PIE, low		AR + ELI + PIE, high		MA + 2ELI (EL)	
	Sample		Sample		Sample	
	1 (N = 165)	2 (N = 318)	1 (N = 165)	2 (N = 318)	1 (N = 165)	2 (N = 318)
AI + 2 PIE, low	1.00	1.00	.53	.60	.54	.61
AR + ELI + PIE, high	.53	.60	1.00	1.00	.91	.91
MA + 2 ELI (EL)	.54	.61	.91	.91	1.00	1.00
AR + 2 PA (CO_A)	.37	.42	.80	.80	.68	.68
PA + 2 MA (CO_B)	.52	.57	.77	.77	.84	.84
PA + 2 SM (GM)	.54	.61	.79	.79	.78	.78
MA + 2 AI (MM)	.80	.86	.70	.70	.79	.79
VE + 2 ACS (CL)	.31	.39	.68	.68	.55	.55
VE + AR (GT)	.35	.45	.84	.85	.68	.68
VE + 2 ARC (RC)	.28	.35	.60	.60	.53	.53

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The composites named above were slightly less effective, from the standpoint higher of absolute validity or of differential validity, than some other selectors resulting from the compositing procedure (Table 2). However, the more efficient composites in the school samples included one or more additional experimental measures which would entail additional changes in the existing ACB. Also, some would require validation against on-job performance.

To determine whether a more sizable increment in validity might be achieved by use of valid material without appreciably increasing time and processing effort required for the ACB, an item analysis of the three additional most promising tests was conducted. The Mathematics Test was included as the most valid single test for school success in Electronics MOS, and second only to the Personal Inventory for Electronics, high complexity, for on-job performance in Electronics MOS. The General Electrical Information Test was used instead of the Electronics Information (ELI) test of the ACB for which item scores were not available. The experimental test appeared similar to ELI in content, correlation with other ACB tests, and obtained validity coefficients. Only the radio items of the General Electrical Information Test were included, as being more specific to the MOS under consideration than the remaining items and less duplicative of more general items in other tests. Item analysis in two school samples resulted in selection of 26 items from the Mathematics test, 26 items from the General Electrical Information Test, and 10 radio items. All items selected had significant biserial r's ($P < .05$) and P values between .15 and .85. These 62 items were scored for all members of school subsamples 4 and 5 who had completed the parent tests up through the highest numbered items selected. This restriction appeared to have a negligible effect on the distribution of criterion scores as evidenced by the means and SD's shown in Table 4. The total number correct of these 62 items was used as the score for a new predictor variable designated RME, which was included in the cross validity analysis.

Table 4

CRITERION MEANS AND SD's OF SCHOOL SUBSAMPLES 4 AND 5, AND THE SAME SUBSAMPLES RESTRICTED TO THOSE WHO COMPLETED ALL RME ITEMS

	Subsample 4			Subsample 5		
		Mean	SD	N	Mean	SD
Total sample	161	84.16	6.57	319	85.53	5.90
Restricted sample (completed RME items)	113	84.25	6.96	183	85.90	5.87

Cross Validation

Unbiased validity coefficients, corrected for multivariate restriction in range, of more valid tests and appropriate composites were computed in school subsamples 4 and 5 (Table 5). Also shown in Table 5 are estimates of unbiased validity coefficients in the follow-up samples of on-job personnel who had been in the school samples. N's in the latter samples were inadequate for other than supportive indications of relative validity of initial tests and composites. Coefficients were not computed in the even smaller samples in which RME data were available. The means, standard deviations, and validity coefficients for all ACB and experimental Electronics Selection Battery tests for both the full and retricted school and on-job cross-validation sample (subsamples 4, 5, 8, and 9) are contained in Appendix Tables A-3 and A-4.

