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RELIABILITY
OF SCORES FOR FISCAL YEAR 1981
ARMY APPLICANTS:

ARMED SERVICES VOCATIONAL
APTITUDE BATTERY FORMS 8, 9, AND 10

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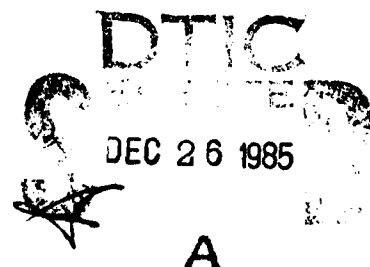


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sample of FY 1981 Army applicants who repeated the ASVAB, having failed to achieve the required cut-score on the first test. These applicants showed greatest improvement on the speeded subtests.



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FOREWORD

The Armed Services Vocational Aptitude Battery is a multiaptitude test battery used for selection and classification of United States military personnel. Major Army research efforts are underway which are directed at relating scores achieved by enlisted accessions on this test to performance and success in training and on the job. The purpose of this research was to verify the reliability of the reported scores to ensure that validation research was grounded on accurate ASVAB test scores. The results of this research verify that scoring and reporting of the ASVAB results at MEPCOM installations is reasonably accurate.

Research also was conducted to examine the test score changes for applicants who failed to achieve the required ASVAB cut scores for enlistment. The results of this research indicate that these applicants showed greatest change in the speeded subtests of the ASVAB.

This research was carried out under contract by RESEARCH APPLICATIONS, INCORPORATED of Rockville, Maryland under the direction of the Selection and Classification Technical Area in response to the requirements of Army Project No. 2Q263731A792.

**STUDY OF THE RELIABILITY OF SCORES FOR FISCAL YEAR 1981 ARMY APPLICANTS:
ARMED SERVICES VOCATIONAL APTITUDE BATTERY FORMS 8, 9 AND 10**

BRIEF

REQUIREMENTS:

To assess the accuracy of Armed Services Vocational Aptitude Battery (ASVAB) subtest scores as reported by Military Enlistment Processing Command (MEPCOM) Military Entrance Processing Stations (MEPS), and the contracted Mobile Examining Test (MET) sites for purposes of establishing a reliable FY 1981 Army applicant data base.

PROCEDURES:

Answer sheets completed by initial test applicants for the U.S. Army were rescored by an independent contractor. The scores reported by the MEPS for each subtest of the ASVAB were compared to the scores computed for each subtest of the ASVAB by the independent contractor. Also, an analysis of test-retest scores achieved by the Army applicants was conducted using ASVAB score data reported by the MEPS.

FINDINGS:

More than 143,000 Army applicants had matching MEPS and contractor-scored ASVAB data. A subtest comparison of test scores indicated that the mean of six of the ten subtest scores reported by the MEPS differed from those computed by the contractor. However, computations of the AFQT and Army Combat composite indicated agreement in the classification of applicants in approximately 97% and 94% of the cases, respectively. The analyses of the data for those applicants who took the ASVAB twice showed that retesting raised speeded test scores achieved by this group to the level of those applicants who did not retest. There was little or no change in the scores for the power tests.

UTILIZATION:

The results of the test score comparison verify the accuracy of scores reported by the MEPS. The retested applicants improved their scores on the two speeded tests, and on two of the eight power tests. However, all power subtest scores remained significantly lower than those achieved by one-time ASVAB examinees.

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INTRODUCTION

The U.S. Army, along with the other major branches of the military service, uses the Armed Services Vocational Aptitude Battery (ASVAB) for selection and classification of enlistees. A long-term major research effort is being initiated by the Army to relate the scores achieved on this test to performance in training and on the job.

The ASVAB tests are administered throughout the United States through a large testing network. The network consists of 68 Military Entrance Processing Stations (MEPS) and numerous satellite testing locations, or Mobile Examining Test Sites (METS). The test scores are computed at the MEPS and forwarded to a central registry to develop a record for each applicant.

In FY 1981, there were more than 490,000 applicants for the Army. The accuracy of the scoring of the ASVAB at the MEPS is of great interest to the Army, because of the need to have reliable ASVAB score data on the FY 1981 accession cohort. To evaluate the accuracy of ASVAB test scores reported by the MEPS required rescreening the original ASVAB answer sheets and comparison of the two sets of scores.

Included in the FY 1981 applicant pool were almost 30,000 individuals who failed to qualify for enlistment based on their initial scores on the ASVAB and who were retested. Data were available from MEPS files to examine the changes in their test scores as a result of repeated administration of the ASVAB and to compare these changes with those scores achieved by single administration applicants.

The work conducted in this research, therefore, was carried out in two concurrent efforts. The first effort was designed to yield information about the reliability of the ASVAB test scores as reported by the MEPS. The second effort was designed to examine the effects of retesting on scores achieved by applicants who failed to attain a minimally acceptable score for enlistment on previous test administrations. The methods, procedures and results of the data analyses followed in each effort are described in turn in the remainder of this report.

PART I. RELIABILITY OF MEPS-REPORTED ASVAB SCORES

The ASVAB consists of ten subtests administered during a two-hour and forty-five minute session to screen applicants for military service. Each of the major branches of the service use a composite of four of the subtests, Word Knowledge (WK), Arithmetic Reasoning (AR), Paragraph Comprehension (PC) and Numerical Operations (NO) as a minimum criterion for acceptance. This composite is known as the Armed Forces Qualifying Test (AFQT).

The remaining six subtests of the ASVAB are combined in various ways with some of the AFQT subtests to form composites of specific interest to branches of the military for initial classification of the applicants. The Combat Composite (CO) consisting of the Coding Speed (CS), Mechanical Comprehension (MC) and Auto/Shop Information (AS) subtests, and the Electronics Composite (EL) consisting of the General Science (GS), Mathematics Knowledge (MK) and Electronics Information (EI) subtests are two of those which are used by the Army to further classify applicants for initial assignment. Both the raw subtest scores and the scores for the AFQT, CO and EL composites were compared using a large number of original test answer sheets sent to the Army by the MEPS.

METHOD

In fiscal year 1981, more than 198,000 Army applicants who took the ASVAB on one occasion only were identified for the study through submission of original test responses by the MEPS.

To prepare the test answer sheets for scanning, the project staff first performed a sorting routine in which the answer sheets designated for services other than the Army, those for the Army National Guard and Reserves, and also the Army retests and verifications, were separated from the Active Army initial test responses.

It was expected that the MEPS would provide completed answer sheets covering all of the months from October 1980 through September 1981. It was found that for a majority of the MEPS, answer sheets for some of these months were missing. In most cases, the answer sheets missing were those for the months before April 1981. The fact that answer sheets for several months of testing would not be available for study resulted in ARI's decision to abandon plans for analysis of these data by month of testing.

In a number of cases, social security numbers and other demographic and identification data were missing from the answer sheets. Where possible, these data were copied from the computer sheets attached to the answer sheets. Where computer sheets were not available, the ARI applicant file was used to categorize the examinee. However, since the data were merged with the ARI applicant file by social security number, missing or incompletely filled in social security numbers resulted in some loss of data.

Other losses occurred in the data preparation process. Many of the MEPS had sent answer sheets with the pages stapled together. The optical scanning machines tended to reject answer sheets with staple holes in the area of the sequence number.

Preprocessing computer programs eliminated 15,214 records with bad social security numbers and 224 data sets with bad test versions. In all, 183,413 ASVAB data sets were scored; and 149,825 one-time only records were successfully merged with the ARI applicant file. Given the estimate of 490,000 Army applicants, the number of records matched by the contractor represented 31% of the total applicant data file provided by the MEPS.

ANALYSES

A series of analyses was conducted on the initial test takers only Army applicant pool to examine the reliability of the MEPS reported tested scores. The applicant data pool was initially screened to eliminate those individuals with out-of-range or missing scores from any one of the ten subtests. The applications of this procedure yielded a final applicant pool of 143,279 for analysis.

RESULTS

Using the responses from the initial test only data base, the mean and standard deviation of each of the subtest scores were computed for all matched applicant data sets. A comparison of the differences between the means indicated that, although for six of the ten subtests of the ASVAB significant differences were detected (see Table 1), only the mean difference in scores for Coding Speed (CS) appeared large enough to require further examination. The comparative score data revealed that the greatest number of scores which did not match was in the CS subtest. A count was made of the number of MEPS by percent of matching CS scores for males. Only one MEPS had a 100% match; but there were only 17 cases in the data base for this MEPS. In general, most of the MEPS (62 in all) had matched CS subtest scores for males for between 70% and 90% of the male cases. Almost half of the MEPS (29) had matched scores for between 80% and 84% of the cases.

The results of a factor analysis of the subtest scores achieved by this group were consistent with findings from other factor analyses research of ASVAB test scores. Two factors, power and speed, emerged for the analyses.

The AFQT, CO and EL composites were computed to examine the differences in classification of initial test only based on contractor and MEPS reported data.

The AFQT composite score was computed using MEPS reported and contractor compiled scores for the matched groups of applicants. The AFQT consists of the sum of the scores obtained on the AR, WK and PC subtests and one-half of the score obtained on the NO subtest. The AFQT raw score composites were

TABLE 1. Comparison of MEPCOM and Contractor Scored Sample Subtest Means.

Subtest Name	Number of Items	MEPCOM		CONTRACTOR		
		$\bar{x}$	sd	$\bar{x}$	sd	z
General Science (GS)	25	13.906	5.323	13.893	5.319	0.654
Arithmetic Reasoning (AR)	30	15.974	6.879	15.954	6.875	0.779
Word Knowledge (WK)	35	22.433	8.129	22.307	8.148	4.154
Paragraph Comprehension (PC)	15	9.368	3.586	9.331	3.604	2.758
Numerical Operations (NO)	50	33.433	10.634	33.319	10.708	2.860
Coding Speed (CS)	84	41.983	15.052	41.695	15.013	5.128
Auto/Shop Information (AS)	25	14.486	5.705	14.433	5.724	2.482
Mathematics Knowledge (MK)	25	10.956	5.218	10.932	5.216	1.231
Mechanical Comprehension (MC)	25	13.321	5.184	13.292	5.188	0.474
Electronics Information (EI)	20	10.957	4.063	10.905	4.073	3.430

N = 143,279

converted to the categories used by the Armed Forces for enlistment. The number of applicants was tabulated by AFQT category for each AFQT composite (see Table 2). The breakdowns for the AFQT categories are as follows:

<u>AFQT Category</u>	<u>AFQT Raw Score Range</u>
I	101-105
II	84-100
IIIA	76- 83
IIIB	65- 75
IVA	56- 64
IVB	49- 55
IVC	38- 48
V	0- 37

The number of applicants who changed from one AFQT category to another based on these computations was seen as an indication of the error associated with scoring these subtests. Since the shift in the applicants' AFQT category could be the result of errors made by both the MEPS and the contractor in scoring the test, it was determined that any estimate of the error in classification should be adjusted empirically. In this case, the number of applicants one cell to the left and right of the category on the diagonal would be used to estimate the error of assignment.

A simple difference between these two values was computed and an average error rate was estimated for cell categories. There appears to be an estimated error rate of $\pm 1.37\%$ by the MEPS in assigning applicants to mental categories. Based on the AFQT scores of 490,000 Army applicants who were tested during FY 1981, this error rate would translate to a little more than 6,700 applicants.

A similar error rate analysis was performed using transformed subtest scores which constitute the CO and EL composites. The CO composite consists of a sum of the transformed AR, CS, MC and AS subtest scores (see Table 3). The average error rate computed for this composite was $\pm 2.10\%$. Again, for the estimated total of 490,000 applicants this error rate translates into approximately 10,300 persons. The EL composite consists of a sum of the transformed GS, AR, MK and EI subtests scores (see Table 4). The average error rate computed for this composite was $\pm 2.14\%$. This error rate translates into approximately 10,500 persons for this composite.

DISCUSSION

The results of the comparison of the MEPS-reported ASVAB scores and the contractor computed ASVAB scores showed that there were few discrepancies found. As with previous efforts conducted by ARI, on smaller samples of applicants, the greatest number of disparate score comparisons was identified with the CS subtest. The differences in score reporting for this subtest may be attributable to factors such as mistiming and misscoring of the items. Furthermore, the error rate in categorizing applicants by composite also was found to be minimal (see Tables 5, 6 and 7).

TABLE 2. Comparison of AFQT Category Assignment Based on AFQT Scores Computed by Contractor and Reported by MEPS: FY 1981 Applicants.*

MEPS Reported Score Composite Category	Contractor Scored AFQT Mental Category								Total
	I	II	IIIA	IIIB	IVA	IVB	IVC	V	
	AFQT Raw Score Range								
	101-105	84-100	76-83	65-75	56-64	49-55	38-48	0-37	
I	3,137	85	7	2	0	0	3	6	3,240
II	26	26,964	310	144	20	7	21	33	27,525
IIIA	0	73	16,327	361	53	17	14	38	16,883
IIIA	2	15	64	25,464	434	70	25	67	26,141
IVA	0	4	7	110	19,015	355	91	42	19,624
IVB	0	0	1	7	127	14,415	378	72	15,000
IVC	0	4	1	7	23	144	18,560	354	19,093
V	0	5	2	4	10	17	127	15,590	15,755
Total	3,165	27,154	16,720	26,099	19,683	15,028	19,220	16,205	143,279
% of Total	2.2	19.0	11.7	18.2	13.7	10.5	13.4	11.3	100.0

*AFQT = AR + WK + PC + 1/2NO.

TABLE 3. Comparison of Army Combat (CO) Composite Category Assignments Based on Scores Computed by Contractor and Reported by MEPS: FY 1981 Applicants.*

MEPS Reported Score Composite Category	Contractor Scored Composite Category									Total
	120+	110-119	105-109	100-104	95-99	90-94	85-89	80-84	40-79	
120+	11,872	291	23	25	12	17	12	6	19	12,277
110-119	81	15,586	333	118	30	19	16	18	46	16,247
105-109	12	84	8,532	299	33	34	13	9	26	9,042
100-104	12	30	116	13,492	338	72	32	16	70	14,178
95-99	4	13	23	129	11,398	371	70	27	60	12,095
90-94	6	12	4	34	112	11,585	388	67	93	12,301
85-89	4	4	4	12	27	147	12,192	374	159	12,923
80-84	1	2	6	4	16	31	128	10,301	481	10,970
40-79	4	9	7	18	23	30	81	208	42,861	43,241
Total	11,996	16,034	9,048	14,133	11,989	12,306	12,932	11,026	43,815	143,279
% of Total	8.4	11.2	6.3	9.9	8.4	8.6	9.0	7.7	30.5	100.0

*CO = AR + AS + MC + CS

TABLE 4. Comparison of Army Electronics (EL) Composite Category Assignments Based on Scores Computed by Contractor and Reported by MEPS: FY 1981 Applicants.*

MEPS Reported Score Composite Category	Contractor Scored Composite Category									Total
	120+	110-119	105-109	100-104	95-99	90-94	85-89	80-84	40-79	
120+	11,829	136	19	11	13	6	3	2	6	12,025
110-119	42	16,727	166	84	27	23	19	6	11	17,105
105-109	4	50	9,204	130	39	30	7	8	13	9,485
100-104	3	10	44	11,785	154	75	28	21	26	12,146
95-99	0	3	7	51	10,482	165	45	27	30	10,810
90-94	1	5	8	19	74	12,835	191	78	72	13,283
85-89	0	2	0	3	13	91	10,371	178	119	10,777
80-84	3	1	2	3	9	17	80	10,615	282	11,012
40-79	4	8	3	4	9	27	31	124	46,422	46,632
Total	11,886	16,943	9,453	12,090	10,820	13,270	10,775	11,060	46,982	143,279
% of Total	8.3	11.8	6.6	8.4	7.6	9.3	7.5	7.7	32.8	100.0

*EL = GS + AR + MK + EI

TABLE 5. Rescoring Shifts in AFQT Assigned Mental Category in Percents for MEPCOM and Contractor Scored FY 1981 Army Applicants*, N = 143,279.

MEPS Reported Score Mental Category	Contractor Computed Score Mental Category						
	V	IVC	IVB	IVA	IIIB	IIIA	II&I
I&II	0	0	0	0	1	2	100
IIIA	0	0	0	0	1	98	0
IIIB	0	0	0	2	98	0	0
IVA	0	0	2	97	0	0	0
IVB	0	2	96	1	0	0	0
IVC	2	97	1	1	0	0	0
V	96	1	0	0	0	0	0
% of Total	11	13	11	14	18	12	21

*AFQT = AR + WK + PC + 1/2NO

TABLE 6. Rescoring Shifts in CO Composite in Percents for MEPCOM and Contractor Scored FY 1981 Army Applicants*, N = 143,279.

MEPS Reported Score	Contractor Computed Score								
	120+	110-119	105-109	100-104	95-99	90-94	85-89	80-84	40-79
120+	99	2	0	0	0	0	0	0	0
110-119	1	97	4	1	0	0	0	0	0
105-109	0	1	94	2	0	0	0	0	0
100-104	0	0	1	95	3	1	0	0	0
95-99	0	0	0	1	95	3	1	0	0
90-94	0	0	0	0	1	94	3	1	0
85-89	0	0	0	0	0	1	94	3	0
80-84	0	0	0	0	0	0	1	93	1
40-79	0	0	0	0	0	0	1	2	98
% of Total**	8	11	6	10	8	9	9	8	30

*CO = AR + AS + MC + CS

**May not total 100 due to rounding

TABLE 7. Rescoring Shifts in EL Composite in Percents for MEPCOM and Contractor Scored FY 1981 Army Applicants*, N = 143,279.

MEPS Reported Score	Contractor Computed Score								
	120+	110-119	105-109	100-104	95-99	90-94	85-89	80-84	40-79
120+	100	1	0	0	0	0	0	0	0
110-119	0	99	2	1	0	0	0	0	0
105-109	0	0	97	1	0	0	0	0	0
100-104	0	0	0	98	1	1	0	0	0
95-99	0	0	0	0	97	1	0	0	0
90-94	0	0	0	0	1	97	2	1	0
85-89	0	0	0	0	0	1	96	2	0
80-84	0	0	0	0	0	0	1	96	1
40-79	0	0	0	0	0	0	0	1	99
% of Total**	8	12	7	8	8	9	8	8	33

*EL = GS + AR + MK + EI

**May not total 100 due to rounding

PART II. RETEST APPLICANT STUDY

More than 36,000 applicants were identified who had two sets of ASVAB scores reported on their record, indicating that they may have taken the battery on more than one occasion. A number of those individuals, however, were found to have been given a verification form of the ASVAB as a result of scoring inconsistencies or suspect test taking. These individuals were removed from the larger group who were considered to be retested applicants. Furthermore, applicants whose subtest scores on all ten subtests were found to be the same for the two sets of scores reported were dropped from the data base. Finally, if the sum of the AFQT composite exceeded the raw score maximum, these applicants were dropped from further analyses. From the original pool of 36,000 applicants, 27,911 were identified as having been retested.

METHOD

A series of analyses was conducted on the retest army applicant pool to examine the differences in the test scores of those applicants whose records indicated that they had taken the ASVAB more than once. The two most recent scores were used for comparison purposes.

The initial and retest scores were factor analyzed. Mean and standard deviations of the initial and retest scores were compared for each subtest. Comparisons of the AFQT, CO and EL composite scores for retested applicants were made.

RESULTS

A tabulation of the number of individuals who took the ASVAB on two different occasions is shown in Table 8. As can be seen from this table, 1,774 (6%) of the individuals appeared to have taken the same version as both initial and retests. Given this number, it was determined that further analyses of the retest data would be conducted separately for this group of individuals.

A comparison of the mean subtest scores for all retested applicants yielded the same results for both groups; that is, those who took the same version of the ASVAB as a retest and those who took different versions of the ASVAB as a retest (see Tables 9 and 10). A graph of the frequency distributions of the retest scores for the Word Knowledge subtest shows similar distributions for both groups (see Figures 1 and 2). Further support for these results are demonstrated in the graphs of initial and retest mean scores and plots of the reciprocal of the standard deviation of each mean retest score for the Word Knowledge subtest presented in Figures 3 and 4, respectively.¹

¹Graphic distributions for all subtests may be found in the Appendices.

TABLE 8. Number of Initial and Retested FY 1981 Army Applicants by ASVAB Operational Test Version.

Number Taking Retest of Test Version	Number Taking Initial Test of Test Version						Total
	8A	8B	9A	9B	10A	10B	
8A	354	669	1,042	983	932	954	4,934
8B	700	328	1,035	841	957	832	4,693
9A	1,029	1,061	310	600	873	906	4,779
9B	1,012	871	660	258	919	702	4,422
10A	954	989	973	877	273	517	4,583
10B	1,050	830	969	799	601	251	4,500
Total	5,099	4,748	4,989	4,358	4,555	4,166	27,911

TABLE 9. Comparison of Mean Subtest Scores for Retested Applicants.

Subtest Name	Initial		Retest		Mean of Absolute Differences		Z _{IR}
	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	
GS	10.786	3.703	11.117	3.785	2.551	2.053	10.441
AR	11.353	3.826	11.911	4.214	3.020	2.438	16.383
WK	17.465	5.476	17.984	5.736	3.318	2.902	10.934
PC	7.342	2.699	7.770	2.839	2.288	1.844	18.252
NO	29.334	8.848	32.271	9.322	6.092	5.612	38.178
CS	36.356	13.204	42.007	13.450	9.886	9.307	50.089
AS	11.366	4.638	11.882	4.737	2.680	2.329	4.112
MK	7.989	2.950	8.325	3.037	2.569	2.120	13.258
MC	10.354	3.884	11.077	4.105	2.790	2.311	19.040
EI	8.717	3.168	9.111	3.195	2.392	1.990	14.630

TABLE 10. Retest Applicants Means and Standard Deviations.

Different Versions of ASVAB (N = 26,137)*					
Subtest Name	Initial		Retest		z
	$\bar{x}$	sd	$\bar{x}$	sd	
GS	10.804	3.674	11.104	3.756	9.231
AR	11.371	3.788	11.902	4.162	15.254
WK	17.512	5.405	17.982	5.675	9.696
PC	7.365	2.680	7.771	2.812	16.897
NO	29.407	8.784	32.321	9.286	36.856
CS	36.446	13.122	42.104	13.382	48.806
AS	11.391	4.632	11.882	4.733	11.986
MK	7.991	2.919	8.313	2.999	12.439
MC	10.373	3.872	11.076	4.096	20.164
EI	8.736	3.153	9.102	3.172	13.230
AFQT Composite	51.200	10.524	54.063	11.967	29.044
CO Composite	168.779	18.694	175.142	19.816	37.761
EL Composite	164.499	17.152	167.237	18.373	17.611

Same Version of ASVAB (N = 1,774)					
Subtest Name	Initial		Retest		z
	$\bar{x}$	sd	$\bar{x}$	sd	
GS	10.512	4.102	11.309	4.194	5.722
AR	11.091	4.346	12.043	4.916	6.111
WK	16.776	6.397	18.015	6.584	5.685
PC	6.994	2.951	7.759	3.165	7.446
NO	28.267	9.686	31.532	9.812	9.974
CS	35.032	14.288	40.567	14.338	11.517
AS	10.997	4.710	11.890	4.804	5.591
MK	7.962	3.371	8.499	3.540	4.627
MC	10.083	4.048	11.090	4.237	7.238
EI	8.433	3.360	9.238	3.509	6.979
AFQT Composite	49.246	13.920	53.836	14.787	9.520
CO Composite	166.271	21.713	174.421	22.485	10.933
EL Composite	162.742	21.038	168.427	22.514	7.771

*3,008 took same non-AFQT portion of the ASVAB

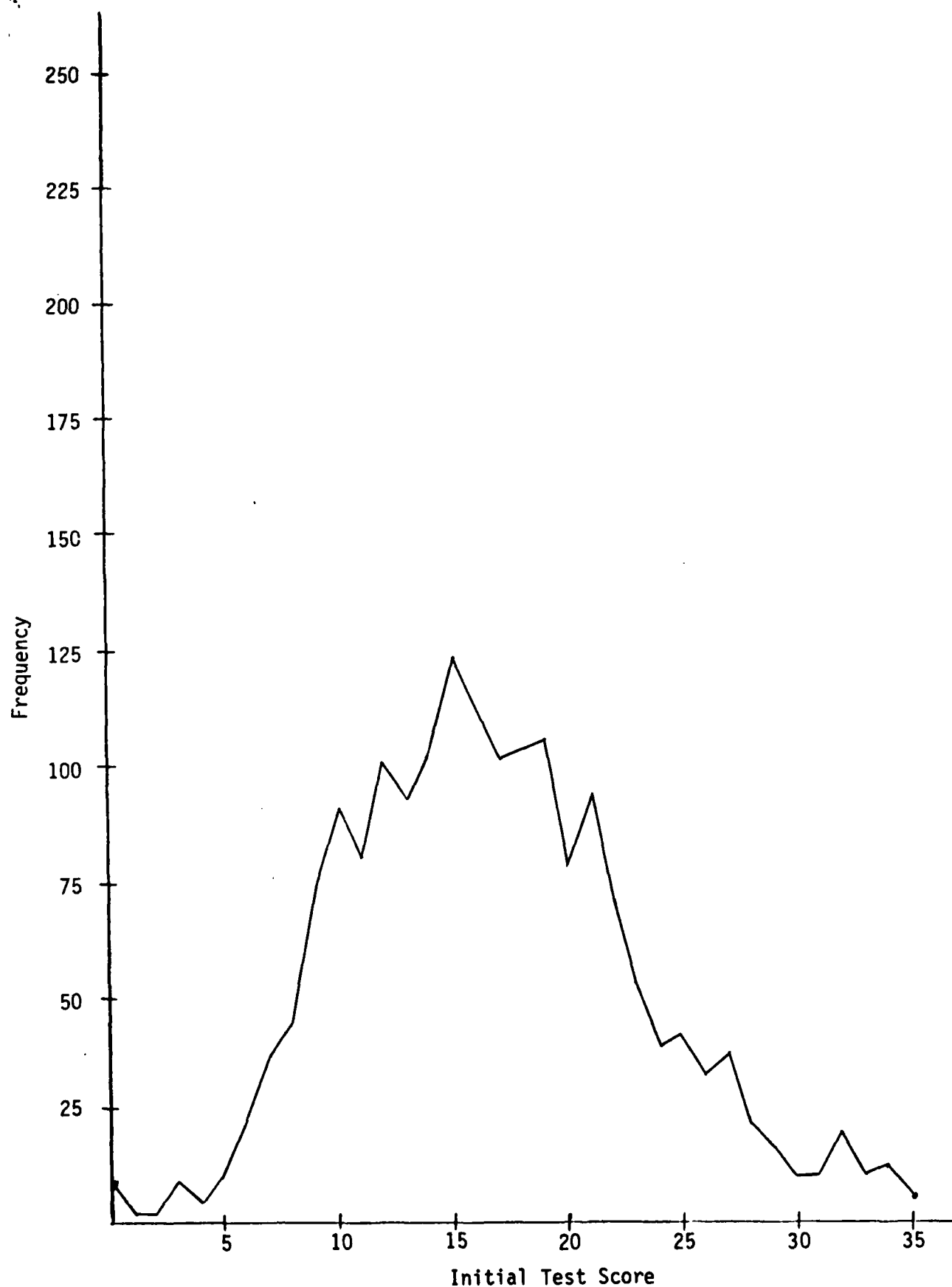


Figure 1. Frequency of Word Knowledge Subtest, retest population, same version of ASVAB (N = 1,774).

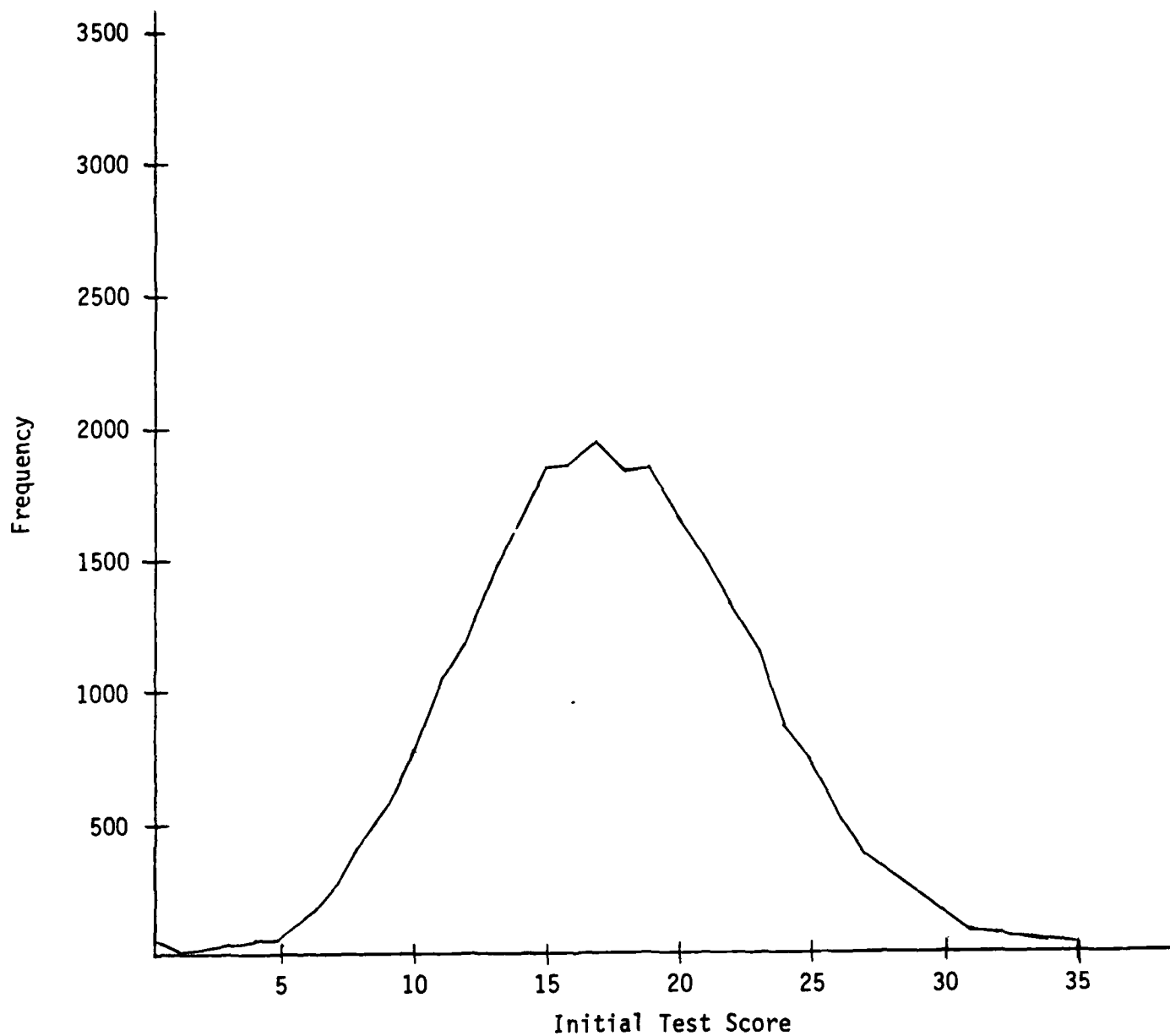


Figure 2. Frequency of Word Knowledge Subtest, retest population, different versions of ASVAB (N = 26,136)

