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GATB LONGITUDINAL MATURATION STUDY.

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THIS ARTICLE DESCRIBES RESULTS OF THE FIRST IN A SERIES OF THREE LARGE-SCALE LONGITUDINAL STUDIES CONDUCTED BY THE U.S. EMPLOYMENT SERVICE TO INCREASE THE USEFULNESS OF THE GENERAL APTITUDE TEST BATTERY (GATB) FOR COUNSELING HIGH SCHOOL STUDENTS. THE FINAL SAMPLE CONSISTED OF 26,708 HIGH SCHOOL STUDENTS. ALL WERE TESTED WITH THE GATB IN 1958, AND THOSE IN THE LOWER HIGH SCHOOL GRADES WERE RETESTED IN THE 12TH GRADE. RESULTS WERE AS FOLLOWS--(1) STABILITY COEFFICIENTS WERE HIGHEST FOR THE 11TH-GRADE SAMPLE AND LOWEST FOR THE NINTH-GRADE SAMPLE, (2) INTERVAL BETWEEN INITIAL TESTING AND RETESTING HAD VERY LITTLE RELATIONSHIP TO SIZE OF PRACTICE EFFECT, (3) MATURATION INCREASES WERE LARGEST BETWEEN THE NINTH AND 12TH GRADE AND SMALLEST BETWEEN THE 11TH AND 12TH GRADE, AND (4) OCCUPATIONAL APTITUDE PATTERN STABILITY WAS INCREASED THROUGH USE OF A "BAND" AROUND THE CUTTING SCORES. THIS SPEECH WAS PREPARED FOR THE AMERICAN PERSONNEL AND GUIDANCE ASSOCIATION CONVENTION (WASHINGTON, D.C., SESSION 231, APRIL 7, 1966). (JH)

SPEECH

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Place - Shoreham Hotel
Club C

Time - April 7, 1966
10:00-11:50 A.M.

Title - GATB LONGITUDINAL MATURATION STUDY

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Abstract

This article describes results of the first in a series of three large-scale longitudinal studies conducted by the U. S. Employment Service to increase the usefulness of the GATB for counseling high school students. The final sample consisted of 26,708 high school students. All were tested with the GATB in 1958, and those in the lower high school grades were retested in the twelfth grade. Results were as follows: (1) Stability coefficients were highest for the eleventh grade sample and lowest for the ninth grade sample, (2) Interval between initial testing and retesting had very little relationship to size of practice effect, (3) Maturation increases were largest between the ninth and twelfth grade and smallest between the eleventh and twelfth grade, (4) OAP stability was increased through use of a "band" around the cutting scores.

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The General Aptitude Test Battery (GATB) has been widely used in the vocational counseling of high school seniors for the past 15 years. During the 1963-64 school year, the Employment Service tested about 340,000 seniors in about 10,000 schools for this purpose. Aptitude norms for lower high school grades were developed several years ago (Droege, 1960), and the GATB has been used increasingly by school counselors in the educational-vocational counseling of students at the ninth and tenth grade levels. Several hundred schools have arranged to use the GATB in this way through release agreements between State Employment Services and State Departments of Education or individual schools (Culhane, 1964; Wysong, 1965).

In the spring of 1958 the U. S. Employment Service initiated a series of three large-scale longitudinal studies to increase the usefulness of the GATB as a tool for counseling high school students. The overall design involved testing students in the ninth, tenth and eleventh grades and retesting them

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in the twelfth grade. (There was also provision for testing a control group of students in the twelfth grade at the time students in the lower grades were tested initially.) The first of the three studies was concerned with obtaining longitudinal data on effects of maturation on aptitude scores. The purpose of the second study was to obtain data on validity of GATB aptitude scores for predicting academic success in high school. The purpose of the third study was to determine the validity of GATB aptitude scores and Occupational Aptitude Patterns for predicting success in college and occupations two years after high school. Figure 1 shows the data collection schedule for the three-study series. The data for all three studies have been collected and the data for the maturation study have been analyzed.

The primary purpose of the GATB longitudinal maturation study was to investigate effects of the maturation or growth process on aptitude scores. Specific aspects of maturation studied were (1) stability of aptitude measurement[1] in lower high school grades and (2) average aptitude score increases in high school attributable to effects of maturation or growth. Although maturation was the primary focus in the study, it was possible to obtain data also on effects of practice (previous exposure to GATB testing) on retest aptitude scores as a by-product of the data analysis.

The importance of stability of aptitude measurement in lower high school grades, and the possible effects of maturation on stability, should be emphasized. Aptitude tests cannot be used with confidence unless there is evidence that they have substantial stability of measurement over a period of time.