The composite previously selected as the most useful selector for Electronics MOS--AR + PIE, high + ELI--had higher absolute and differential validity on cross validation than did EL, although differences were smaller than in the original analysis. The newly derived composite RME + PIE, high and the RME alone were each more valid for electronics MOS than was EL in the school samples. No appropriate full samples were available in which unbiased estimates of the RME or the new composite could be obtained. However, means and standard deviations of scores on all tests were much the same in full school samples and in samples reduced to those who had completed all items through the highest number selected on the RME parent tests (Appendix Table A-3). While some shrinkage would be likely, there is no reason to believe that the relative effectiveness of the selector composites would shift. In fact, this composite might have a greater margin of effectiveness over the EL in the on-job setting than it did in the school setting, in view of the fact that personal inventories focusing on interests, experience, and personality factors are typically, relative to other predictors, more useful in predicting job success than in predicting school success. On the other hand, the PIE validity coefficients obtained in this study may be somewhat inflated by a predisposition on the part of the sample members to respond in a particular way based on the fact that they were already working in an electrical or electronics job. This may be somewhat academic, since completion of school training is a prerequisite to job assignment.

Independence of the New Measures

The stated objective of differentiating between potential for electronics and for electrical MOS was satisfactorily met by several composites. The AR + PIE, high + ELI composite was a better predictor of both school and job performance in electronics MOS than in electrical MOS. The AI + 2 PIE, low composite was more valid for electrical than for electronics MOS. It was, in fact, the only composite to equal or surpass EL in validity and also predict school and on-job success better in electrical MOS than in electronics MOS.

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Table 5

UNBIASED VALIDITY COEFFICIENTS OF PREVIOUSLY SELECTED COMPOSITES, A NEW PREDICTOR, AND A COMPOSITE INVOLVING THE NEW PREDICTOR

Tests and Composites	Restricted School Sample (Completed RME Items)		Complete School Sample		Complete Follow-up Sample	
	High MOS Sample 4 (N = 113)	Low MOS Sample 5 (N = 183)	High MOS Sample 4 (N = 161)	Low MOS Sample 5 (N = 319)	High MOS Sample 8 (N = 49)	Low MOS Sample 9 (N = 108)
AR	.54	.54	.66	.49	.45	.30
ELI	.76	.46	.68	.43	.44	.21
AI	.59	.45	.55	.39	.41	.33
PIE, high	.58	.42	.49	.34	.32	.15
PIE, low	.29	.49	.27	.42	.23	.36
RME	.77	.57	---	---	---	---
AR + PIE, high + ELI	.79	.59	.78	.54	.50	.29
AI + 2 PIE, low	.45	.52	.41	.45	.35	.39
RME + PIE, high	.76	.56	---	---	---	---
EL	.76	.51	.74	.48	.44	.26

A second aspect of differential validity is the degree of independence from other aptitude areas. To what extent do the new composites measure abilities specific to the electronics and/or electrical occupational area rather than abilities common to other areas? The best estimate of this overlap within the limits of present data was the average correlation of each composite of interest with seven other Aptitude Areas. Using the r's of subsamples 4 and 5 corrected for multivariate restriction and employing Fisher's z transformation, the results shown in Table 6 were obtained. The complete table of r's for these subsamples is contained in Appendix Table A-5.

Table 6

AVERAGE CORRELATION OF SELECTED PREDICTORS WITH APTITUDE AREA COMPOSITES
(Reduced Subsamples 4 plus 5. N = 296)

Average Correlation with:	EL	AR + PIE, high + ELI	AI + 2PIE, low	RME + PIE, high	RME
7 aptitude areas	.71	.74	.58	.61	.67
7 aptitude areas plus AI + 2 PIE, low	---	.66	.58	.59	.62

The AR + PIE, high + ELI composite offered no reduction in correlation with other aptitude areas, whereas AI + 2 PIE, low effected considerable improvement. When both AR + PIE, high + ELI (for electronics MOS) and AI + 2 PIE, low (for electrical MOS) were included in the calculations, the average of the correlation coefficients dropped perceptibly.

The RME + PIE, high composite, which on the basis of results in the school samples appeared to be a promising predictor (equivalent to EL) of electronics performance, was also the most satisfactory in terms of indicated overlap with other aptitude areas.