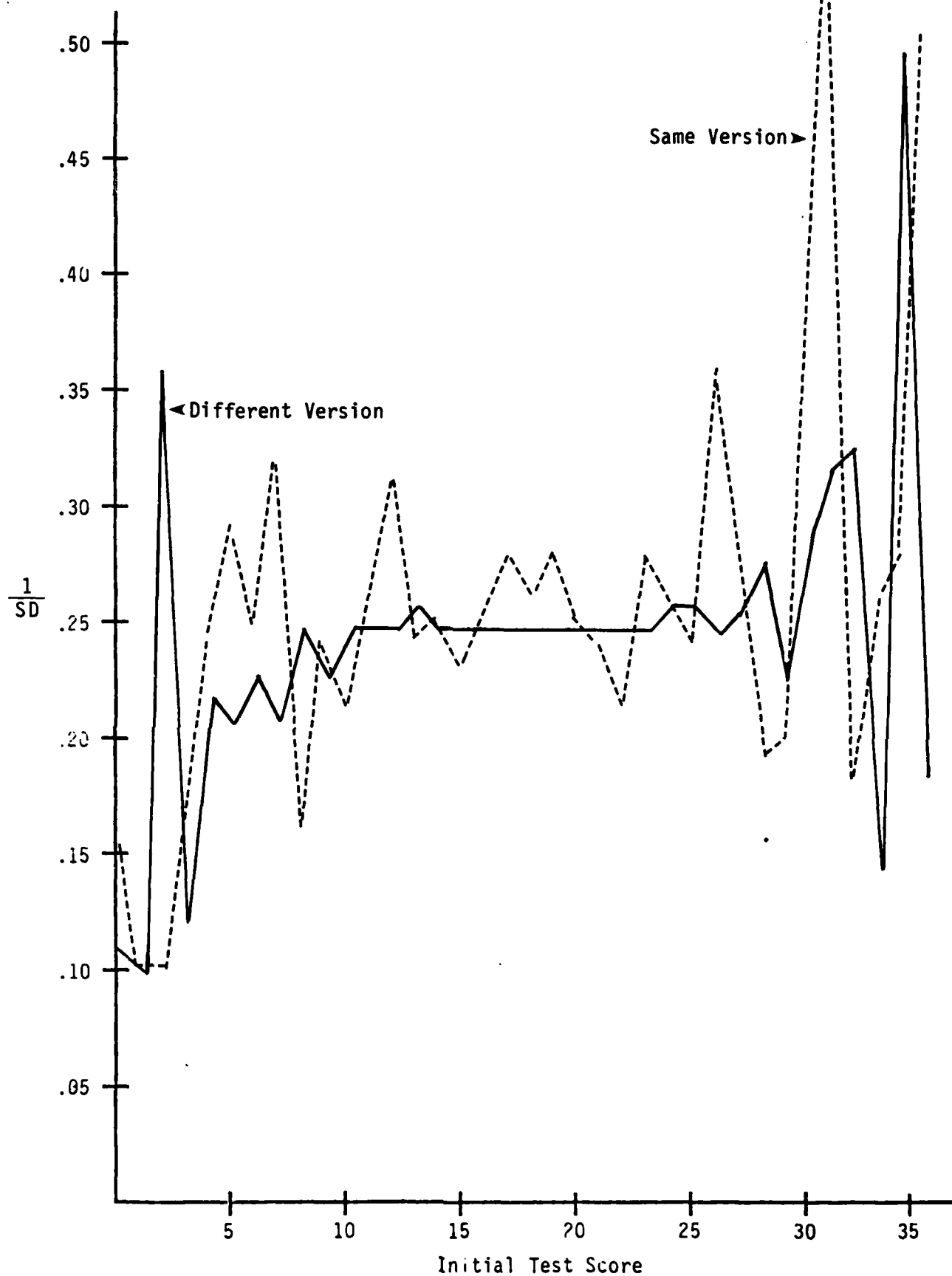


Figure 3. $\frac{1}{SD}$, Word Knowledge Subtest, retest population same and different versions of ASVAB (N = 1,774)

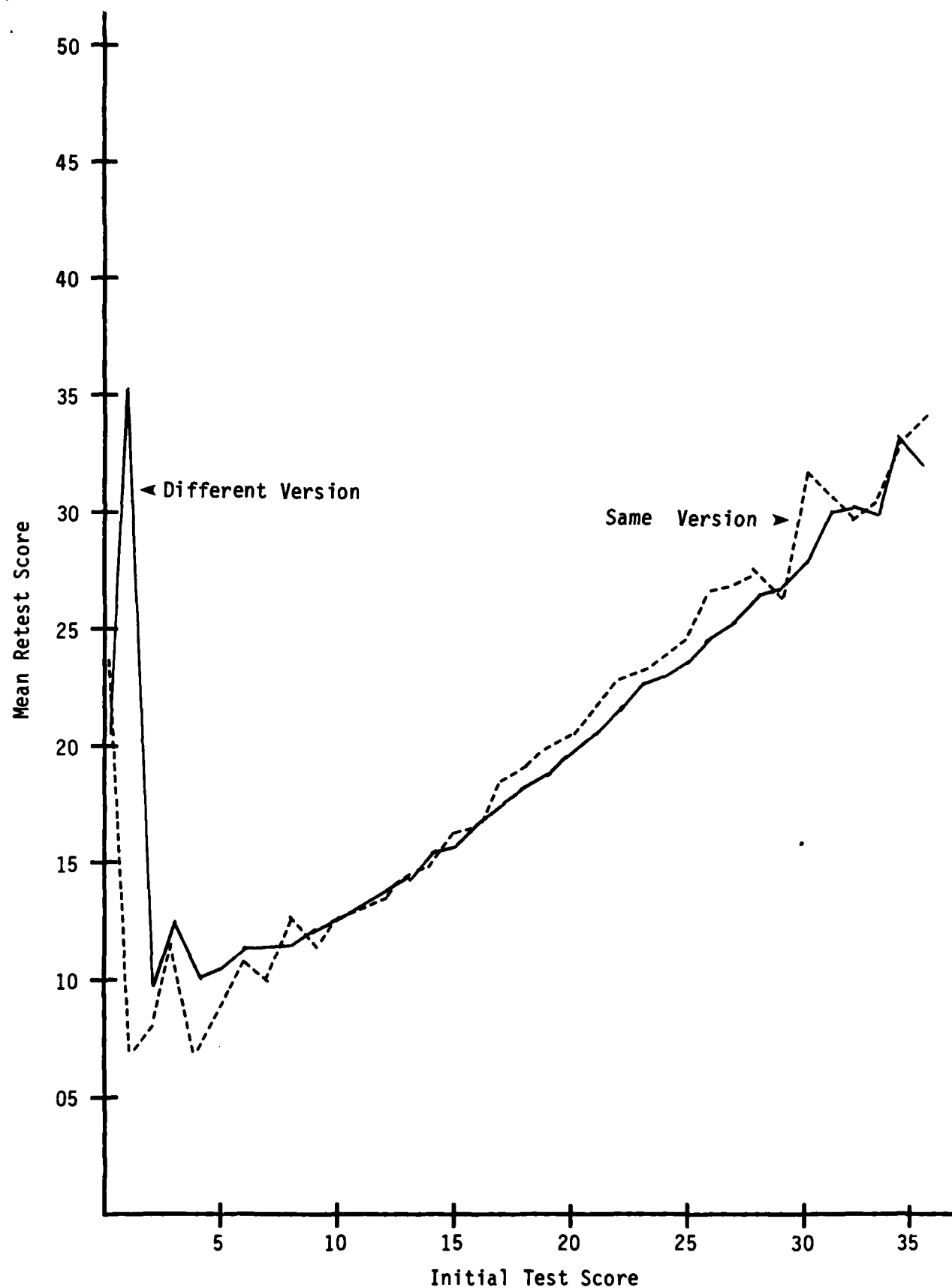


Figure 4. Mean retest score, Word Knowledge Subtest, retest population same and different versions of ASVAB (N = 26,136)

As can be seen from Table 9, there is a significant increase in the mean subtest scores between the initial and retest administration. This increase might be attributed to the practice effects of test taking. Indeed the largest increases in mean scores were found to be in the two speeded subtests.

A comparison of the retest applicants' mean scores was made with the initial test only applicants' mean scores for each subtest to examine the differences which reflect actual numbers of items that were answered correctly. The mean scores for the last previous and most recent tests for the retest applicants and the initial test only applicants were converted to percent correct for each subtest (see Table 11). The difference in percent correct for initial test only applicants and retest applicants' scores was computed for each subtest. The difference was multiplied by the number of items in each subtest to generate an index of the approximate difference in actual number of items answered correctly by the initial only applicants as compared to the retested applicants.

The two power tests which showed the greatest difference in the index were AR and WK. There were no differences in this index for the two speeded subtests; however, when the same computation was made for these two tests using percent values it was found that a difference of four and six items were answered correctly for NO and CS, respectively. This result tends to support the notion that practice effects were influencing the scores of these two subtests.

Whereas, the previous comparisons were made to examine the effects of scoring differences on shifts between AFQT categories, the data in Table 12 presents shifts made in AFQT categories by virtue of retests taken by this group of applicants. As with previous results, where the average mean scores were higher for the most recent testing than for the last previous testing, the table shows in numbers the persons who changed from a lower AFQT category to a higher one. Although the number who shift appears to be large, particularly in the lower scoring categories, this shift is expected due to the construction of the AFQT. Table 13 shows similar results for the Army CO Composite. The shift into a higher category is reflected in the nature of the structure of the subtests which comprise this component. Shifts to higher categories are easier to achieve for lower scoring applicants because the category intervals are relatively short. Thus, an increase in one's speediness on the CS subtest alone could be sufficient to move the applicant easily at least one category.

Table 14 shows the shifts which occurred between categories for the EL composite, a composite which contains no speeded subtests. As can be seen from this table, far fewer category shifts occur between the initial and speeded subtests.

The scoring shifts in percents for the AFQT, CO and EL composites are presented in Tables 15, 16 and 17. As can be seen from these tables, AFQT is the most stable of the composites.

TABLE 11. Comparison of Average Percent Correct Responses and Standard Scores of ASVAB Subtest Items for Initial and Retest Testing Army Applicants and All Army Applicants With Scored Matched Tests From Contractor.

Subtest Name	Number of Items in Subtest (1)	Retested Applicants (N = 27,911)				Std. Score	All Matched Army Applicants (N = 143,279) Percent Correct (4)	Approximate Number Of Items Different (4-3)*1 (5)	Approximate Number Of Items Different (4-2)*1 (6)
		Std. Score	Initial Percent Correct (2)	Std. Score	Retest Percent Correct (3)				
GS	25	40	43.2	40	44.4	46	55.6	3	3
AR	30	41	37.9	42	39.7	48	53.2	4	5
WK	35	39	50.0	40	51.4	46	64.1	5	5
PC	15	40	49.1	43	51.8	46	62.5	2	2
NO	50	44	58.8	47	64.6	48	66.9	1	4
CS	84	46	43.4	49	50.1	49	50.0	0	6
AS	25	41	45.6	43	47.5	46	57.9	3	3
MK	25	43	32.0	44	33.3	48	43.8	3	3
MC	25	40	41.5	42	44.3	46	53.2	2	3
EI	20	42	43.7	42	45.5	47	54.8	2	2
Total Difference								25	36

TABLE 12. Frequency of Initial and Retest Scores FY 1981 Army Applicants by AFQT Mental Category.*

Retest Scores AFQT Mental Category	Initial Test Scores AFQT Mental Category								Total
	I 101-105	II 84-100	IIIA 76-83	IIIB 65-75	IVA 56-64	IVB 49-55	IVC 38-48	V 0-37	
I	8	12	0	3	1	0	0	4	28
II	4	127	55	19	24	7	13	17	266
IIIA	0	35	63	157	277	24	23	18	597
IIIB	0	14	54	574	3,079	579	191	49	4,558
IVA	1	6	8	179	3,497	2,210	1,248	77	7,226
IVB	0	1	3	31	1,275	2,247	2,632	169	6,358
IVC	0	2	3	10	337	1,297	3,964	880	6,493
V	0	2	0	4	54	123	983	1,219	2,385
Total	13	199	186	977	8,562	6,487	9,054	2,433	27,911
% of Total	.1	.7	.7	3.5	30.7	23.2	32.4	8.7	100.0

*AFQT = AR + WK + PC + 1/2NO

TABLE 13. Frequency of Initial and Retest Scores FY 1981 Army Applicants for Army CO Composite.*

Retest Score	Initial Score									Total
	120+	110-119	105-109	100-104	95-99	90-94	85-89	80-84	40-79	
120+	44	46	5	9	3	4	0	0	15	126
110-119	12	77	68	145	71	40	26	10	28	477
105-109	1	34	58	167	156	92	43	12	24	587
100-104	1	19	61	308	411	367	224	101	112	1,604
95-99	1	10	28	161	368	474	473	278	297	2,090
90-94	0	3	5	67	271	516	681	617	786	2,946
85-89	0	2	2	31	103	383	707	948	1,851	4,027
80-84	1	2	1	7	31	171	465	815	2,607	4,100
40-79	6	2	5	10	35	118	385	995	10,397	11,953
Total	66	195	233	905	1,449	2,165	3,005	3,776	16,117	27,911
% of Total	.2	.7	.8	3.2	5.2	7.8	10.8	13.5	57.8	100.0

*CO = AR + AS + MC + CS

TABLE 14. Frequency of Initial and Retest Scores FY 1981 Army Applicants for EL Composite.*

Retest Score	Initial Score									Total
	120+	110-119	105-109	100-104	95-99	90-94	85-89	80-84	40-79	
120+	47	19	5	4	1	1	2	3	6	88
110-119	13	72	40	39	17	11	2	7	24	226
105-109	0	20	49	81	73	44	15	12	27	321
100-104	3	5	40	186	234	239	77	47	56	887
95-99	1	8	23	125	265	404	270	195	159	1,450
90-94	1	2	8	94	258	589	657	597	552	2,758
85-89	1	2	4	16	106	412	649	792	1,302	3,284
80-84	2	2	1	8	54	283	500	853	2,151	3,855
40-79	3	1	4	6	39	198	599	1,583	12,609	15,042
Total	71	132	174	559	1,047	2,181	2,771	4,089	16,886	27,911
% of Total	.2	.5	.6	2.0	3.8	7.8	9.9	14.7	60.5	100.0

*EL = GS + AR + MK + EI

TABLE 15. Scoring Shifts in Percents for AFQT Composite From Initial to Retest: FY 1981 Army Applicants.*

Retest AFQT Mental Category	Initial Test AFQT Mental Category							
	V	IVB	IVA	IIIC	IIIB	IIIA	II	I
I	0	0	0	0	0	0	6	<u>62</u>
II	1	0	0	0	2	30	<u>64</u>	31
IIIA	1	0	0	3	16	<u>34</u>	18	0
IIIB	2	2	9	36	<u>59</u>	29	7	0
IIIC	3	14	34	<u>41</u>	18	4	3	8
IVA	7	29	<u>35</u>	15	3	2	1	0
IVB	36	<u>44</u>	20	4	1	2	1	0
V	<u>50</u>	11	2	1	0	0	1	0
% of Total**	9	32	23	31	4	1	1	0

*AFQT = AR + WK + PC + 1/2NO

**May not total 100 due to rounding

TABLE 16. Scoring Shifts in Percents for CO Composite from Initial to Retest: FY 1981 Army Applicants.*

Retest Score	Initial Test Score								
	120+	110-119	105-109	100-104	95-99	90-94	85-89	80-84	40-79
120+	<u>67</u>	24	2	1	0	0	0	0	0
110-119	18	<u>39</u>	29	16	5	2	1	0	0
105-109	2	17	<u>25</u>	18	11	4	1	0	0
100-104	2	10	26	<u>34</u>	28	17	7	3	1
95-99	2	5	12	18	<u>25</u>	22	16	7	2
90-94	0	2	2	7	19	<u>24</u>	23	16	5
85-89	0	1	1	3	7	18	<u>24</u>	25	11
80-84	2	1	0	8	2	8	15	<u>22</u>	16
40-79	9	1	2	1	2	5	13	26	65
% of Total**	0	1	1	3	5	8	11	14	58

*CO = AR + AS + MC + CS

**May not total 100 due to rounding

TABLE 17. Scoring Shifts in Percents for EL Composite from Initial to Retest: FY 1981 Army Applicants.*

Retest Score	Initial Test Score								
	120+	110-119	105-109	100-104	95-99	90-94	85-89	80-84	40-79
120+	66	14	3	1	0	0	0	0	0
110-119	18	55	23	7	2	1	0	0	0
105-109	0	15	28	14	7	2	1	0	0
100-104	4	4	23	33	22	11	3	1	0
95-99	1	6	13	22	25	19	10	5	1
90-94	1	2	5	17	25	27	24	15	3
85-89	1	2	2	3	10	19	23	19	8
80-84	3	2	1	1	5	13	18	21	13
40-79	4	1	2	1	4	9	22	39	75
% of Total**	0	0	1	2	4	8	10	15	61

*EL = GS + AR + MK + EI

**May not total 100 due to rounding

DISCUSSION

The impact of this practice effect must be considered in light of the potential for marginally-qualified individuals to become eligible for enlistment in the Armed Services. The capability of an individual to change his or her qualifying score by increasing the speed at which the NO questions are answered have both positive and negative implications. On the one hand, it might be a positive indication that the individual has a willingness and capability to learn repetitive tasks. On the other hand, it might be an indication that the individual has only limited skills, such as the ability to acquire speed in performing simple computations. Indeed, a close examination of the retest means and standard deviations shows not only an increase in the average subtest scores, but a comparable increase in the spread of the scores. Thus, the gain achieved in the speeded test scores may be offset by the loss of points in the power tests.

GENERAL DISCUSSION AND RECOMMENDATIONS

The two major purposes of this project were to examine the reliability of the ASVAB data reported by the MEPS; and to examine the relationships between the scores reported for Army applicants who took the ASVAB on more than one occasion. Comparisons were made of ASVAB subtest scores reported by Army applicants from a pool of individuals who applied for military service during fiscal year 1981. In addition, test-retest scores were compared for approximately 30,000 applicants.

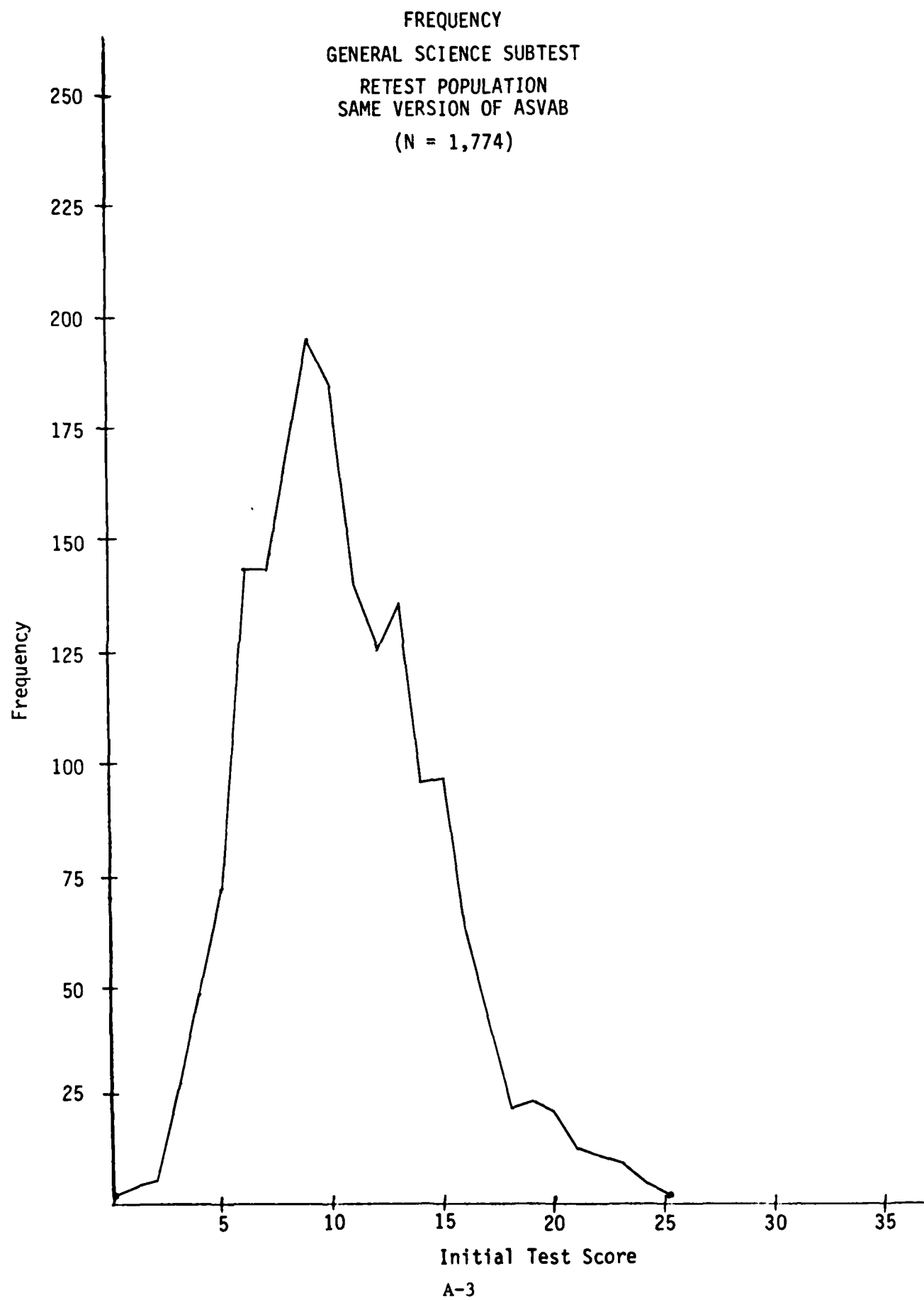
The MEPS reported scores were found to be highly reliable with the exception of those for the CS subtest. This result is consistent with other similar research conducted by the ARI. It is recommended that both factors be more closely examined to determine if remedial steps are required to achieve more accurate scores on this subtest.

The analyses of the test-retest data for applicants revealed the potential impact of practice effects on increasing scores for speeded subtests of the ASVAB. A recommended solution to this problem is the introduction of a practice test prior to the administration of the initial battery so as to minimize the potential for large differences in the test-retest scores which may be attributable to such an effect.

Finally, an assessment of the scoring error rate using the AFQT and Army Combat Composite resulted in small percentages for both composites. Nevertheless, it is recommended that these data be examined more closely to determine the effects of errors in scoring the various subtests, using more robust techniques, such as polynomial models to determine the effects of the error by individual subtests and processing stations.

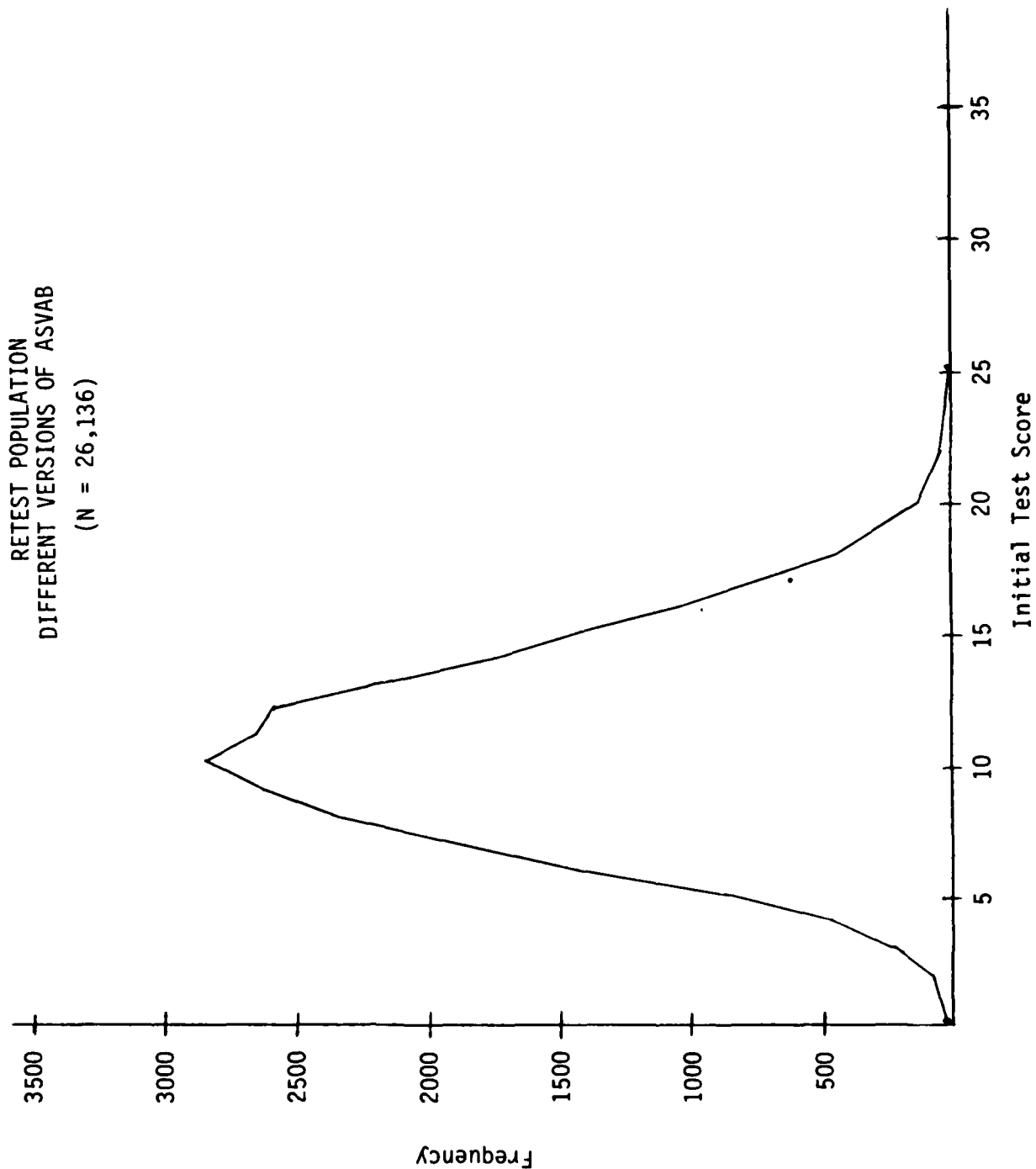
APPENDIX A

FREQUENCIES FOR ASVAB SUBTESTS:
RETESTED APPLICANT POOL

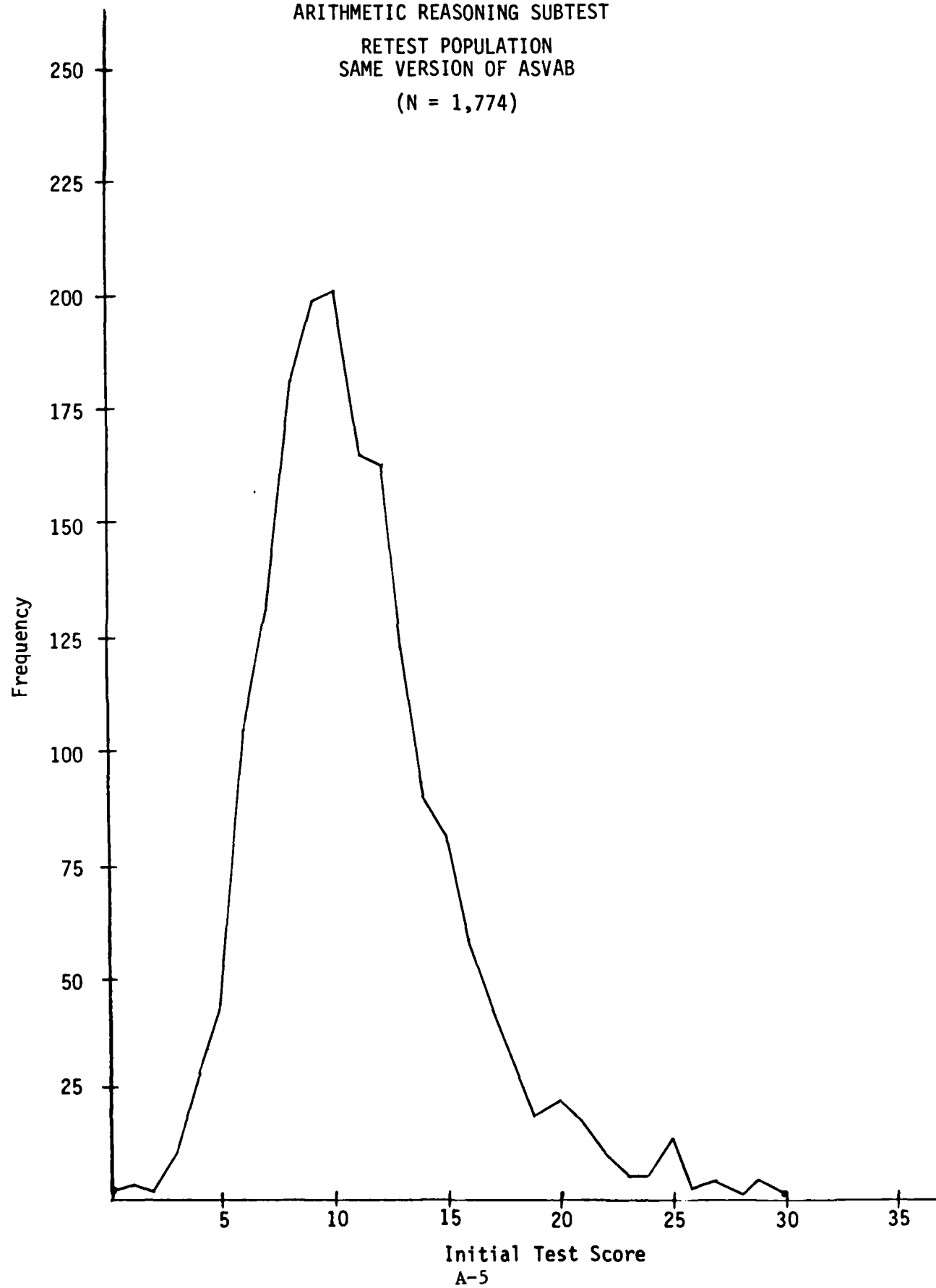


FREQUENCY

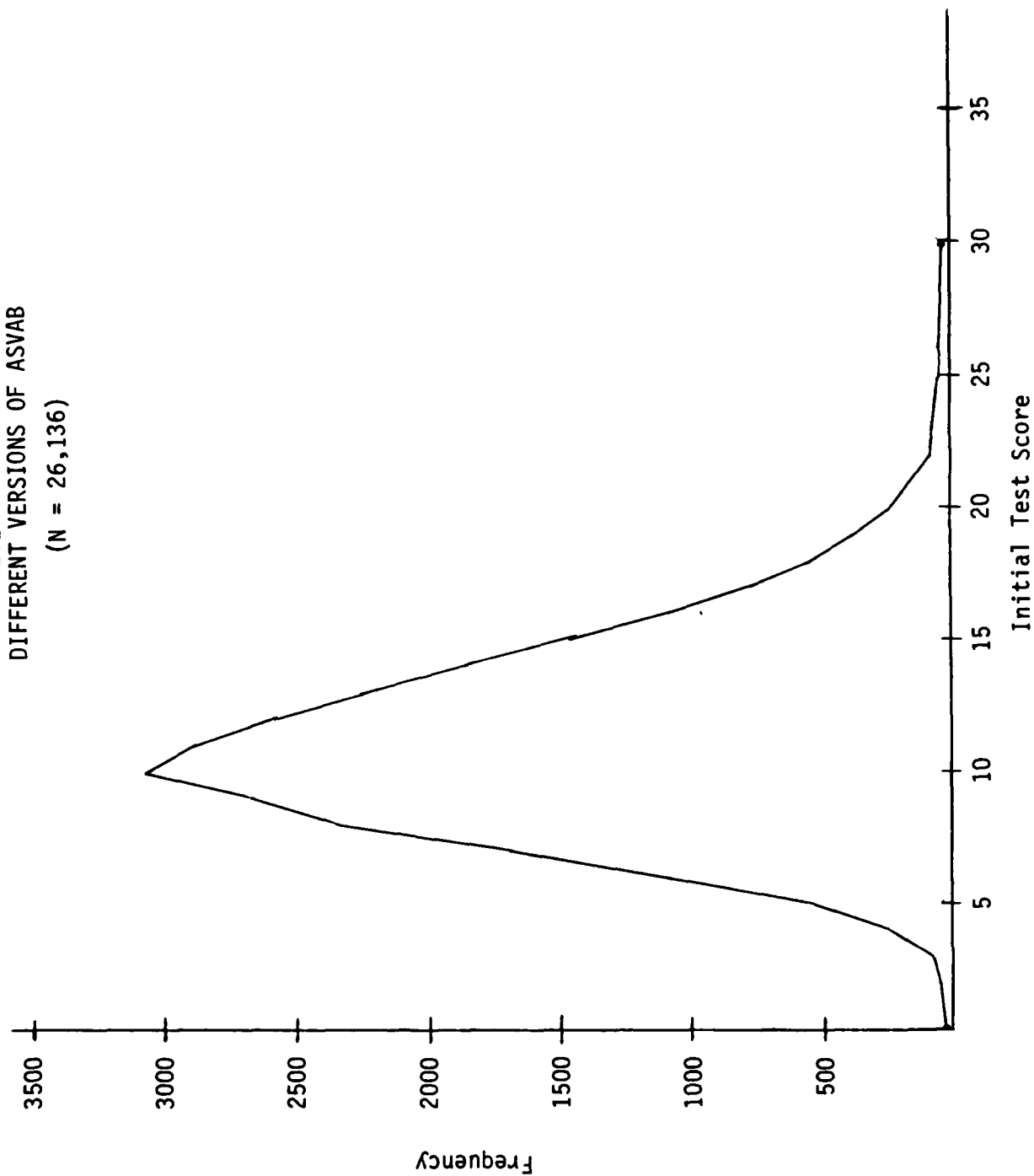
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RETEST POPULATION
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(N = 26,136)



