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**JOB APTITUDE REQUIREMENT WAIVERS
FOR RETRAINED AIRMEN**

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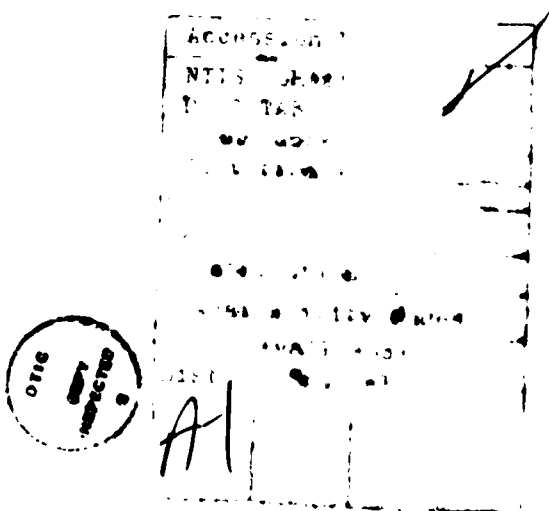
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> The viability of current Air Force policy to waive 10 points of the minimum job entry aptitude requirement for airmen retraining from one occupational specialty to another was evaluated. Optimum tradeoffs between aptitude discounts and performance achievements were examined for retrainees through performance comparisons with new recruits (non-retrainees) in entry-level technical training. Academic achievement and attrition rates were examined for 19,885 retrainees and 231,317 non-retrainees attending 272 technical schools. The specialties were categorized for analysis into 18 subgroups based on common mandatory aptitude prerequisites. Multiple linear regression analyses		

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→ were used to explore the relationships among performance criteria, retraining status, and aptitude predictors in each subgroup. Performance differences for retrainees and non-retrainees at various aptitude levels were then evaluated. Overall, the results supported the 10-point waiver practice for retrainees. The implications for retrainee management of instituting a more liberal policy are discussed. ↑

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SUMMARY

Objective

The objective was to assess empirically whether performance achievements by retrained airmen justify discounting aptitude requirements and, if so, to determine the magnitude of the allowable discount.

Background

It is current Air Force policy to waive 10 points of the job entry aptitude requirement for airmen retraining into a second occupational specialty. The 10-point waiver was instituted to encourage job changes among airmen for the purpose of alleviating manpower imbalances in overage and shortage Air Force specialties (AFSs). Retrainees' prior military experience, motivation, and education were factors that managers judged would offset any detrimental influence of lower aptitude on performance in the new AFS. This investigation of the waiver practice was requested by managers responsible for retraining policy and program operation.

Approach

Aptitude minimums, which qualify new accessions for AFS entry, are based in large part on the lowest performance level needed for satisfactory accomplishment of basic skills training. Consequently, the performance in technical training of non-prior-service recruits (non-retrainees) at the minimum qualifying aptitude level was selected as the standard against which to compare retrainees. Through this approach, it was possible to determine if retrainees with lower aptitudes could meet minimum performance standards.

Specifics

Method. Data on 19,880 retrainees and 231,317 non-retrainees attending 272 basic technical schools between 1973 and 1977 were extracted from historical personnel files. Predictor variables were retraining status and aptitude scores from the Armed Services Vocational Aptitude Battery (ASVAB). The primary performance criterion was a standardized final school grade which reflected academic achievement level. An attrition criterion (pass/fail) was used as a secondary performance indicator. Multiple linear regression analyses were conducted separately for each of 18 subgroups of schools categorized by their aptitude entry prerequisite. Analyses of direction and magnitude of performance differences for retrainees versus non-retrainees at various aptitude levels were conducted specifically to address the waiver question.

Findings and Discussion. Summary descriptive statistics indicated that retrainees achieved higher final grades on the average in all school subgroups and usually had lower attrition rates from training than did non-retrainees. However, mean aptitude scores for non-retrainees were higher in most subgroups (11 of 18).

Statistical analysis results revealed that the performance levels of the two groups differed significantly in the majority of subgroups. Overall, the scholastic achievements of retrainees were superior to non-retrainees with equivalent aptitudes. Significant results for the attrition criterion were obtained less regularly. Retrainees had higher probabilities of training completion at fixed aptitudes in about half of the school categories. The performance successes enjoyed by retrainees despite their lower average aptitude may be attributable to their familiarity with military life and to their prior occupational experience (mean time in service before retraining was 5.4 years).

Follow-on analyses indicated that retrainees with 10 aptitude points discounted would be expected to achieve final grades comparable to non-retrainees at the entry aptitude cutoff. In 14 of 18 subgroups, scholastic achievements among retrainees were high enough to warrant more than a 10-point discount. Similar trends in waiver values were observed in graduation rate analyses for 6 subgroups. For purposes of evaluating policies on entry requirements from these data, the focus should be on the more stable final school grade criterion. Unlike the pass/fail criterion, the grade measure pertains almost exclusively to academic achievement in training and is the validation criterion for ASVAB, the assessment instrument used to measure aptitude qualifications to enter an AFS.

Conclusions

Collectively, the findings were viewed as substantiating evidence for the current aptitude waiver for retrainees. Results further suggested that a more liberal discount would be defensible for many AFSs in the event that manpower requirements for retrainees increased sharply. Academic standards would be maintained by retrainees with job entry prerequisites discounted up to 15 points.

PREFACE

This research was accomplished in support of a Request for Personnel Research (RPR 77-12, Retrainee Follow-Up Study) submitted by managers responsible for policy and operation of the Airman Retraining Program (AF/MPPP; AFMPC/MPCM & MPCR). The study was conducted under Project 7734, Force Management System; Task 773408, Personnel Utilization and Retention System; Work Unit 77340804, Evaluation of the Air Force Airman Retraining Program.

Analysis results of the investigation were previously documented in the 1980 conference *Proceedings of the Military Testing Association*. Subsequently, in 1981, aptitude percentile scores for a portion of the study sample were determined to be in error due to norming problems with Forms 5, 6, and 7 of the Armed Services Vocational Aptitude Battery (ASVAB). The current publication is based on corrected ASVAB scores and replaces the earlier document.

Sincere appreciation is extended to Mr. Jim Friemann and his staff in the Technical Services Division, Air Force Human Resources Laboratory, for system analysis and computer programming support on the project.

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JOB APTITUDE REQUIREMENT WAIVERS FOR RETRAINED AIRMEN

I. INTRODUCTION

Qualifications for entry into Air Force enlisted specialties have for many years been based primarily on the aptitude requirements of the job. Job selection and assignment procedures require that new accessions meet minimum aptitude levels for any job specialties for which they wish to be considered (AFR 35-1, 1981; AFR 39-1, 1982). A notable exception to the standard is current policy for enlisted personnel retraining from one Air Force specialty (AFS) to another. A 10-point aptitude waiver may be granted to participants in the Airman Retraining Program who are seeking to qualify for a second specialty (AFR 39-4, 1979).

The waiver policy was incorporated in regulatory guidance for the retraining program in the early 1960s. At the time, many AFSs had manpower imbalances with too few or too many personnel assigned to accomplish the specialty mission. The waiver practice was introduced to encourage retraining from overage to shortage AFSs. Less stringent job entry requirements were intended to improve job opportunities for enlistees by increasing the number of specialties for which most enlistees qualified. Air Force managers judged that such factors as a retrainee's prior exposure to military life, experience in a military occupation, initiative, motivation, and education would offset any detrimental influence of lower aptitude on performance in the new AFS (J. Reese, HQ USAF/MPPP, personal communication, 18 October 1979). According to records maintained by the Air Force Manpower and Personnel Center (AFMPC), between 1973 and 1977 about 5% of the 10,000 to 15,000 applicants for retraining each year obtained an aptitude waiver to enter their projected retraining AFS.