CONCLUSIONS

From analysis of the experimental selection instruments, three measures have emerged as having good potential for differentiating between abilities required for electronics MOS and those required for electrical MOS of lower complexity. Two of the measures are obtained by applying different scoring keys to a single instrument, the Personal Inventory for Electronics. A third measure, the RME, was made up of valid radio, mathematics, and electrical information items from several of the tests. When composites including these measures were evaluated as predictors of performance in electronics MOS as opposed to electrical MOS, the following conclusions were drawn:

1. There appear to be ability and personal factors related to success in electronics MOS which are distinct and distinguishable from those related to success in electrical MOS.

2. Factors associated with performance in electronics MOS were delineated and measured to a greater degree by predictors in the present study, both experimental and operational, than were factors associated with performance in electrical MOS.

3. A composite of the high complexity score of the Personal Inventory for Electronics with two ACB tests, Arithmetic Reasoning and Electronics Information, was the most satisfactory selector for both school and job performance in electronics MOS as distinguished from electrical MOS, and superior to the EL aptitude area, which is the operational selector for both job categories. However, relationship of the experimental composite to the operational aptitude areas was disappointingly high--slightly higher, in fact, than that of EL to the other seven aptitude areas. For electronics school success, the RME when combined with the PIE, high was as effective as EL and resulted in less overlap with other aptitude areas than did any other electronics composite.

4. Another composite, formed by double weighting the low complexity score of the Personel Inventory for Electronics in combination with the Automotive Information Test of the ACB, was as effective a predictor of electrical MOS performance as EL, and a better predictor of school and job success in electrical MOS than in electronics MOS. This composite had the further advantage of yielding a lower average correlation with operational aptitude areas than did any other composite considered.

5. Estimates of overlap with aptitude area composites indicated that introduction of the two measures--but not measures for electronics selection alone--would reduce overlap. When the AI + 2 PIE, low composite was included in the calculations, the average correlation of the AR + PIE, high + ELI with other composites was reduced to below that obtained for EL.

6. New tests are introduced into the ACB with the objective of improving the differential classification of enlisted input as a whole. Evaluation of the contribution these measures could make to overall differential classification as part of the aptitude area system remains to be determined. This determination will rest on comprehensive studies in which validity of all composites or components thereof is appraised in terms of differential prediction achieved for all important groups of related jobs.

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APPENDIX

Statistical Tables from which Results Presented in the Technical Supplement were Abstracted

Table A-1

MEANS, STANDARD DEVIATIONS AND VALIDITY COEFFICIENTS OF EXPERIMENTAL ELECTRONICS SELECTION BATTERY AND ACB TESTS
(School Samples 1 and 2)

Variables	Sample 1-Electronics (N = 165)			Sample 2-Electrical (N = 318)		
	Mean	S.D.	r[a]	Mean	S.D.	r[a]
Criterion (Final Course Grade)	83.77	7.82	---	85.94	6.28	---
Math Total	41.54	16.41	.70	31.27	13.41	.48
Object Completion	19.73	4.36	.20	18.31	4.82	.35
Letter Combinations	16.23	4.86	.46	14.21	4.67	.40
Table Reading 1	28.57	11.20	.43	23.04	11.31	.48
Directional Plotting	15.06	10.77	.58	10.40	8.81	.41
Spatial Visualization	15.88	11.31	.56	9.97	9.51	.51
Data Flow	16.70	4.77	.42	14.36	5.84	.50
Following Directions	58.52	22.98	.54	34.50	25.12	.47
General Science and Radio Info.	41.89	15.00	.66	31.52	13.03	.48
Figure Analogies	42.44	12.91	.52	37.36	13.78	.47
Verbal Analogies	23.13	9.39	.55	17.92	8.18	.42
Dial Reading	32.98	12.57	.51	27.05	13.49	.52
Table Reading 2	25.38	11.48	.35	21.84	11.97	.53
General Electrical Information	37.95	14.05	.67	26.69	11.58	.44
Personal Inventory (PIE, high)	31.78	7.19	.49	29.31	6.28	.34
Personal Inventory (PIE, low)	43.15	8.28	.25	40.75	9.02	.41
ARC	104.41	20.00	.43	95.99	20.00	.33
VE	118.96	20.00	.61	106.36	20.00	.41
AR	119.04	20.00	.66	105.32	20.00	.49
PA	124.70	20.00	.54	111.33	20.00	.49
MA	122.04	20.00	.62	110.46	20.00	.50
ACS	116.12	20.00	.50	107.35	20.00	.37
SM	119.87	20.00	.58	109.67	20.00	.50
AI	112.64	20.00	.42	105.50	20.00	.44
ELI	125.94	20.00	.67	113.46	20.00	.43

[a]Corrected for multivariate restriction in range on ACB tests.