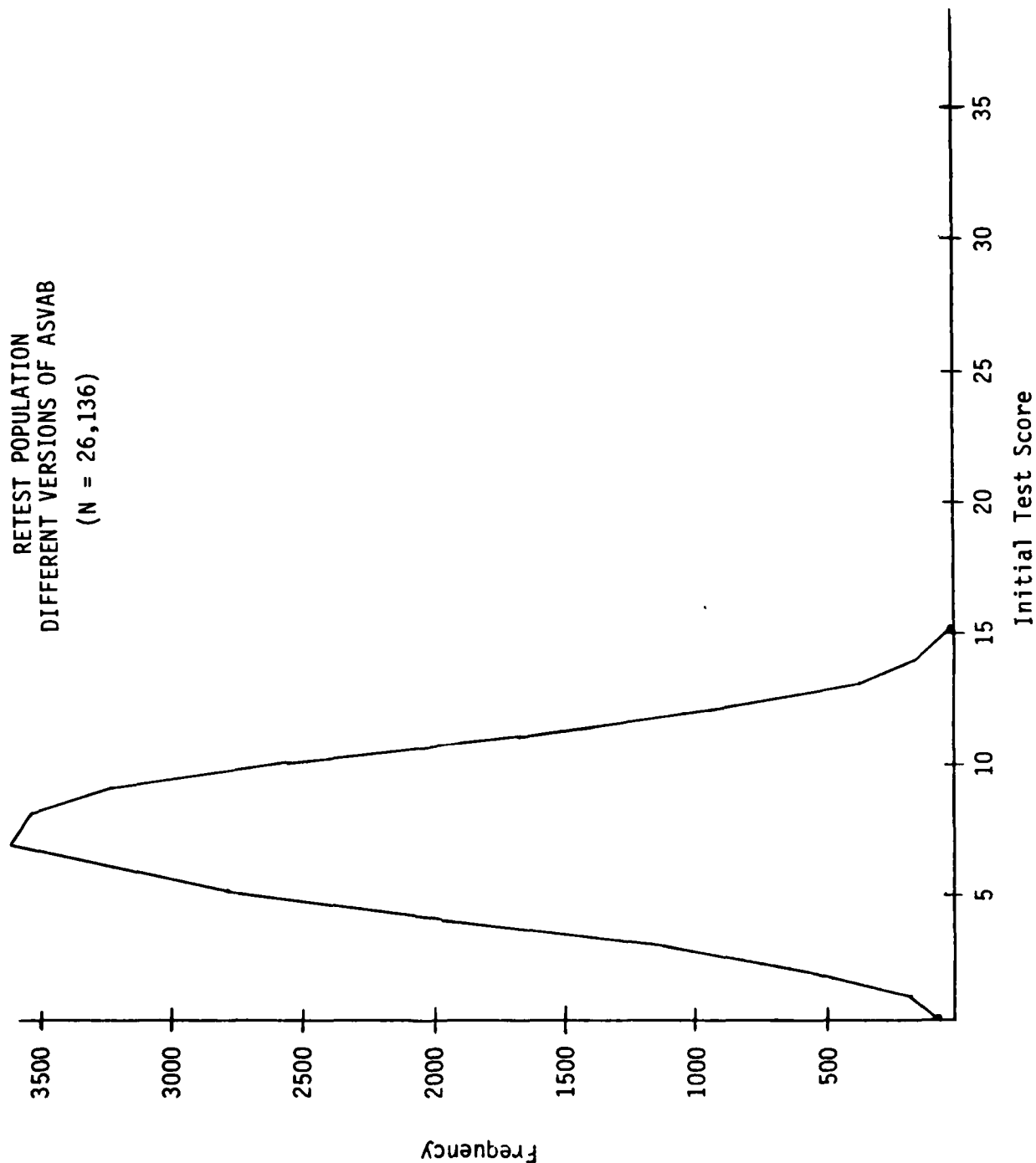
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ARITHMETIC REASONING SUBTEST
RETEST POPULATION
SAME VERSION OF ASVAB
(N = 1,774)



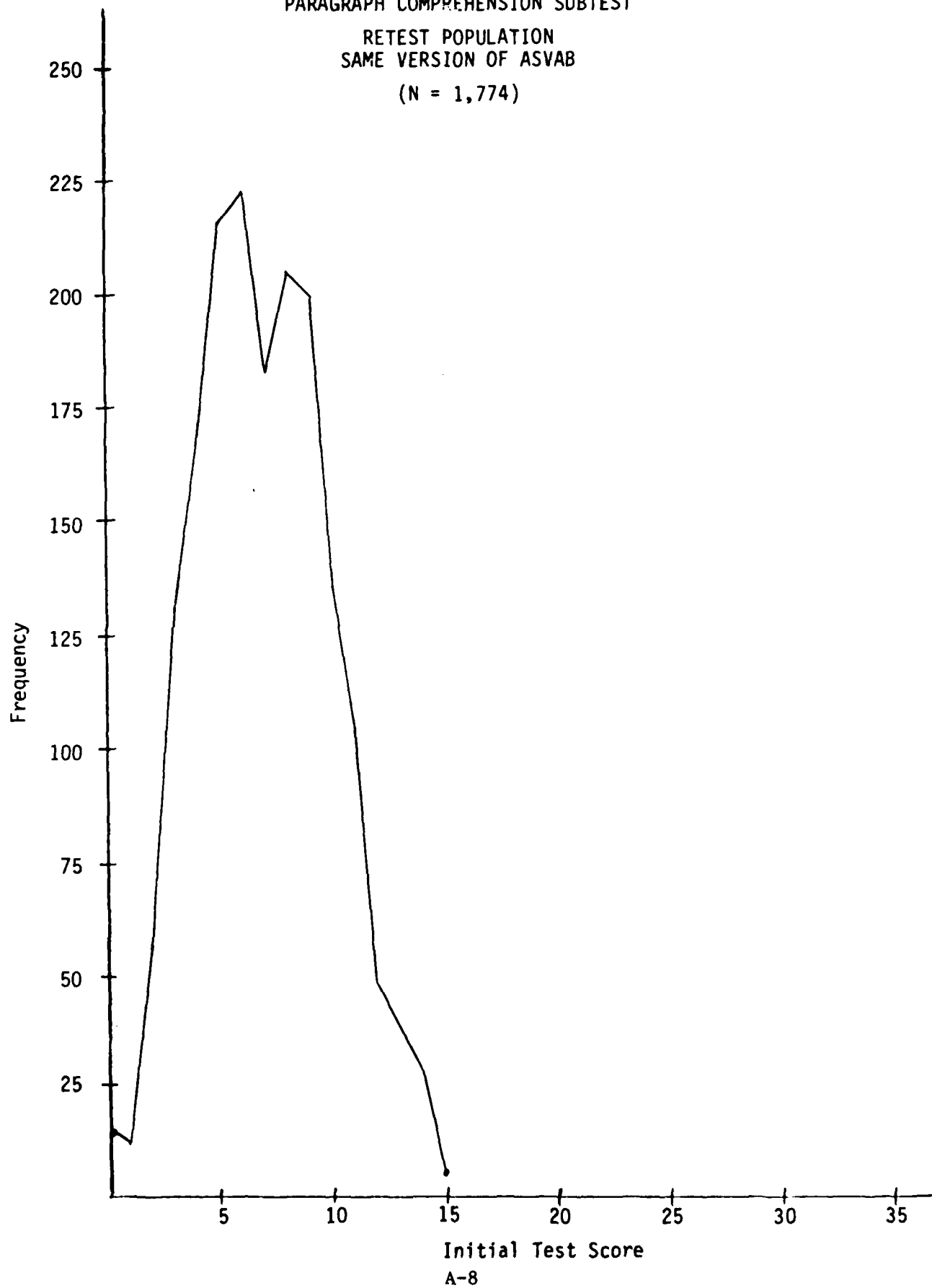
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ARITHMETIC REASONING SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)



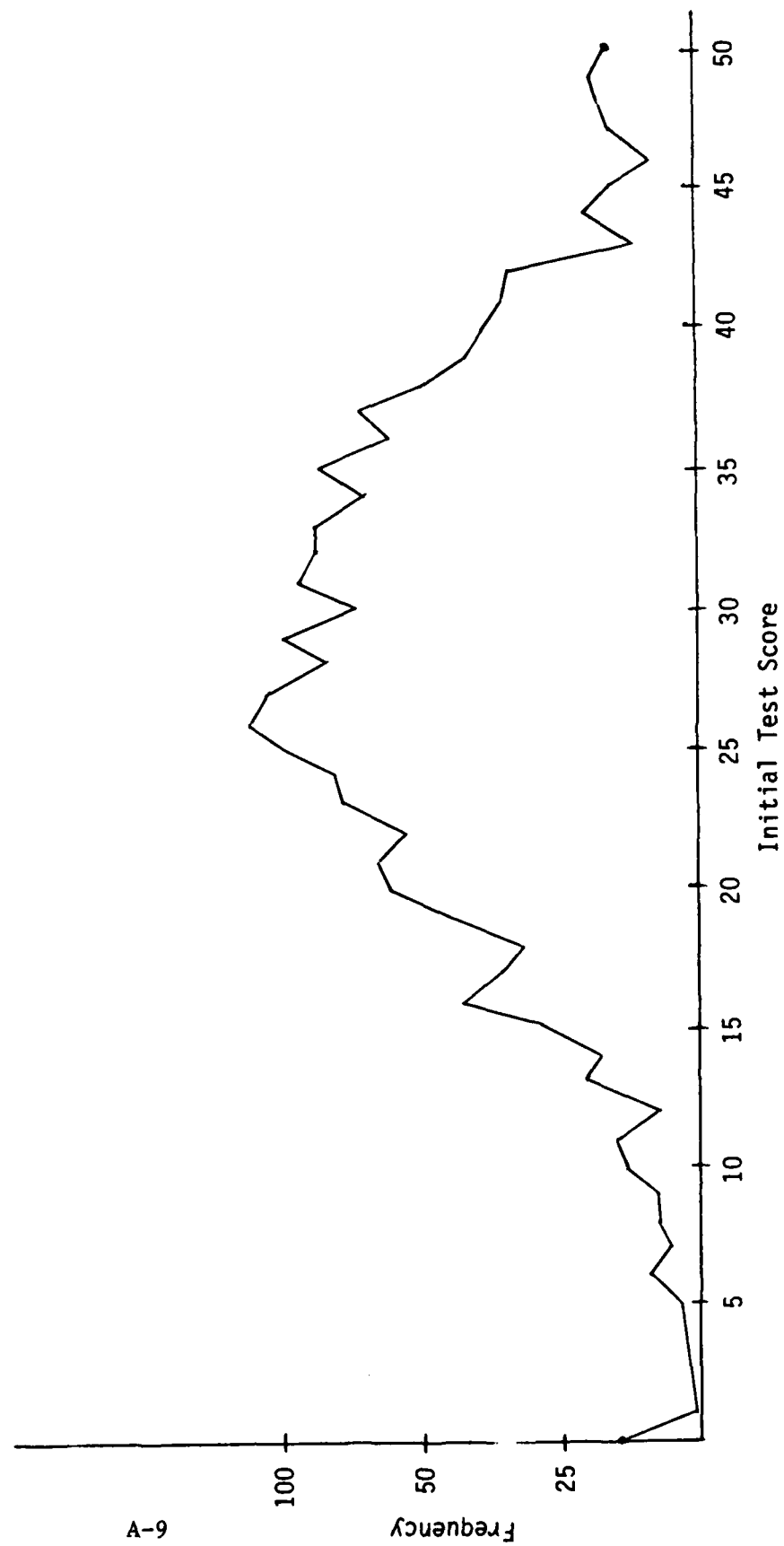
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PARAGRAPH COMPREHENSION SUBTEST
RETEST POPULATION
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(N = 26,136)



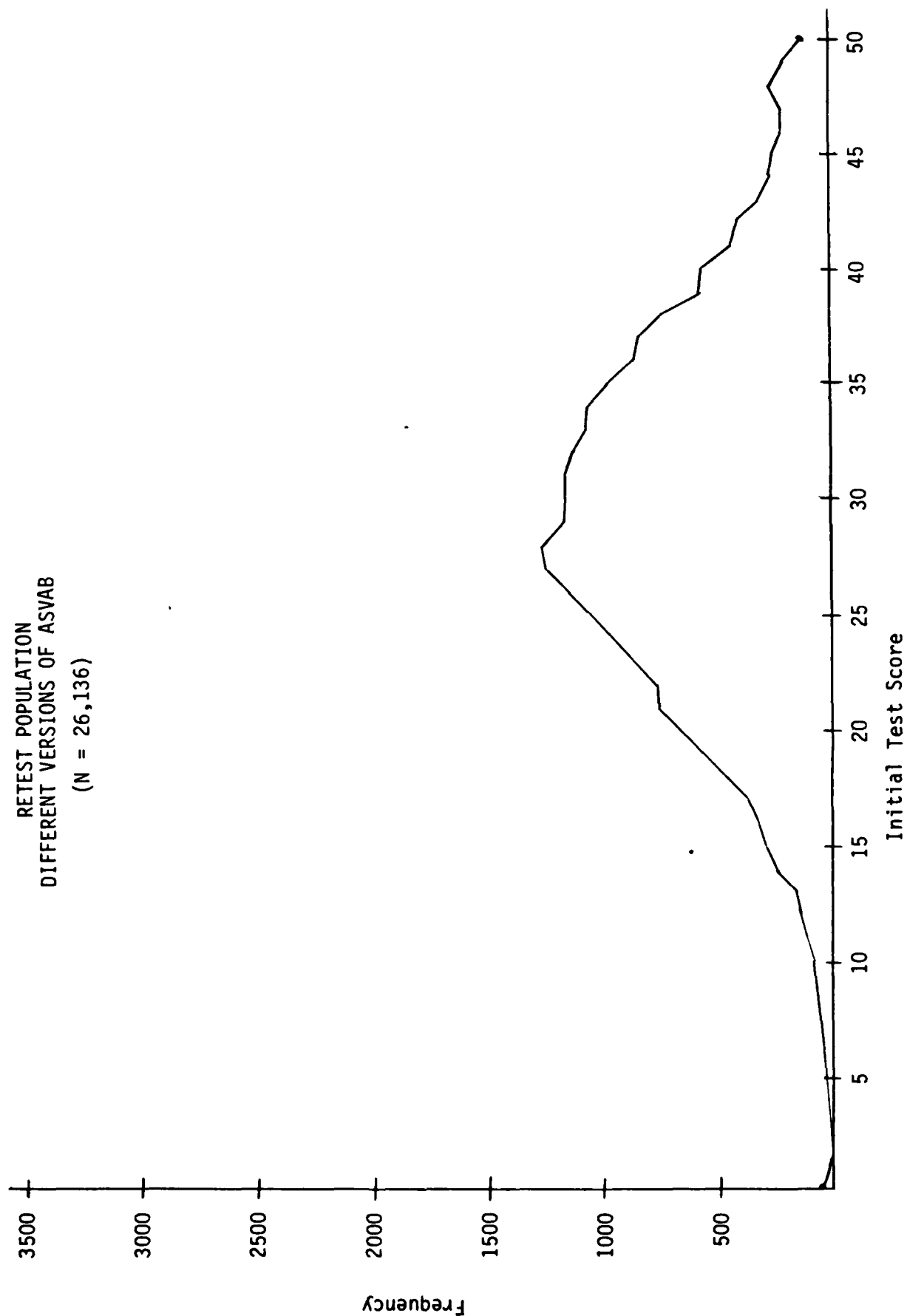
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SAME VERSION OF ASVAB
(N = 1,774)



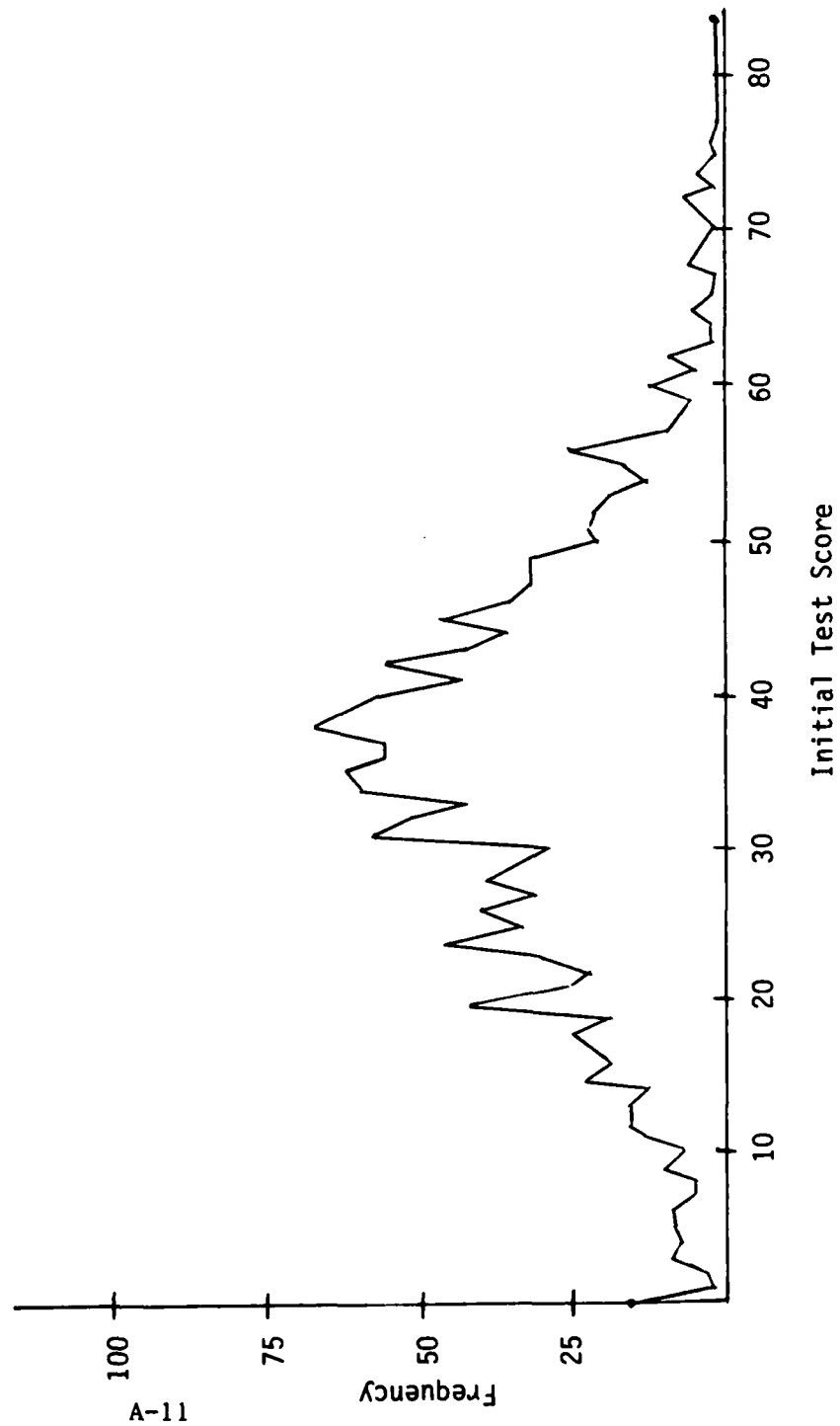
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SAME VERSION OF ASVAB
(N = 1,774)



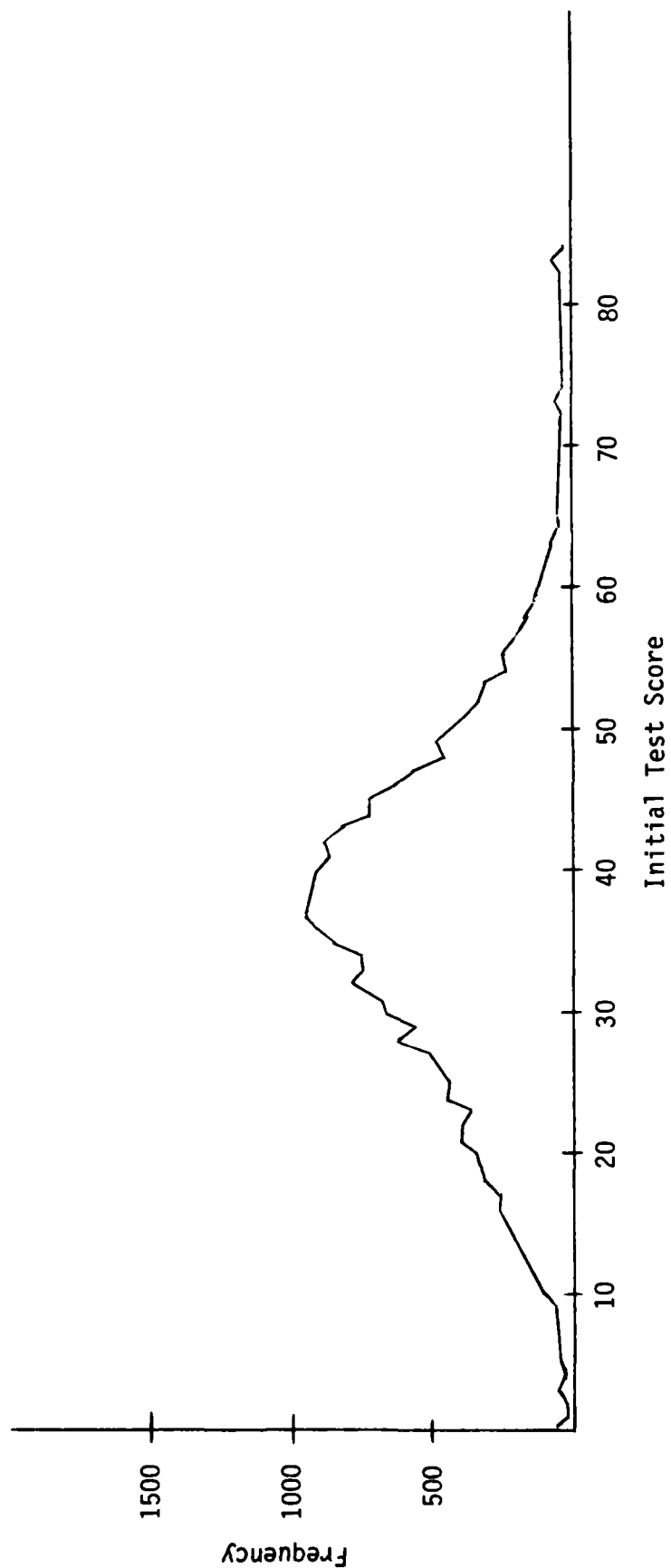
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 DIFFERENT VERSIONS OF ASVAB
 (N = 26,136)



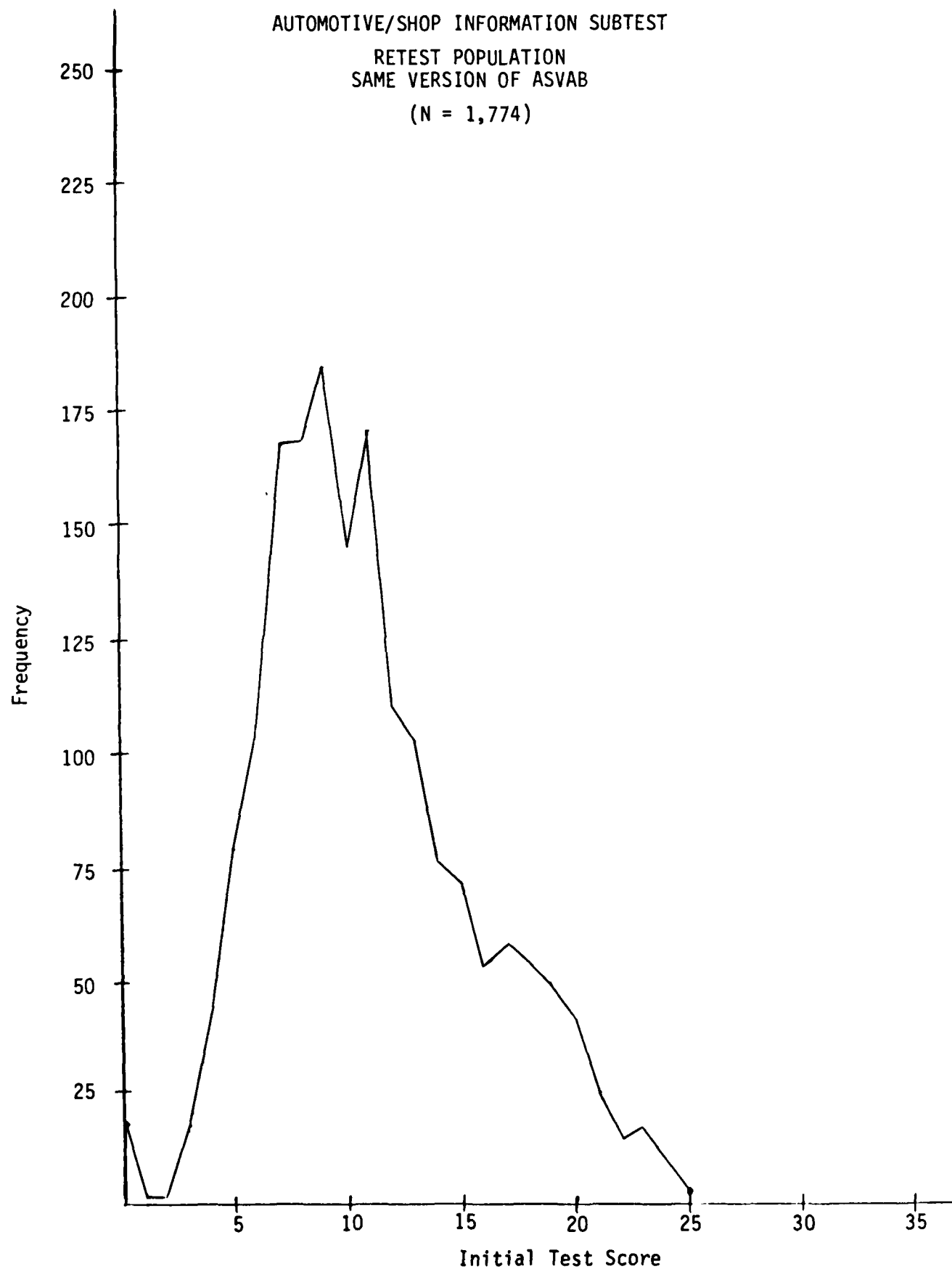
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CODING SPEED SUBTEST
RETEST POPULATION
SAME VERSION OF ASVAB
(N = 1,774)



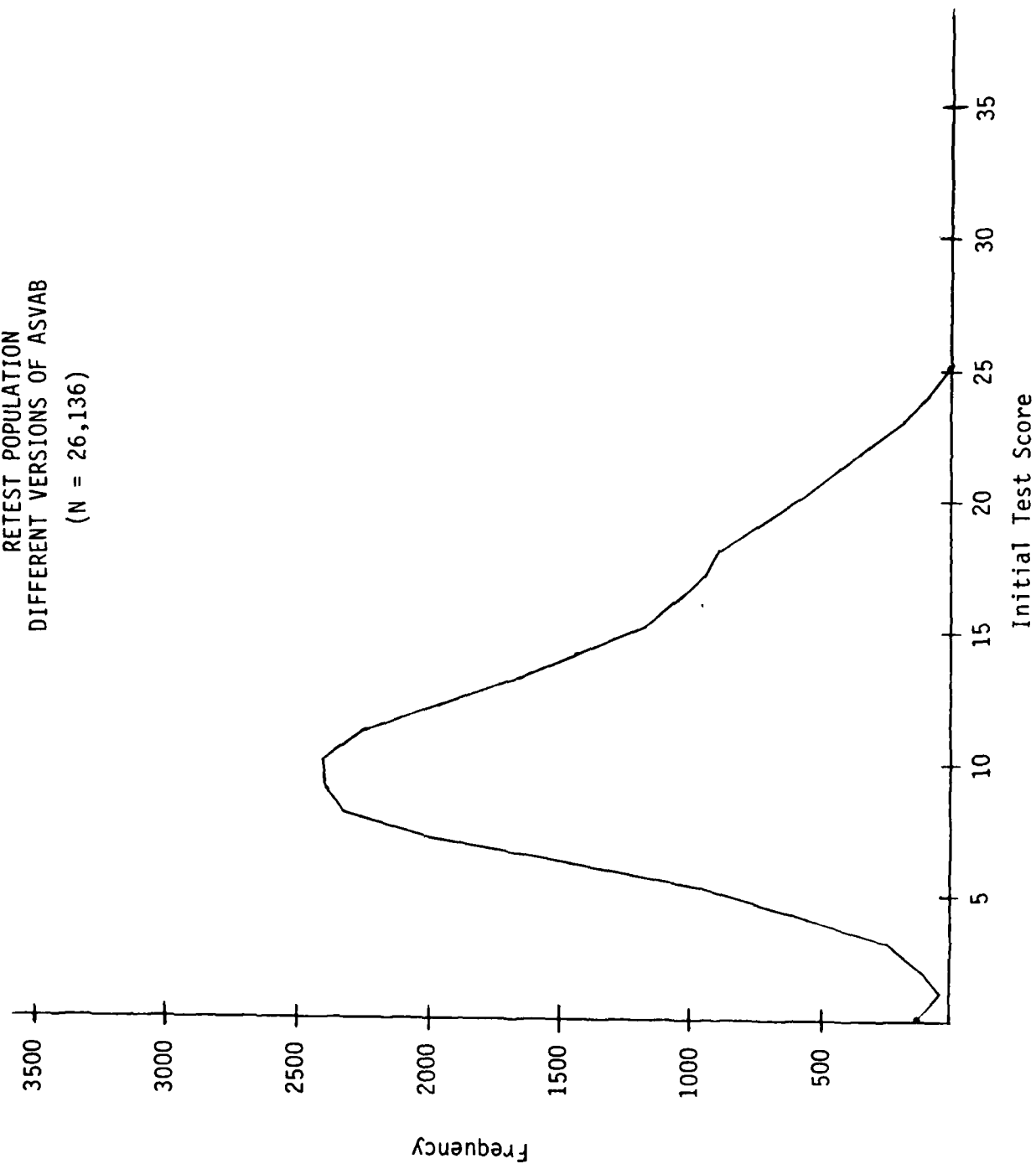
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 CODING SPEED SUBTEST
 RETEST POPULATION
 DIFFERENT VERSIONS OF ASVAB
 (N = 26,136)



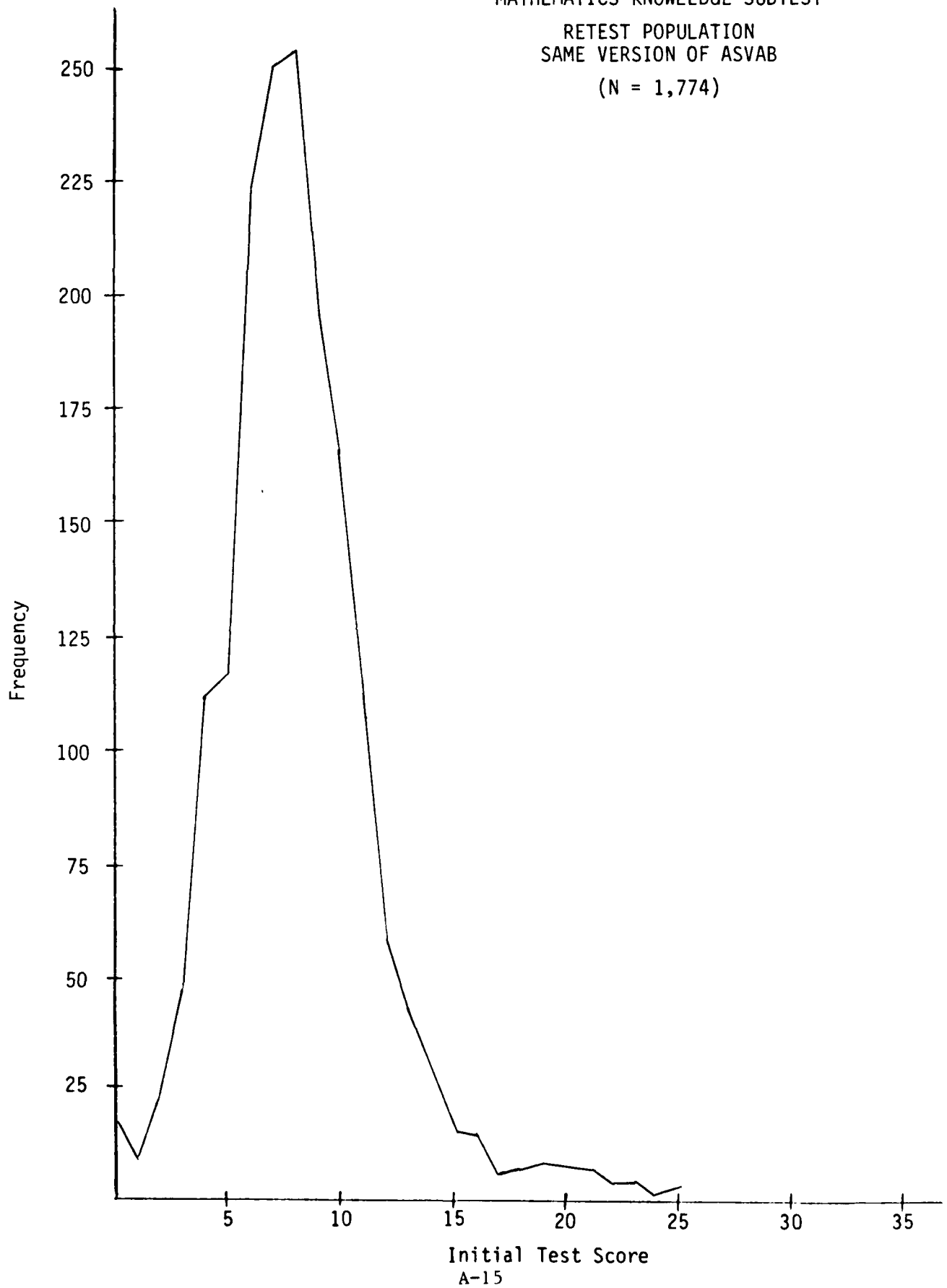
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RETEST POPULATION
SAME VERSION OF ASVAB
(N = 1,774)



