PRL-TDR-64-18

Predicting First Year Achievement of Air Force Academy Cadets Class of 1964

By

Robert E. Miller

Technical Documentary Report PRL-TDR-64-18

July 1964

PERSONNEL RESEARCH LABORATORY
AEROSPACE MEDICAL DIVISION
AIR FORCE SYSTEMS COMMAND
Lackland Air Force Base, Texas

Project 7717, Task 771706

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FOREWORD

The validation of USAFA selection tests has been a joint project of the Academy and the Personnel Research Laboratory since admission of the initial class of 1959. The Academy develops the Selection Battery and collects the data. The Laboratory develops experimental test batteries, carries out data reduction and analysis, and reports the results for each entering class of cadets. Previous reports cover classes 1959 through 1963.

ABSTRACT

Applicants for each Air Force Academy class take a battery of selection tests to establish their qualifications. Entering cadets take an additional battery consisting mainly of nonacademic experimental tests, developed as part of a program for the production of officer selection and classification devices. Both batteries are validated at the end of the fourth class year against academic and nonacademic criteria. In the class of 1964 the criteria were the Academic Standard Score, Cadet Effectiveness Rating (CER), Residualized Cadet Effectiveness Rating (with respect to physical aptitude), Extracurricular Activities Standard Score, Nonacademic Standard Score, and Early Motivational Elimination. Using multiple regression techniques, it was found that there are measures in both the selection and experimental batteries having validity for each of the criteria. Multiple correlations up to .63 were obtained with the Academic score as the criterion, and up to .51 with the CER. Validities are not significantly different from those observed in the class of 1963 for selection tests common to both classes. Previously observed fluctuating validities appear to have stabilized.

This report has been reviewed and is approved.

John Patterson, Col USAF
Commander

A. Carp
Technical Director

Personnel Research Laboratory

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PREDICTING FIRST YEAR ACHIEVEMENT OF AIR FORCE ACADEMY CADETS, CLASS OF 1964

1. PROBLEM

Each year a battery of experimental tests is administered to the entering class at the Air Force Academy. These batteries are part of a research and development program for the production of officer selection and classification tests. During the several years of this program at the Academy, there has been an increasing tendency to construct the batteries primarily from tests which, on empirical or theoretical grounds, were believed to have validity as predictors of nonacademic criteria. The nonacademic criteria of greatest interest have generally been the Cadet Effectiveness Rating (CER) or its equivalent, and Early Motivational Elimination from the Academy. Some tests are included in the experimental batteries primarily to provide data from which the new class may be characterized in terms of selected variables.

Scores derived from each experimental battery are validated when the desired criterion data have become available. Ordinarily, the criteria used are those which mature approximately one year after the test administration. The ultimate objective of these validation studies is to locate test items and scales which have sufficient promise to warrant further development toward possible selection uses, either at the Air Force Academy only or generally throughout the Air Force. Routinely, the selection tests administered by the Academy to candidates for admission are included in the validation studies.

The present report is concerned with the predictive validities of both the selection and experimental batteries administered to the Air Force Academy class of 1964. The criteria are those which matured at the end of the fourth class (freshman) year for this class. They include the academic average and a variety of nonacademic criteria, some of which have not been previously reported in this series.

2. METHOD

The experimental test battery was administered to new cadets in the class of 1964 within a few days of arrival at the Academy. The selection tests had been previously administered at examining centers to applicants for admission to the class. Scores from both batteries were collated with the criterion data at the end of the fourth class year, and product moment correlation coefficients were computed between each predictor and criterion. One of the criteria, Early Motivational Elimination, was actually a dichotomy of retainees vs early motivational eliminees. Validities against this criterion took the form of point-biserial correlations. Means and standard deviations of each predictor and criterion were computed, and all criteria were intercorrelated except Early Motivational Elimination. This was excluded because none of the early eliminee group had scores in other criterion variables.

The class of 1964 initially contained 786 cadets, including 13 turnbacks from previous classes. In validating predictors against each criterion except Early Motivational Elimination, only cadets with complete predictor and criterion data were included. This operation reduced the number of cases for study to 495. In validating predictors against Early Motivational Elimination, cases were not excluded solely because they lacked other criterion data, but all cases eliminated from the Academy for nonmotivational reasons, and cases lacking complete predictor data, were excluded. Thus in the validation against Early Motivational Elimination, there were 616 cases available for study, of which 121 were early motivational eliminees.

In addition to computing product moment correlations between predictors and criteria, a number of multiple linear regression analyses were performed. These yielded multiple correlation coefficients between selected sets of predictors and criteria, the squares of these coefficients, and standard partial regression coefficients for the predictors. Variables were chosen for inclusion in the analyses in such a way that their unique and valid contribution to the total predicted criterion variance could be determined in the context of other predictors. Most analyses were designed either to show the contribution of experimental predictors in contexts primarily of selection tests, or to show the contribution of the Air Force Officer Qualifying Test (AFQT), a selection test, in contexts primarily of other selection tests. At the time the analyses were designed, the utility of the AFOQT in the selection battery was being questioned.

The method of testing the unique and valid contribution of sets of predictors by multiple regression analyses has been described in detail by Bottenberg & Ward (1963). Briefly, the squared multiple validity coefficient of a full set of predictors is compared with the squared coefficient of a subset of these. A hypothesis specifies that the regression weights of all predictors in the full set but not in the subset are zero. The hypothesis is rejected if the value of the test statistic F exceeds the value which cuts off a specified proportion of the area under the F distribution. For the present analyses, the proportion was specified as .01. Rejection of the hypothesis implies that at least one variable in the full set but not in the subset has a nonzero regression weight in the context of the subset. The full set need not contain all the variables under study in relation to a given criterion.

3. VARIABLES

Selection Variables

The selection variables are essentially the same as those used in selecting previous Academy classes. One of these variables, the AFOQT, is the instrument used throughout the Air Force in officer selection and classification programs. The form administered as a selection test for the Academy class of 1964, Form G, yields five standard aptitude scores and four interest scores. In addition, the test yields a special aptitude score used only in the Air Force Academy selection program. This is the Airmanship composite and is the only AFOQT variable weighted into the final selection composite for Academy cadets.