Prior research on Navy and Air Force personnel suggested that military service experience had a positive influence on the performance of retrainees in technical training for second specialties (Booth, McNally, & Berry, 1975; Skinner & Alley, 1983). These studies provided indirect evidence in support of the aptitude waiver practice and its underlying rationale but did not permit an empirical assessment of whether performance achievements by retrainees justified discounting aptitude requirements and, if so, of the magnitude of the allowable discount. Such information would be of value to Air Force managers concerned with the selection and classification of retrainees. The present study objective was to determine the optimum tradeoff in technical school performance and aptitude levels for retrained airmen.

II. APPROACH

The conceptual framework for the study is based on current job assignment procedures in the Air Force. Mandatory minimum aptitude requirements for most specialties reflect the lowest performance level needed to accomplish entry-level training satisfactorily. Consequently, the performance in training of non-prior-service recruits at the minimum qualifying aptitude level was selected as the standard against which to compare retrainees. Aptitude differentials for retrainees achieving performance levels equivalent to the recruit standard could then be evaluated.

The study methodology provided for the examination of aptitude and performance relationships in the technical training environment. Technical training was suited to the present research interests for several reasons. Performance comparisons between retrainees and recruits were possible, since the majority of retrainees preparing for their second specialty attend the same basic technical schools as recruits. Further, a representative sample of AFSs could be evaluated, because the majority of AFSs require formal skills training. A final, important consideration was that achievement levels on the Armed Services Vocational Aptitude Battery (ASVAB), the aptitude assessment instrument used to measure qualifications to enter an AFS, are validated against technical school performance, specifically the final grade earned at course completion. This academic achievement measure was the primary performance criterion of interest. Secondary consideration was given to school attrition as a criterion (pass/fail ratios).

The approach used to evaluate the aptitude waiver policy is illustrated in Figure 1, which shows four possible research outcomes. Each has different implications for Air Force retrainee management. Scores on the selector aptitude measure are plotted on the horizontal axis and technical school performance on the vertical axis. An increasing relationship between aptitude and performance for retrainees and recruits is represented. Where the groups are shown to differ, constant differences in performance at all levels of aptitude are depicted. In the outcome shown in Figure 1a, retrainees who score 10 points below the job entry cutoff perform as well as new accessions with the minimum qualifying score. This finding would support the current 10-point waiver procedure with its attendant advantage of enlarging the pool of enlistees eligible for retraining. An alternative outcome is shown in Figure 1b. Retrainingees scoring more than 10 points below the cutoff achieve performance levels comparable to new accessions at the cutoff. A more liberal selection policy for retrainees would be feasible under this condition. In the event of severe career field manpower imbalances, the capability to retrain enlistees with lower aptitude, while maintaining acceptable performance, would be valuable to managers. Figure 1c illustrates a third potential outcome. Retrainingees and recruits achieve equivalent performance levels at all aptitudes. Substandard performance by retrainees with aptitudes below the cutoff is reflected. This condition would suggest that entry requirements applied to retrainees should be equivalent to those applied to recruits. Manning flexibility currently realized by retraining managers would likely decrease. A final outcome is shown in Figure 1d. New accessions at all aptitude levels are portrayed as performing better than retrainees. This finding would suggest the need for more stringent qualifications for retrainees than for recruits. In this event, the manpower pool of prospective retrainees would be substantially curtailed. The analyses conducted in this study were designed to determine which of the possible outcomes best represented the relationship between aptitudes and performance among the selected samples.

III. METHOD

Air Force historical personnel files were the source of data for the study. Aptitude and training performance measures for enlisted personnel who completed basic technical training between July 1973 and December 1977 were extracted from files maintained by the Technical Services Division, Air Force Human Resources Laboratory. These files, together with records provided by AFMPC, were used to determine retraining status. Excluding cases with missing or invalid data, the total sample contained 251,202 enlistees attending 272 technical schools. For ease of discussion, non-prior-service airmen will hereafter be referred to as non-retrainees, since they lack prior experience in an AFS. As shown in Table 1, both retrained and non-retrained groups included male and female enlistees and were racially mixed, with the majority having completed at least a high school education. The retrained airmen had served an average of 65 months (5.4 years) before starting entry-level technical training for their second specialty. The majority (72.6%) had retrained near the end of their first enlistment (after 36 months of service), probably in conjunction with reenlistment, or during subsequent enlistment periods. This percentage reflects Air Force policy which discourages retraining prior to the 36-month point due to lower retainability of inexperienced airmen.

Table 1. Percentage of Retrainingees and Non-Retrainingees by Educational Level, Sex, and Race Categories

Retraining Status	N	Educational Level		Sex		Race		
		High School Graduate	High School Non-Graduate	Male	Female	White	Black	Other/Unknown
Retrainee	19,885	99.16	.84	92.98	7.02	80.38	17.64	1.98
Non-Retrainingee	231,317	97.91	2.09	88.80	11.20	84.54	13.13	2.33

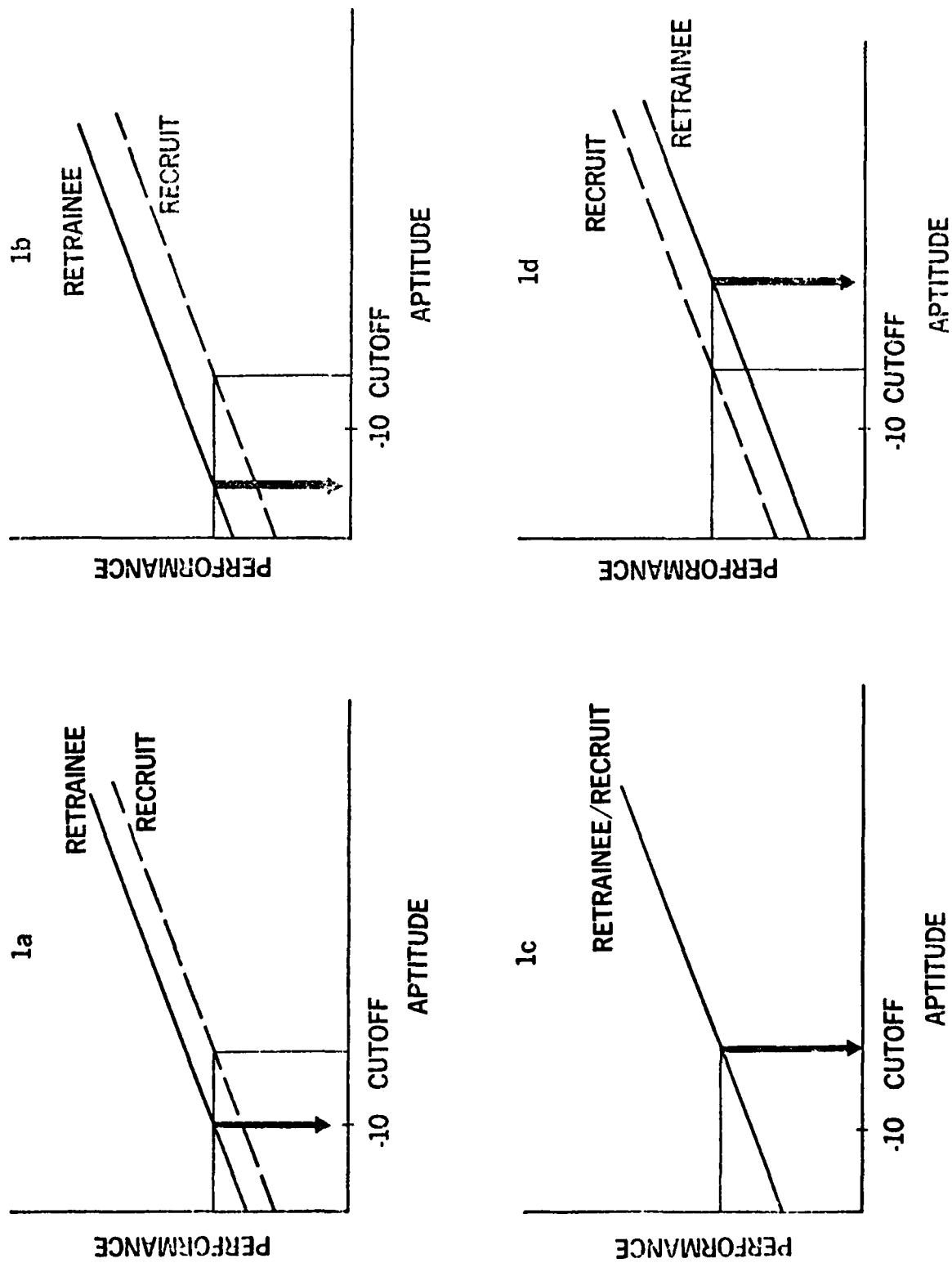


Figure 1. Hypothetical relationships between training performance and aptitude for retrainees and recruits.