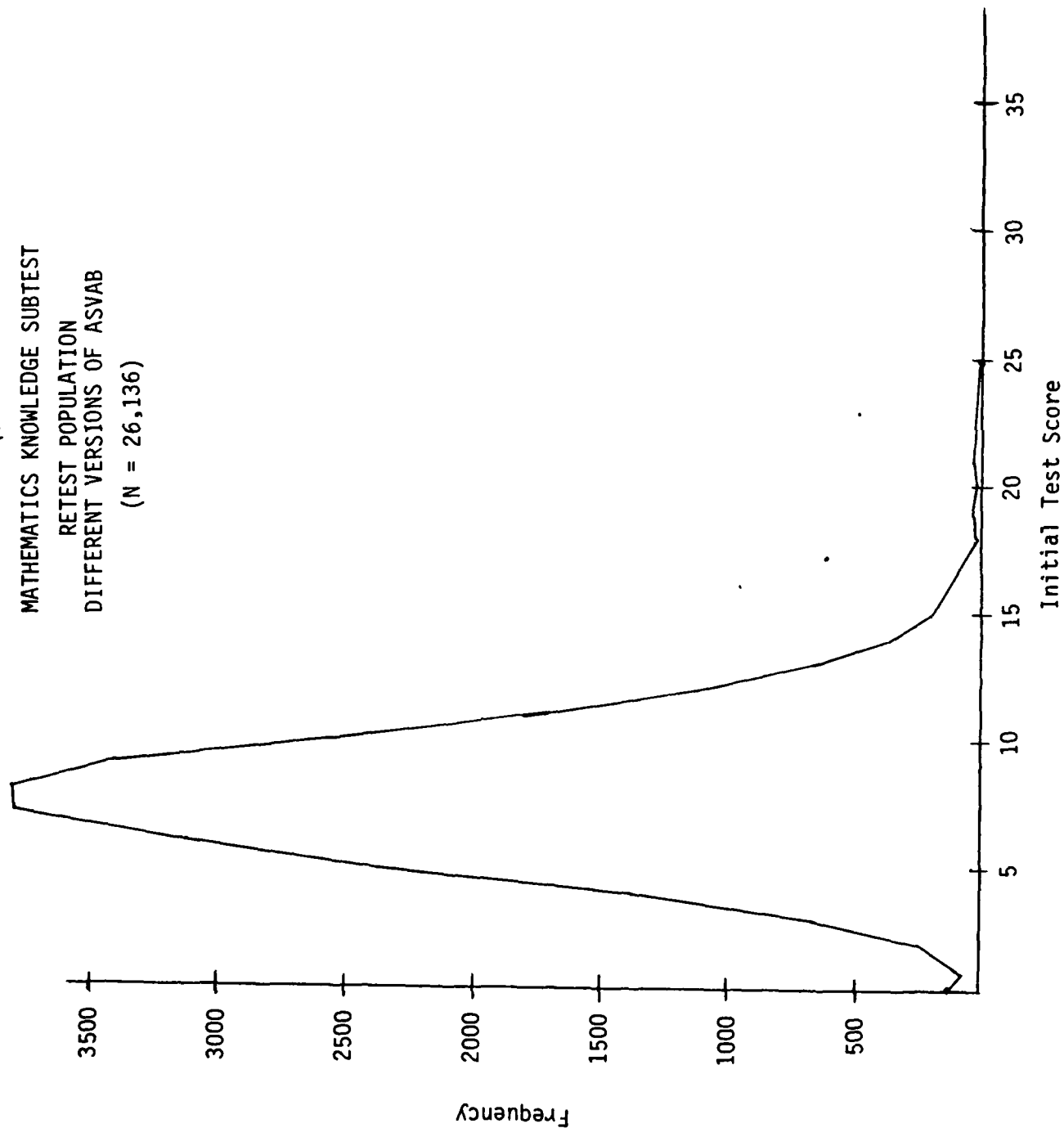
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RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)



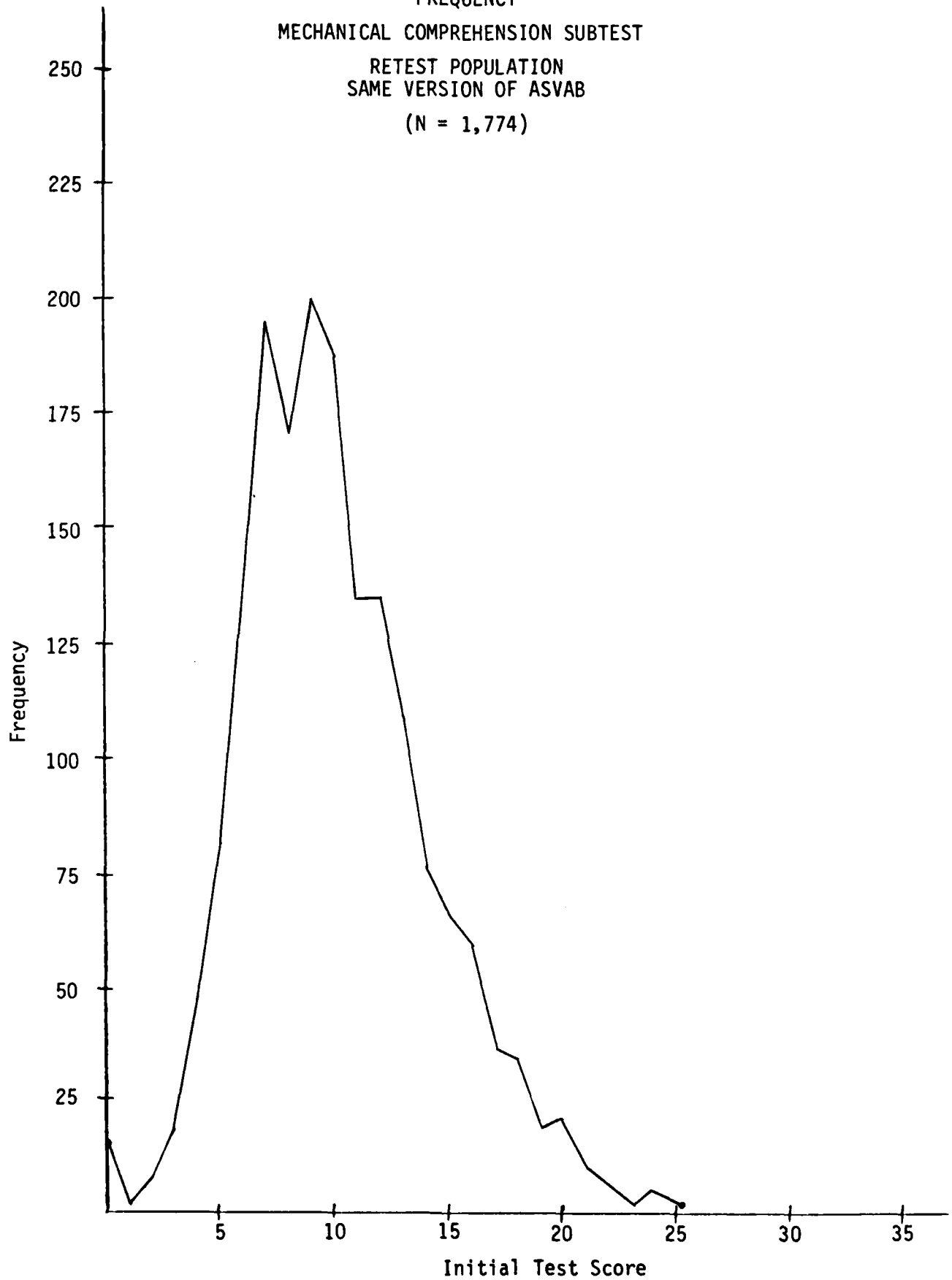
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SAME VERSION OF ASVAB
(N = 1,774)



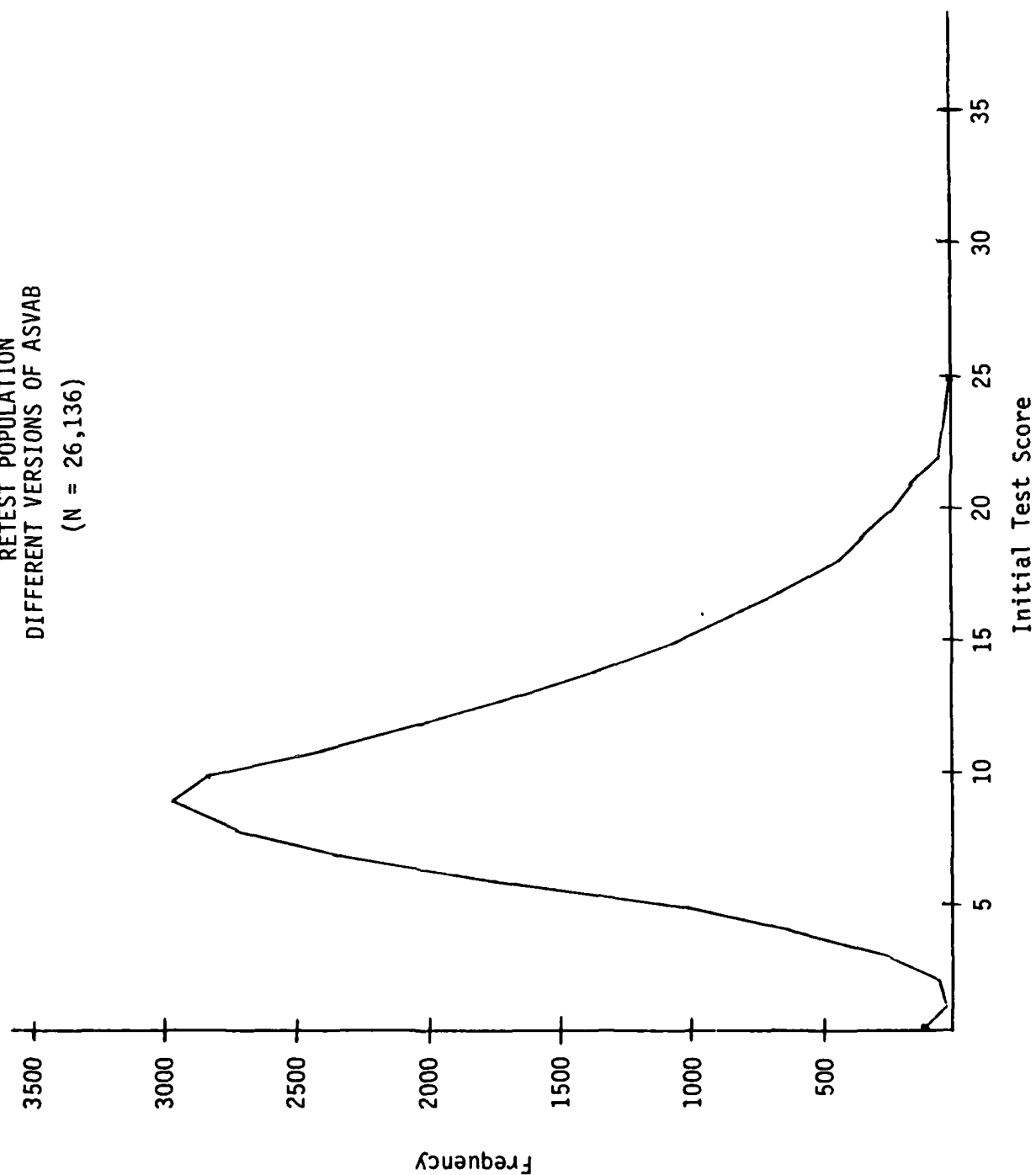
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 (N = 26,136)



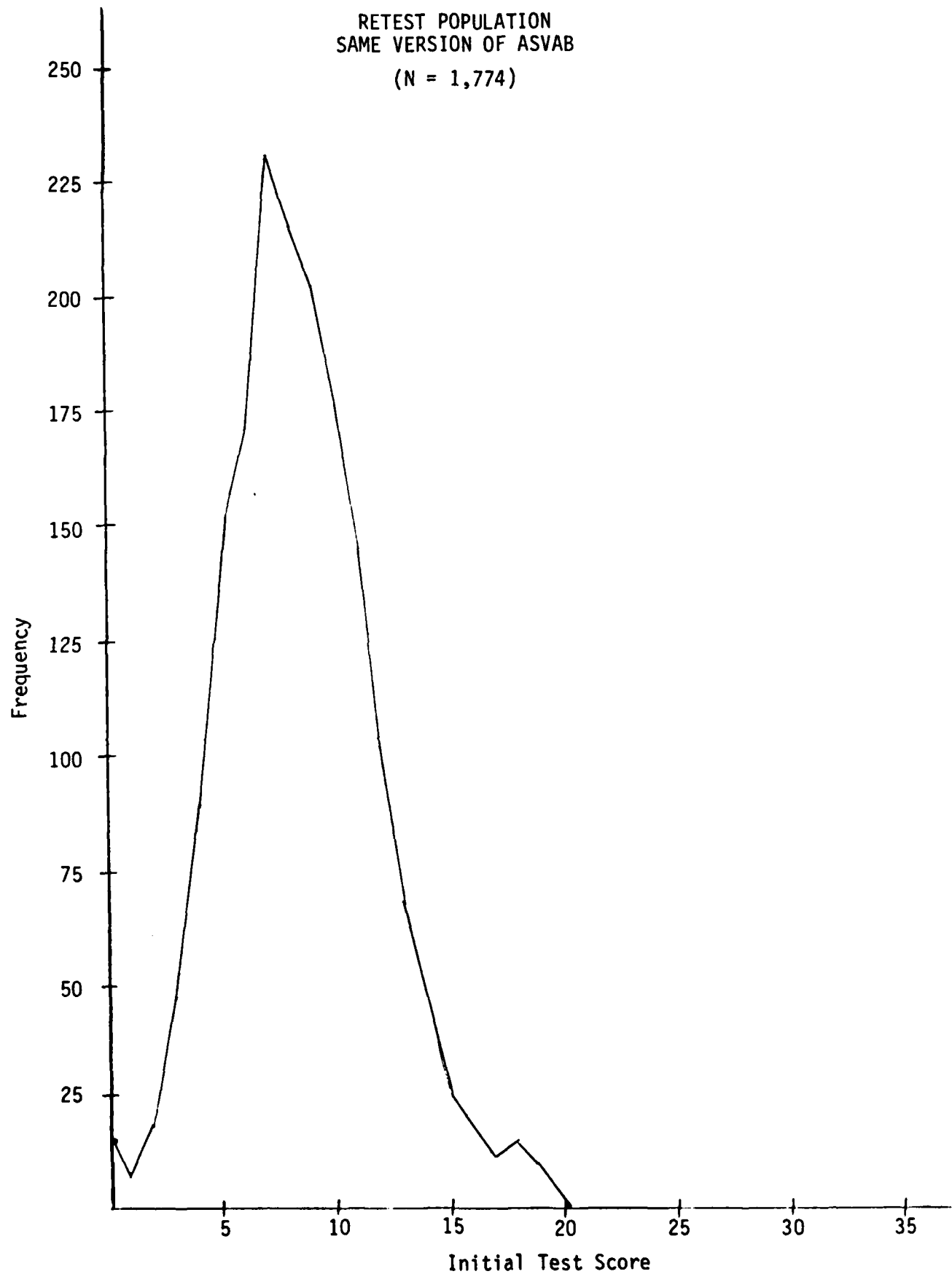
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SAME VERSION OF ASVAB
(N = 1,774)



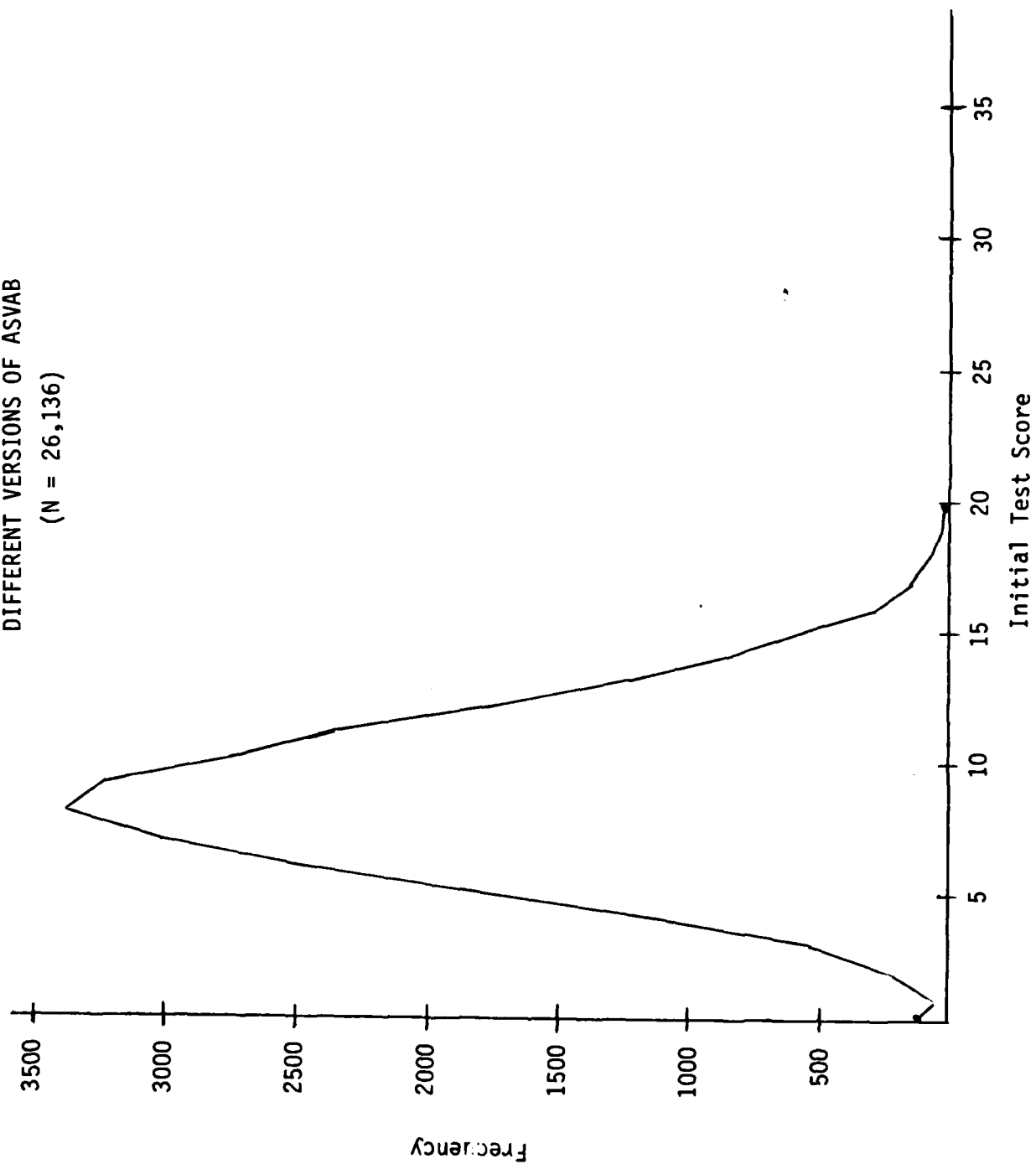
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MECHANICAL COMPREHENSION SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)



FREQUENCY
ELECTRONICS INFORMATION SUBTEST
RETEST POPULATION
SAME VERSION OF ASVAB
(N = 1,774)



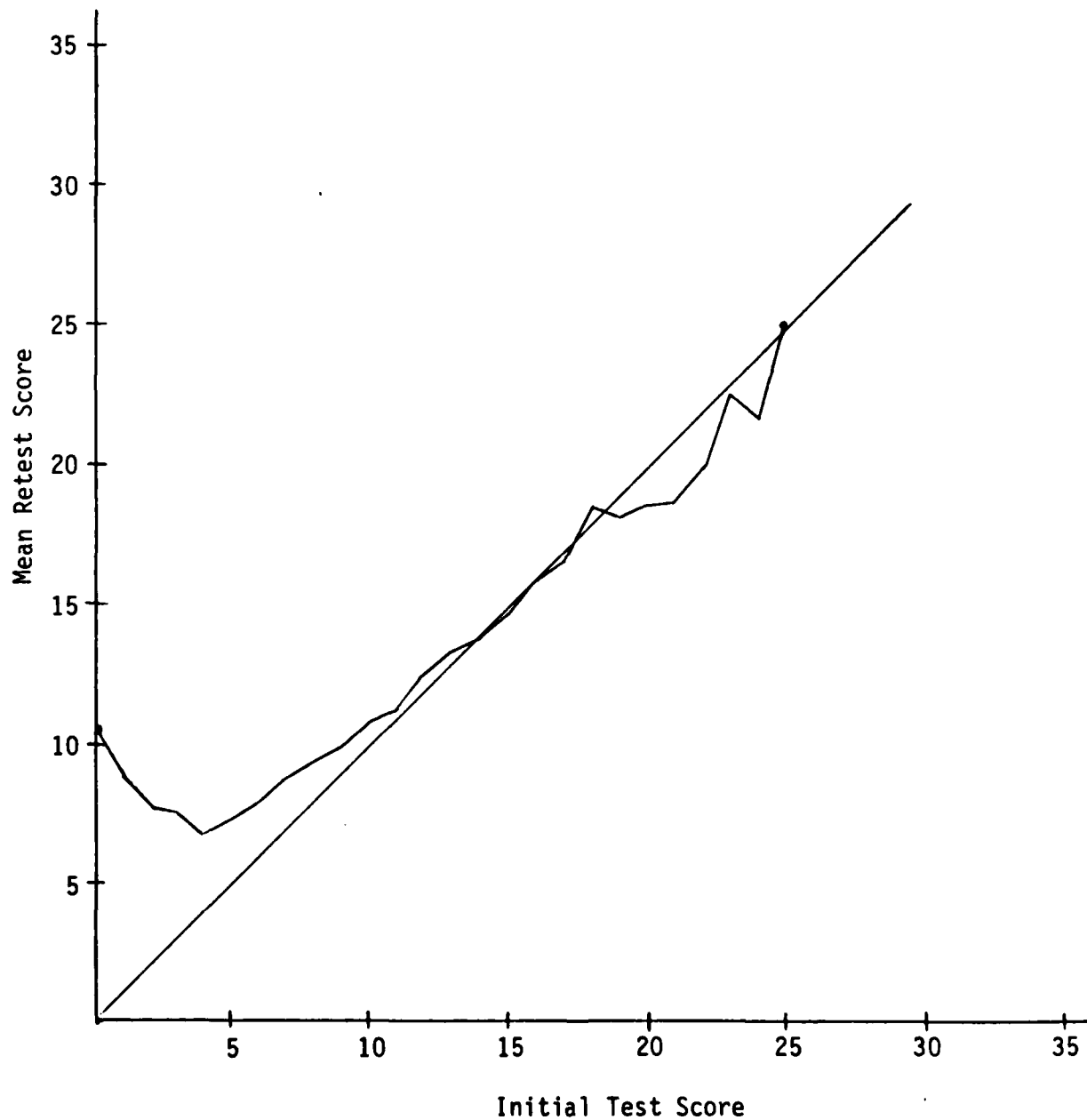
FREQUENCY
ELECTRONICS INFORMATION SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)



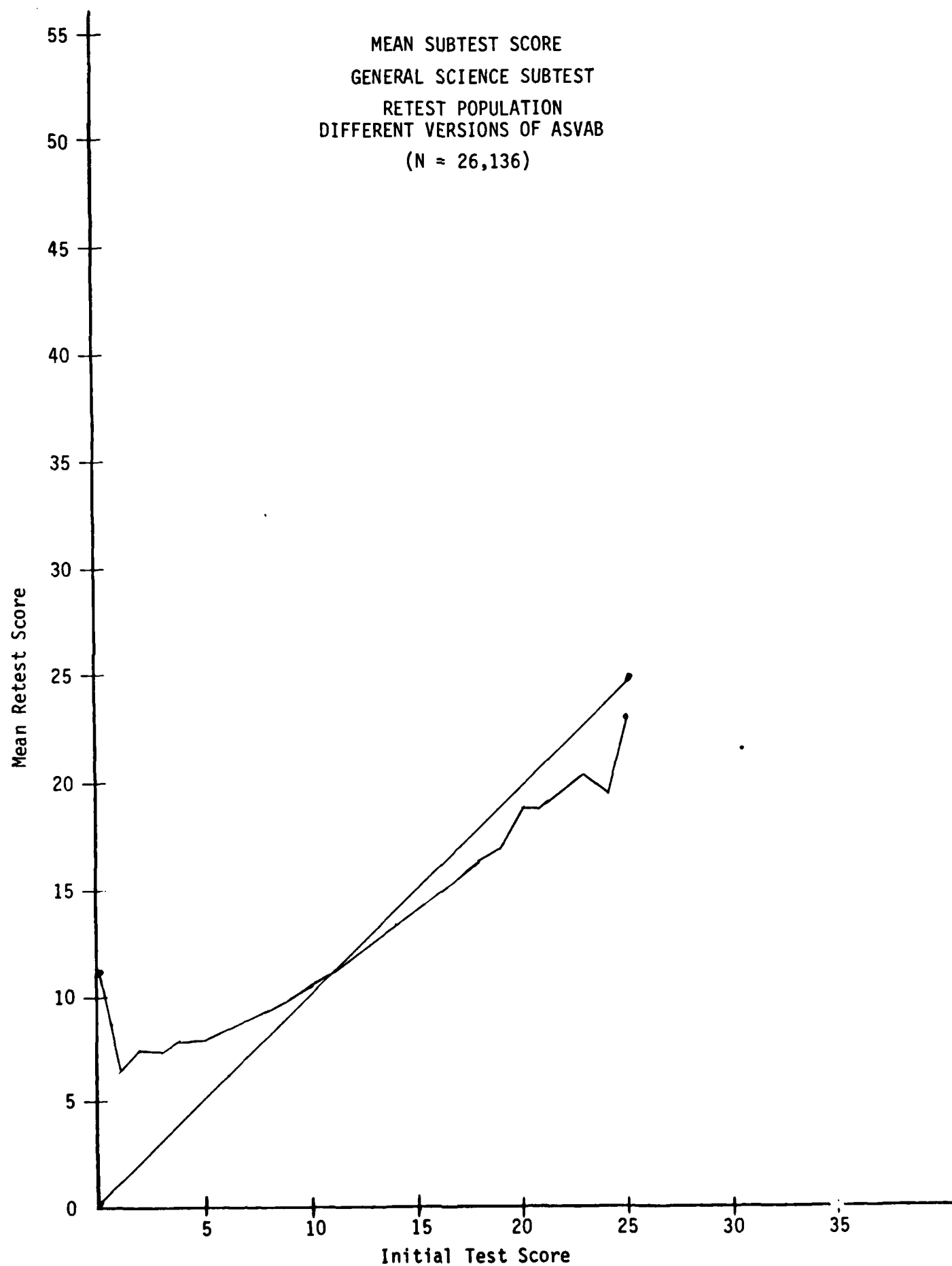
APPENDIX B

MEAN RETEST SCORES FOR ASVAB SUBTESTS:
RETESTED APPLICANT POOL

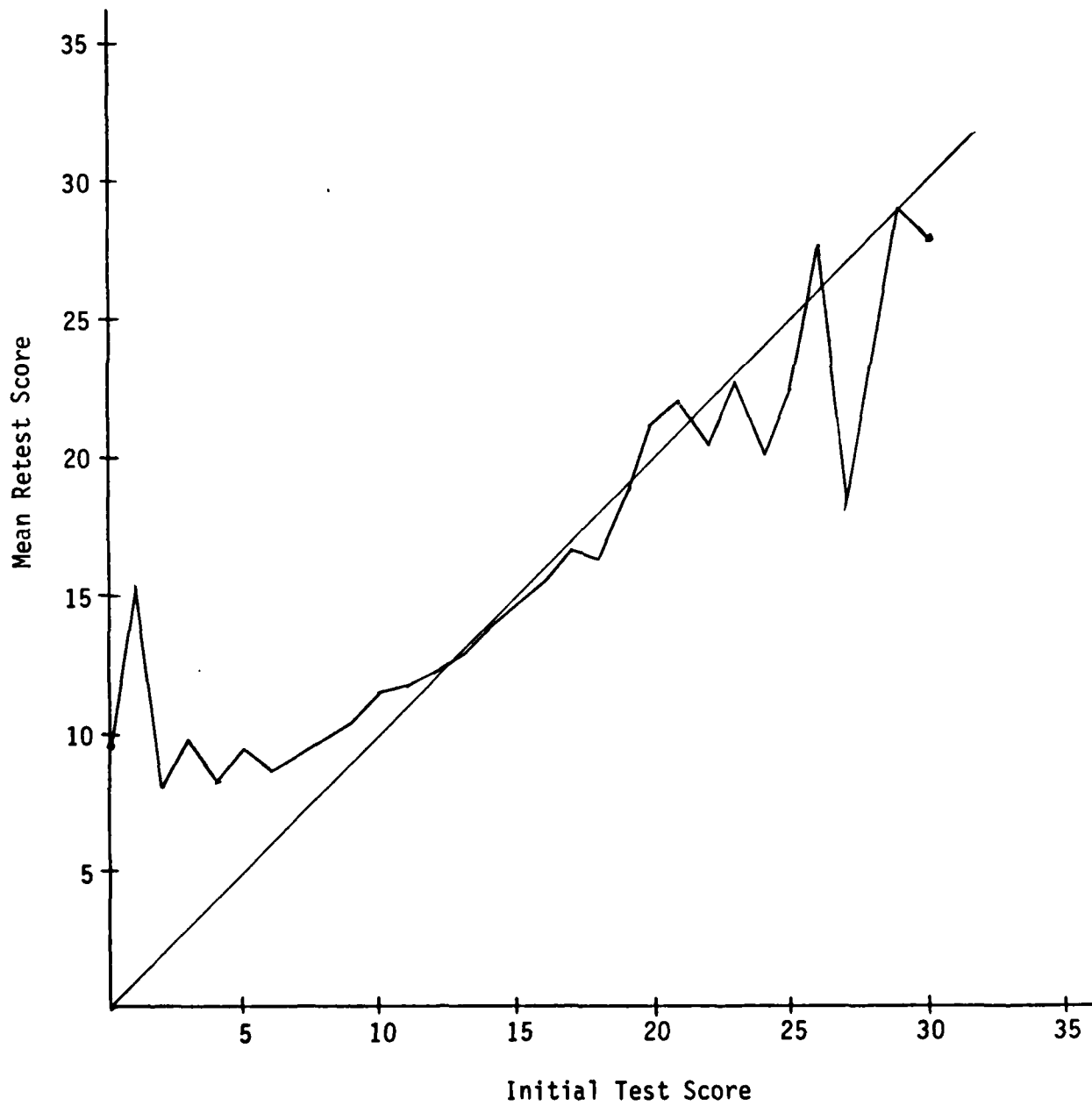
MEAN RETEST SCORE
GENERAL SCIENCE SUBTEST
RETEST POPULATION
SAME VERSION OF ASVAB
(N = 1,774)