The principal academic predictors in the selection battery are the College Entrance Examination Board (CEEB) tests and High School Rank. The sum of the CEEB Verbal Aptitude and English Composition tests constitutes the CEEB Verbal Composite, while the sum of the Mathematics Aptitude and Intermediate or Advanced Mathematics tests constitutes the CEEB Quantitative Composite. Both composites are actually used in selection, as well as the single tests. Examinees are given the option of taking either the intermediate or advanced level of the mathematics achievement test, but in the validation study no distinction was made between the two levels. High School Rank is the rank in the high school graduating class, with adjustments for the size of the high school class and, in some cases, for college or preparatory school work completed following high school.

An important nonacademic selection test is the Physical Aptitude Examination (PAE). This is a measure of physical strength, coordination, and agility through the use of pushups, shuttle runs, vertical jumps, and similar performances administered individually under standardized conditions. Other nonacademic selection measures are the Athletic and Nonathletic Activities Indexes. These are inventories of participation in, and recognition for, extracurricular activities while in high school.

The Airmanship composite, CEEB tests and composites, High School Rank, and the various nonacademic predictors are weighted and combined to form the Examination Composite, which is used to establish an overall order of merit at the time of selection. The components of this composite and their weights are identical with those in the class of 1963. Adjustments are finally made in the Examination Composite by a panel of rating officers, but these adjustments are not included in the variable as reported here.

Age has been included as an additional selection variable because age limits are imposed as a requirement for selection. Within these limits, however, age does not function as a selection variable. Age is reported in years. The standard aptitude and interest variables of the AFOQT are reported in raw score form. All other selection variables are reported as standard scores or sums of standard scores. The standard score scale used has a mean of 500 and a standard deviation of 100.

Experimental Variables

The experimental variables are reported in raw score form. Data on Years of College were collected during the experimental testing sessions. Attendance at an Academy preparatory school was excluded from consideration. Data on prior college attendance were also collected during the selection process to permit adjustments which might be desired in the High School Rank. However, no prior college work is required for admission.

Among the experimental predictors are two commercial personality tests, both of which have been administered to previous classes. One, the Edwards Personal Preference Schedule (EPPS), is a forced choice instrument measuring 16 variables derived from Murray's system of manifest needs. The other, the Gordon Personal Profile (GPP), is a brief measure of characteristics known to be important to good adjustment in a variety of social and educational situations. An interaction variable was generated from one of the scales of this test and the PAE. Such an interaction accounted for a relatively large proportion of the predicted variance in the Cadet Effectiveness Rating when studied in an earlier class (Creager & Miller, 1961).

Another personality measure used in the experimental battery is the Self Insight Test. This test was developed as an indirect measure of leadership ability through an assessment of personal strengths and weaknesses. Items were derived from lists of strengths and weaknesses collected from cadets in the class of 1961.

An additional test category in the experimental battery is the biographical inventory. One such instrument, the Officer Effectiveness Inventory (OEI), contains biographical and self-descriptive items resembling those in biographical subtests of the AFOQT. The items are concerned with interests, preferences, and past experiences. The test yields nine subtest scores and a total score which is generated from weighted subtests.

Another inventory in the experimental battery is the High School Activities Inventory (HSAI). This instrument is used as a class characterization device with which data can be accumulated for public relations purposes and for counseling Academy applicants. It is also processed to yield scores in athletic, nonathletic, and total extracurricular activities engaged in while in senior high school. In content, it resembles the selection Activities Indexes. The revised scores for the HSAI are weighted to approximate the Activities Indexes. The original HSAI scores are weighted by number of years of participation.

The Cadet Personnel Inventory (CPI) and Answer Sheet Marking (ASM) may be regarded as a sub-battery of experimental tests. The former is a new consolidation of items and scales from tests which proved valid for the prediction of Cadet Effectiveness Ratings in earlier classes. The Communality scale is taken from the Air Force Preference Inventory, the

Dependency and Heteronomy scales are from the Pensacola Z Survey, and the CER scale is a collection of mainly biographical items from several sources. Answer Sheet Marking resembles a conventional test of routine clerical facility, but its scores are interpreted as a measure of carefulness. In the class of 1961 it showed validity as a predictor of Cadet Effectiveness Ratings (Creager & Miller, 1960). These two instruments represent the early stages of a sub-battery in which valid predictors of Cadet Effectiveness Ratings from all previous experimental batteries are being brought together for possible future selection use. These tests are referred to below as the CPI-ASM sub-battery.

Another sub-battery administered to the class of 1964 is composed of the Color-Form, Design Preference, Dot Estimation, Word Knowledge, and Self Crediting tests. These make up a loosely organized sub-battery of tests having in common the objective of measuring factors which are fairly well established in the psychological literature. The criteria in the present validation study may not be the most appropriate for them.

Color-Form is a series of three booklets calling for recognition responses to colored circles, to names of colors, and to names of colors printed in inappropriately colored ink. The booklets are always presented in a fixed order, and the set established by the first two is presumed to create a stressful situation for responding to the third. Each booklet is separately scorable. The score for the third (Color-Form C) is regarded as a measure of ability to perform under stress. The test is further interpreted as a measure of the neatness-responsibility factor.

The Design Preference Test consists of geometric designs of varying complexity, presented in groups of eight. The examinee chooses the design he likes best from each group. It is assumed that examinees whose personality structures are complex, creative, and open to unresolved experiences will tend to prefer the more complex designs. The score is interpreted as a measure of complexity.

Dot Estimation and Word Knowledge are measures of decisiveness. This measurement is accomplished by requiring the performance of tasks which are impossible under the conditions of testing. Dot Estimation requires discrimination between pairs of panels in terms of which member of the pair contains the greater number of dots. Each panel has about the same number of dots, and counting of dots is precluded by the time limits. Word Knowledge is presented as a traditional vocabulary test, but there is no basis for choosing a correct alternative. Both tests are scored in terms of the number of items attempted, and the scores are interpreted as measures of willingness to commit one's self to an answer quickly.