Predictor Variables

Retraining status and aptitude were used as predictor variables. Enlistees were identified as probable retrainees if AFMPC files indicated that a retraining application had been processed for the individual. Retraining status was subsequently verified by one of two methods. The enlistees were confirmed as retrainees if their assignment specialty before retraining was different from the technical school specialty or if their technical training records designated them as retrainees. Non-retrainees were non-prior-service airmen attending training in preparation for their first military specialty assignment. Aptitude scores were derived from the ASVAB. The ASVAB yields four aptitude index (AI) composites: Mechanical (M), Administrative (A), General (G), and Electronic (E). Raw scores on the composites are converted to a 20-interval centile scale (01, 05, 10, ..., 95). Scores achieved on the selector AI for the technical school attended were used in the analyses.

Performance Criteria

Final school grade and pass/fail status in technical training were used as criteria. The primary criterion, final school grade, reflected academic achievement level in percentiles ranging from 60 to 99. Since performance rating standards in each school could not be assumed to be equivalent, final school grades were standardized to permit analysis at other than the AFS level. The standard score transformation yielded a mean final school grade equal to 50.0 and a standard deviation equal to 10.0 in each technical school. The reason for terminating technical training was used as a basis for generating the pass/fail dichotomy. School graduates were identified as passes. Failures were defined as those personnel who eliminated from training due to substandard academic performance, medical disqualification, or other reasons. It should be noted that the final school grade sample was a subset of the pass/fail sample; school graduates (passes) for whom an academic achievement measure was available composed the final school grade sample.

Attendees of the technical schools were categorized into subgroups for analysis. It was undesirable to analyze each specialty separately due to insufficient sample sizes for some AFSs as well as to the large number of AFSs overall. Categories of AFSs with common selector aptitude index (SAI) requirements were therefore established in keeping with Air Force personnel selection practices. Entry requirements cited in personnel classification regulations in effect during the 1973 through 1977 time frame were applied. The SAI level designates the minimum aptitude score on one of the four AI composites needed to enter an AFS. To illustrate, specialties in the Mechanical aptitude area were categorized by minimum aptitude scores of 40, 50, and 60 to form SAI subgroups designated M40, M50, and M60, respectively. Specialties with entry prerequisites on both or either of two SAIs were categorized by the first requirement cited. These procedures resulted in 18 SAI subgroups. The total number of cases by SAI subgroup in the final school grade analysis sample and in the pass/fail analysis sample are presented in Table 2. Also shown for each subgroup are the number of AFSs and the five-digit Air Force identification code of those specialties with the highest technical school enrollment.

Analyses

Descriptive statistics for the analysis samples were obtained in the form of frequencies, percentages, means, and standard deviations of each predictor and criterion variable within SAI subgroups. Relationships among training performance criteria, retraining status, and aptitudes were explored using multiple linear regression techniques (Bottenberg & Ward, 1963). Two series of parallel analyses, one for each of the performance criteria, were conducted within SAI subgroups. The starting model contained predictor variables for retraining status, aptitude (linear and curvilinear terms), and their interactions. F-tests of significance of full and restricted models were conducted in sequence for retraining status and aptitude effects and, if appropriate (i.e., statistically significant), were followed by tests for the interaction of the two basic predictors and/or for aptitude curvilinearity. For those sources of effect that were found to be significant, the direction and magnitude of performance differences were evaluated for each subgroup to gain additional insight into the findings and their implications for aptitude entry prerequisites for retrained airmen. A detailed discussion of these analyses is presented in Appendix A.

Table 2. Selector AI Subgroup Composition

SAI Subgroup	Final Grade N	Pass/Fail N	Number of AFSs	Representative AFSs
M40	30,158	32,492	52	42132, 42133, 42330, 42335, 42632, 43230, 53133, 53430
M50	38,679	40,376	23	43130, 43131C, 43131E, 43131F, 44330G, F54330, 54530, 60531
M60	12,809	13,463	2	46130, 46230
A40	9,798	10,275	6	60230, 60231, 70230
A50	1,036	1,064	1	60530
A60	16,661	18,653	9	20731, 29333, 64530, 73230
A70	655	673	1	65130
A80	3,443	3,641	4	67231, 67232
G40	35,233	36,570	12	57130, 62230, 63130, 64730, 81130
G50	4,755	4,937	4	53135, 81230
G60	27,780	33,982	39	27230, 27430, 27630, 29130, 81230, 90230, 90430, 90630
G65	519	566	1	55330
G70	68	121	2	24130, 79131
G80	4,888	6,142	23	2030RU, 20530, 20630, 25130, 25231
E50	2,126	2,444	5	54130G, 54231
E60	3,581	4,314	8	36231, 36232, 36234, 36330
E70	437	454	1	46330
E80	35,224	41,035	79	30332, 30430, 30434, 30630, 30730, 32531, 32830, 32831, 32833
TOTAL	227,850	251,202	272	

IV. RESULTS

General characteristics of the analysis samples are reflected by summary statistics of predictor and criterion variables within SAI subgroups. Table 3 presents the summary data for the final school grade sample. The total number of graduates for whom a final score was available was 227,850. Of these, approximately 8% (N = 17,502) were retrained airmen attending basic formal training in conjunction with a change in occupational specialty. The remaining 92% (N = 210,348) were non-retrainees without prior military service. Retrainees typically comprised less than 20% of the cases in the SAI subgroups. The percentage of retrainees was higher than the percentage of non-retrainees only in the A70 and G70 subgroups.

Summary data for the aptitude variables indicate that aptitude achievement for non-retrainees was higher on the average at the majority of SAI levels (11 of 18). Mean ASVAB scores of non-retrainees ranged from about 1 to 8 points higher in these subgroups. Retrainees scored slightly better on aptitude (usually 1 to 2 points) in seven subgroups. Mean values of the standardized final school grade criterion indicate that the academic performance of retrainees in the 18 SAI subgroups was higher than the average score (50.0) in each technical school. Compared to non-retrainees, the academic performance of retrainees was superior by about 1 to 12 standardized points in all subgroups.