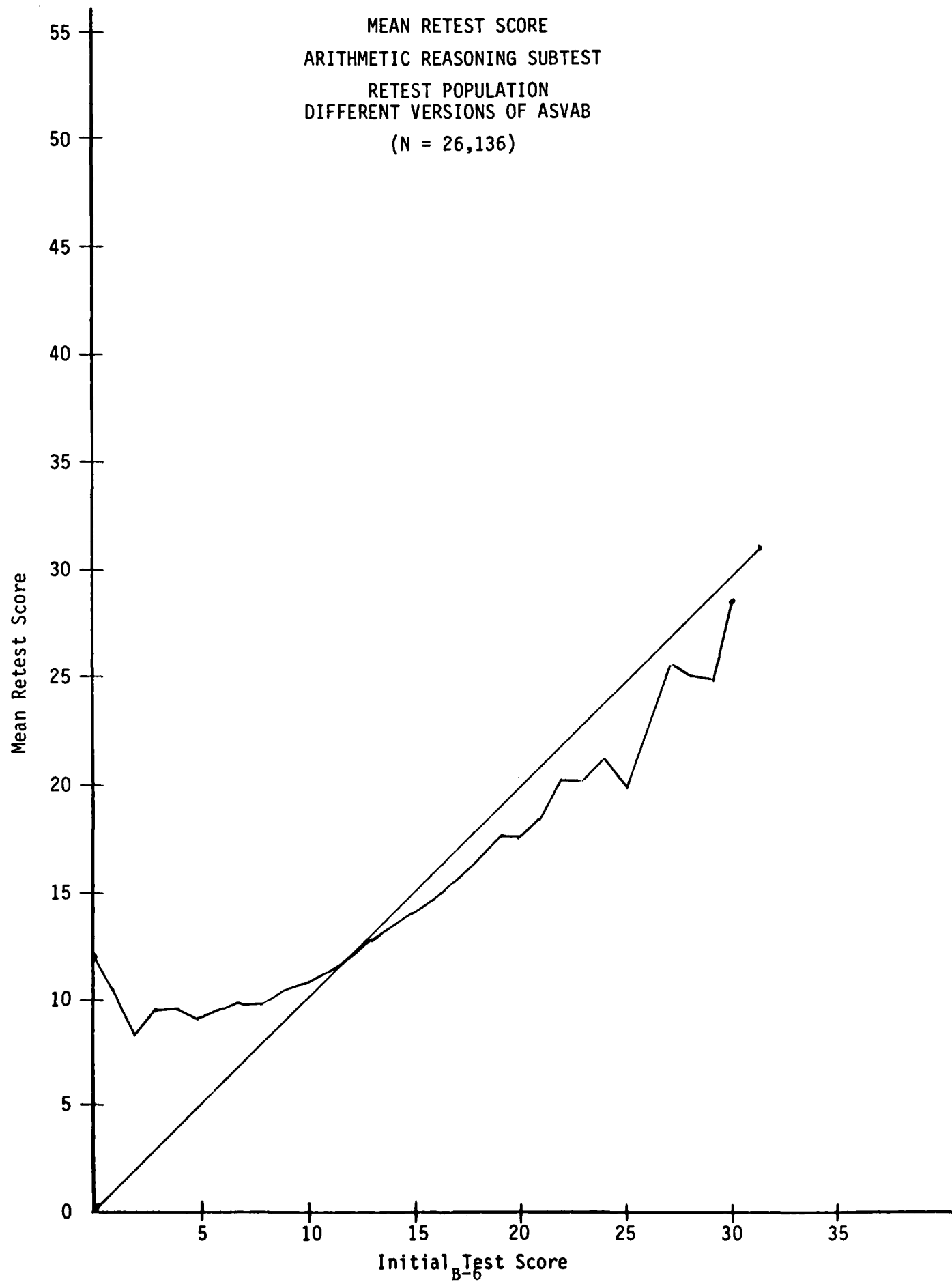
MEAN SUBTEST SCORE
GENERAL SCIENCE SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)



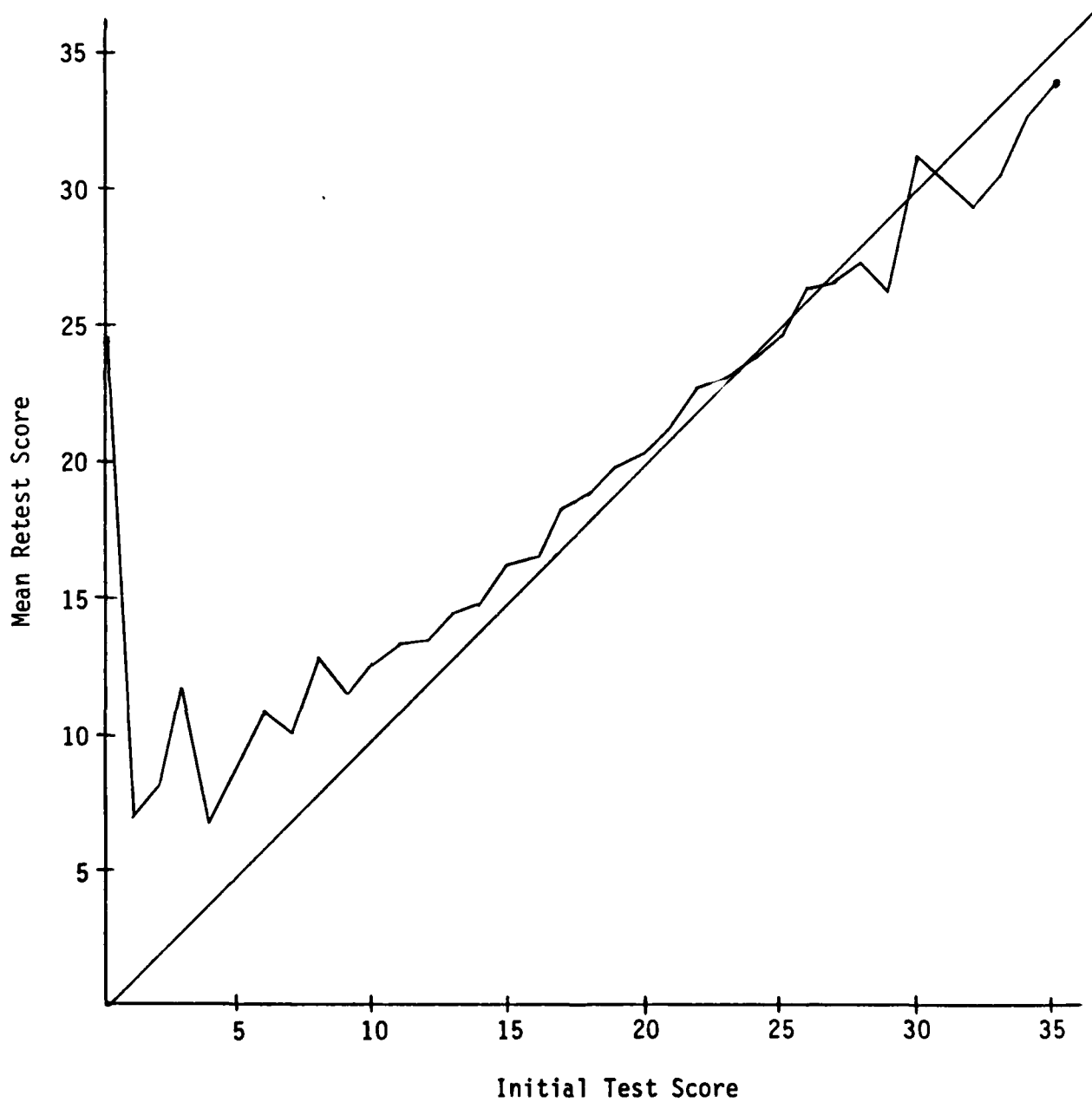
MEAN RETEST SCORE
ARITHMETIC REASONING SUBTEST
RETEST POPULATION
SAME VERSION OF ASVAB
(N = 1,774)



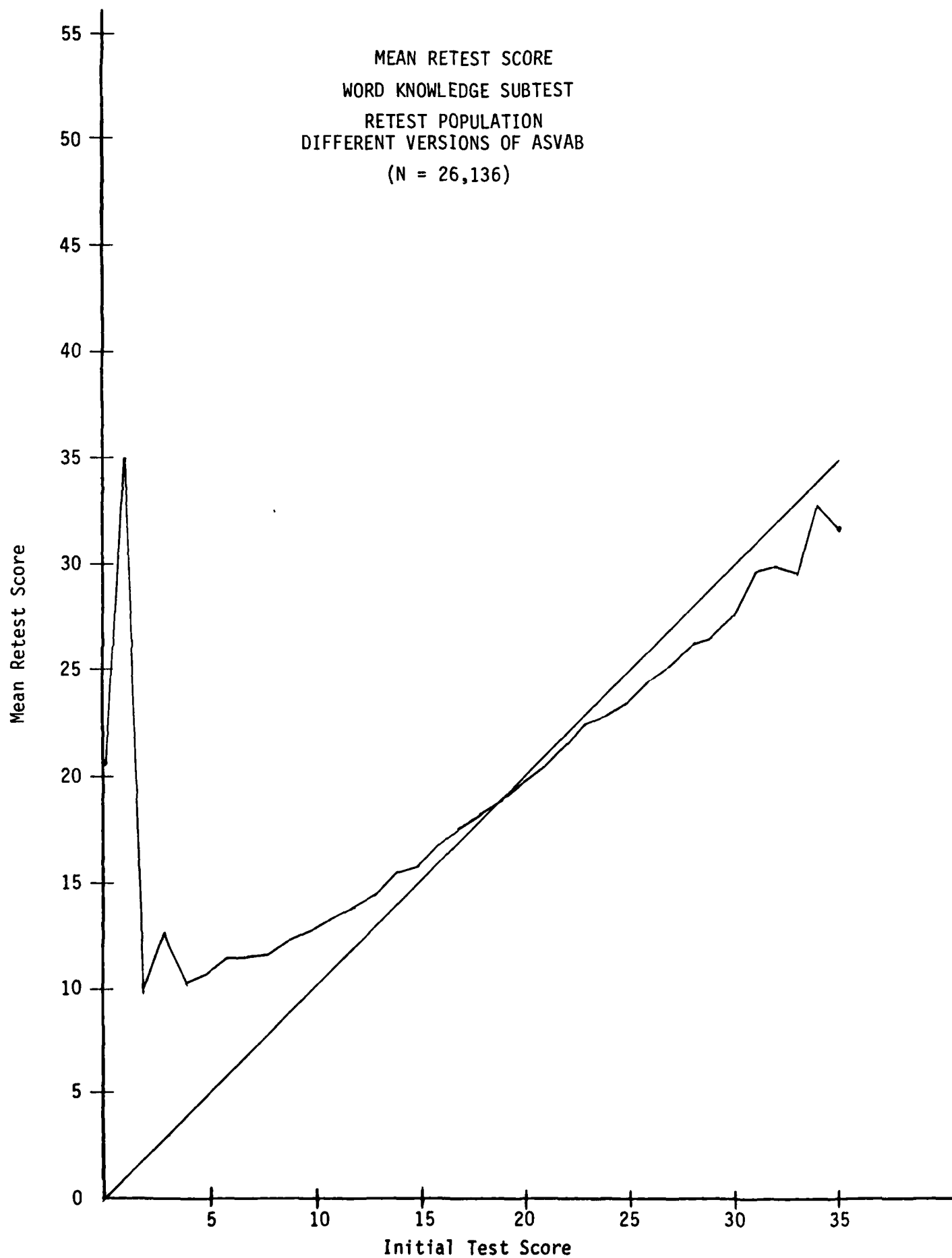
MEAN RETEST SCORE
ARITHMETIC REASONING SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)



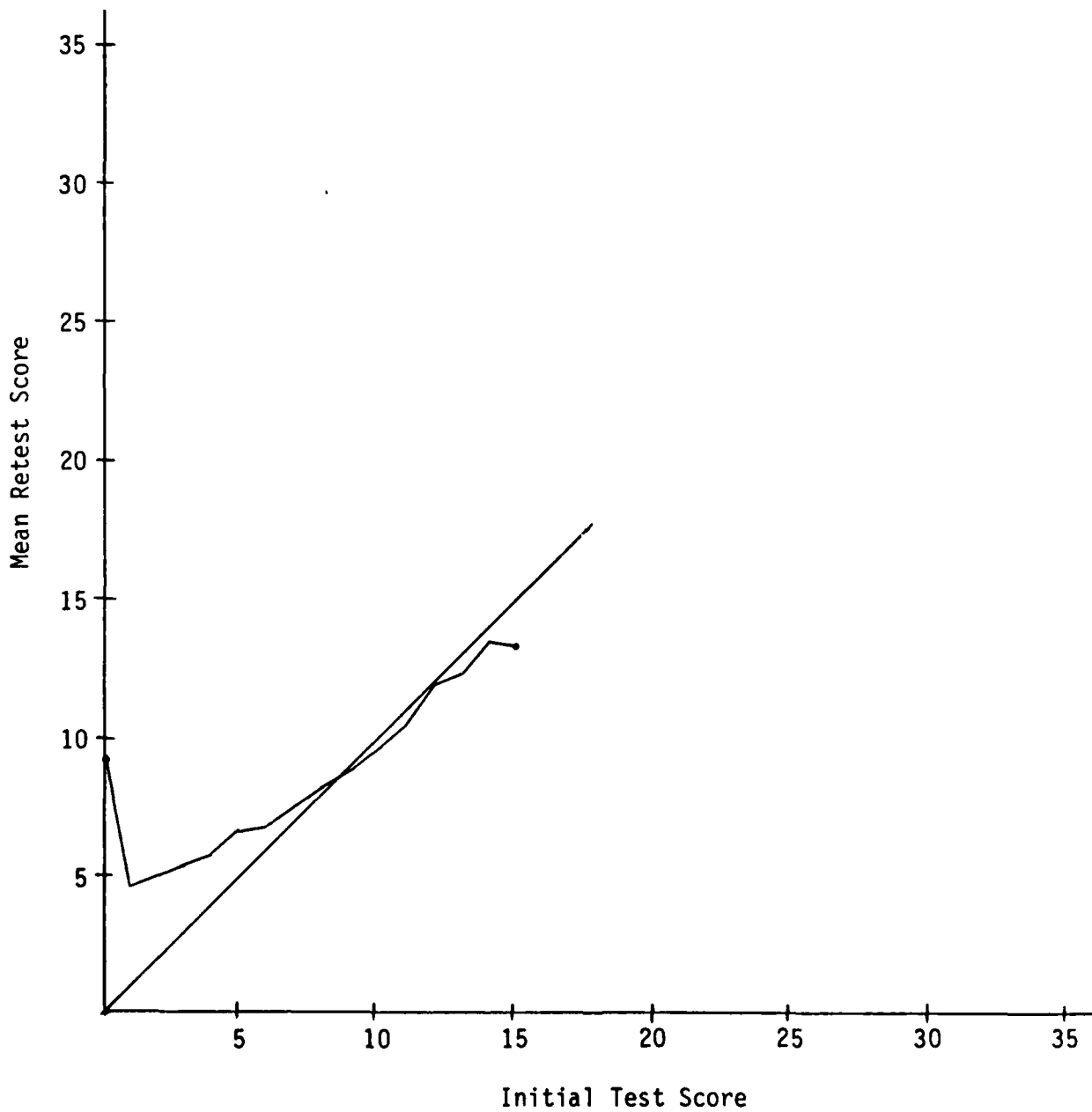
MEAN RETEST SCORE
WORD KNOWLEDGE SUBTEST
RETEST POPULATION
SAME VERSION OF ASVAB
(N = 1,774)



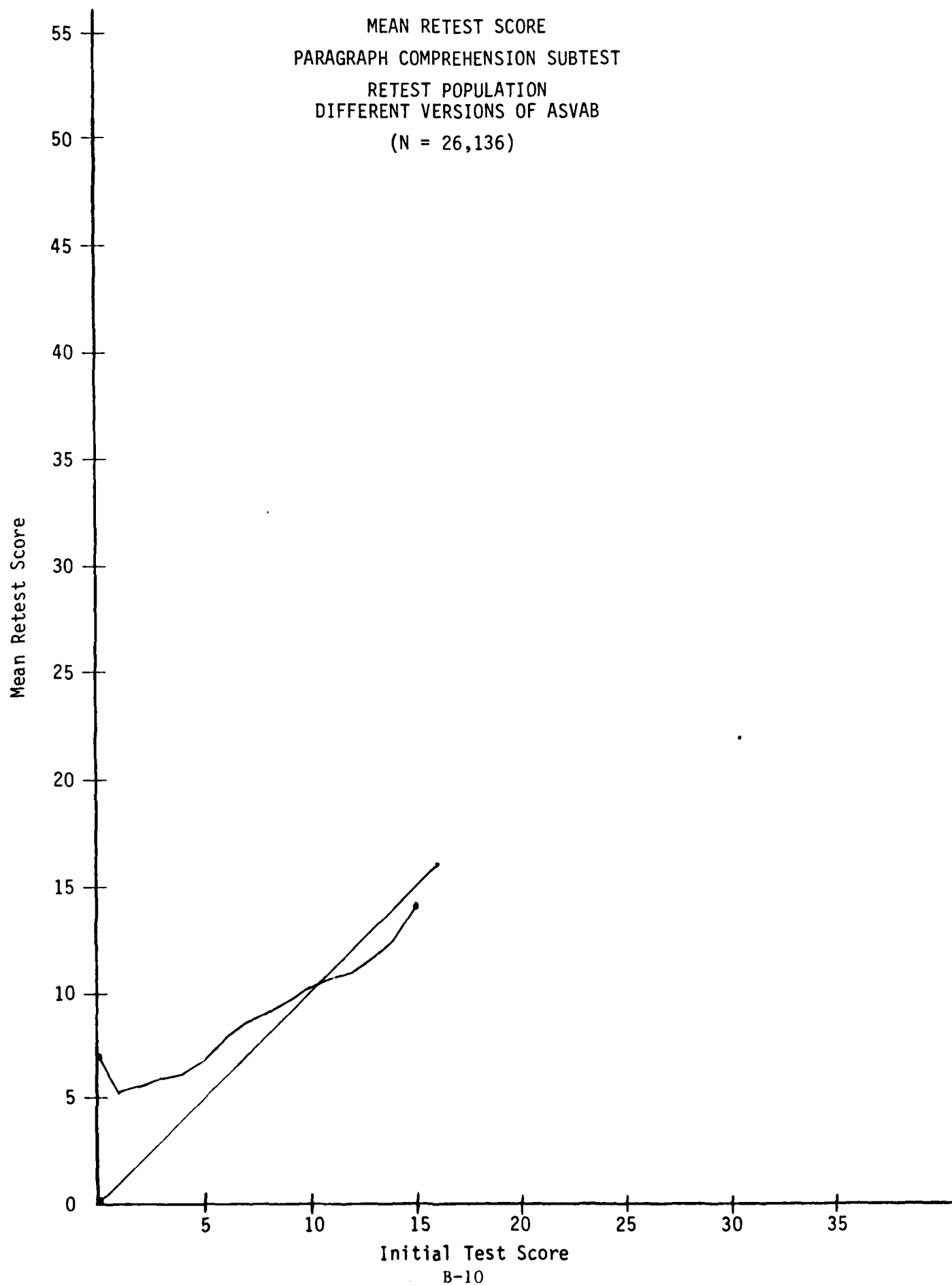
MEAN RETEST SCORE
WORD KNOWLEDGE SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)



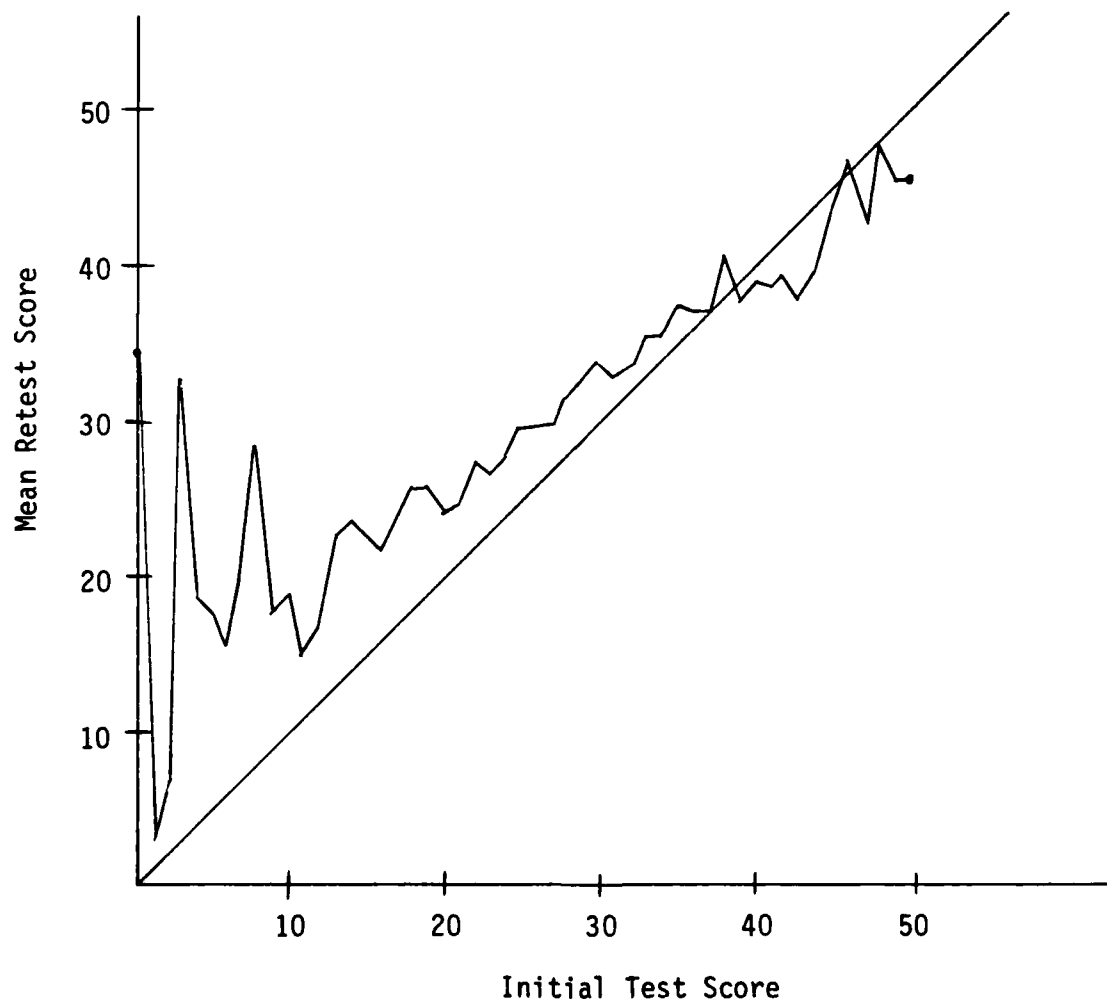
MEAN RETEST SCORE
PARAGRAPH COMPREHENSION SUBTEST
RETEST POPULATION
SAME VERSION OF ASVAB
(N = 1,774)



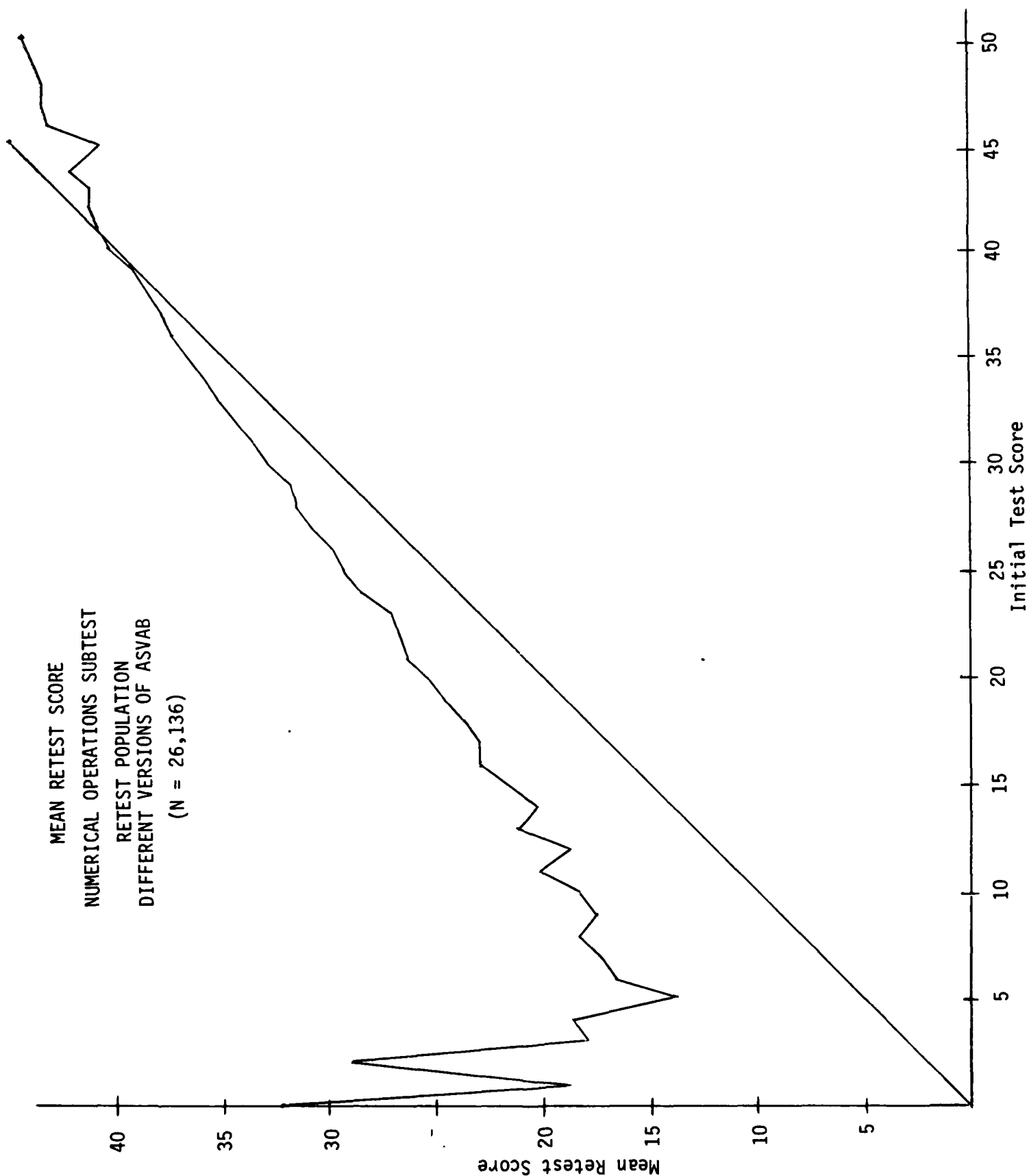
MEAN RETEST SCORE
PARAGRAPH COMPREHENSION SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)



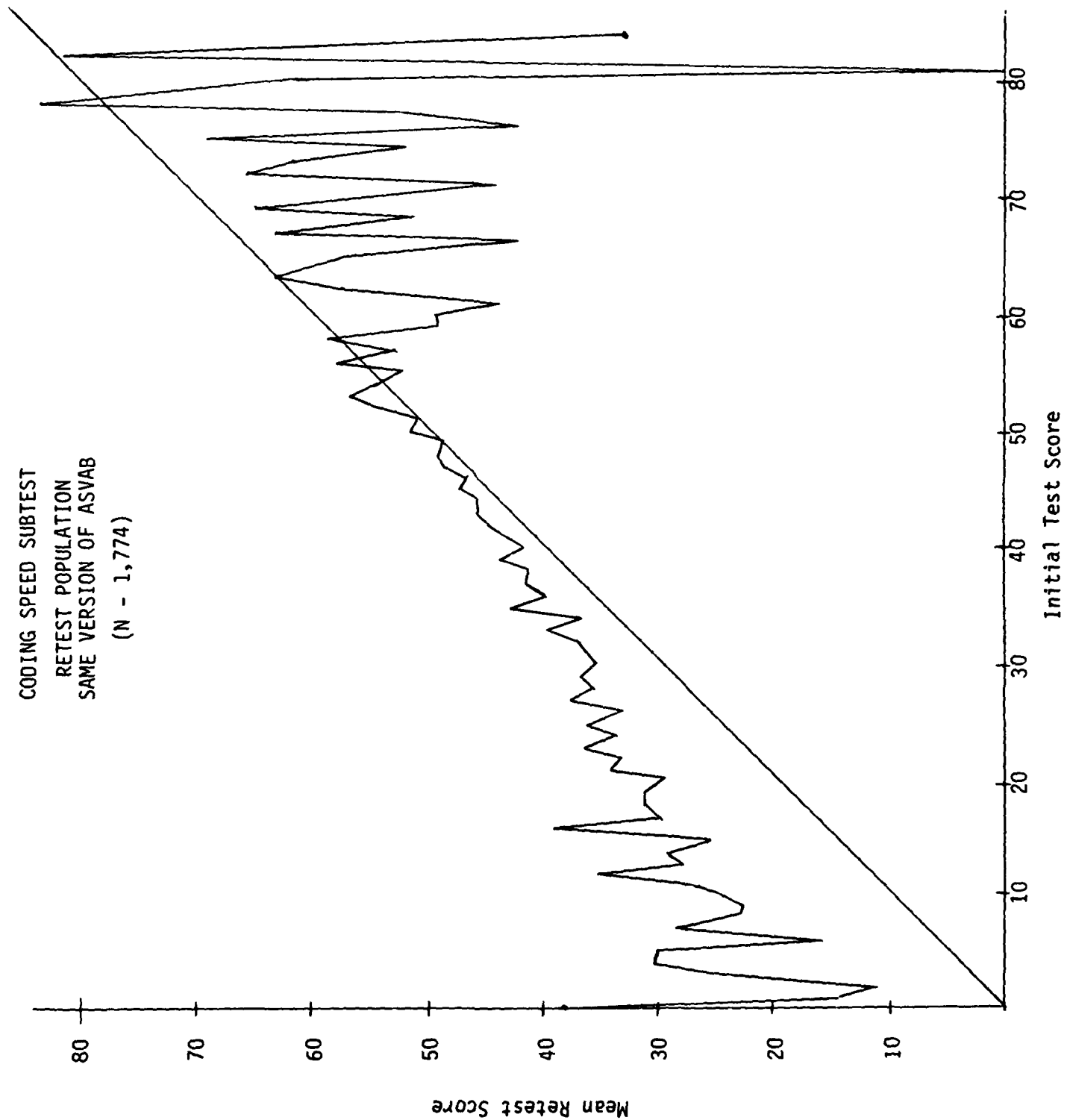
MEAN RETEST SCORE
NUMERICAL OPERATIONS SUBTEST
RETEST POPULATION
SAME VERSION OF ASVAB
(N = 1,774)



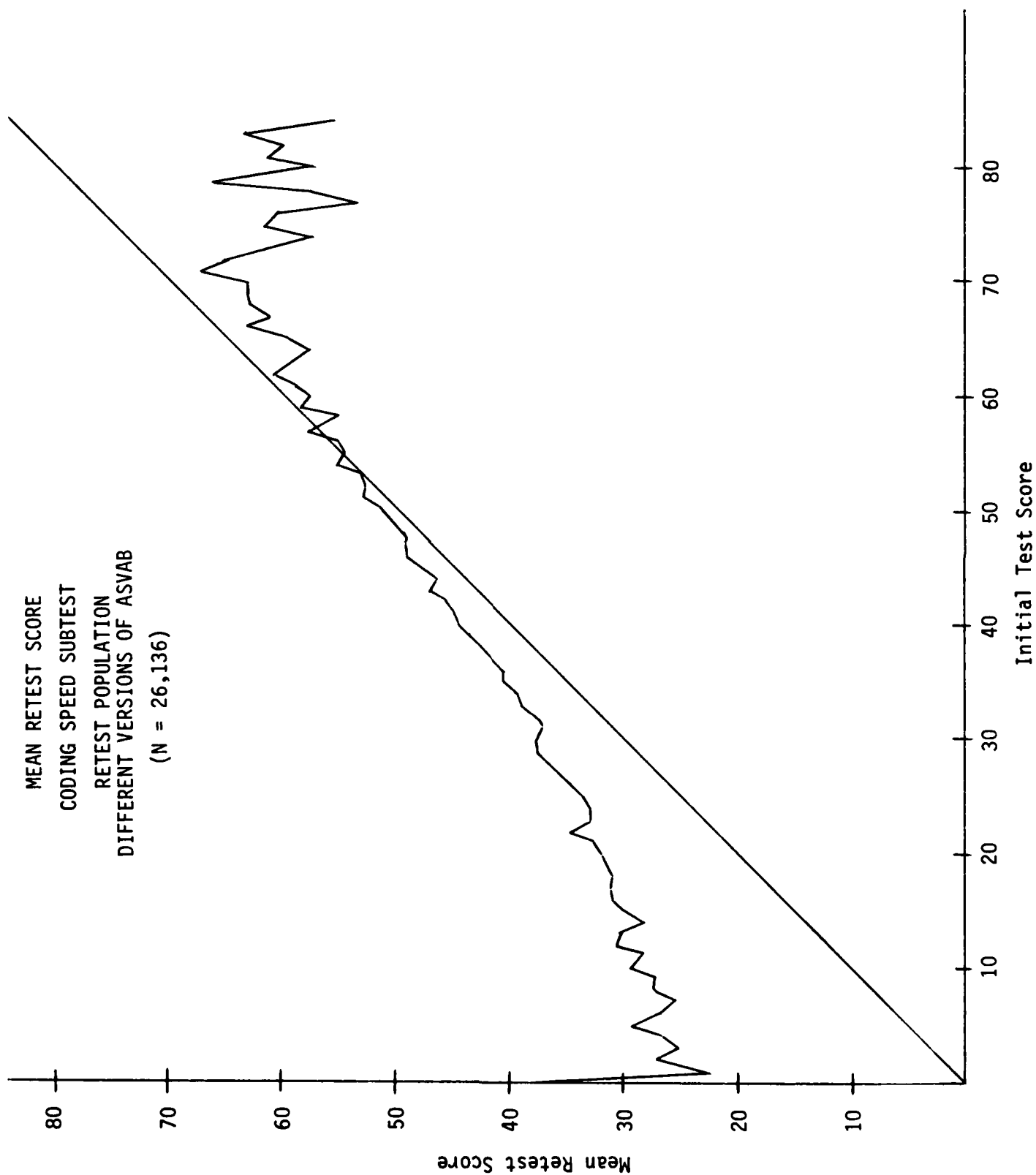
MEAN RETEST SCORE
NUMERICAL OPERATIONS SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)