The Self Crediting Test consists of three brief numerical reasoning subtests of increasing difficulty. A conventional numerical ability score may be obtained from each and from the sum of all three. In addition, a Risk score is obtained from each and from the total. This is accomplished by requiring the examinee to "bet" from 1 to 5 points on each subtest. Each correctly answered item is then weighted into the subtest score according to the number of points risked. For each incorrect item, the same number of points is subtracted from the examinee's score on that subtest. The weighted scores are interpreted as a measure of a risk factor or of self-confidence.

An additional experimental measure validated in the class of 1964 is the CER Prediction Composite. This is a weighted composite of PAE, GPP Responsibility, CPI Communality, CPI Heteronomy, and Answer Sheet Marking scores. The weights are approximately the mean raw score weights obtained in multiple linear regression analyses involving these variables in two or more previous classes. This composite may here be regarded as a cross validation of the system containing these predictors and having the Cadet Effectiveness Rating as the criterion.

Criteria

The Academic Standard Score is the total of quality points earned during the fourth class year in standard score form. All courses for which numerical grades were assigned are included in this criterion.

The Cadet Effectiveness Rating (CER) is a measure of performance in the military affairs of the Cadet Wing. Each cadet is rated by all other members of his squadron who are in his class or classes senior to his. These ratings are averaged, and the average is combined with a similar rating by his Air Officer Commanding. This composite is converted to a standard score metric to yield the final CER.[1] Ratings are in the areas of attitude, performance of duty, leadership ability, and bearing and dress. The Residualized CER is a new criterion generated from the CER by removing the variance which is predictable from the PAE. This criterion is thus a measure of cadet effectiveness apart from the influence of physical aptitude. This Residualized CER is the only criterion of which the Academy makes no current use.

The Extracurricular Activities Standard Score is a nonacademic criterion of some interest because, in a service academy setting, extracurricular participation is taken as an important indicator of leadership performance. The score is determined by assigning weights to various recognized activities in proportion to their judged contribution to the status or welfare of the Cadet Wing. Each cadet is graded on a 4-point scale for his performance in each such activity. His score is the sum of the products of his hours of participation, grades, and weights for the activities in which he is involved. The score thus determined is finally converted to standard score form. The sum of this score and the CER standard score constitutes the Nonacademic Standard Score.

The Early Motivational Elimination criterion is more fully described as a dichotomy: retention vs early motivational elimination. This criterion was scored *1* for retention and *0* for early motivational elimination. Cadets eliminated from the Academy for any reason judged to have a significant motivational component are counted as motivational eliminees. An elimination roster as of August 1961 was the basis for this criterion. Thus early eliminees are considered to be those eliminated during the year following admission to the Academy.

4. RESULTS AND CONCLUSIONS

Details of the validation analyses and tables of results are presented in the Appendix. Briefly, the following conclusions may be drawn:

1. Few statistically significant changes in validity are seen between the classes of 1963 and 1964 in tests common to both. No significant changes are seen in the validities of tests or other measures actually used in selection. The statistically nonsignificant changes, however, are in a downward direction in most cases.

2. Changes in means and standard deviations between the two classes suggest that the self-selection process among potential candidates may still be increasing somewhat in rigor with respect to nearly all areas of selection testing.

3. The formerly observed unstable validities against the academic criterion and the CER have become stable, possibly as an effect of stabilized content and methods in the Academy curriculum.

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[1] Beginning with admission of the class of 1965, this criterion was superseded by the Military Rating.

4. The selection tests continue to have relatively high validities for the criteria they are intended to predict. Each criterion is predictable by at least one selection variable. The best single predictors of the Academic Standard Score, the Extracurricular Activities Standard Score, and the Nonacademic Standard Score are found in the selection battery. (Table 1)

5. All criteria are predictable by more than one experimental test. The best single predictors of the CER, Residualized CER, and Early Motivational Elimination are in the experimental battery. Differences in validity between the best selection and experimental tests for a given criterion are small, except where the Academic Standard Score is the criterion. (Table 2)

6. Intercorrelations of the criteria are low where independence of the criteria can be reasonably expected from their definitions. Correlations are fairly high among most other criteria. The correlation between the CER and Residualized CER is very high. (Table 3)

7. The aptitude composites of the AFOQT make a unique and valid contribution to the predicted variance in the Academic Standard Score in the context of several other predictors chosen primarily from the selection battery. (Table 4)

8. The PAE makes a unique and valid contribution to the predicted CER variance in several contexts of other predictors, but not in all contexts studied. The PAE and other tests in combination make a contribution in some contexts, but not in all. The HSAI total score makes a contribution to the predicted CER variance in the contexts in which it was studied. The CPI-ASM sub-battery also makes such a contribution. Selected AFOQT aptitude composites do not. (Tables 5, 6)

9. The CPI-ASM sub-battery and the HSAI total score each separately make a contribution to the predicted variance in the Residualized CER in the same contexts in which they contributed to prediction of the original CER. The selected AFOQT composites do not so contribute. (Tables 7, 8)

10. A fairly extensive set of variables from both the selection and experimental batteries does not contribute to prediction of the Extracurricular Activities Standard Score in the context of the PAE and Athletic Activities Index. (Table 9)

11. The CPI-ASM sub-battery makes a contribution to the prediction of the Nonacademic Standard Score in the context of other academic and nonacademic predictors from the selection and experimental batteries. (Table 10)

12. The CPI-ASM sub-battery makes a contribution to the prediction of Early Motivational Elimination in the context of other academic and nonacademic predictors. (Table 11)

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APPENDIX. STATISTICAL RESULTS

THE DATA

Data from this validation study are presented in several tables. Table 1 shows the mean, standard deviation, and correlation of each selection variable with each criterion. Table 2 presents the corresponding data for each experimental variable. Table 3 presents the distribution statistics and intercorrelations of the criteria.