Table 3. Summary Statistics for Final School Grade Criterion Analysis

SAI Subgroup	Retrainee					Non-Retrainee				
	N	Final Grade		Aptitude		N	Final Grade		Aptitude	
		Mean	SD	Mean	SD		Mean	SD	Mean	SD
M40	1,351	52.39	10.12	60.23	18.33	28,807	49.89	9.98	58.31	20.33
M50	1,974	53.65	10.44	63.44	16.13	36,705	49.88	9.92	65.35	17.59
M60	160	50.43	9.52	61.88	15.90	12,649	50.07	9.99	69.75	15.13
A40	347	55.42	9.95	60.98	16.61	9,451	49.84	9.94	59.81	15.83
A50	66	58.09	9.56	66.14	15.76	970	49.34	9.77	64.98	13.66
A60	1,614	55.41	9.52	65.87	14.41	15,047	49.47	9.87	66.45	15.50
A70	350	53.29	9.03	75.43	11.04	305	46.52	9.61	76.00	8.94
A80	230	55.28	9.48	82.89	8.62	3,213	49.57	9.93	85.00	8.22
G40	1,036	54.21	9.39	63.27	15.17	34,197	49.97	9.99	61.49	15.67
G50	272	50.94	11.18	65.97	14.85	4,483	47.56	10.26	68.36	13.62
G60	4,956	52.46	9.85	70.46	13.37	22,824	49.95	9.84	73.08	13.76
G65	144	52.54	10.28	78.02	12.76	375	48.91	9.69	82.59	10.12
G70	35	55.76	8.93	73.57	10.25	33	43.90	7.01	74.85	8.02
G80	671	52.22	9.89	81.59	10.87	4,217	49.68	9.91	86.18	8.16
E50	336	54.79	9.34	65.34	14.12	1,790	49.12	9.84	66.00	13.48
E60	489	52.05	10.26	71.61	14.62	3,092	49.65	9.94	69.52	11.76
E70	26	53.10	8.73	80.96	8.66	411	48.10	10.10	76.62	11.74
E80	3,445	53.92	9.93	84.88	7.71	31,779	49.56	9.91	84.52	8.47
Total	17,502					210,348				

Summary descriptive data for the pass/fail analysis sample which totalled 251,202 cases are shown in Table 4. In terms of percentages, the sample breakout by retraining status was comparable to the final school grade analysis sample, with 8% retrained airmen (N = 19,885) and 92% non-retrained airmen (N = 231,317). Findings for the aptitude predictor by SAI subgroup were likewise highly similar for the two analysis samples. Inspection of performance measures on the pass/fail criterion, tabled as percentage of graduates (pass) and eliminees (fail), indicated that the majority of school attendees successfully completed training. Percentages of graduates for SAI subgroups ranged from 86 to 100 for retrainees and from 81 to 98 for non-retrainees. In 10 of 18 subgroups, the percentage of retrainees who successfully completed training was higher than that of non-retrainees.

Statistical analysis results for the final school grade criterion within each of the SAI subgroups are provided in source table format (see Table B1 in Appendix B) and are summarized in Table 5. The overall retrainee versus non-retrainee comparisons in the first row of the table indicate that retraining status contributed significantly to the prediction of academic achievement level over and above the selector AI in 17 of 18 subgroups. That is, with the exception of E70 schools, retrainees were found to attain different final school grades than did non-retrainees at fixed aptitude levels. The effects of entry level aptitudes were found to be significant in all subgroups. Both retrainees and non-retrainees as a group exhibited systematic differences in final grade level as a function of aptitudes. Interaction effects for retraining status and aptitude predictors were not commonly detected. Rather, in over two-thirds of the subgroups, final school grades for retrainees versus non-retrainees differed by a constant amount across the aptitude range of interest from the selector AI to the 95th percentile. Exceptions to this general trend were M40, M50, G60, G80, and E80 schools. Finally, the form of the relationship between the grade criterion and aptitude predictor was typically curvilinear (12 of 18 subgroups) indicating that grade level did not increase in equal increments throughout the range of aptitude.

Table 4. Summary Statistics for Pass/Fail Criterion Analysis

SAI Subgroup	Retrainee					Non-Retrainee				
	N	Pass/Fail		Aptitude		N	Pass/Fail		Aptitude	
		% Pass	% Fail	Mean	SD		% Pass	% Fail	Mean	SD
M40	1,521	95.60	4.40	60.29	18.52	30,971	95.75	4.25	57.99	20.44
M50	2,102	95.24	4.76	63.15	16.20	38,274	96.48	3.52	64.96	17.75
M60	177	93.22	6.78	61.58	16.01	13,286	95.86	4.14	69.49	15.23
A40	377	93.10	6.90	60.31	16.64	9,898	96.12	3.88	59.64	15.83
A50	66	100.00	0.00	66.14	15.76	998	98.00	2.00	65.03	13.65
A60	1,683	97.33	2.67	65.86	14.41	16,970	94.87	5.13	66.93	15.34
A70	353	99.43	.57	75.40	11.04	320	97.19	2.81	75.95	8.86
A80	239	96.23	3.77	82.97	8.60	3,402	95.36	4.64	84.94	8.38
G40	1,101	96.46	3.54	63.16	15.31	35,469	97.42	2.58	61.49	15.64
G50	302	99.34	.66	65.71	14.68	4,635	96.74	3.26	68.27	13.64
G60	6,010	95.12	4.88	70.03	13.33	27,972	94.35	5.65	72.79	13.48
G65	159	91.19	8.81	76.86	13.07	407	94.10	5.90	82.05	10.30
G70	73	90.41	9.59	74.73	10.33	48	93.75	6.25	76.98	9.51
G80	841	91.32	8.68	81.44	10.84	5,301	81.04	18.96	86.00	8.26
E50	367	92.37	7.63	64.97	14.26	2,077	86.81	13.19	65.23	13.43
E60	593	86.34	13.66	71.57	14.46	3,721	84.31	15.69	68.73	11.80
E70	27	96.30	3.70	80.74	8.57	427	97.19	2.81	76.30	11.89
E80	3,894	91.88	8.12	84.56	7.83	37,141	87.81	12.19	83.95	8.60
Total	19,885					231,317				

Table 5. Summary of Statistical Findings

Source of Effect	SAI Subgroup																	
	Mechanical			Administrative					General					Electronic				
	40	50	60	40	50	60	70	80	40	50	60	65	70	80	50	60	70	80
Final School Grade																		
Retraining Status (R)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	ns	*
Aptitude (A)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
R X A Interaction	*	*	ns	ns	ns	ns	ns	ns	ns	ns	*	ns	ns	*	ns	ns	—	*
Curvilinear Aptitude	*	*	*	ns	ns	*	ns	ns	*	*	*	*	ns	*	*	*	ns	*
Pass/Fail																		
Retraining Status (R)	ns	*	ns	*	ns	*	ns	ns	*	ns	*	ns	ns	*	*	*	ns	*
Aptitude (A)	*	*	*	*	ns	*	ns	*	*	*	*	*	ns	*	*	*	*	*
R X A Interaction	—	ns	—	*	—	ns	—	—	ns	—	*	—	—	ns	ns	*	—	*
Curvilinear Aptitude	*	*	ns	ns	—	ns	—	ns	*	ns	*	ns	—	ns	ns	ns	ns	*

Note. An asterisk (*) in the table indicates statistical significance ($p < .05$) for a predictor. The designation ns specifies a non-significant predictor. A dash (-) indicates F-test was inappropriate and assumed to be non-significant.

Detailed analysis results for the pass/fail criterion are presented by SAI subgroup in Appendix B (see Table B2). As shown in the first line of the pass/fail analysis in Table 5, significant retraining status effects were found in 9 of 18 subgroups. In the same 9 subgroups (M50, A40, A60, G40, G60, G80, E50, E60, E80), entry-level aptitudes were also observed to have a significant influence on course completion. In an additional 6 subgroups where retraining status effects were not found, aptitude effects were obtained bringing the total to 15 subgroups. No consistent pattern was apparent from results of the test of the interaction of the two major predictors. Constant and non-constant differences in course completion rates for retrainees and non-retrainees with equivalent aptitudes were observed about equally often in the subgroups. With regard to the relationship between the pass/fail criterion and aptitude, the linear form predominated (10 of 15 subgroups).

Inspection of the regression coefficients associated with subgroup equations for the two performance criteria revealed several data trends in the magnitude and direction of results. Retrainees consistently achieved higher final school grades than did non-retrainees at fixed aptitudes. Furthermore, graduation rates for retrainees were sometimes superior. However, instances where their likelihood of training completion was comparable to that of non-retrainees were more common. Performance achievements by non-retrainees never exceeded those of retrainees in terms of final school grade level and only rarely in course completion rate (e.g., M50, G40). The characteristic finding for the aptitude variables was that performance improved with higher aptitude scores for both retrainees and non-retrainees. Final school grades increased from 4 to 13 standardized grade points among retrainees and from 2 to 13 points among non-retrainees across the aptitude range of interest (minimum selector AI to 95th percentile). The increase in probabilities of training completion ranged from 1% to 14% for retrainees and from 1% to 19% for non-retrainees.