A recent study has shown that the aptitudes of the GATB do have good stability for adult groups when the interval between first and second administration of the test is as long as three years (Droege, in press). But other studies have shown that there may be differences in the rate of progress of the maturation process for individuals who may not have reached full aptitude maturity. Thus, a question arises as to whether individual differences in rate of maturation have a serious detrimental effect on stability of aptitude measurement in lower high school grades. If so, the test scores of the younger high school students could not be expected to provide stable indications of occupational and educational potentialities. It would follow that use of aptitude tests for long-range counseling of students in lower high school grades could not be justified. Some data on GATB aptitude stability for high school samples are available from earlier studies (Droege) but they do not represent a systematic effort to obtain data on comparable samples of boys and girls and comparable samples of ninth, tenth, and eleventh graders.

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[1] The term "stability of measurement" is used here to refer to the relationship between initial test scores and retest scores for a specified group of individuals.

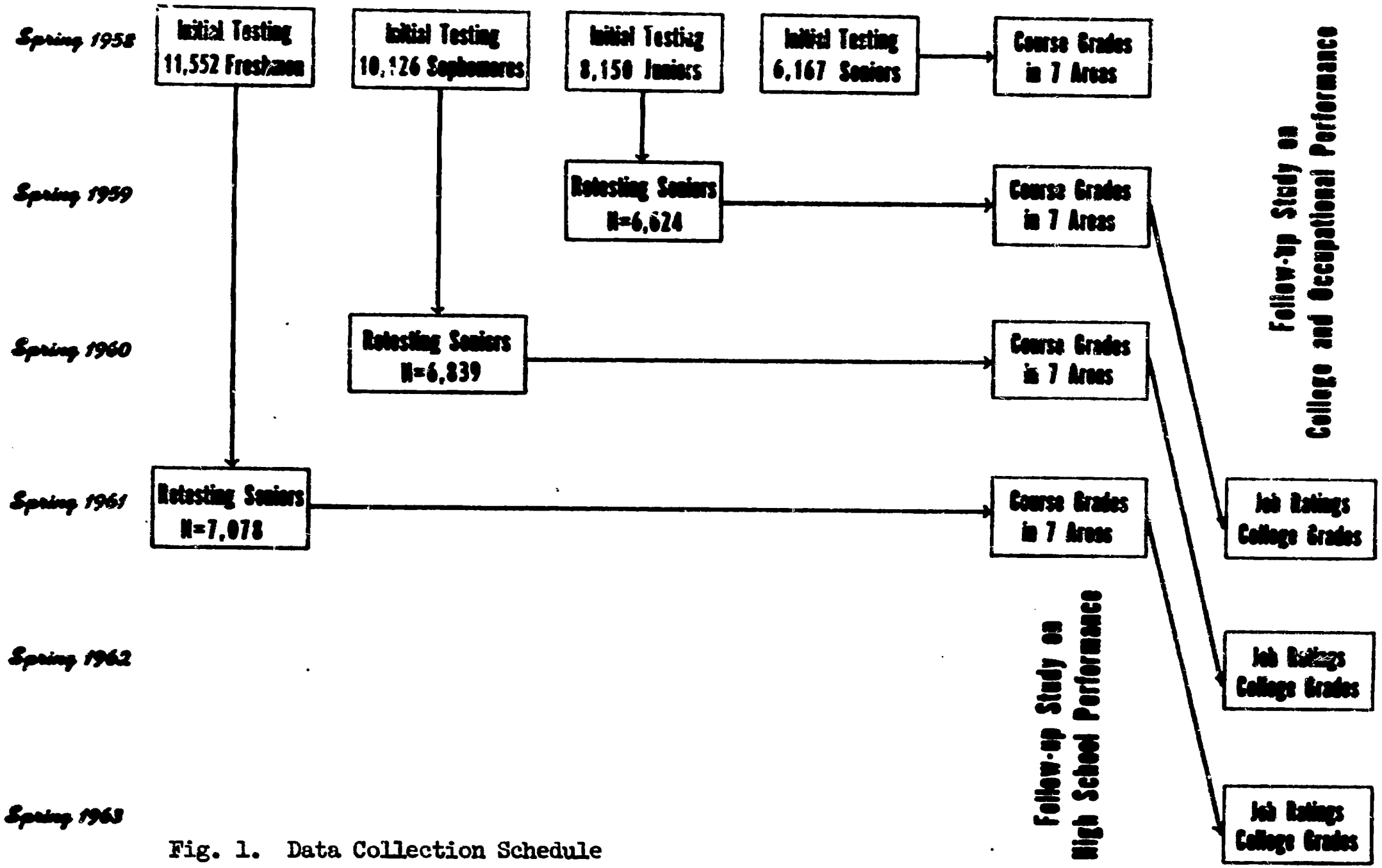

Fig. 1. Data Collection Schedule

PROCEDURE

The experimental design included both test-retest and independent-sample approaches for investigating effects of maturation on test scores. As pointed out before, maturation may affect both stability of measurement and level of aptitude score. An indication of aptitude stability over the period between initial testing in a lower high school grade and retesting in the twelfth grade is provided by the product-moment correlation between initial test scores and retest scores. But an estimate of the average increase in score level attributable to effects of maturation cannot be made from a simple comparison of initial test and retest data. Some of this increase in scores upon retesting results from the initial testing experiences (practice effect). Estimation of the portion of the increase attributable to practice effect and the portion attributable to maturation is possible through use of an independent control sample. In this study the control sample was the sample tested in the twelfth grade at the time the experimental samples were tested initially in lower high school grades. The control and experimental samples were comparable in the sense that they all included only "survivors" to the same point in the twelfth grade. Comparisons of scores of the control sample with the twelfth grade retest scores of the samples tested initially in lower high school grades provides a basis for estimating average practice effects. Comparisons of scores of the control sample with the initial scores of samples tested in lower high school grades provides a basis for estimating average maturation effects. When the average effects of practice and maturation are estimated in this way, their sum is equal to the difference between initial test mean score and retest mean score for the experimental samples.

Nineteen State Employment Services, in cooperation with 168 schools, participated in the data collection. The samples were obtained from schools where it was possible to test students at all grade levels and to retest the ninth, tenth, and eleventh graders in the twelfth grade. In most instances, substantially all students in all four high school grade levels of the participating school were tested. When this was not possible, a sample was selected for testing.