The remaining tables show the results of the multiple linear regression analyses. There is a separate table for each set of analyses against a given criterion. Each such table shows the standard partial regression coefficients; the multiple correlation (R) between the predictors and the criterion; and the squared multiple correlation (R^2). The relevant portions of the zero-order validity tables (Tables 1 and 2) are reproduced in each regression analysis table.

Where the analyses against a given criterion permit the testing of more than one hypothesis, a separate table is provided summarizing the hypotheses and the result of testing them. Tables 6 and 8 are of this type. They specify the hypotheses in abbreviated form, the regressions which were compared in testing the hypotheses, the computed values of F, and the statistical significance of the F values. In abbreviated form, the hypotheses specify only that certain predictors "make no contribution." The term *contribution*, however, always means unique and valid contribution to the total predicted criterion variance in the context of the subset of predictors. Two or more hypotheses may be identical except for the specification of the context. The context can be determined by noting the predictors included in the subset used to test the hypothesis. In the columns showing which regressions were compared, the analysis involving only the subset is always shown last.

Table 1. **Validity of Selection Tests**

	CRITERIA							
PREDICTOR	ACADEM	CER	RESID CER	EXTRA CURRIC ACTIV	NON ACADEM	EARLY MOTIV ELIM	MEAN	SD
N:	495	495	495	495	495	616		
AFOQT COMPOSITES								
PILOT	.17	−.06	−.02	−.09	−.09	.05	136.2	28.3
NAVIGATOR-TECH	.35	−.06	−.02	−.09	−.10	.06	180.6	25.2
OFFICER QUALITY	.45	−.01	.03	−.09	−.06	.03	148.8	14.7
VERBAL	.30	−.11	−.07	−.09	−.13	.05	52.2	8.5
QUANTITATIVE	.45	−.08	−.05	−.07	−.10	.06	56.5	7.5
AIRMANSHIP	.23	−.03	.01	−.09	−.08	.05	567.9	82.3
FLYING INTEREST	.02	.06	.07	−.07	−.01	.04	19.9	3.0
TECHNICAL INTEREST	.02	−.10	−.10	−.06	−.10	.02	11.4	3.7
ADMINISTRATIVE INT	−.04	−.02	.00	−.02	−.03	−.06	5.9	3.5
QUANTITATIVE INT	.07	−.10	−.07	−.09	−.12	−.03	12.7	4.0
HIGH SCHOOL RANK	.41	.03	.02	−.01	.01	.06	569.7	98.5
CEEB TESTS								
VERBAL APTITUDE	.31	−.08	−.04	−.02	−.06	.03	592.0	68.1
ENGLISH COMP	.30	.02	.04	−.05	−.02	.05	593.1	74.7
VERBAL COMPOSITE	.35	−.03	.00	−.04	−.05	.05	1185.1	122.7
MATH APTITUDE	.35	−.09	−.05	−.04	−.09	.04	667.7	61.9
INTERMEDIATE MATH	.28	−.06	−.04	−.02	−.05	.08	654.0	75.1
QUANT COMPOSITE	.35	−.08	−.05	−.03	−.07	.07	1321.8	121.2
PHYSCIAL APT EXAM	.01	.29	.00	.38	.44	.09	558.7	93.3
ACTIVITIES INDEX								
ATHLETIC	−.05	.31	.16	.40	.47	.10	531.5	98.0
NONATHLETIC	.13	.29	.26	.13	.27	.00	544.3	99.9
EXAMINATION COMP	.50	.20	.11	.21	.27	.15	591.4	34.3
AGE	−.17	.13	.10	.01	.09	−.02	18.4	0.9

Note.—Minimum r for $P < .01$ is .12.