Aptitude Waiver Analysis

Further analyses were conducted to address the aptitude waiver question specifically. The expected performance level for non-retrainees with the minimum selector AI was determined for both training criteria in each subgroup. The aptitude required for retrainees to achieve the same expected performance level was then computed. Decisions about the magnitude of the allowable waiver were based on the difference between the retrainees' computed aptitude score and the entry cutoff score for each subgroup. These findings are summarized for both criteria by subgroup in Table 6.

Table 6. Aptitude Discount Points for Retrainees by Training Performance Criterion and SAI Subgroup

SAI Subgroup	Final School Grade	Pass/Fail
M40	10	0
M50	>10	0
M60	10	0
A40	>10	0
A50	>10	0
A60	>10	>10
A70	>10	0
A80	>10	0
G40	>10	0
G50	>10	0
G60	>10	<10
G65	>10	0
G70	>10	0
G80	>10	>10
E50	>10	>10
E60	10	>10
E70	0	0
E80	>10	10

If data supported a waiver, the discount value is expressed as greater than, equal to, or less than the current 10-point waiver. A value of zero (0) is shown to indicate non-support for a waiver in schools where retrainees' expected performance was comparable to or poorer than that of non-retrainees' at the cutoff. For the final school grade criterion, the waiver data indicated that retrainees with 10 aptitude points below the cutoff would be expected to achieve final grades comparable to or higher than those of non-retrainees in 17 of 18 subgroups. Schools with an E70 selector were the single exception; expected grades of retrainees and non-retrainees at the cutoff were the same. In 14 subgroups the computed discount value exceeded 10 points. The pass/fail criterion data indicated that 10 points or more were discountable in one-third of the subgroups. In the remaining schools, graduation rates did not differ for the two groups or were lower for retrainees than for non-retrainees at the entry cutoff.

V. DISCUSSION AND CONCLUSIONS

The overall results support the Air Force policy of waiving 10 points of the job entry aptitude requirement for enlisted personnel who retrain to a second military specialty. Analyses of the primary indicator of training success (academic grade) strongly suggest that retrained airmen with waivers would be expected to meet academic standards in technical training. While the results concerning the final school grade criterion were more consistent than for the pass/fail criterion, both provide evidence in defense of the waiver practice.

The finding that training performance demonstrations by retrained airmen justify an entry requirement discount is noteworthy in light of mean aptitudes which indicated that retrainees' ASVAB scores were comparable to or lower than those of non-retrainees. Retrainees probably capitalize on their familiarity with service life and with the demands of military occupations to compensate for lower aptitude levels. Such an interpretation grounded on experiential factors is consistent with other research (Booth et al., 1975; Skinner & Alley, 1983). Motivational influences may be operating, as well. As tenure increases, enlistees have typically been found to strengthen their military commitment, as shown by improved job satisfaction and increased propensity to reenlist (Gould, 1976). The normal attrition process in the military may underlie this body of findings. Over time, a residual group of more motivated and capable enlistees, of which retrainees would be a part, is created by attrition. Together, the experiential and motivational influences bolster the rationale of Air Force management for adopting the waiver policy. That rationale was that other retrainee characteristics would offset the difference in aptitude levels.

A possible explanation for the finding that the performance criteria—final school grade and pass/fail—did not yield equivalent results in all SAI subgroups may be found in the nature of the two criteria. Final school grade pertains almost exclusively to academic achievement in technical school whereas pass/fail is more complex in definition. Failures in training can and do occur for reasons that have nothing to do with academics, for example, medical disqualification, disciplinary problems, or personal hardships. For purposes of evaluating policies on entry requirements from these data, the primary emphasis should be on the more stable academic criterion, with secondary consideration given to the possible impact on attrition rates.

Beyond the support demonstrated for the operational 10-point waiver policy, the present study has important implications for future retrainee management. In the event that manpower requirements for retrained airmen increased sharply, a more liberal aptitude discount would be defensible for most Air Force specialties. Current study results suggest that academic performance levels in technical training would not fall below acceptable standards with entry prerequisites discounted up to 15 points. However, if less stringent entry requirements were adopted, management would need to recognize that training attrition rates among retrainees in some AFSs (e.g., M60, G70) would likely increase above levels found among general recruits.

Future applications of these data should consider certain study design features. AFS subgroup configurations, as previously described, impose some restrictions on data generalizations. Changes in AFS affiliation could alter waiver results for affected subgroups. To address the more obvious concern about the effect of increases or decreases in existing entry aptitude cutoffs, it is believed that such changes would have only a marginal impact on the utility of current findings. In the majority of school subgroupings (12 of 18), results would hold for the primary academic achievement indicator. That is, the relative scholastic standing of retrainees versus non-retrainees along the aptitude percentile scale would not change at points above or below the entry cutoffs inspected in the current study. However, waiver decisions would

need to be reevaluated in the 6 subgroups where interaction effects were obtained for retraining status and aptitude predictors, if entry requirements were revised. Finally, while it is assumed that performance findings in the technical school environment would carry over to the job site for retrained and non-retrained airmen with the same amount of experience in the specialty, this assumption could be tested and additional information on entry requirement discounts for retrainees could be gained using a similar study design with job performance measures as criteria.

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APPENDIX A: SPECIFICATIONS FOR MULTIPLE LINEAR REGRESSION ANALYSIS

Statistical Analysis

The statistical analysis was conducted using the generalized linear regression model outlined by Bottenberg and Ward (1963). In this procedure, the accuracy of prediction (R^2) associated with a given set of predictor variables (full model) is compared with the accuracy associated with a number of reduced sets (restricted models). The full model used initially is designed to reflect the various potential relationships among the expected values in the population. The restricted models are formed by hypothesizing specific relationships among these values and imposing the resulting restrictions on the starting model. Comparisons of the degree to which each of these models fit the obtained data in terms of predictive accuracy then serve as a basis for determining statistical significance. Each comparison between full and restricted models is evaluated using the F statistic and associated probability value:

$$F = \frac{(R_f^2 - R_r^2)/df_1}{(1 - R_f^2)/df_2}$$

where

- R_f^2 = Squared multiple correlation - full model
- R_r^2 = Squared multiple correlation - restricted model
- df_1 = Number of independent predictor variables in full model minus the number of independent predictor variables in the restricted model
- df_2 = Total number of observations minus the number of independent predictor variables in the full model.

The starting model and the various restricted models that were defined for the analysis contained variables as specified in Table A1. Categorical group membership variables (coded 1 if the corresponding observation was a member of the group; 0 otherwise) were used to define retraining status. Since it was assumed that the effects of aptitude would be no more complex than a second-degree polynomial (curvilinear), these variables were represented by both linear and squared terms in the analysis. First-order interaction terms were included for aptitude by retraining status. There were six independent predictor variables in the model.

Statistical comparisons between the models were performed in the sequence described in Figure A1. An initial overall test for retraining effects (both main effects and interaction) was followed by a test for aptitude effects. If retraining and/or aptitude effects were found to be significant, testing procedures for interaction effects alone and/or aptitude curvilinearity continued sequentially through the network until the most appropriate model was determined.

Computing Estimates of Expected Values (Predicted Scores)

As a followup to the statistical analysis, an effort was made to evaluate the magnitude and direction of the significant effects on training performance. For each separate analysis, the most appropriate regression model served as a basis for computing estimates of expected values (predicted criterion scores). In these computations, for example, predicted scores for non-retrainees could be compared to those of retrainees with the same fixed aptitudes. Scores from one of these analyses - predicted final school grades for the M60 selector A1 group - are shown in Table A2 and plotted in Figure A2. The expected values for retrainees exceed by a constant amount (2 grade points) the expected values for non-retrainees at all aptitude levels.