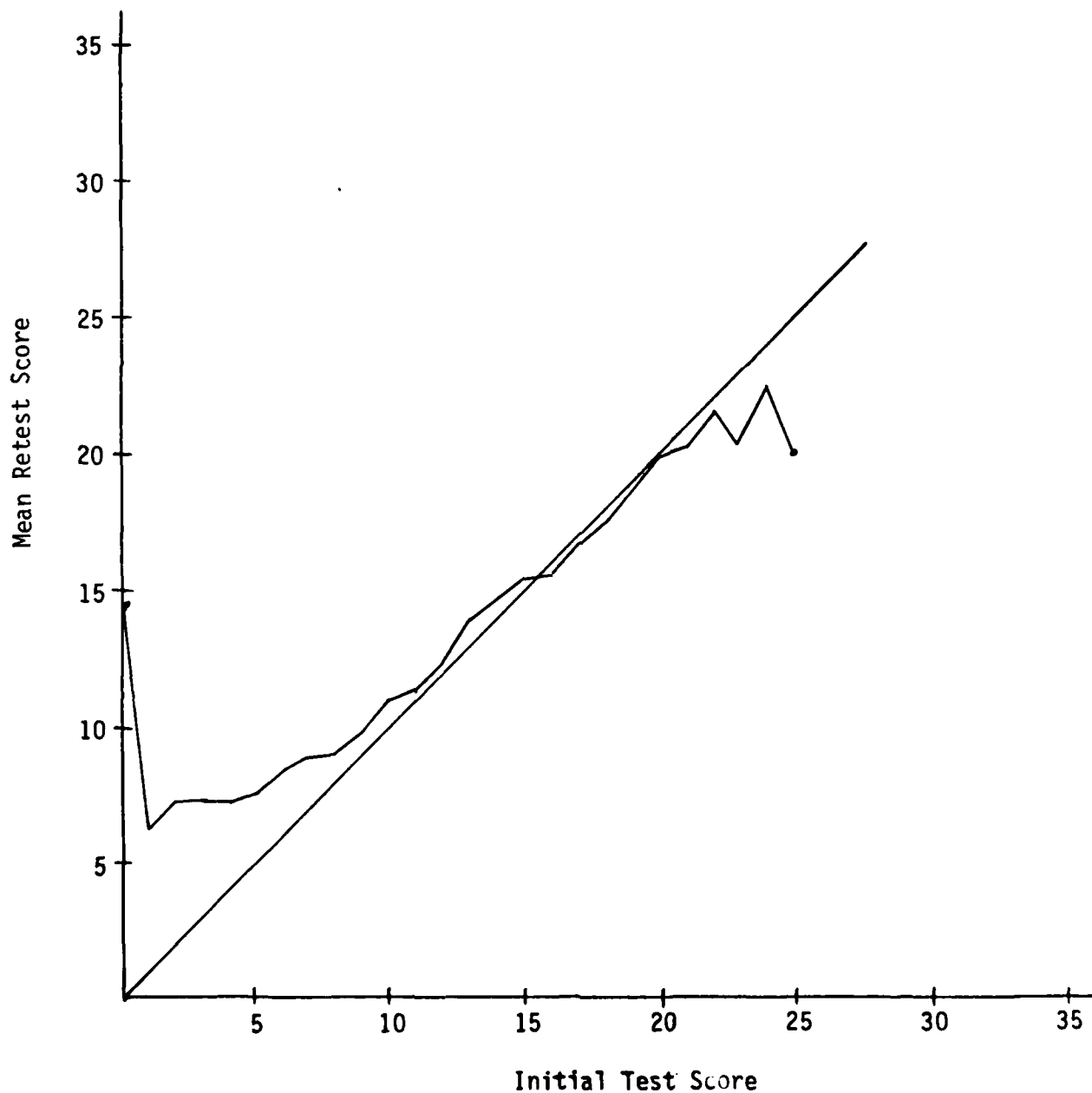
MEAN RETEST SCORE
CODING SPEED SUBTEST
RETEST POPULATION
SAME VERSION OF ASVAB
(N - 1,774)



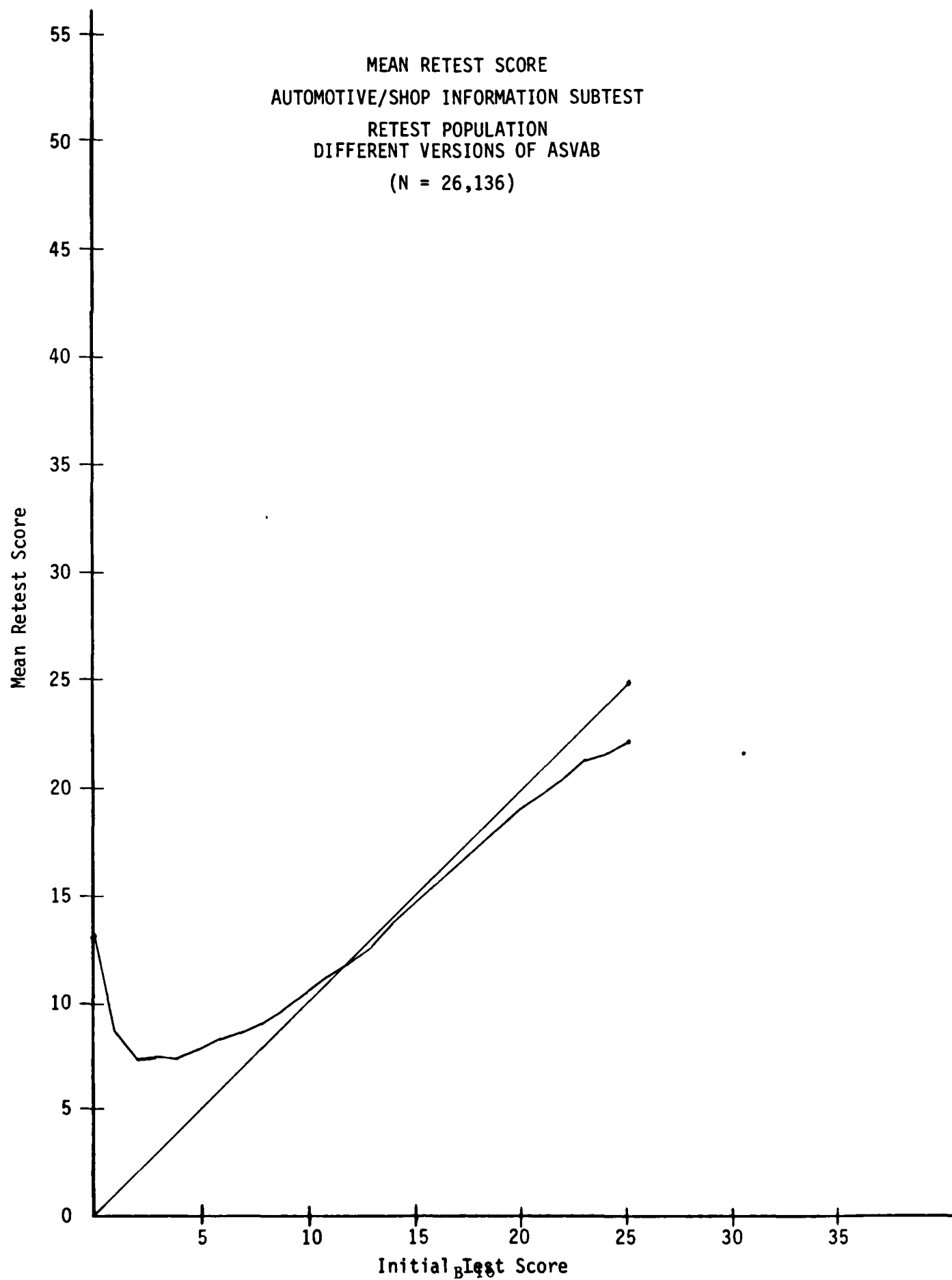
MEAN RETEST SCORE
CODING SPEED SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)



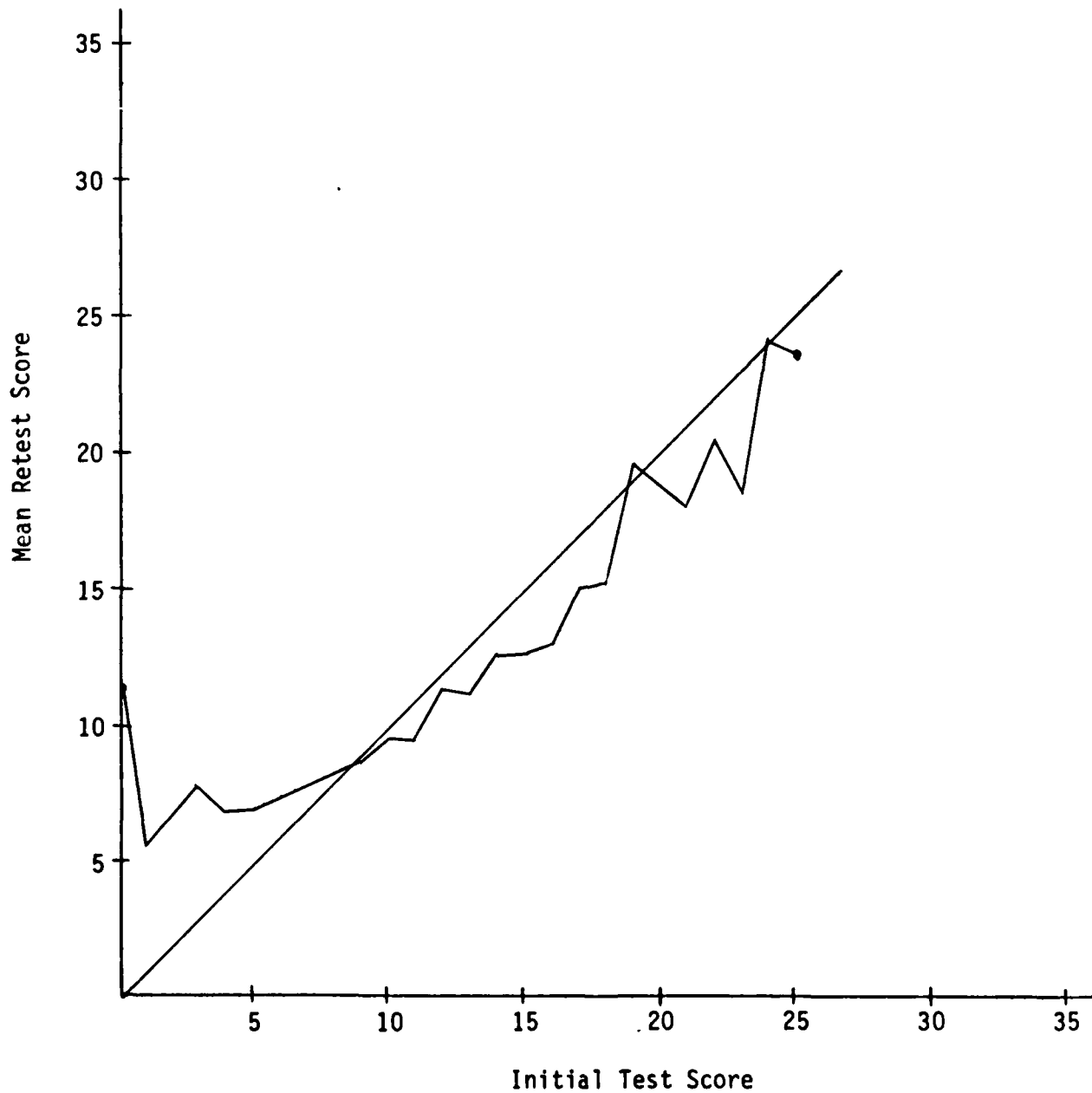
MEAN RETEST SCORE
AUTOMOTIVE/SHOP INFORMATION SUBTEST
RETEST POPULATION
SAME VERSION OF ASVAB
(N = 1,774)



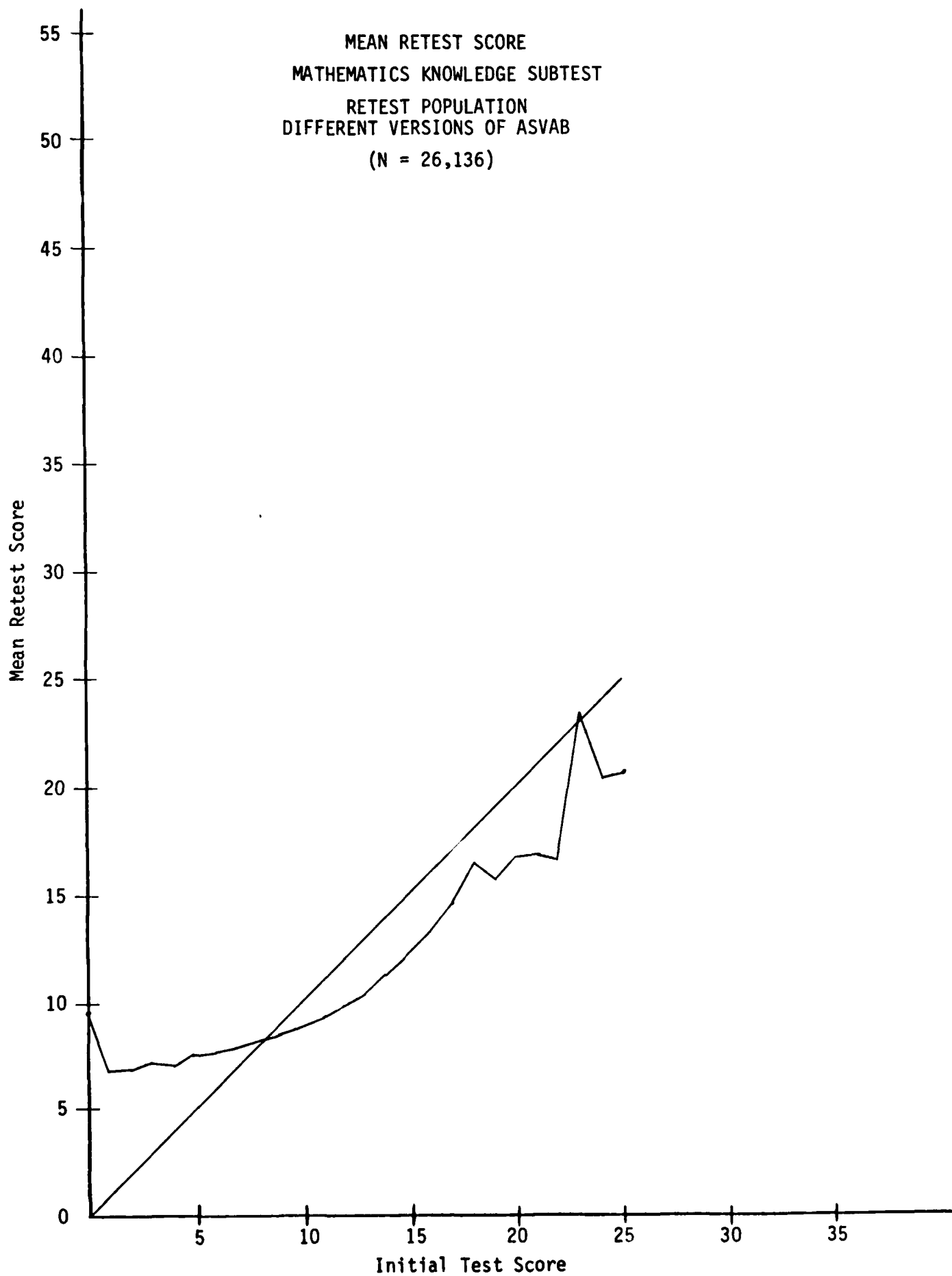
MEAN RETEST SCORE
AUTOMOTIVE/SHOP INFORMATION SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)



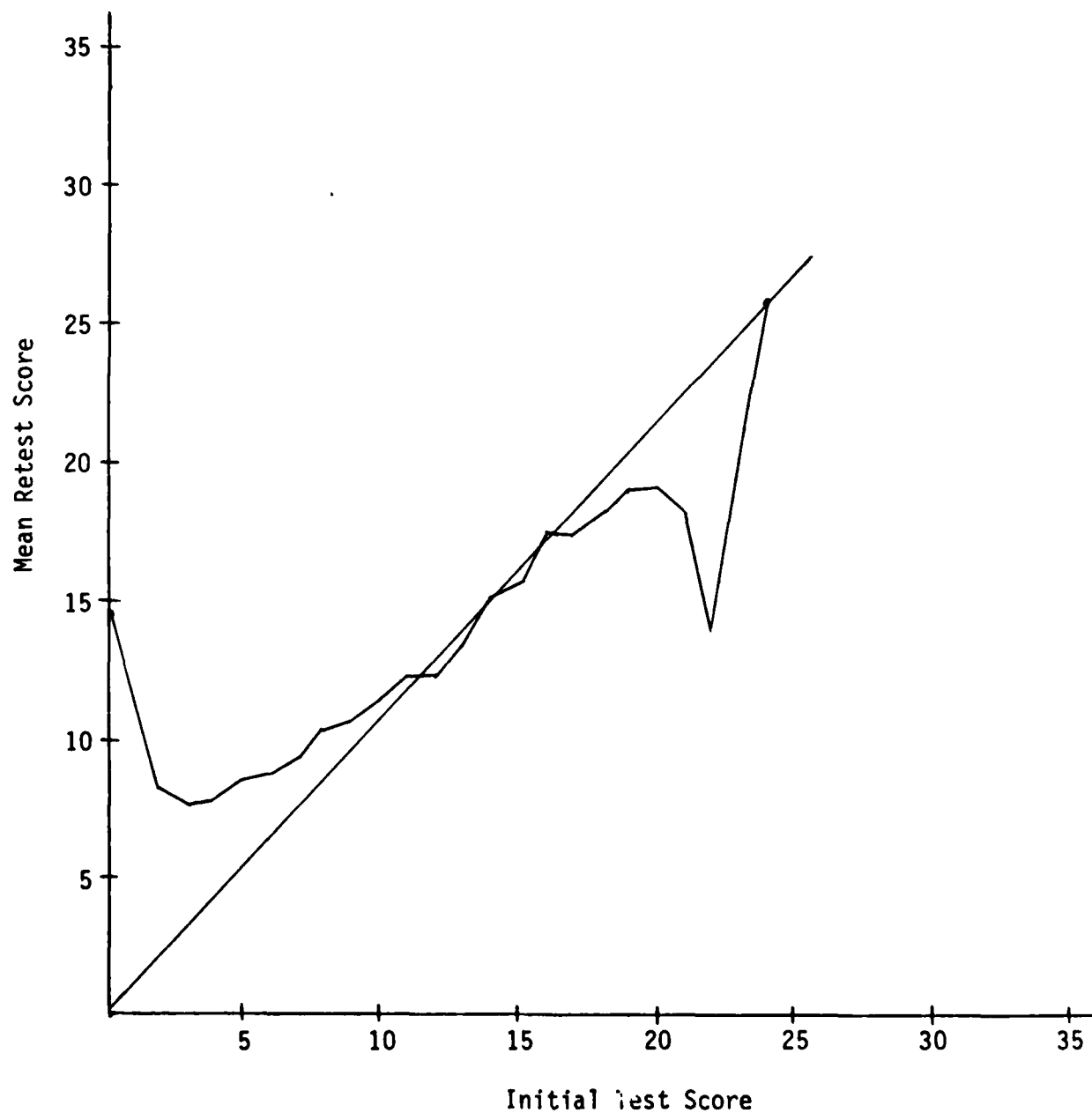
MEAN RETEST SCORE
MATHEMATICS KNOWLEDGE SUBTEST
RETEST POPULATION
SAME VERSION OF ASVAB
(N = 1,774)



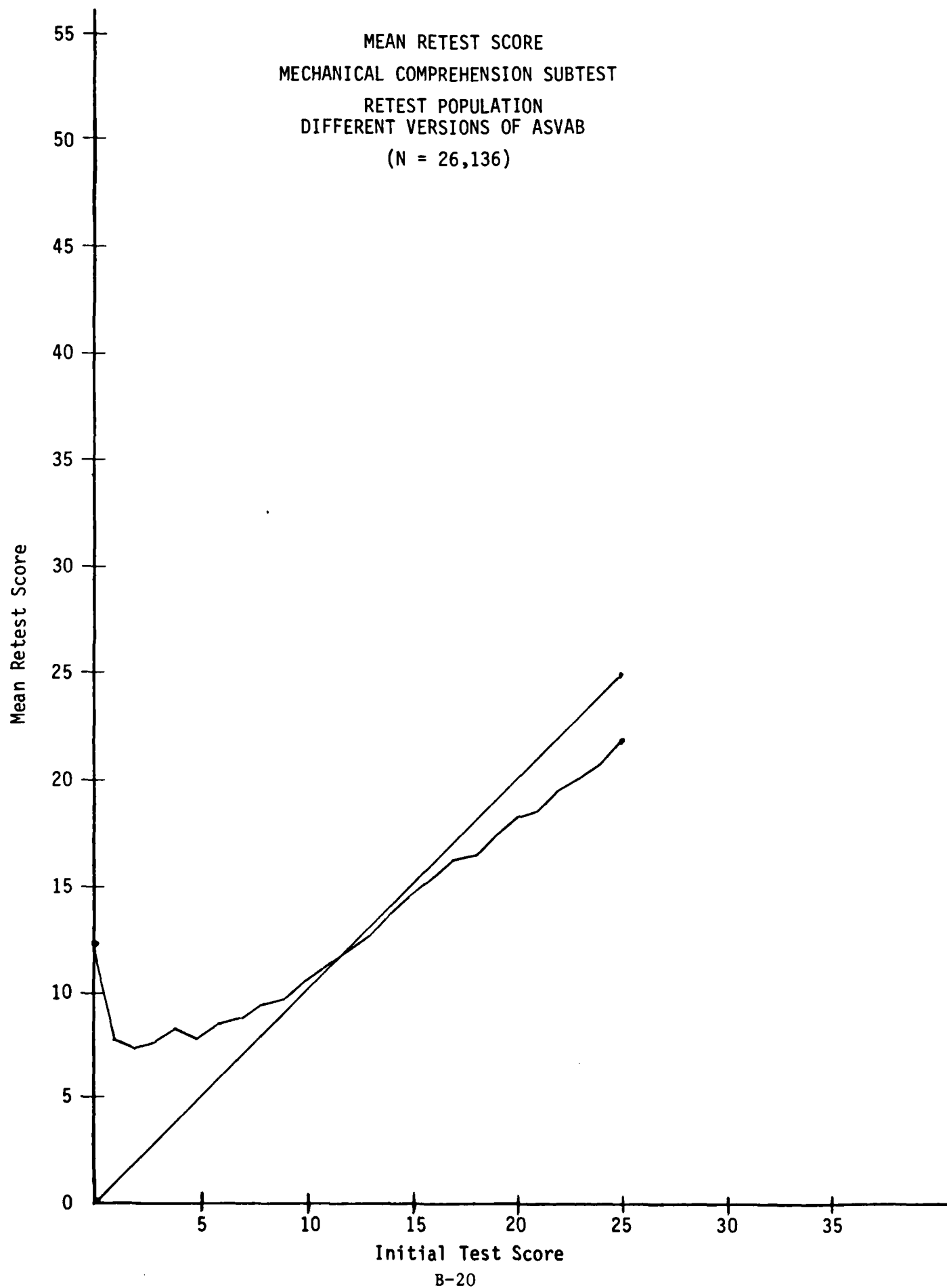
MEAN RETEST SCORE
MATHEMATICS KNOWLEDGE SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)



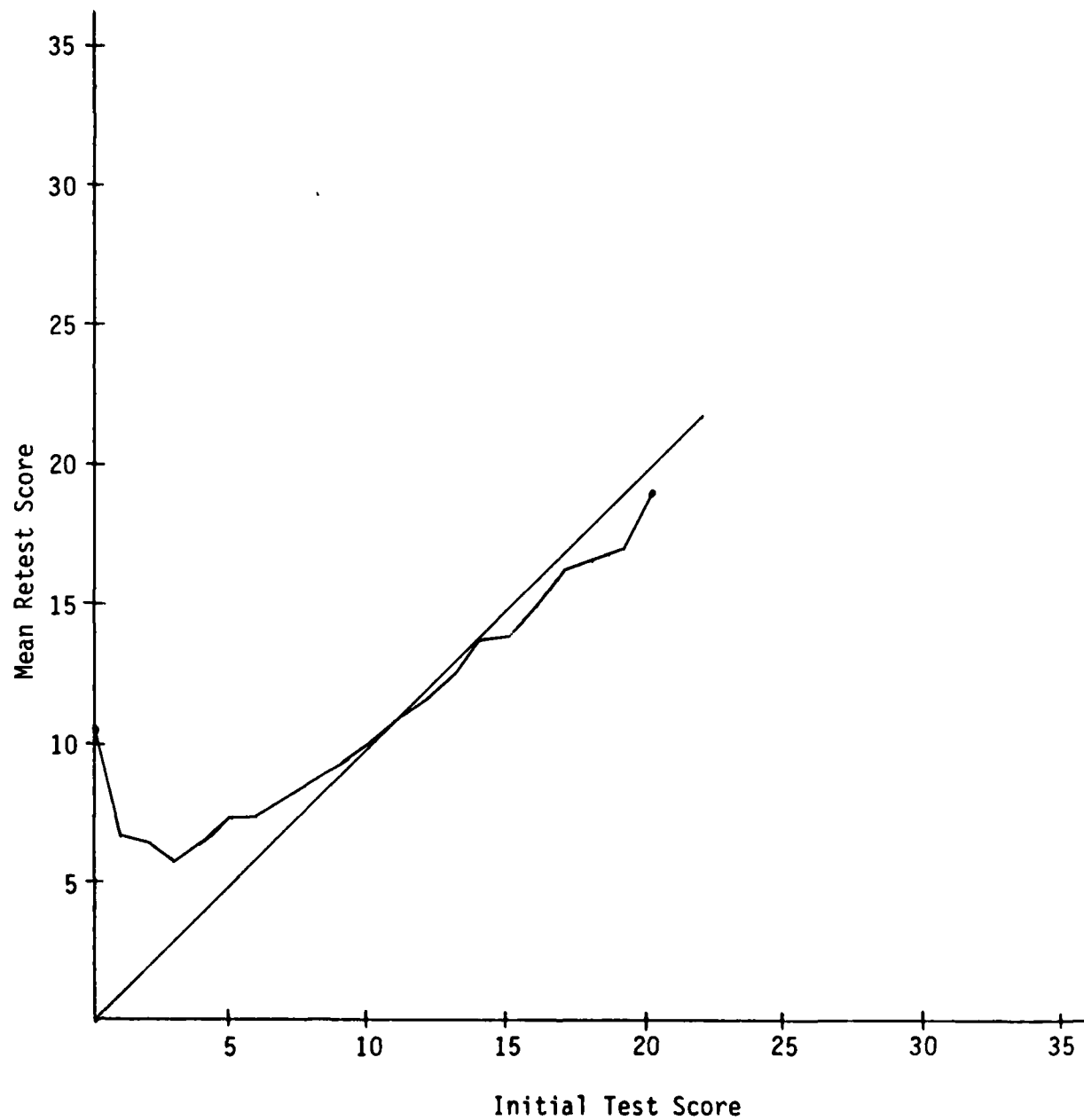
MEAN RETEST SCORE
MECHANICAL COMPREHENSION SUBTEST
RETEST POPULATION
SAME VERSION OF ASVAB
(N = 1,774)



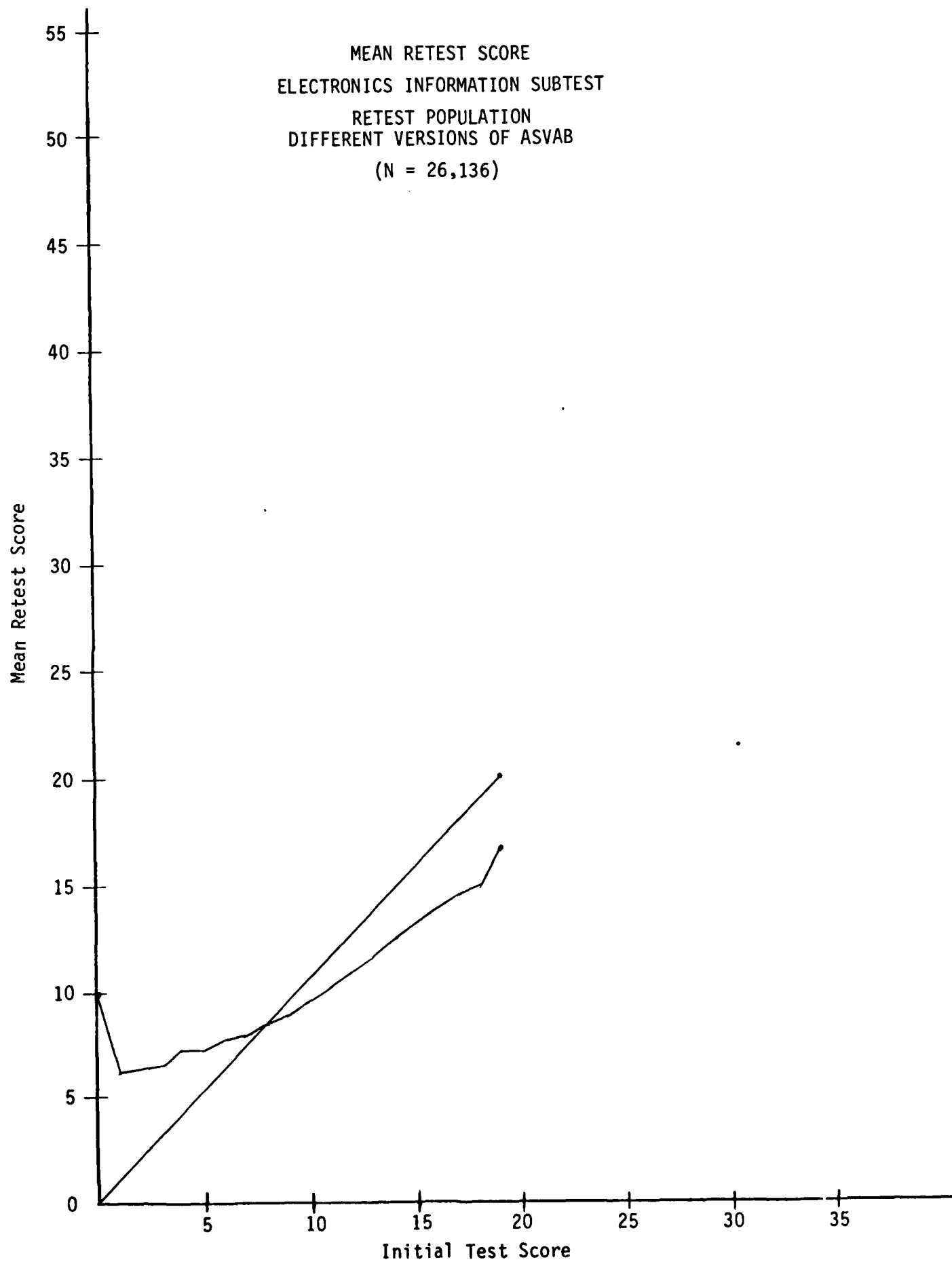
MEAN RETEST SCORE
MECHANICAL COMPREHENSION SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)



MEAN RETEST SCORE
ELECTRONICS INFORMATION SUBTEST
RETEST POPULATION
SAME VERSION OF ASVAB
(N = 1,774)