Table 2. **Validity of Experimental Tests**

PREDICTOR	CRITERIA: ACADEM	CER	RESID CER	EXTRA CURRIC ACTIV	NON ACADEM	EARLY MOTIV ELIM	MEAN	SD
N:	495	495	495	495	495	616		
YEARS OF COLLEGE	−.03	.12	.11	−.05	.05	−.01	0.3	0.6
GORDON PERS PROFILE								
ASCENDANCY	.03	.09	.08	.08	.11	.02	7.4	4.7
RESPONSIBILITY	.06	.08	.07	−.04	.02	.12	7.7	5.4
EMOTIONAL STABILITY	.02	.03	.03	−.03	.00	.19	7.3	5.4
SOCIABILITY	−.05	.08	.07	.10	.11	−.02	5.6	5.2
TOTAL	.03	.12	.11	.04	.11	.14	28.0	11.2
INTERACTION, PAE & GPP RESP	.06	.14	.07	.04	.12	.15	4339.6	3174.1
EDWARDS PERS PREF SCHED								
ACHIEVEMENT	.06	.03	−.02	.10	.08	.03	17.8	3.8
DEFERENCE	.04	.00	.00	−.02	−.01	.04	12.1	3.8
ORDER	.04	.03	.03	−.07	−.02	−.03	11.7	4.7
EXHIBITION	−.07	−.01	.02	.04	.02	.08	14.5	3.6
AUTONOMY	−.03	−.13	−.12	−.02	−.10	−.09	11.2	4.5
AFFILIATION	.02	.10	.11	.10	.13	.00	13.9	4.3
INTRACEPTION	.03	−.05	−.07	−.03	−.05	.05	15.5	5.0
SUCCORANCE	.08	−.01	.00	.01	.00	−.04	8.6	4.4
DOMINANCE	.07	.12	.12	.02	.09	.04	18.8	4.2
ABASEMENT	.03	.02	.02	−.03	.00	.06	13.7	4.7
NURTURANCE	−.01	.06	.06	.01	.05	−.03	11.1	5.0
CHANGE	.01	.05	.08	−.04	.00	.09	14.8	5.0
ENDURANCE	.06	.07	.05	−.02	.03	.03	14.5	5.9
HETEROSEXUALITY	.01	.08	.08	.03	.07	.01	10.9	5.8
AGGRESSION	.09	.05	.04	−.01	.03	−.02	10.9	4.7
CONSISTENCY	.05	.03	.04	−.01	.01	.01	5.3	1.9
SELF INSIGHT TEST	.03	−.06	−.06	.06	.00	−.08	7.5	2.5
CADET PERSONNEL INVEN								
COMMUNALITY	.06	.15	.12	.00	.10	.12	47.8	5.1
DEPENDENCY	−.01	.23	.22	.02	.16	.13	27.5	5.7
HETERONOMY	−.10	.13	.12	.06	.11	.01	34.5	5.9
CER	−.09	.39	.31	.19	.38	.11	10.3	8.3
ANSWER SHEET MARKING	.13	.18	.17	.07	.16	.08	67.6	7.8
OFFICER EFFECT INVEN								
EDUCATIONAL SUCCESS	.26	.09	.08	.11	.13	.03	4.1	1.0
CULTURE	.04	−.02	−.03	.02	.00	−.01	1.5	1.5
READING	.19	−.08	−.03	−.11	−.12	−.05	2.7	1.6
LIGHT LEISURE	−.04	−.06	−.04	−.07	−.08	−.0	2.0	1.6
RISK	.00	.17	.13	.14	.20	.03	12.4	4.5
SOCIALIZED AGGRESSION	.04	.26	.23	.18	.29	.02	12.7	5.1
OFFICER LEADERSHIP	.10	.18	.14	.05	.15	.01	33.3	6.6
EXTROVERSION	−.03	.26	.18	.20	.30	.07	6.0	2.2
INTELLECTUAL APT	.13	−.03	−.02	−.07	−.07	−.03	34.0	4.0
TOTAL	.11	−.12	−.11	−.13	−.16	−.03	37.2	11.4
HS ACTIVITIES INVENTORY								
ATHLETIC	−.02	.25	.10	.36	.40	.06	7.1	5.7
NONATHLETIC	.09	.15	.13	.07	.14	.04	12.7	6.5
TOTAL	.05	.25	.15	.26	.33	.06	19.8	9.6
REVISED ATHLETIC	−.03	.26	.11	.31	.58	.05	35.4	29.8
REVISED NONATHLETIC	.05	.26	.22	.09	.22	.02	47.6	34.8
REVISED TOTAL	.02	.31	.20	.23	.36	.04	83.0	53.2
CER PREDICT COMP	.06	.31	.14	.21	.33	.16	558.6	53.8

(Table continued on next page)

Table 2 (*Continued*)

PREDICTOR	CRITERIA							
	ACADEM	CER	RESID CER	EXTRA CURRIC ACTIV	NON ACADEM	EARLY MOTIV ELIM	MEAN	SD
COLOR-FORM								
COLOR-FORM A	.06	−.03	−.01	−.03	−.04	−.01	12.5	2.4
COLOR-FORM B	.06	.01	.01	.01	.0.	.0[illegible]	16.1	3.6
COLOR-FORM C	.10	.13	.12	.02	.09	.0[illegible]	21.2	2.6
DESIGN PREFERENCE TEST	−.08	.02	.02	−.02	.00	.00	25.4	8.0
DOT ESTIMATION	.16	.15	.14	.0[illegible]	.13	.01	65.8	11.3
WORD KNOWLEDGE	.01	.06	.05	.09	.10	.0[illegible]	54.3	2.4
SELF CREDITING TEST, NUM								
ABILITY A	.10	−.0[illegible]	−.0[illegible]	.06	−.01	.0[illegible]	9.4	1.0
ABILITY B	.11	.02	.03	.02	.03	−.0[illegible]	[illegible].4	2.2
ABILITY C	.10	.01	.02	−.04	−.02	−.03	4.[illegible]	2.2
TOTAL ABILITY	.14	.00	.01	.01	.01	−.02	21.5	4.1
RISK A	.02	−.0[illegible]	−.09	−.0[illegible]	.00	−.02	4.9	0.4
RISK B	.05	−.08	−.09	.01	−.05	−.08	4.6	0.[illegible]
RISK C	.03	−.09	−.09	−.01	−.0[illegible]	−.06	4.0	1.2
TOTAL RISK	.04	−.10	−.11	.01	−.06	−.0[illegible]	13.5	1.9

Note.—Minimum *r* for $P = .01$ is .12.

ZERO-ORDER VALIDITIES

It has been pointed out in previous reports (Miller, 1960b; Creager & Miller, 1960; Miller & Creager, 1969; Miller, 1961) that the history of the testing program at the Air Force Academy has shown a generally declining trend in the validities of tests from year to year, starting from extremely high validities in the class of 1959. This decline is best observed in the selection tests because these contain the only scales administered to all classes. The declining trend usually has been attributed to increasingly rigorous selection requirements, with resulting increase in the severity of the test range restriction. An additional factor tending to produce the same effect is an increase in the rigor of self-selection among potential candidates as the realities of academic and military life at the Academy become more widely known. Counseling materials prepared by the Academy for potential candidates have probably encouraged this self-selection process.

By the time the validation study for the class of 1963 was accomplished, it appeared that the downward trend in validities had virtually ceased (Miller, 1961). Comparisons of the classes of 1963 and 1964 in terms of tests common to both suggest that the downward trend remains essentially arrested. The tests common to both classes are the selection tests and four of the experimental measures (Years of College, HSAI, OEI, and Self Insight Test). While minor fluctuations in validities are noted in most of these common measures from one class to the other, the differences are generally not statistically significant. Significance tests were applied by converting validity coefficients in both classes to Fisher *z* coefficients and testing the differences between corresponding *z*s. The only test scale whose validity shifted downward at the .01 level of significance was the AFOQT Administrative Interest composite for the prediction of the Academic Standard Score ($z = 3.05$). Two other validities shifted to an extent which was significant at the .05 level but not at the .01 level. These were for Age and Years of College as predictors of the Academic Standard Score ($z = 2.09$ in both cases). These doubtfully significant changes

Table 3. **Intercorrelation of Criteria**

(N = 495)

CRITERION	1	2	3	4	MEAN	SD
1 Academic Standard Score					510.4	90.1
2 Cadet Effectiveness Rating	.18				505.8	97.3
3 Residualized Cadet Effectiveness Rating	.19	.96			500.0	93.1
4 Extracurricular Activities Standard Score	.02	.18	.07		498.3	98.7
5 Nonacademic Standard Score	.12	.76	.69	.77	1004.1	150.6
6 Early Motivational Elimination (N = 616)	--	--	--	--	0.8	0.4

were in opposite directions. None of the scores actually used in selecting the class of 1964 showed a significant change in validity against either the academic average or the CER, the criteria common to this class and the class of 1963. However, most of the nonsignificant validity fluctuations in the selection and experimental batteries were in a downward direction.