Table A1. Model Specifications

Model	Component Predictors
1 (Starting Model)	$Y' = U + \text{Ret} + \text{Non-Ret} + \text{AI} + \text{AI}^2 + \text{Ret AI} + \text{Non-Ret AI} + \text{Ret AI}^2 + \text{Non-Ret AI}^2$
2	$Y' = U + \text{AI} + \text{AI}^2$
3	$Y' = U + \text{Ret} + \text{Non-Ret}$
4	$Y' = U$
5	$Y' = U + \text{Ret} + \text{Non-Ret} + \text{AI} + \text{AI}^2$
6	$Y' = U + \text{Ret} + \text{Non-Ret} + \text{Ret AI} + \text{Non-Ret AI}$
7	$Y' = U + \text{Ret} + \text{Non-Ret} + \text{AI}$
8	$Y' = U + \text{AI}$

Note. Predictor variables were defined as follows:

- U = Unit vector
- Ret = 1 if retrainee; 0 otherwise
- Non-Ret = 1 if non-retrainee; 0 otherwise
- AI = ASVAB percentile for Selector AI (M, A, G, or E aptitude score where applicable)
- AI² = ASVAB percentile squared
- Ret AI = ASVAB percentile if retrainee; 0 otherwise (interaction vector)
- Non-Ret AI = ASVAB percentile if non-retrainee; 0 otherwise (interaction vector)
- Ret AI² = ASVAB percentile squared if retrainee; 0 otherwise
- Non-Ret AI² = ASVAB percentile squared if non-retrainee; 0 otherwise

Table A2. Predicted Final School Grades for Personnel Attending M60 Technical Training Courses

Aptitude	Predicted Final School Grade	
	Retrainee	Non-Retrainee
35	45.73	43.76
40	46.40	44.43
45	47.13	45.16
50	47.93	45.96
55	48.80	46.83
60	49.73	47.76
65	50.73	48.76
70	51.79	49.82
75	52.92	50.95
80	54.12	52.15
85	55.38	53.41
90	56.71	54.74
95	58.10	56.14

Note. Predicted scores at aptitude levels below the cutoff represent extrapolations from scores predominately above 60 percentile points.

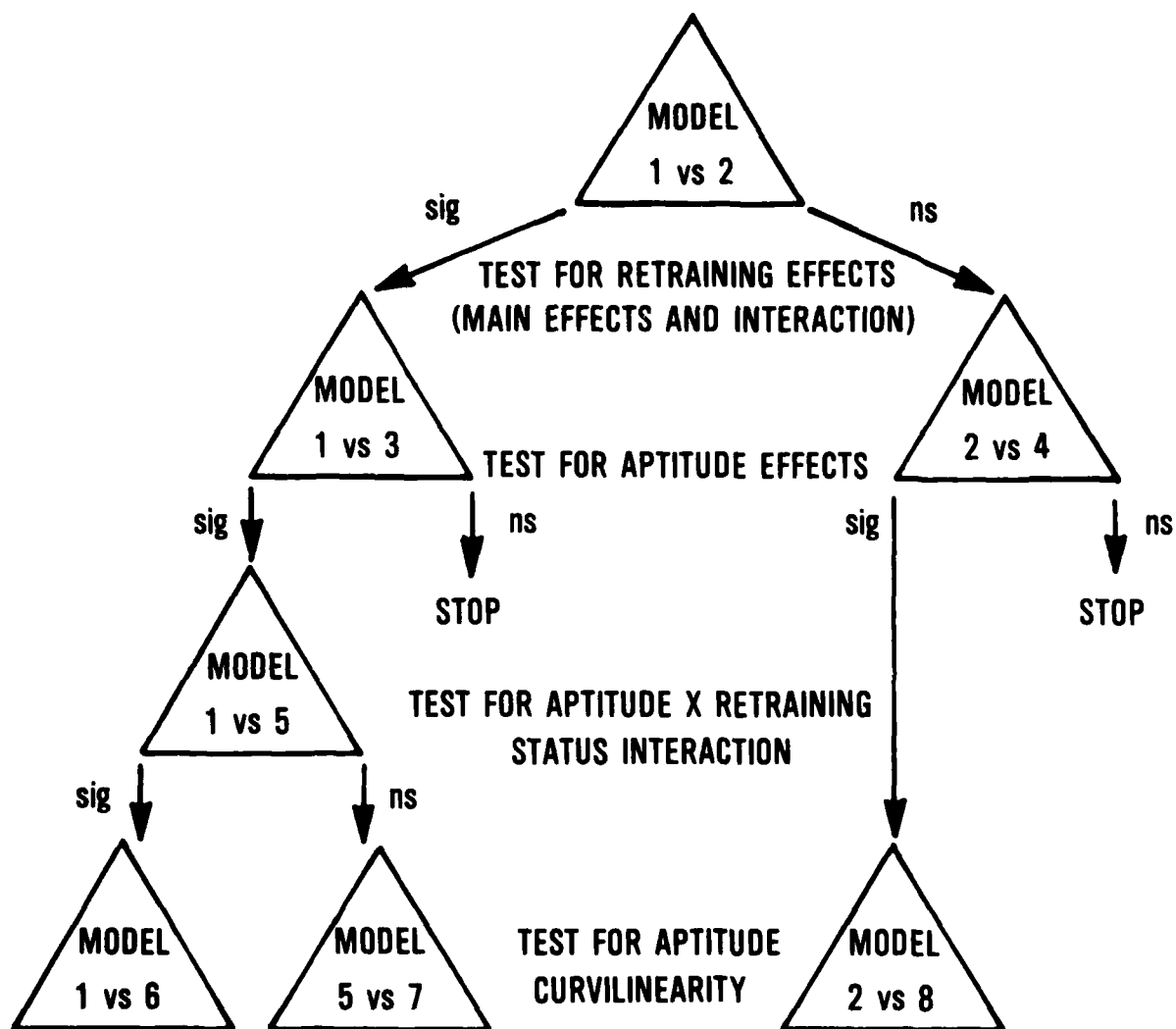


Figure A1. Sequential F-test comparisons.