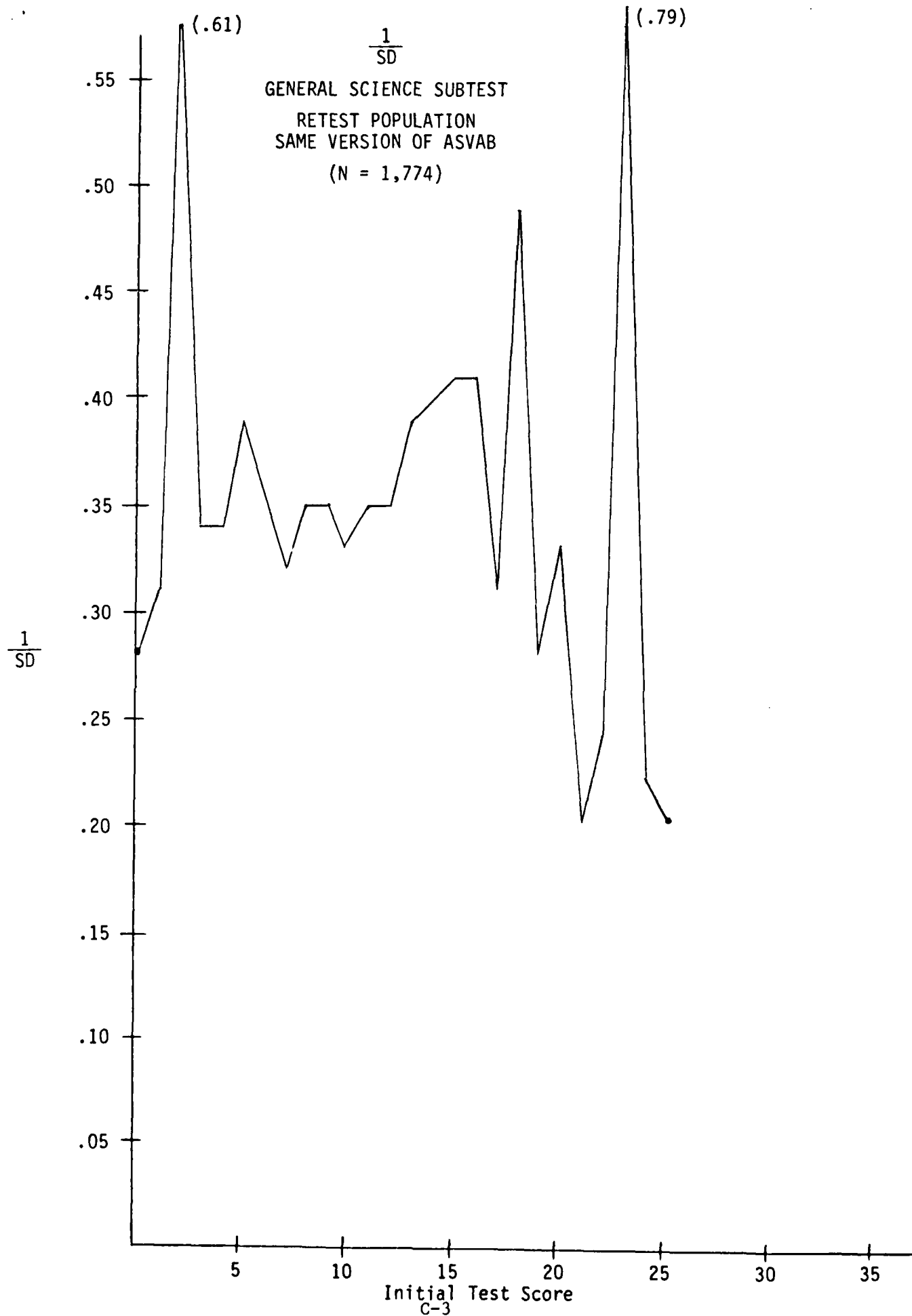


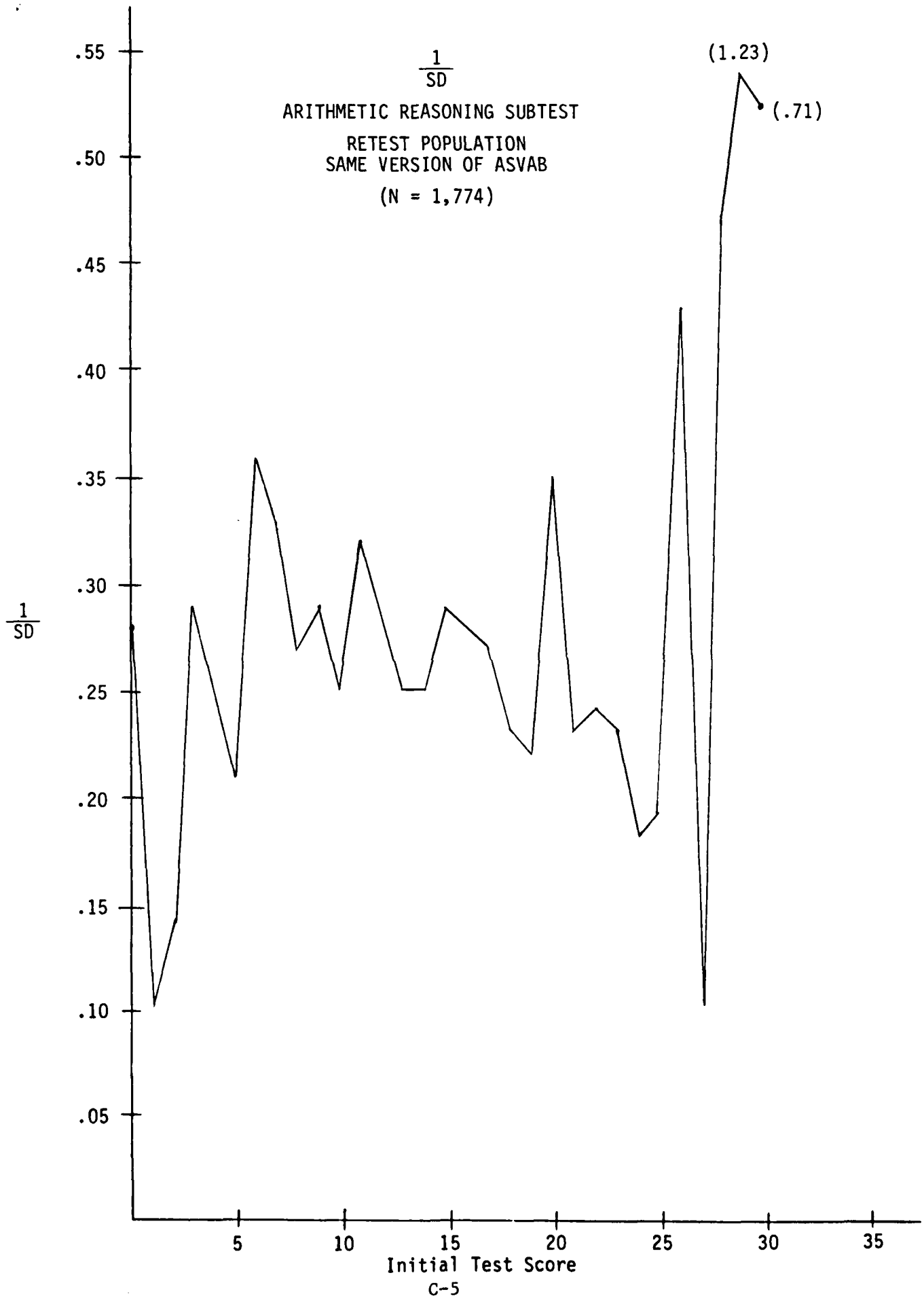
MEAN RETEST SCORE
ELECTRONICS INFORMATION SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)



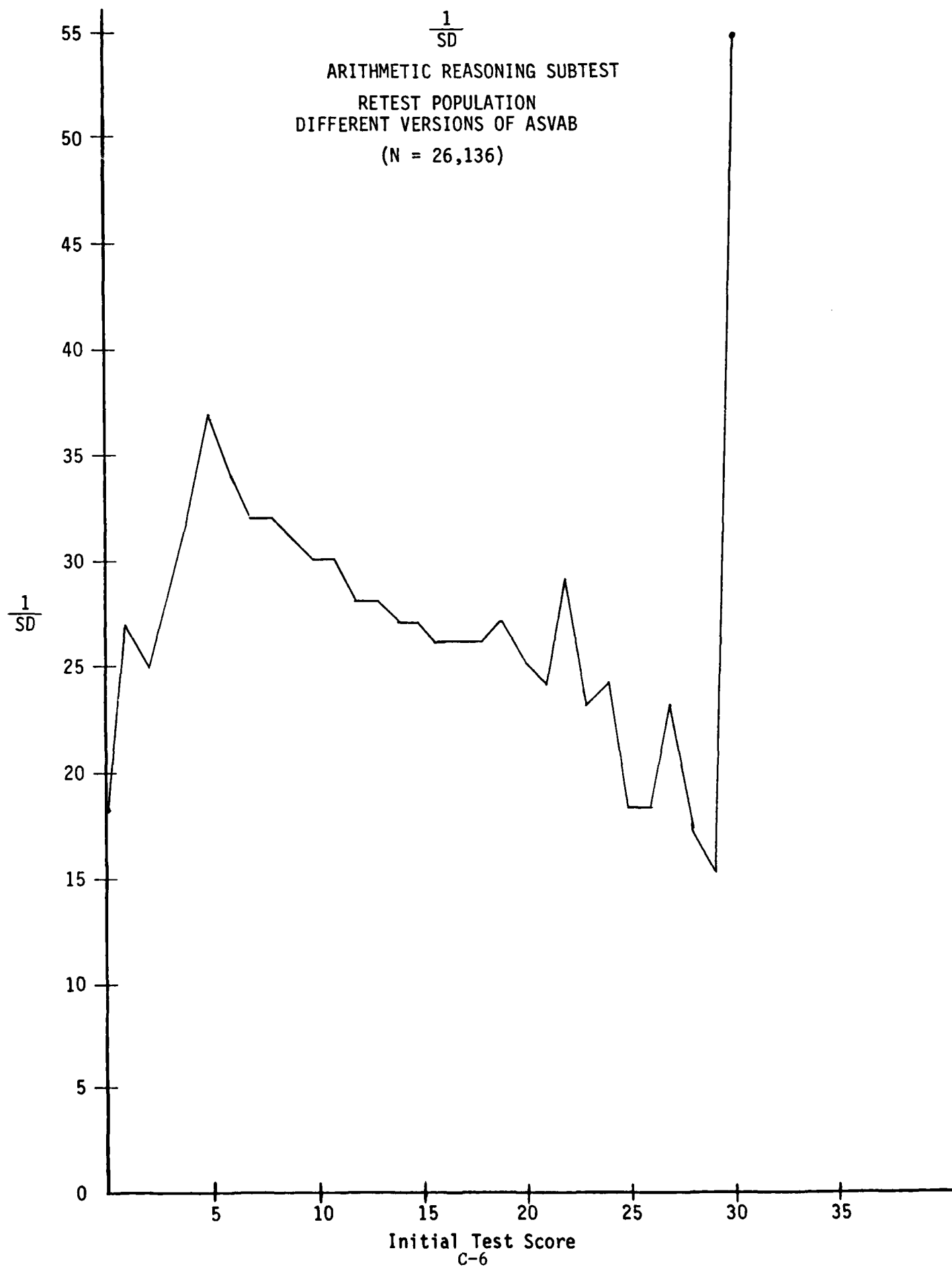
APPENDIX C

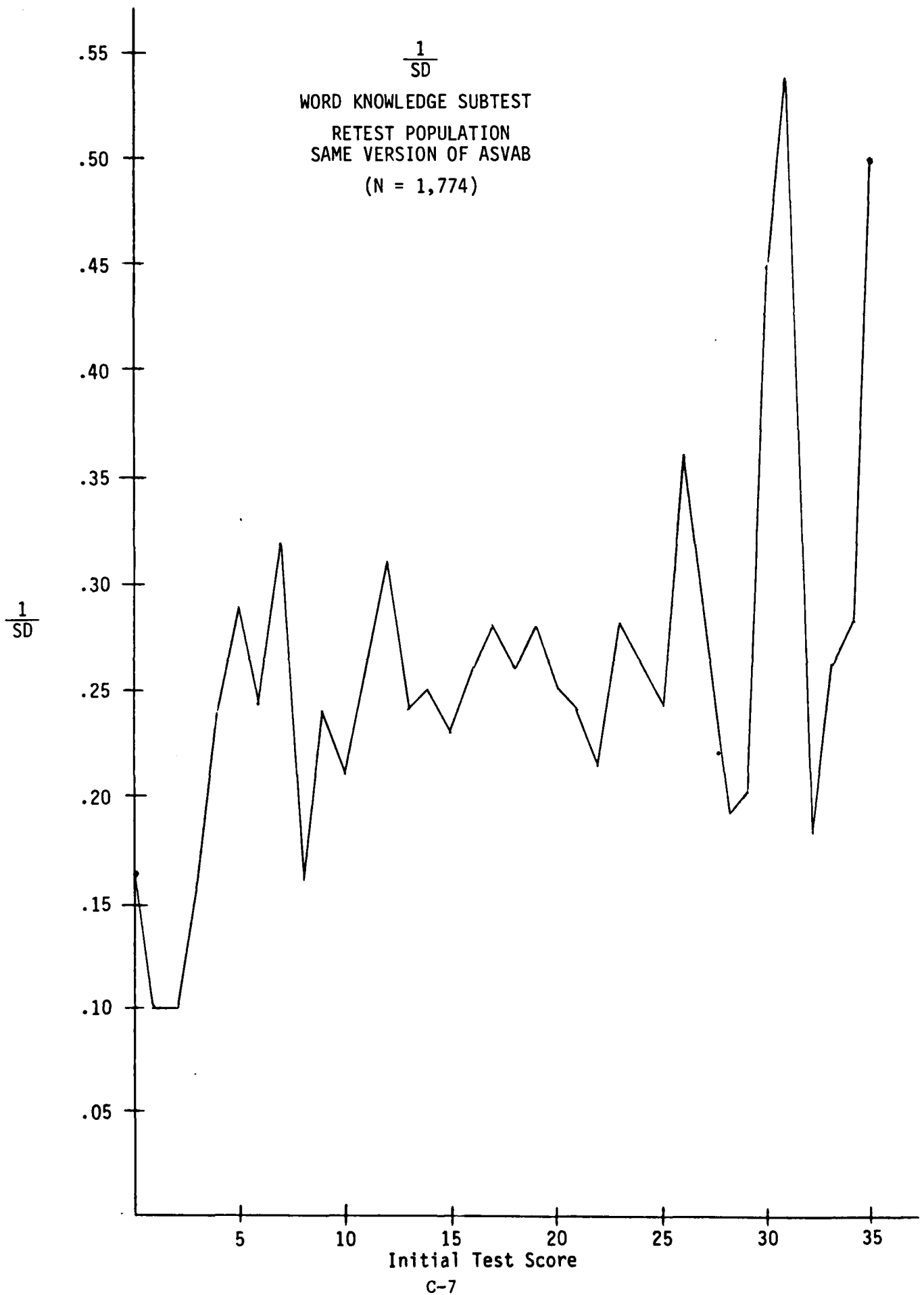
INFORMATION FUNCTIONS FOR ASVAB SUBTESTS:
RETESTED APPLICANT POOL



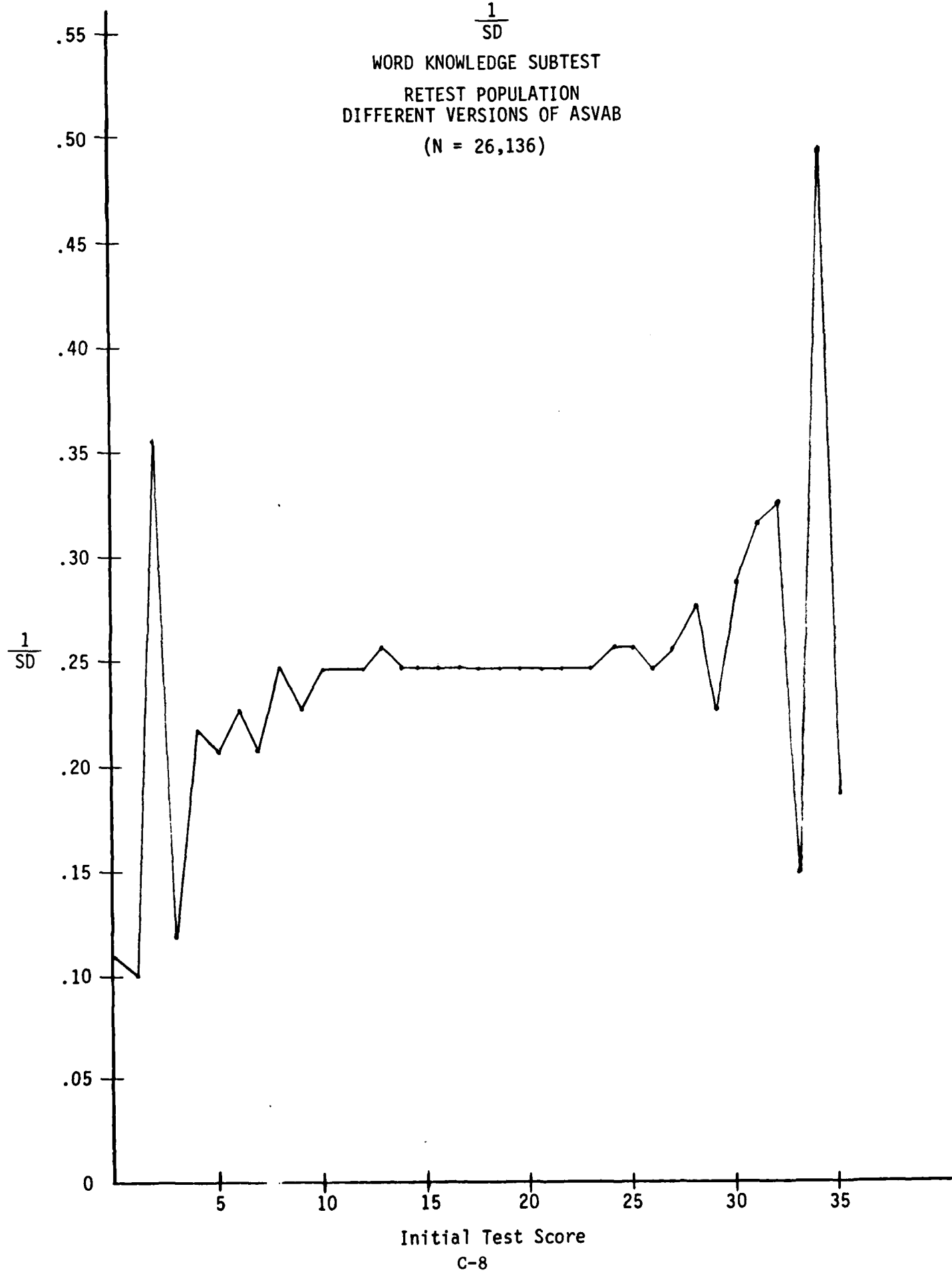


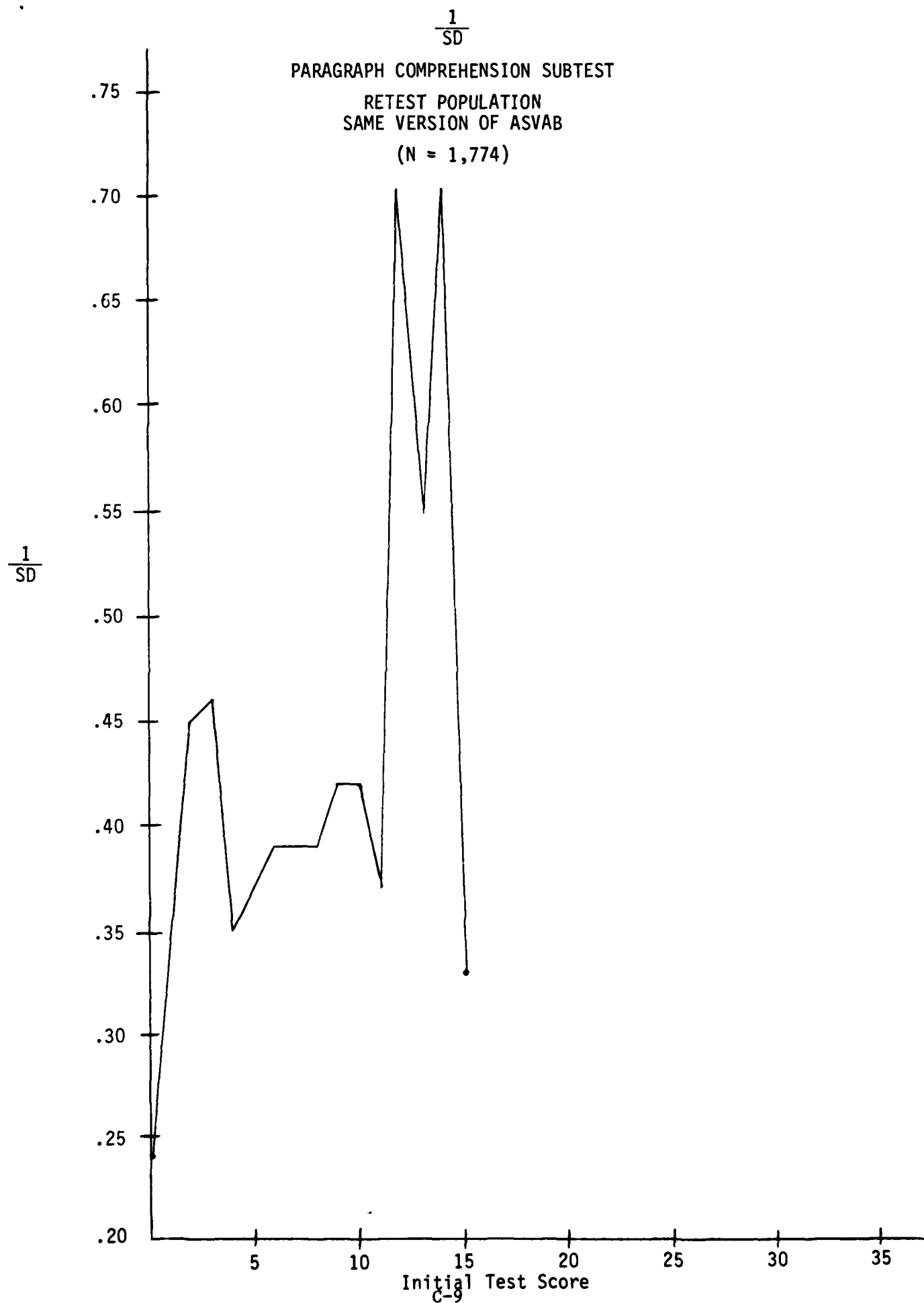
$\frac{1}{SD}$
ARITHMETIC REASONING SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)





$\frac{1}{SD}$
WORD KNOWLEDGE SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)

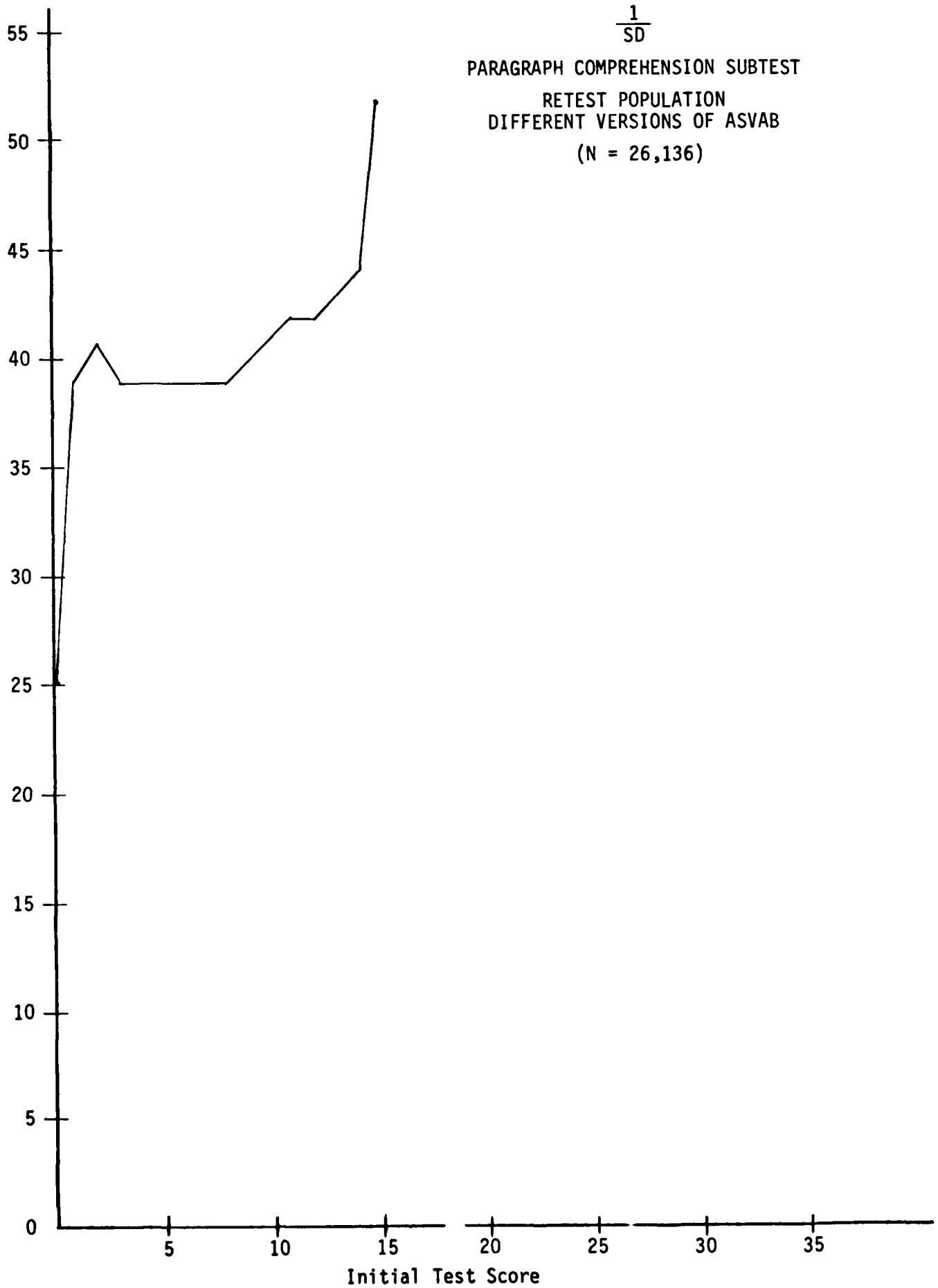




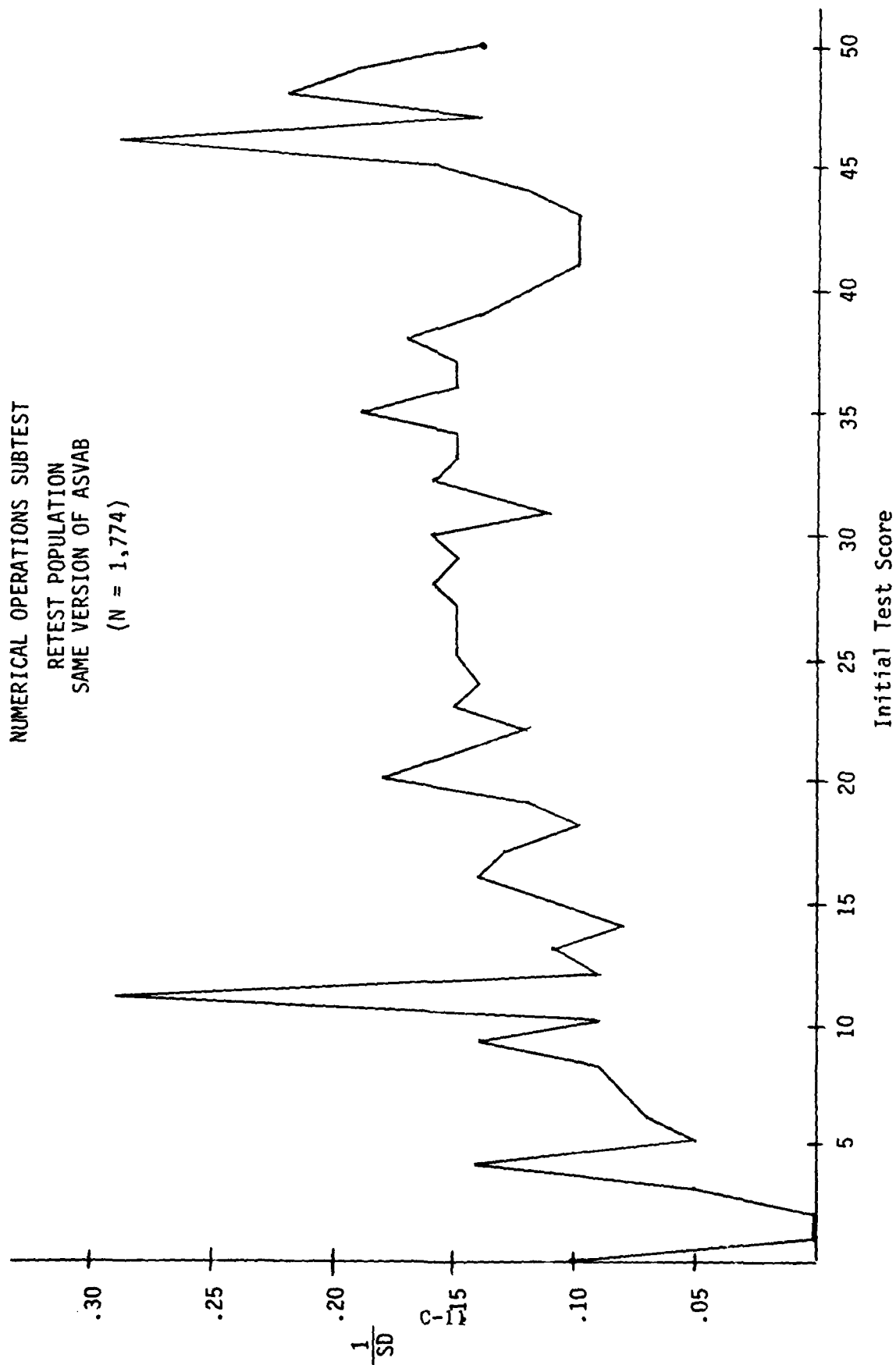
$\frac{1}{SD}$

PARAGRAPH COMPREHENSION SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)

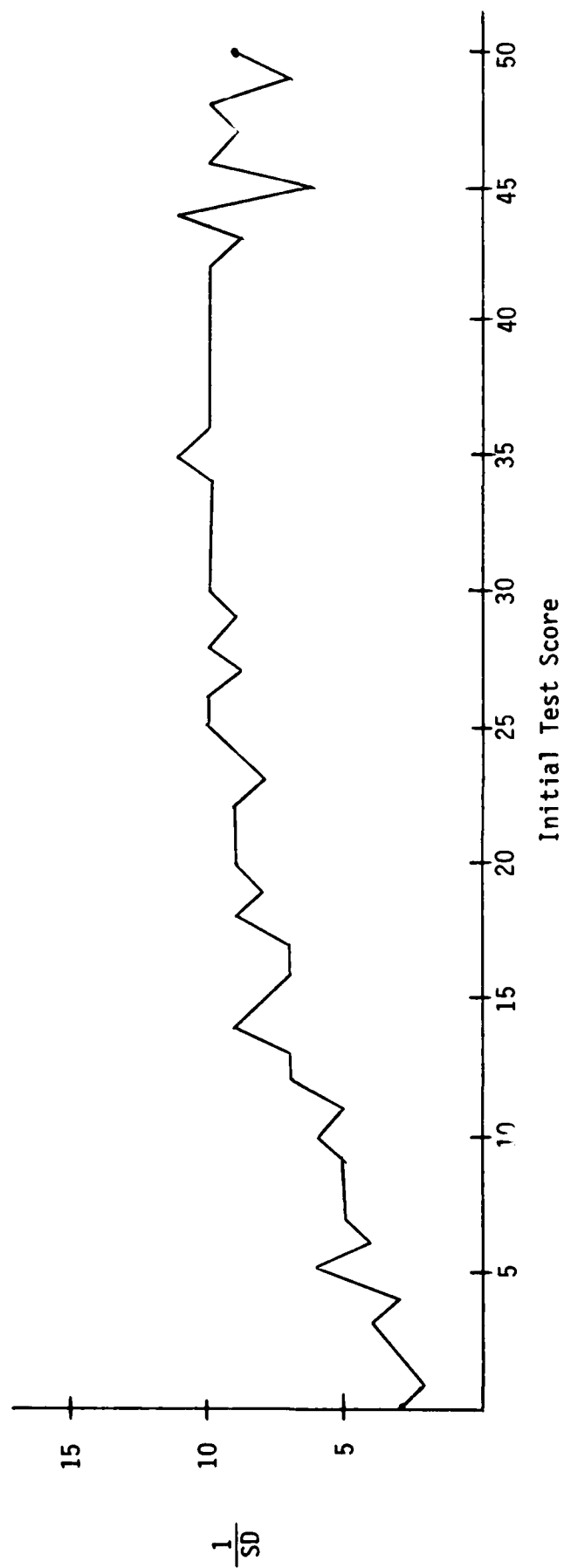
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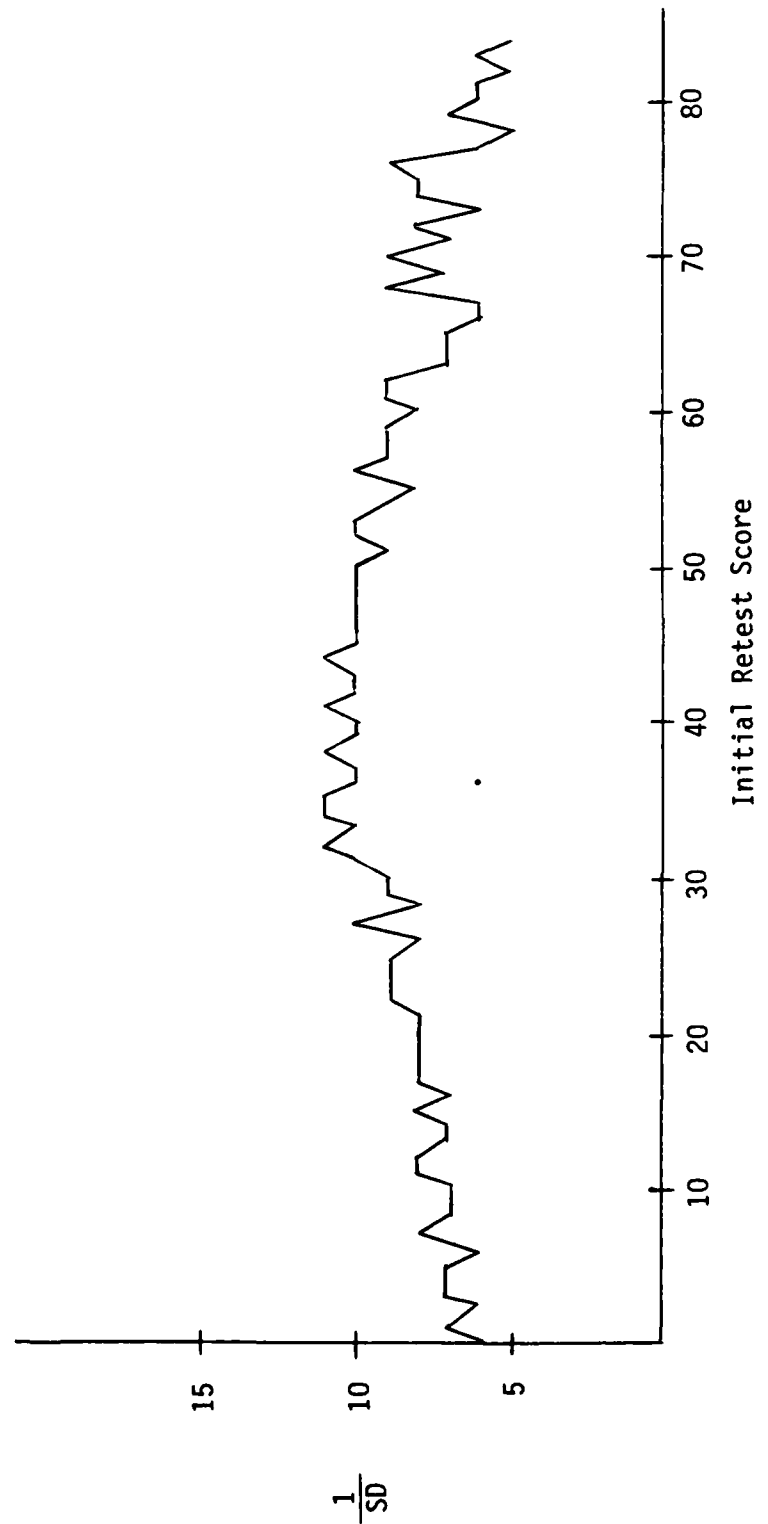
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 NUMERICAL OPERATIONS SUBTEST
 RETEST POPULATION
 SAME VERSION OF ASVAB
 (N = 1,774)