When means and standard deviations of tests common to the classes of 1963 and 1964 are compared, the means in the class of 1964 tend to be higher and the standard deviations tend to be smaller than in the class of 1963. The formal requirements for selection in the two classes are identical, both with respect to qualifying scores and weights in the Examination Composite. The increase in range restriction is therefore best interpreted as evidence that self-selection still tends toward somewhat increased severity, apparently in practically all areas of selection testing.

Even while the selection requirements and the self-selection process became increasingly rigorous across several earlier classes, a tendency existed for the same predictors to fluctuate markedly in validity from one class to the next (Creager & Miller, 1960; Miller & Creager, 1960; Miller, 1961). The fluctuations were most noticeable when individual course grades were used as criteria, but they were also observable in the academic average and the CER. It is apparent that these excessive fluctuations are no longer seen for criteria common to the present and earlier studies. The explanation cannot be given in terms of the selection process. While the available data do not provide an explanation, it is reasonable to suppose that experience with early classes has led to relatively enduring decisions about course content, methods of presentation, and techniques of evaluation. Stability of this sort should tend to stabilize the predictor validities.

The selection tests continue to show relatively high validities for the criteria they were intended to predict. Each criterion is predictable from at least one of the selection variables. Each criterion is also predictable from various experimental tests. The best single predictor of the Academic Standard Score is the Examination Composite, while the best predictor of both the Extracurricular Activities Standard Score and the Nonacademic Standard Score is the Athletic Activities Index. These predictors belong to the selection battery. On the other hand, the best single predictor of the CER and the Residualized CER is the CER scale of the Cadet Personnel

Inventory, while the best predictor of Early Motivational Elimination is the Emotional Stability scale of the Gordon Personal Profile. Differences between the best selection and experimental predictors are slight, however, except in the prediction of the Academic Standard Score. Few of the experimental tests were expected to have validity for this criterion. Most scales of the commercial tests were not valid for any criterion.

Criterion intercorrelations in Table 3 show a satisfactory degree of independence of the criteria where independence is to be expected. A fairly high correlation exists between the Nonacademic Standard Score and both the CER and the Extracurricular Activities Standard Score, but this is because the Nonacademic Standard Score is merely the sum of the other two. There is also a high correlation between the Nonacademic Standard Score and the Residualized CER, which in turn has a very high correlation with the original CER. Other correlations in the table are low. A value of 500.0 was arbitrarily added to the computed mean of the Residualized CER to yield a mean comparable to those of the other standard score criteria.

REGRESSION ANALYSES

Prediction of the Academic Standard Score

Table 4 presents the results of regression analyses against the Academic Standard Score. Entries in columns A and B are beta weights associated with the predictors in the two analyses performed. Predictors were chosen to test the hypothesis that the aptitude composites of the AFOQT do not make a unique and valid contribution to the predicted Academic Standard Score variance in the context of several other predictors, mostly from the selection battery.

Table 4. Regression Analysis Against Academic Standard Score

(N = 495)

PREDICTOR	VALIDITY	A	B
AFOQT Pilot Composite	.17	.00	--
AFOQT Navigator-Technical Composite	.35	.00	--
AFOQT Officer Quality Composite	.45	.19	--
AFOQT Verbal Composite	.30	-.07	--
AFOQT Quantitative Composite	.45	.19	--
AFOQT Airmanship Composite	.23	.04	--
High School Rank	.41	.25	.30
CEEB Verbal Aptitude	.31	.11	.16
CEEB English Composition	.30	.14	.15
CEEB Mathematics Aptitude	.35	.00	.14
CEEB Intermediate Mathematics	.28	.08	.16
Athletic Activities Index	-.05	.05	.04
Nonathletic Activities Index	.13	.12	.12
Age	-.17	.19	-.20
Years of College	-.03	.08	.13
R^2		.4023	.3578
R		.63	.60

Results of testing this hypothesis support the conclusion that the AFOQT aptitude composites do make a unique and valid contribution to prediction of the Academic Standard Score when added to a combination of predictors consisting of High School Rank, the four CEEB tests, the two Activities Indexes, Age, and Years of College. Thus the hypothesis is rejected. Computation of the F statistic used in testing the hypothesis takes account of the fact that the Airmanship composite is determined by a linear combination of the Pilot, Navigator-Technical, and Quantitative composites. The obtained value of F is 7.15.

Prediction of the Cadet Effectiveness Rating

Table 5 shows the results of the several regression analyses performed against the CER as the criterion. The analyses permit the testing of 14 hypotheses. These hypotheses are stated in abbreviated form in Table 6, along with the results of the hypothesis tests.

It has been observed previously that the PAE is a consistently valid predictor of the CER, and that it makes a unique and valid contribution in a variety of contexts of other tests, though not in all contexts studied (Creager & Miller, 1961). Data in Table 6 indicate that the PAE does not make a contribution when added to a combination of other predictors consisting of selected AFOQT composites, High School Rank, the two Activities Index scores, Age, Years of College, and the CPI-ASM sub-battery. Nor does the PAE contribute when the AFOQT composites are removed from this context. However, the PAE does contribute when the AFOQT composites are restored and the CPI-ASM sub-battery is simultaneously removed. The PAE also contributes when added to High School Rank and the CEEB composites, and to these plus the HSAI total score. In general, the PAE makes a unique and valid contribution in several contexts, but not in all contexts containing other valid predictors of the CER. This point may have practical significance, since the contextual predictors are cheaper and more easily administered than the PAE.