Table A-2

MEANS, STANDARD DEVIATIONS AND VALIDITY COEFFICIENTS OF EXPERIMENTAL ELECTRONICS SELECTION BATTERY AND ACB TESTS
(On-Job Samples 6 and 7)

Variables	Sample 6-Electronics (N = 279)			Sample 7-Electrical (N = 419)		
	Mean	S.D.	r[a]	Mean	S.D.	r[a]
Criterion (Performance ratings)	9.72	1.49	---	9.31	1.61	---
Math Total	46.28	15.86	.32	30.18	12.48	.25
Object Completion	20.31	4.96	.10	18.49	4.89	.13
Letter Combinations	17.29	4.46	.13	14.92	4.38	.15
Table Reading 1	35.76	8.65	.21	29.31	10.39	.21
Directional Plotting	22.19	12,14	.18	14.26	9.71	.27
Spatial Visualization	19.16	13.84	.18	9.05	9.26	.17
Data Flow	19.91	3.41	.15	13.85	5.50	.18
Following Directions	58.82	21.43	.21	42.80	24.18	.20
Personal Inventory (PIE, high)	35.65	8.14	.32	28.74	6.15	.15
Personal Inventory (PIE, low)	45.26	8.17	.23	39.11	10.93	.36
ARC	102.80	20.00	.22	94.04	20.00	.11
VE	120.86	20.00	.17	105.48	20.00	.20
AR	122.19	20.00	.22	103.24	20.00	.25
PA	123.23	20.00	.20	107.44	20.00	.19
MA	120.06	20.00	.26	107.55	20.00	.23
ACS	109.68	20.00	.20	101.57	20.00	.26
SM	120.17	20.00	.26	106.49	20.00	.27
AI	114.57	20.00	.32	103.48	20.00	.40
ELI	123.02	20.00	.28	108.42	20.00	.29

[a]Corrected for multivariate restriction in range on ACB tests.

Table A-3

MEANS, STANDARD DEVIATIONS AND VALIDITY COEFFICIENTS OF EXPERIMENTAL ELECTRONICS SELECTION BATTERY AND ACB TESTS

(School Samples 4 and 5[a])

Variables	Sample 4-Electronics (N = 113)			Sample 5-Electrical (N = 183)		
	Mean	S.D.	r[b]	Mean	S.D.	r[b]
Criterion (Final Course Grade)	84.16 (84.25)[c]	8.07 (8.72)	1. (1.)	85.53 (85.90)	6.34 (6.39)	1. (1.)
Math Total	41.33 (42.14)	16.90 (17.35)	.56 (.62)	30.43 (32.11)	13.53 (12.46)	.51 (.57)
Object Completion	19.44 (19.06)	5.40 (5.74)	.29 (.35)	18.50 (18.79)	4.44 (4.35)	.31 (.29)
Letter Combinations	15.53 (16.09)	5.81 (4.76)	.33 (.09)	14.46 (14.70)	4.90 (4.69)	.40 (.36)
Table Reading 1	27.60 (27.58)	11.91 (11.61)	.40 (.34)	23.87 (24.33)	11.56 (11.99)	.52 (.56)
Directional Plotting	15.08 (14.27)	10.55 (10.29)	.40 (.46)	10.88 (10.84)	8.52 (8.27)	.46 (.48)
Spatial Visualization	15.01 (14.63)	12.33 (12.83)	.60 (.65)	10.12 (9.89)	10.06 (9.91)	.48 (.49)
Data Flow	17.01 (17.07)	5.33 (4.91)	.58 (.58)	14.02 (14.16)	6.06 (6.09)	.51 (.51)
Following Directions	54.16 (54.71)	26.61 (26.51)	.35 (.35)	35.76 (36.97)	26.94 (27.21)	.44 (.41)
General Science and Radio Information	42.18 (43.78)	15.55 (15.41)	.73 (.77)	31.35 (33.10)	12.03 (12.03)	.50 (.52)
Figure Analogies	41.01 (39.88)	14.72 (15.76)	.49 (.62)	36.64 (36.92)	15.03 (15.69)	.51 (.52)
Verbal Analogies	22.59 (22.84)	9.45 (9.85)	.48 (.55)	18.35 (18.76)	8.06 (8.08)	.47 (.49)
Dial Reading	33.42 (33.31)	13.47 (12.25)	.44 (.45)	25.75 (27.23)	12.52 (11.86)	.48 (.47)