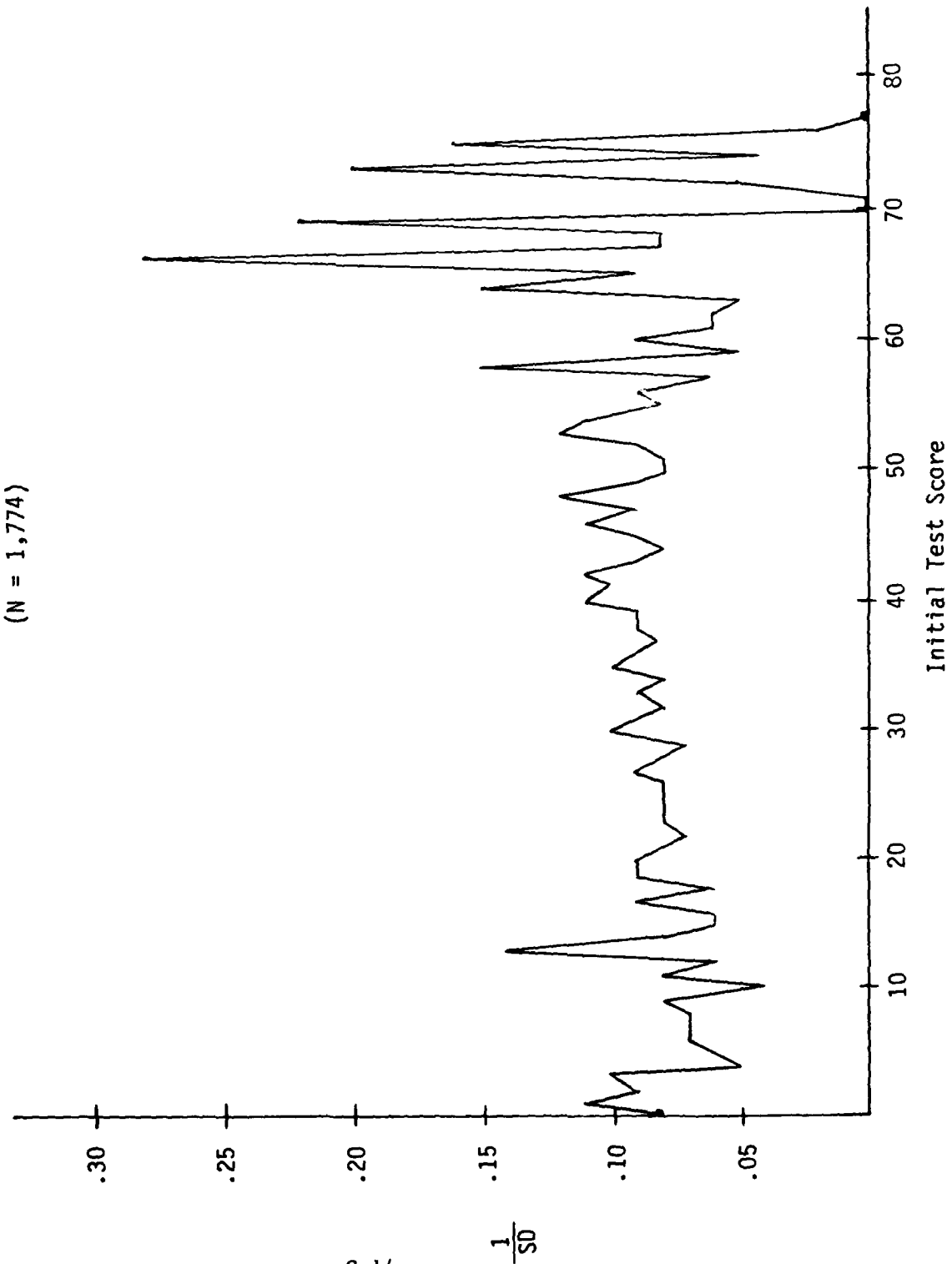
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 NUMERICAL OPERATIONS SUBTEST
 RETEST POPULATION
 DIFFERENT VERSIONS OF ASVAB
 (N = 26,136)



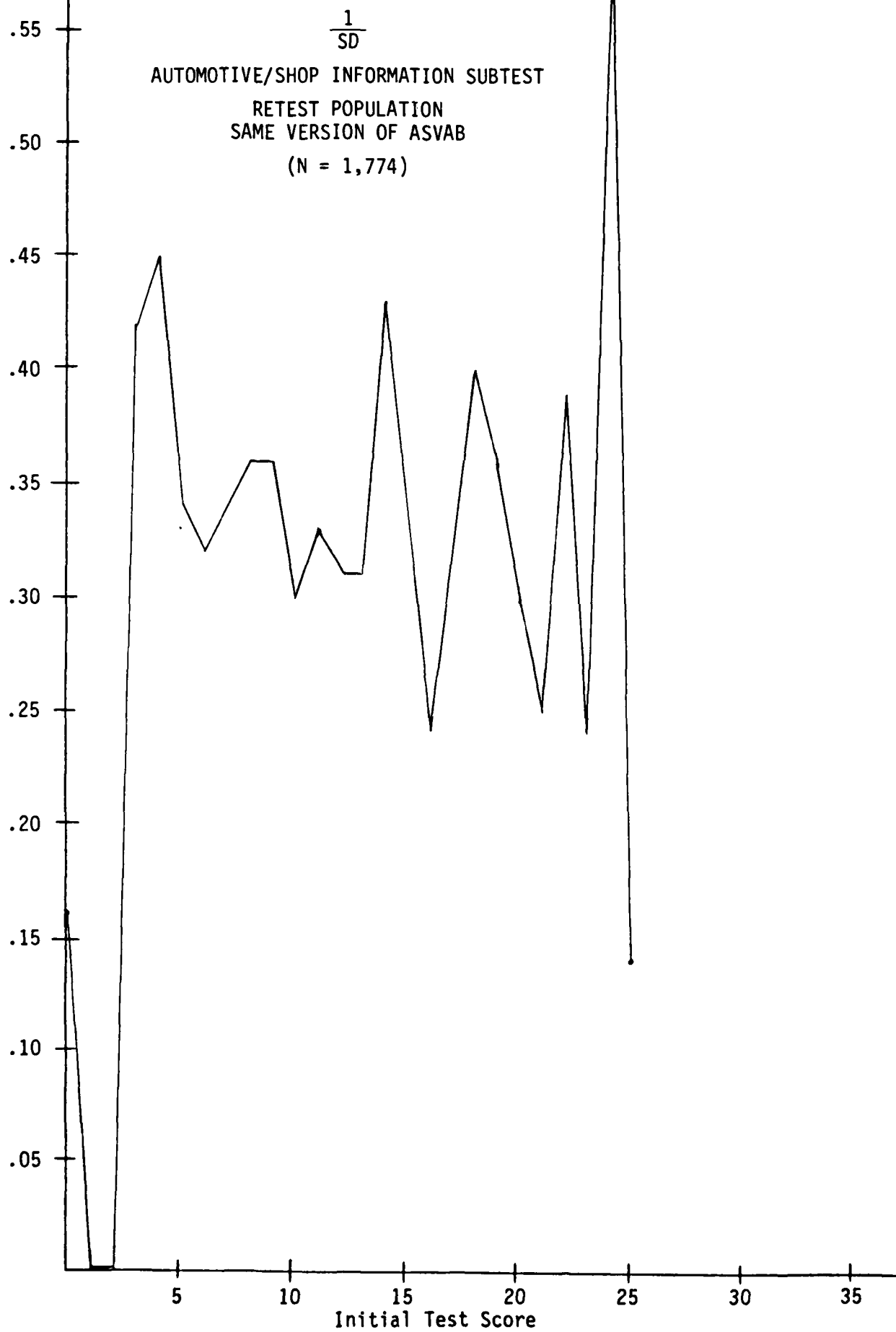
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 CODING SPEED SUBTEST
 RETEST POPULATION
 DIFFERENT VERSIONS OF ASVAB
 (N = 26,136)

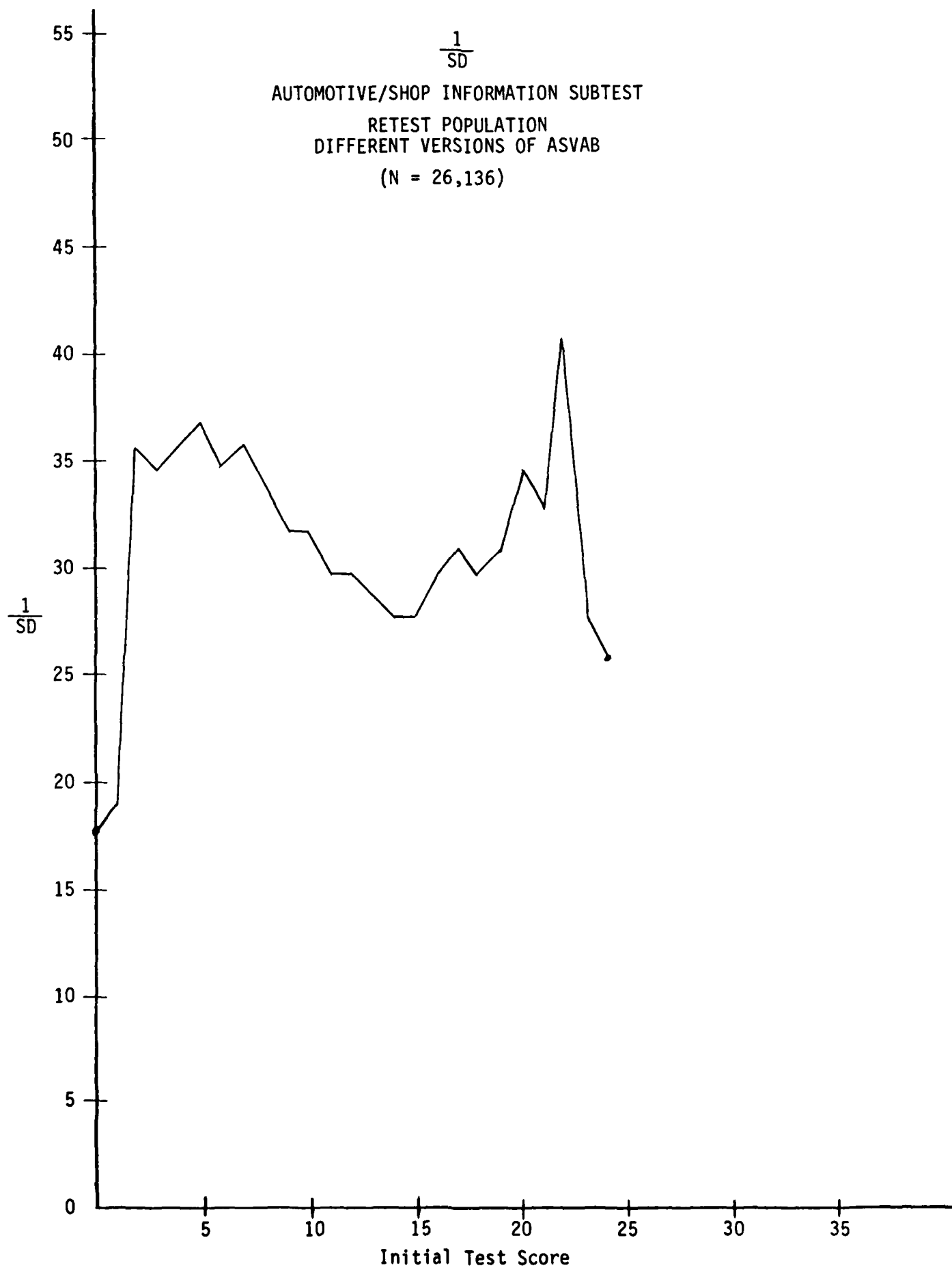


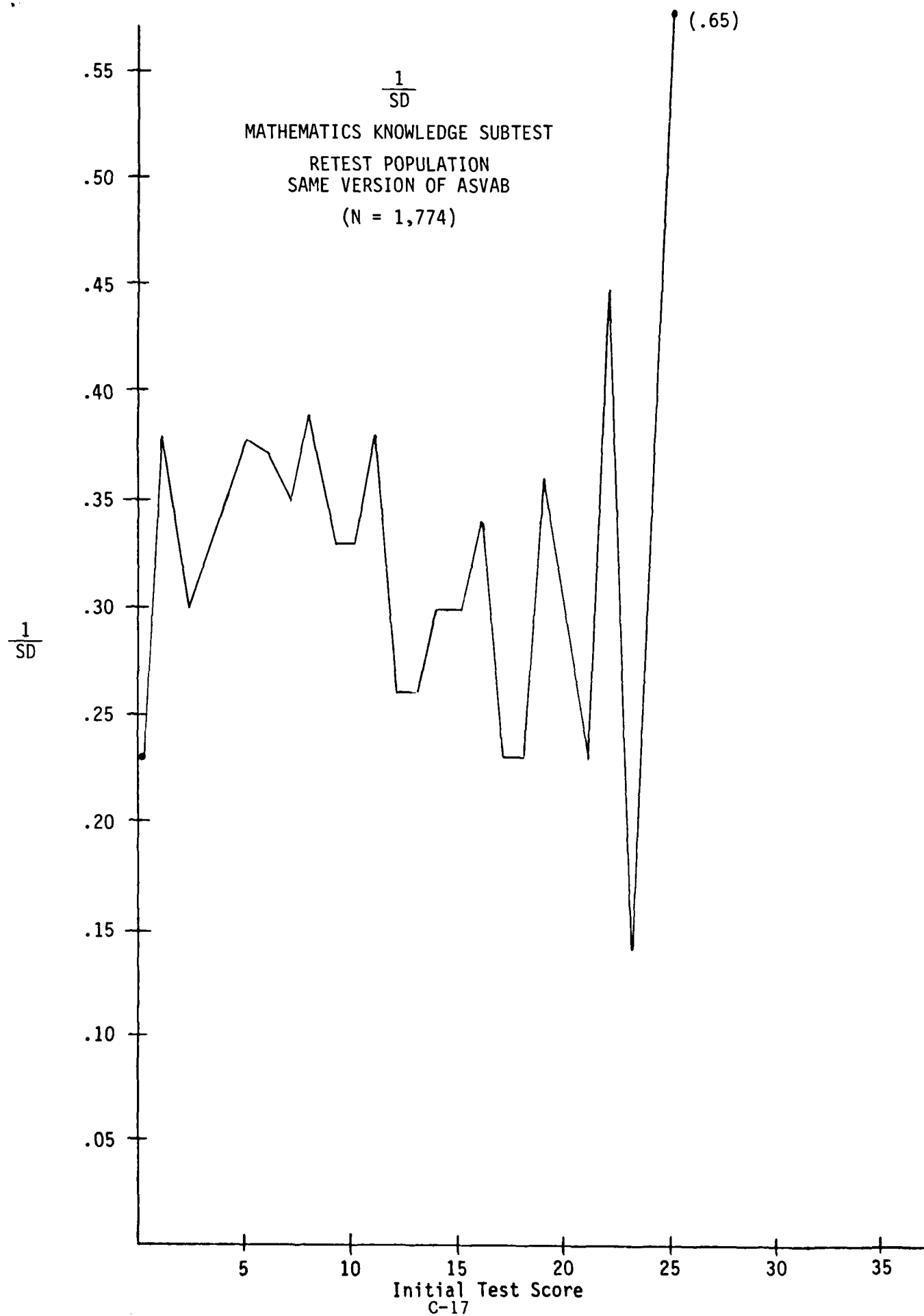
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 CODING SPEED SUBTEST
 RETEST POPULATION
 SAME VERSION OF ASVAB
 (N = 1,774)

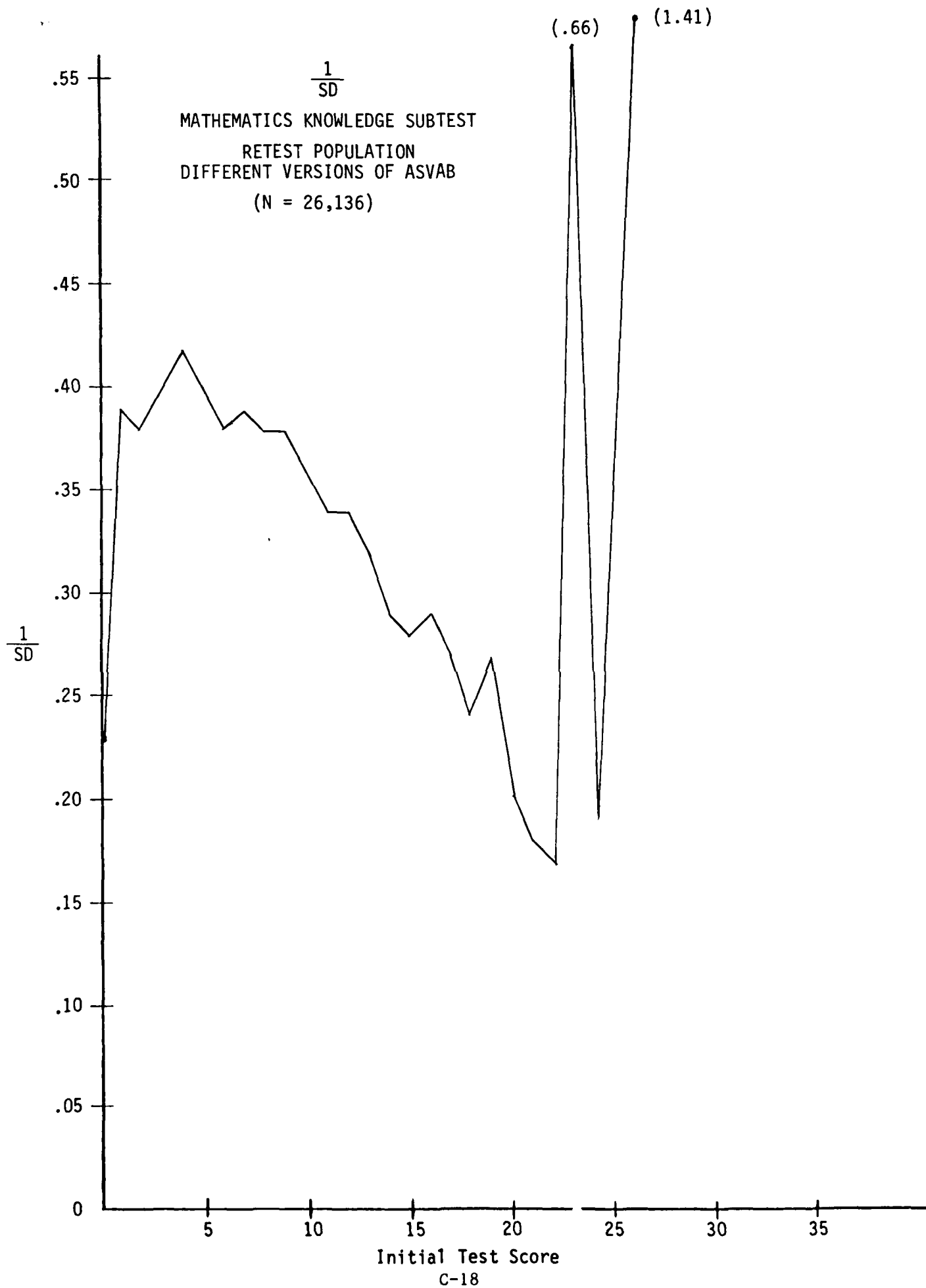


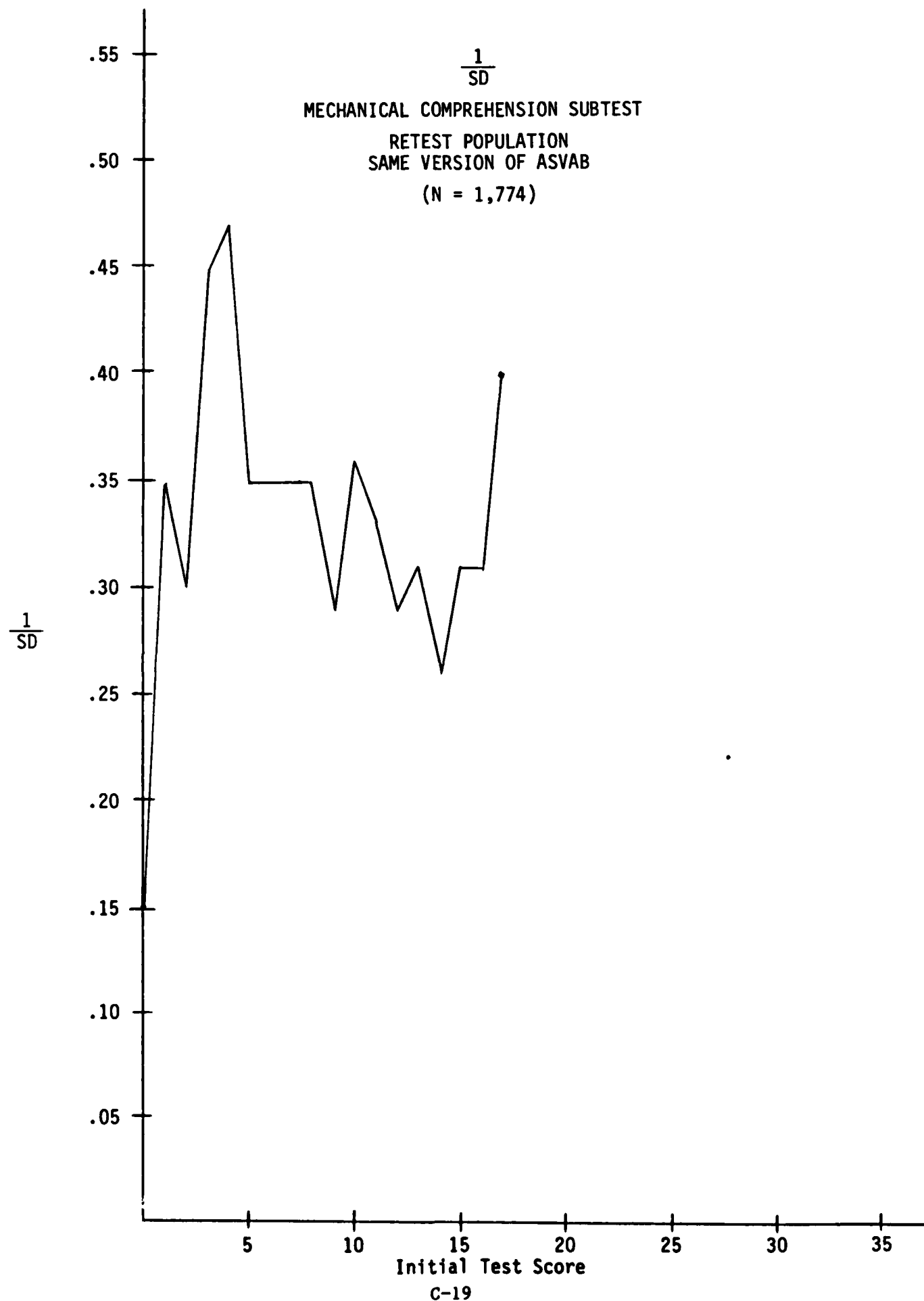
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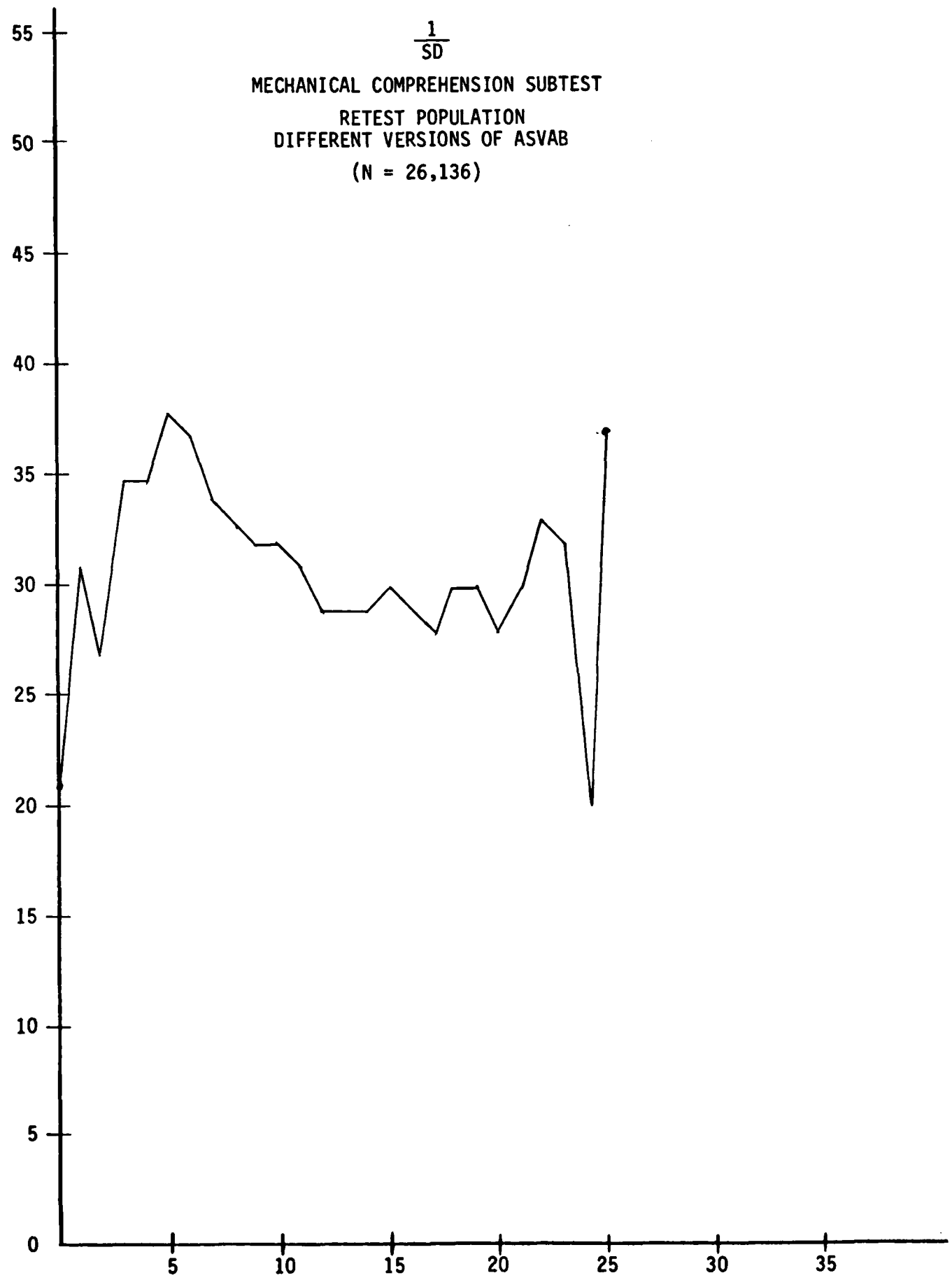




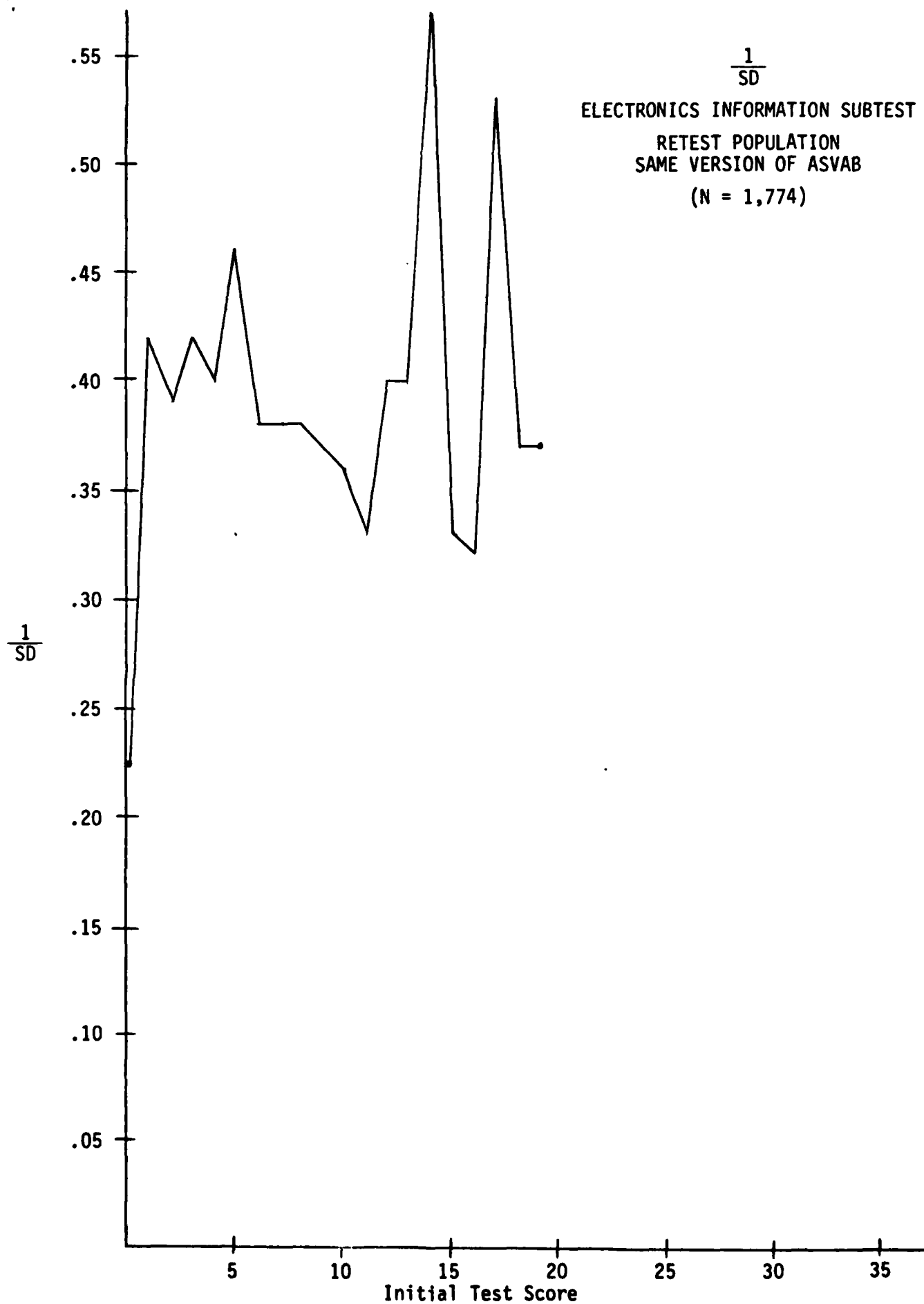
$$\frac{1}{SD}$$

MECHANICAL COMPREHENSION SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)

$$\frac{1}{SD}$$



Initial Test Score



$\frac{1}{SD}$

ELECTRONICS INFORMATION SUBTEST
RETEST POPULATION
DIFFERENT VERSIONS OF ASVAB
(N = 26,136)

$\frac{1}{SD}$