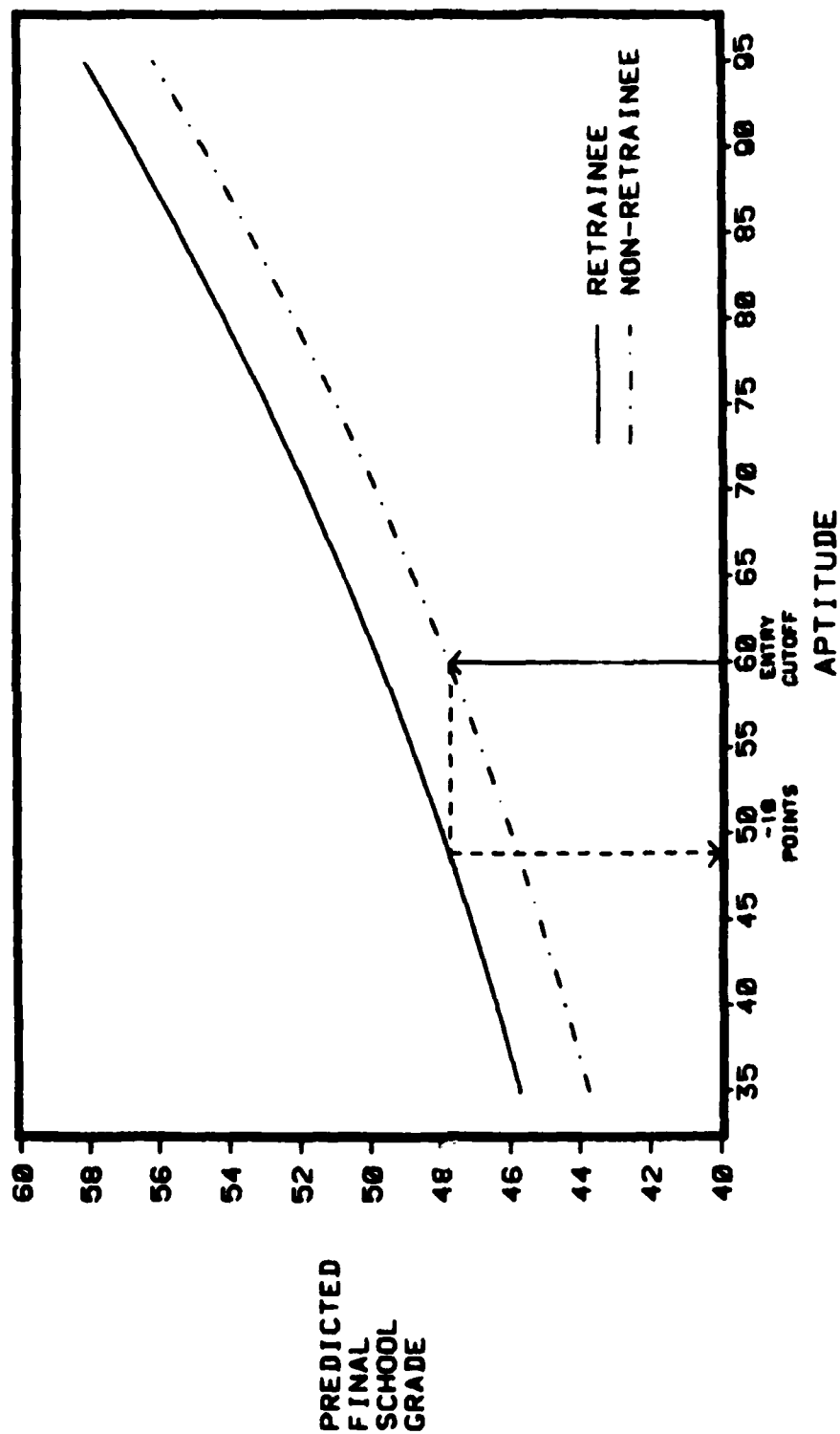


Figure A2. Predicted final school grades for M60 school attendees and aptitude discount value for retrainees.

Computing Aptitude Discount Values

Discount values were computed in subgroups where retrainees' performance was significantly higher than that of non-retrainees. Regression coefficients were used to solve for the aptitude at which the expected performance value for retrainees would be equivalent to the expected performance value for non-retrainees at the selector AI. In the case of final school grade analyses of the subgroup with an M60 selector AI, the equation solution yielded an aptitude score of 48.97 for retrainees. Thus, the computed aptitude discount value for retrainees in the M60 subgroup was 11.03 points which for interpretation and discussion purposes was rounded to 10 points. The computational result is graphically depicted in Figure A2.

**APPENDIX B: SOURCE TABLES FOR TECHNICAL TRAINING
PERFORMANCE CRITERIA**

**Table B1. Final School Grade Criterion Source Table with
F-tests of Significance for 18 SAI Subgroups**

Source	Comparison		R ²		df ₁	df ₂	F*
	Full Model	Restricted Model	Full Model	Restricted Model			
Mechanical 40							
Retraining Status (R)	1	2	.1295	.1269	3	30,152	30.20**
Aptitude (A)	1	3	.1295	.0027	4	30,152	1098.57**
R x A Interaction	1	5	.1295	.1292	2	30,152	5.77**
Curvilinear Aptitude	1	6	.1295	.1215	2	30,152	138.70**
Mechanical 50							
Retraining Status (R)	1	2	.1569	.1475	3	38,673	142.67**
Aptitude (A)	1	3	.1569	.0069	4	38,673	1719.34**
R x A Interaction	1	5	.1569	.1566	2	38,673	6.76**
Curvilinear Aptitude	1	6	.1569	.1471	2	38,673	224.33**
Mechanical 60							
Retraining Status (R)	1	2	.1022	.1016	3	12,803	2.85*
Aptitude (A)	1	3	.1022	.0000	4	12,803	364.49**
R x A Interaction	1	5	.1022	.1021	2	12,803	.88
Curvilinear Aptitude	5	7	.1021	.1003	1	12,805	26.08**
Administrative 40							
Retraining Status (R)	1	2	.0816	.0717	3	9,792	35.26**
Aptitude (A)	1	3	.0816	.0717	4	9,792	189.13**
R x A Interaction	1	5	.0816	.0816	2	9,792	.14
Curvilinear Aptitude	5	7	.0816	.0815	1	9,794	.61
Administrative 50							
Retraining Status (R)	1	2	.1125	.0636	3	1,030	18.89**
Aptitude (A)	1	3	.1125	.0458	4	1,030	19.36**
R x A Interaction	1	5	.1125	.1077	2	1,030	2.79
Curvilinear Aptitude	5	7	.1077	.1072	1	1,032	.56
Administrative 60							
Retraining Status (R)	1	2	.0578	.0256	3	16,655	189.52**
Aptitude (A)	1	3	.0578	.0309	4	16,655	118.82**
R x A Interaction	1	5	.0578	.0577	2	16,655	.83
Curvilinear Aptitude	5	7	.0577	.0548	1	16,657	50.80**
Administrative 70							
Retraining Status (R)	1	2	.1494	.0310	3	649	30.13**
Aptitude (A)	1	3	.1494	.1166	4	649	6.27**
R x A Interaction	1	5	.1494	.1468	2	649	.99
Curvilinear Aptitude	5	7	.1468	.1468	1	651	.05

Table B1. (Continued)

Source	Comparison		R ²		df ₁	df ₂	F*
	Full Model	Restricted Model	Full Model	Restricted Model			
Administrative 80							
Retraining Status (R)	1	2	.0333	.0095	3	3,437	28.18**
Aptitude (A)	1	3	.0333	.0203	4	3,437	11.52**
R x A Interaction	1	5	.0333	.0318	2	3,437	2.57
Curvilinear Aptitude	5	7	.0318	.0311	1	3,439	2.56
General 40							
Retraining Status (R)	1	2	.0791	.0745	3	35,227	58.49**
Aptitude (A)	1	3	.0791	.0051	4	35,227	707.26**
R x A Interaction	1	5	.0791	.0790	2	35,227	2.30
Curvilinear Aptitude	5	7	.0790	.0776	1	35,229	51.75**
General 50							
Retraining Status (R)	1	2	.1543	.1462	3	4,749	15.27**
Aptitude (A)	1	3	.1543	.0058	4	4,749	208.54**
R x A Interaction	1	5	.1543	.1540	2	4,749	.83
Curvilinear Aptitude	5	7	.1540	.1517	1	4,751	12.89**
General 60							
Retraining Status (R)	1	2	.1162	.1006	3	27,774	163.34**
Aptitude (A)	1	3	.1162	.0094	4	27,774	838.96**
R x A Interaction	1	5	.1162	.1154	2	27,774	12.58**
Curvilinear Aptitude	1	6	.1162	.1103	2	27,774	93.37**
General 65							
Retraining Status (R)	1	2	.1851	.1447	3	513	8.47**
Aptitude (A)	1	3	.1851	.0264	4	513	24.98**
R x A Interaction	1	5	.1851	.1844	2	513	.24
Curvilinear Aptitude	5	7	.1844	.1546	1	515	18.77**
General 70							
Retraining Status (R)	1	2	.5049	.1291	3	62	15.69**
Aptitude (A)	1	3	.5049	.3514	4	62	15.36**
R x A Interaction	1	5	.5049	.5049	2	62	.01
Curvilinear Aptitude	5	7	.5049	.5031	1	64	.23
General 80							
Retraining Status (R)	1	2	.0879	.0692	3	4,882	33.40**
Aptitude (A)	1	3	.0879	.0077	4	4,882	107.22**
R x A Interaction	1	5	.0879	.0861	2	4,882	4.77**
Curvilinear Aptitude	1	6	.0879	.0779	2	4,882	26.70**