Table A-3 (continued)

Variables	Sample 4-Electronics (N = 113) Mean	S.D.	r[b]	Sample 5-Electrical (N = 183) Mean	S.D.	r[b]
Table Reading 2	24.56 (24.13)	11.59 (10.82)	.30 (.31)	21.53 (22.43)	11.31 (11.13)	.54 (.56)
General Electrical Information	37.63 (38.88)	13.88 (13.50)	.73 (.75)	28.75 (30.02)	11.26 (11.61)	.44 (.54)
ARC	103.73 (103.56)	20.00 (20.80)	.29 (.24)	94.24 (94.35)	20.00 (16.26)	.39 (.38)
VE	118.46 (119.40)	20.00 (15.07)	.48 (.51)	108.17 (108.60)	20.00 (18.44)	.46 (.44)
AR	120.15 (119.47)	20.00 (16.93)	.54 (.54)	105.02 (105.46)	20.00 (18.76)	.53 (.54)
PA	121.98 (122.11)	20.00 (16.11)	.56 (.53)	109.74 (108.80)	20.00 (17.52)	.50 (.51)
MA	123.30 (123.91)	20.00 (15.47)	.57 (.56)	110.37 (111.93)	20.00 ([illegible].58)	.48 (.47)
ACS	116.07 (116.37)	20.00 (13.16)	.31 (.38)	106.56 (107.41)	20.00 (16.34)	.40 (.40)
SM	117.64 (119.95)	20.00 (11.96)	.56 (.58)	109.05 (110.79)	20.00 (15.47)	.45 (.45)
AI	111.29 (112.97)	20.00 (14.47)	.55 (.59)	104.36 (106.47)	20.00 (16.23)	.39 (.45)
ELI	125.69 (126.60)	20.00 (13.94)	.73 (.76)	113.18 (114.12)	20.00 (13.86)	.42 (.46)
PIE, high	32.39 (32.88)	6.99 (6.89)	.56 (.58)	28.79 (29.51)	6.36 (6.59)	.30 (.42)
PIE, low	43.19 (43.82)	7.73 (8.03)	.27 (.29)	40.85 (42.15)	9.48 (9.17)	.42 (.49)

[a]Regular entries are for full samples.

[b]Corrected for multivariate restriction in range on ACB tests.

[c]Entries in parentheses are for samples reduced to those who completed all items up through the highest number selected on the parent tests of RME.

Table A-4

MEANS, STANDARD DEVIATIONS AND VALIDITY COEFFICIENTS OF EXPERIMENTAL ELECTRONICS SELECTION BATTERY AND ACB TESTS
(School Follow-up Samples 8 and 9)