When the PAE and selected AFOQT composites are treated as a single set of predictors, they fail to make a contribution when added to High School Rank, the two Activities Index scores, Age, Years of College, and the CPI-ASM sub-battery. The PAE and CPI-ASM sub-battery together do make a contribution in a context of selected AFOQT composites, High School Rank, the Activities Index scores, Age, and Years of College. The PAE and HSAI total score together contribute in the context of High School Rank and the CEEB composites.

The HSAI total score alone contributes in the context of High School Rank and the CEEB composites, and in this context plus the PAE. The selected AFOQT composites fail to contribute when added to a context composed of High School Rank, the PAE, the Activities Indexes, Age, Years of College, and the CPI-ASM sub-battery. The AFOQT composites still do not contribute when the PAE is removed from this context. The CPI-ASM sub-battery, on the other hand, does contribute when added to the selected AFOQT composites, High School Rank, the Activities Indexes, Age, and Years of College. This sub-battery continues to contribute when the PAE is added to the context.

Prediction of the Residualized Cadet Effectiveness Rating

The regression analyses performed using the Residualized CER as the criterion are shown in Table 7. These analyses permit testing of three hypotheses shown in abbreviated form in Table 8. These hypotheses parallel three of the hypotheses concerning prediction of the original CER, both with respect to the predictors under study and the contexts.

Results of testing these hypotheses indicate that the AFOQT composites studied do not contribute to prediction of the Residualized CER in the context of High School Rank, the Activities Index scores, Age, Years of College, and the CPI-ASM sub-battery. However, the CPI-ASM

Table 5. **Regression Analysis Against Cadet Effectiveness Rating**

(N = 495)

PREDICTOR	VALIDITY	A	B	C	D	E	F	G	H	I	J
AFOQT Pilot Composite	−.06	−.05	−.08	--	--	−.23	−.24	--	--	--	--
AFOQT Navigator-Technical Comp	−.06	−.01	−.01	--	--	−.13	−.14	--	--	--	--
AFOQT Airmanship Composite	−.03	.08	.11	--	--	.34	.34	--	--	--	--
High School Rank	.03	.00	.00	.00	.00	.02	.02	.00	.00	.03	.04
CEEB Verbal Composite	−.03	--	--	--	--	--	--	.03	.02	.02	.00
CEEB Quant Composite	−.08	--	--	--	--	--	--	−.03	−.04	−.05	−.09
PAE	.29	.10	--	.10	--	.14	--	.22	--	.28	--
Athletic Activities Index	.31	.12	.18	.12	.17	.20	.27	--	--	--	--
Nonathletic Activities Index	.29	.19	.19	.19	.19	.22	.22	--	--	--	--
Age	.13	.05	.06	.05	.06	.09	.10	--	--	--	--
Years of College	.12	.06	.05	.06	.06	.09	.10	--	--	--	--
CPI Communality	.15	.06	.07	.05	.07	--	--	--	--	--	--
CPI Dependency	.23	.03	.02	.03	.03	--	--	--	--	--	--
CPI Heteronomy	.13	−.01	−.01	−.01	−.01	--	--	--	--	--	--
CPI CER	.39	.22	.24	.23	.24	--	--	--	--	--	--
Answer Sheet Marking	.18	.12	.11	.12	.12	--	--	--	--	--	--
HSAI Total	.25	--	--	--	--	--	--	.17	.25	--	--
R^2		.2630	.2581	.2604	.2546	.2005	.1879	.1071	.0625	.0856	.0080
R		.51	.51	.51	.50	.45	.43	.33	.26	.29	.09

Table 6. **Tests of Hypotheses** *(Data from Table 5)*

HYPOTHESIS	REGRESSIONS COMPARED	*F*	P
1 PAE makes no contribution	A and B	3.19	>.05
2 Selected AFOQT composites make no contribution	A and C	0.56	>.05
3 PAE and selected AFOQT composites make no contribution	A and D	1.37	>.05
4 CPI-ASM sub-battery makes no contribution	A and E	8.14	<.01
5 PAE and CPI-ASM sub-battery make no contribution	A and F	8.15	<.01
6 Selected AFOQT composites make no contribution	B and D	0.76	>.05
7 CPI-ASM sub-battery makes no contribution	B and F	9.10	<.01
8 PAE makes no contribution	C and D	3.79	>.05
9 PAE makes no contribution	E and F	7.64	<.01
10 PAE makes no contribution	G and H	22.89	<.01
11 HSAI total score makes no contribution	G and I	11.78	<.01
12 PAE and HSAI total score make no contribution	G and J	27.14	<.01
13 HSAI total score makes no contribution	H and J	30.04	<.01
14 PAE makes no contribution	I and J	41.58	<.01

Table 7. **Regression Analysis Against Residualized Cadet Effectiveness Rating**

(N = 495)

PREDICTOR	VALIDITY	A	B	C	D	E
AFOQT Pilot Composite	−.02	−.08	--	−.25	--	--
AFOQT Navigator-Technical Composite	−.02	−.01	--	−.15	--	--
AFOQT Airmanship Composite	.01	.11	--	.35	--	--
High School Rank	.02	.00	.00	.02	.00	.04
CEEB Verbal Composite	.00	--	--	--	.02	.00
CEEB Quantitative Composite	−.05	--	--	--	−.04	−.09
Athletic Activities Index	.16	.17	.16	.26	--	--
Nonathletic Activities Index	.26	.20	.19	.24	--	--
Age	.10	.05	.05	.10	--	--
Years of College	.11	.08	.10	.11	--	--
CPI Communality	.12	.07	.06	--	--	--
CPI Dependency	.22	.03	.03	--	--	--
CPI Heteronomy	.12	−.01	−.01	--	--	--
CPI CER	.31	.24	.24	--	--	--
Answer Sheet Marking	.17	.11	.12	--	--	--
HSAI Total	.15	--	--	--	.24	--
R^2		.2028	.1984	.1380	.0380	.0053
R		.45	.45	.37	.19	.07