Table B1. (Concluded)

Source	Comparison		R ²		df ₁	df ₂	F*
	Full Model	Restricted Model	Full Model	Restricted Model			
Electronic 50							
Retraining Status (R)	1	2	.1706	.1250	3	2,120	38.83**
Aptitude (A)	1	3	.1706	.0429	4	2,120	81.59**
R x A Interaction	1	5	.1706	.1694	2	2,120	1.48
Curvilinear Aptitude	5	7	.1694	.1626	1	2,122	17.55**
Electronic 60							
Retraining Status (R)	1	2	.1423	.1389	3	3,575	4.69**
Aptitude (A)	1	3	.1423	.0067	4	3,575	141.25**
R x A Interaction	1	5	.1423	.1413	2	3,575	2.10
Curvilinear Aptitude	5	7	.1413	.1319	1	3,577	39.25**
Electronic 70							
Retraining Status (R)	1	2	.2451	.2386	3	431	1.24
Aptitude (A)	2	4	.2386	.0000	2	434	67.99**
R x A Interaction							—
Curvilinear Aptitude	2	8	.2386	.2366	1	434	1.14
Electronic 80							
Retraining Status (R)	1	2	.1361	.1193	3	35,218	228.31**
Aptitude (A)	1	3	.1361	.0168	4	35,218	1216.07**
R x A Interaction	1	5	.1361	.1359	2	35,218	4.01**
Curvilinear Aptitude	1	6	.1361	.1173	2	35,218	384.52**

* A dash (-) indicates F-test was inappropriate and assumed to be non-significant.

* $p < .05$.** $p < .01$.

**Table B2. Pass/Fail Criterion Source Table with
F-tests of Significance for 18 SAI Subgroups**

Source	Comparison		R ²		df ₁	df ₂	F*
	Full Model	Restricted Model	Full Model	Restricted Model			
Mechanical 40							
Retraining Status (R)	1	2	.0214	.0213	3	32,486	.63
Aptitude (A)	2	4	.0213	.0000	2	32,489	354.01**
R x A Interaction							—
Curvilinear Aptitude	2	8	.0213	.0203	1	32,489	35.27**
Mechanical 50							
Retraining Status (R)	1	2	.0171	.0168	3	40,370	3.54*
Aptitude (A)	1	3	.0171	.0002	4	40,370	173.16**
R x A Interaction	1	5	.0171	.0170	2	40,370	1.62
Curvilinear Aptitude	5	7	.0170	.0150	1	40,372	81.01**
Mechanical 60							
Retraining Status (R)	1	2	.0080	.0076	3	13,457	1.70
Aptitude (A)	2	4	.0076	.0000	2	13,460	51.77**
R x A Interaction							—
Curvilinear Aptitude	2	8	.0076	.0076	1	13,460	.67
Administrative 40							
Retraining Status (R)	1	2	.0057	.0041	3	10,269	5.22**
Aptitude (A)	1	3	.0057	.0008	4	10,269	12.43**
R x A Interaction	1	5	.0057	.0050	2	10,269	3.40*
Curvilinear Aptitude	1	6	.0057	.0055	2	10,269	.81
Administrative 50							
Retraining Status (R)	1	2	.0020	.0006	3	1,058	.47
Aptitude (A)	2	4	.0006	.0000	2	1,061	.33
R x A Interaction							—
Curvilinear Aptitude							—
Administrative 60							
Retraining Status (R)	1	2	.0019	.0006	3	18,647	7.87**
Aptitude (A)	1	3	.0019	.0011	4	18,647	3.70**
R x A Interaction	1	5	.0019	.0016	2	18,647	2.05
Curvilinear Aptitude	5	7	.0016	.0016	1	18,649	.85
Administrative 70							
Retraining Status (R)	1	2	.0096	.0019	3	667	1.75
Aptitude (A)	2	4	.0019	.0000	2	670	.63
R x A Interaction							—
Curvilinear Aptitude							—

Table B2. (Continued)

Source	Comparison		R ²		df ₁	df ₂	F*
	Full Model	Restricted Model	Full Model	Restricted Model			
Administrative 80							
Retraining Status (R)	1	2	.0034	.0028	3	3,635	.72
Aptitude (A)	2	4	.0028	.0000	2	3,638	5.05**
R x A Interaction							—
Curvilinear Aptitude	2	8	.0028	.0019	1	3,638	3.21
General 40							
Retraining Status (R)	1	2	.0008	.0006	3	36,564	3.24*
Aptitude (A)	1	3	.0008	.0001	4	36,564	6.49**
R x A Interaction	1	5	.0008	.0007	2	36,564	2.78
Curvilinear Aptitude	5	7	.0007	.0005	1	36,566	4.42*
General 50							
Retraining Status (R)	1	2	.0032	.0017	3	4,931	2.50
Aptitude (A)	2	4	.0017	.0000	2	4,934	4.11*
R x A Interaction							—
Curvilinear Aptitude	2	8	.0017	.0014	1	4,934	1.25
General 60							
Retraining Status (R)	1	2	.0105	.0091	3	33,976	14.96**
Aptitude (A)	1	3	.0105	.0002	4	33,976	88.40**
R x A Interaction	1	5	.0105	.0096	2	33,976	15.19**
Curvilinear Aptitude	1	6	.0105	.0097	2	33,976	13.12**
General 65							
Retraining Status (R)	1	2	.0607	.0602	3	560	.11
Aptitude (A)	2	4	.0602	.0000	2	563	18.03**
R x A Interaction							—
Curvilinear Aptitude	2	8	.0602	.0562	1	563	2.39
General 70							
Retraining Status (R)	1	2	.0436	.0155	3	115	1.13
Aptitude (A)	2	4	.0155	.0000	2	118	.93
R x A Interaction							—
Curvilinear Aptitude							—
General 80							
Retraining Status (R)	1	2	.0110	.0008	3	6,136	21.07**
Aptitude (A)	1	3	.0110	.0086	4	6,136	3.67**
R x A Interaction	1	5	.0110	.0106	2	6,136	.04
Curvilinear Aptitude	5	7	.0106	.0106	1	6,138	.23

Table B2. (Concluded)

Source	Comparison		R ²		df ₁	df ₂	F*
	Full Model	Restricted Model	Full Model	Restricted Model			
Electronic 50							
Retraining Status (R)	1	2	.0230	.0183	3	2,438	3.95**
Aptitude (A)	1	3	.0230	.0036	4	2,438	12.08**
R x A Interaction	1	5	.0230	.0220	2	2,438	1.22
Curvilinear Aptitude	5	7	.0220	.0220	1	2,440	.04
Electronic 60							
Retraining Status (R)	1	2	.0287	.0259	3	4,308	4.14**
Aptitude (A)	1	3	.0287	.0004	4	4,308	31.43**
R x A Interaction	1	5	.0287	.0260	2	4,308	6.11**
Curvilinear Aptitude	1	6	.0287	.0283	2	4,308	1.00
Electronic 70							
Retraining Status (R)	1	2	.0436	.0400	3	448	.55
Aptitude (A)	2	4	.0400	.0000	2	451	9.41**
R x A Interaction							—
Curvilinear Aptitude	2	8	.0400	.0324	1	451	3.61
Electronic 80							
Retraining Status (R)	1	2	.0319	.0304	3	41,029	21.89**
Aptitude (A)	1	3	.0319	.0014	4	41,029	323.80**
R x A Interaction	1	5	.0319	.0315	2	41,029	8.24**
Curvilinear Aptitude	1	6	.0319	.0306	2	41,029	27.63**

* A dash (-) indicates F-test was inappropriate and assumed to be non-significant.

* $p < .05$.** $p < .01$.