Variables	Sample 8-Electronics (N = 49)			Sample 9-Electrical (N = 108)		
	Mean	S.D.	r[a]	Mean	S.D.	r[a]
Criterion (Final Course Grade)	85.12	8.29	.44	85.35	5.86	.29
Math Total	43.59	17.21	.55	30.87	13.27	.28
Object Completion	20.14	5.25	.07	19.08	4.87	.08
Letter Combinations	17.10	4.34	.11	14.31	4.52	.16
Table Reading 1	28.57	10.87	.42	24.47	11.83	.28
Directional Plotting	17.67	11.88	.37	11.35	8.71	.23
Spatial Visualization	17.90	12.35	.36	10.40	10.32	.22
Data Flow	18.35	4.78	.43	14.72	5.64	.34
Following Directions	64.26	16.56	.09	32.92	26.33	.17
General Science and Radio Info.	43.92	17.78	.50	31.54	11.72	.22
Figure Analogies	43.39	12.68	.28	39.88	12.01	.08
Verbal Analogies	23.65	11.15	.28	17.38	7.04	.18
Dial Reading	34.29	13.38	.41	27.76	12.85	.37
Table Reading 2	24.63	11.69	.21	22.13	11.83	.30
General Electrical Information	40.06	15.43	.41	29.54	11.18	.20
ARC	104.16	20.00	.18	94.74	20.00	.13
VE	120.61	20.00	.34	106.70	20.00	.10
AR	122.12	20.00	.45	105.46	20.00	.30
PA	125.84	20.00	.54	112.87	20.00	.32
MA	125.92	20.00	.34	108.96	20.00	.30
ACS	115.47	20.00	.28	105.11	20.00	.24
SM	120.61	20.00	.59	109.70	20.00	.28
AI	113.14	20.00	.41	105.17	20.00	.33
ELI	129.18	20.00	.44	114.81	20.00	.21
PIE, high	33.51	8.08	.32	29.28	6.98	.15
PIE, low	45.38	6.92	.23	40.24	9.66	.36

[a]Corrected for multivariate restriction in range on ACB tests.

Table A-5

CORRELATIONS OF SELECTED PREDICTORS WITH ARMY APTITUDE AREAS FOR SCHOOL CROSS VALIDATION
(Reduced Subsamples 4 and 5)

Selected Predictors	Combat A	Combat B	Electronics	General Maint.	Motor Maint.	Clerical	Gen. Tech.	Radio Code
Subsample 4 (N = 113)								
RME	.73	.71	.85	.74	.60	.57	.72	.58
RME + PIE, high	.66	.63	.80	.69	.60	.46	.61	.48
AR + ELI + PIE, high	.80	.75	.90	.68	.64	.83	.83	.57
AI + 2 PIE, low	.40	.51	.60	.61	.84	.34	.36	.19
EL	.68	.84	1.00	.78	.79	.56	.67	.53
Subsample 5 (N = 183)								
RME	.71	.71	.81	.71	.61	.60	.71	.58
RME + PIE, high	.67	.66	.79	.68	.63	.51	.61	.52
AR + ELI + PIE, high	.81	.76	.90	.79	.69	.67	.84	.60
AI + 2 PIE, low	.54	.64	.71	.69	.89	.45	.53	.37
EL	.68	.83	1.00	.78	.78	.55	.67	.53

AD 23/1,28/4

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U. S. Army Personnel Research Office, OCRD, DA
VALIDATION OF EXPERIMENTAL ELECTRONICS SELECTION BATTERY by
Robert S. Andrews. June 1964. Rept. on Command Systems C-00
Project--40 p. incl tables, figures, 9 Ref.
(USAPRO Technical Research Report 1138)
(DA Project 2J024701A723) Unclassified Report

Accelerated use of electronic systems and equipment in the Army has generated an increasing requirement for means of selecting personnel who can successfully complete electronics training courses and satisfactorily perform in highly critical electronics positions. The present publication summarizes research accomplished in several integrated studies which culminated in development of an experimental electronics selection battery of 15 tests. The component experimental measures--three information, five reasoning ability, six noncognitive ability, one personality background--were evaluated in conjunction with the operational Army Classification Battery (ACB) for effectiveness in differentiating between potential for electronics (high complexity) MOS and electrical (low complexity) MOS. Three measures, two which were derived from a single instrument--the Personal Inventory for Electronics--emerged as the most promising predictors of success in Electronics MOS. The third measure, RME, was composed of radio, mathematics, and electronics information items from several of the tests. These measures will be included in comprehensive studies of experimental and operational predictors as part of the total classification battery and aptitude area system.

AD 23/1,28/4

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AD 23/1,28/4

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