Table 8. **Tests of Hypotheses** *(Data from Table 7)*

HYPOTHESIS	REGRESSIONS COMPARED	*F*	P
1 Selected AFOQT composites make no contribution	A and B	0.88	>.05
2 CPI-ASM sub-battery makes no contribution	A and C	7.82	<.01
3 HSAI total score makes no contribution	D and E	16.66	< .01

sub-battery does contribute in a context of selected AFOQT composites, High School Rank, the Activities Index scores, Age, and Years of College. Further, the HSAI total score contributes in the context of High School Rank and the CEEB composites. The conclusions concerning each of the three hypotheses are identical with those for the parallel hypotheses pertaining to the original CER as the criterion.

Prediction of the Extracurricular Activities Standard Score

Prediction of the Extracurricular Activities Standard Score by regression methods is shown in Table 9. The only analysis initially performed against this criterion was the one shown in column A of the table. Its purpose was merely to determine the multiple validity coefficient of a fairly extensive group of predictors when this criterion was used. By inspection, it appeared that only two of the predictors, the PAE and Athletic Activities Index, accounted for nearly all the predicted criterion variance. One additional analysis was then performed to test the hypothesis that the group of predictors other than the PAE and Athletic Activities Index does not make a contribution when these two predictors constitute the context. A test of this hypothesis supported the conclusion that the predictors do not contribute in the context of the PAE and Athletic Activities Index. The value of F is 0.55.

Table 9. **Regression Analysis Against Extracurricular Activities Standard Score**

(N = 495)

PREDICTOR	VALIDITY	A	B
AFOQT Pilot Composite	−.09	.00	--
AFOQT Navigator-Technical Composite	−.09	.03	--
AFOQT Airmanship Composite	−.09	.00	--
High School Rank	−.01	−.04	--
PAE	.38	.23	.23
Athletic Activities Index	.40	.27	.28
Nonathletic Activities Index	.13	.05	--
Age	.01	.02	--
Years of College	−.05	−.06	--
CPI Communality	.00	−.04	--
CPI Dependency	.02	−.04	--
CPI Heteronomy	.04	.05	--
CPI CER	.19	.01	--
Answer Sheet Marking	.07	.04	--
R^2		.2128	.2020
R		.46	.45

Prediction of the Nonacademic Standard Score

Results of the regression analyses using the Nonacademic Standard Score as the criterion are shown in Table 10. The two analyses against this criterion were designed to test the hypothesis that the CPI-ASM sub-battery makes no contribution in the context of selected AFOQT composites, High School Rank, the PAE, the two Activities Indexes, Age, and Years of College. It is concluded that the CPI-ASM sub-battery does make a unique and valid contribution in this context. This conclusion is based on a significant computed F value of 4.77.

Table 10. **Regression Analysis Against Nonacademic Standard Score**

(N = 495)

PREDICTOR	VALIDITY	A	B
AFOQT Pilot Composite	−.09	−.01	−.10
AFOQT Navigator-Technical Composite	−.10	.00	−.02
AFOQT Airmanship Composite	−.08	.05	.12
High School Rank	.01	−.02	−.01
PAE	.44	.21	.24
Athletic Activities Index	.47	.26	.31
Nonathletic Activities Index	.27	.16	.17
Age	.09	.05	.08
Years of College	.05	−.01	.00
CPI Communality	.10	.00	--
CPI Dependency	.16	.00	--
CPI Heteronomy	.11	.02	--
CPI CER	.38	.16	--
Answer Sheet Marking	.16	.11	--
R^2		.3373	.3044
R		.58	.55

Prediction of Early Motivational Elimination

Table 11 presents the results of analyses using Early Motivational Elimination as the criterion. Again two analyses were performed, and one hypothesis was tested. The hypothesis is that the CPI-ASM sub-battery makes no contribution in a context identical with that involved in the prediction of the Nonacademic Standard Score. The conclusion is that the CPI-ASM sub-battery does make a unique and valid contribution in the specified context. The value of F is 4.10.

Table 11. **Regression Analysis Against Early Motivational Elimination**

(N = 616)

PREDICTOR	VALIDITY	A	B
AFOQT Pilot Composite	.05	.02	.02
AFOQT Navigator-Technical Composite	.06	.07	.07
AFOQT Airmanship Composite	.05	.00	.00
High School Rank	.06	.05	.04
PAE	.09	.02	.04
Athletic Activities Index	.10	.10	.11
Nonathletic Activities Index	.00	−.07	−.04
Age	−.02	.00	.00
Years of College	−.01	−.03	−.02
CPI Communality	.12	.08	--
CPI Dependency	.13	.13	--
CPI Heteronomy	.01	−.08	--
CPI CER	.11	.04	--
Answer Sheet Marking	.08	.06	--
R^2		.0549	.0227
R		.23	.15

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13. ABSTRACT

Applicants for each Air Force Academy class take a battery of selection tests to establish their qualifications. Entering cadets take an additional battery consisting mainly of nonacademic experimental tests, developed as part of a program for the production of officer selection and classification devices. Both batteries are validated at the end of the fourth class year against academic and nonacademic criteria. In the class of 1964 the criteria were the Academic Standard Score, Cadet Effectiveness Rating (CER), Residualized Cadet Effectiveness Rating (with respect to physical aptitude), Extracurricular Activities Standard Score, Nonacademic Standard Score, and Early Motivational Elimination. Using multiple regression techniques, it was found that there are measures in both the selection and experimental batteries having validity for each of the criteria. Multiple correlations up to .63 were obtained with the Academic score as the criterion, and up to .51 with the CER. Validities are not significantly different from those observed in the class of 1963 for selection tests common to both classes. Previously observed fluctuating validities appear to have stabilized.

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It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS), (S), (C), or (U)*.

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