The initial testing was done during the period February 1 through April 30, 1958. The twelfth graders were tested with Form A of the B-1002 edition of the GATB. The eleventh, tenth, and ninth graders were tested with Form B of B-1002. They were retested as twelfth graders with Form A during the period February 1 through April 30 in the years 1959, 1960 and 1961, respectively.

Of the 35,995 students initially tested for the study, 26,708 were included in the final samples. Those not in the final samples were excluded for a variety of reasons, including dropout or transfer to other schools during the period between initial testing and retesting, incomplete data available, and absent from school on retesting date. Table 1 shows the number of cases in the final samples by grade, sex and size of school.

TABLE 1

NUMBER OF CASES IN THE FINAL SAMPLE

School Size	Grade 9		Grade 10		Grade 11		Grade 12		Total
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	
Under 100	265	313	295	367	247	328	269	310	2,394
100 - 199	537	555	564	551	490	494	490	482	4,163
200 - 399	752	869	722	828	736	809	663	777	6,156
400 and Over	1,844	1,943	1,767	1,745	1,756	1,764	1,606	1,570	13,995
TOTAL	3,398	3,680	3,348	3,491	3,229	3,395	3,028	3,139	26,708

Table 2 shows the mean and standard deviation of years of age at initial testing for the samples. The boys were slightly older and slightly more variable in age than girls at each grade level. Otherwise, there were no irregularities in the age data for the samples.

TABLE 2

MEAN AND STANDARD DEVIATION OF YEARS OF AGE AT INITIAL TESTING

Grade	Boys			Girls		
	N	M	S.D.	N	M	S.D.
9	3398	14.9	.6	3680	14.8	.5
10	3348	15.9	.6	3491	15.8	.5
11	3229	16.9	.6	3395	16.8	.5
12	3028	17.9	.6	3139	17.8	.5

RESULTS

Table 3 shows the GATB aptitude means and standard deviations for the four samples. This table contains basic information used to generate other tables and graphs to be introduced. Before proceeding further, however, the following points about Table 3 should be noted:

1. The aptitude mean scores for the twelfth grade sample tended to be somewhat higher than 100, the mean for the GATB General Working Population sample. The standard deviations were lower than 20, the standard deviation for the GATB General Working Population sample.

2. Aptitudes with the largest male-female differences in mean scores were Spatial Aptitude (boys averaged higher), Form Perception, Clerical Perception, Motor Coordination, and Finger Dexterity (girls averaged higher). The findings are consistent, applying equally well to the results for the ninth, tenth, eleventh and twelfth grade samples. These findings confirm results of previous research on sex differences in aptitude scores for high school samples (U. S. Department of Labor, 1962) and are similar to results obtained for a sample of adults with a wide age range (Droege, Crambert, and Henkin, 1963).

3. Retest mean scores were higher than initial test means, indicating the operation of effects of maturation and/or practice.

TABLE 3

MEANS AND STANDARD DEVIATIONS OF GATB APTITUDES FOR THE FOUR SAMPLES
(See Table 1 for Number of Cases)

Aptitude	Grade 9 Sample				Grade 10 Sample				Grade 11 Sample				Grade 12 Sample	
	Gr. 9 Test		Gr. 12 Test		Gr. 10 Test		Gr. 12 Test		Gr. 11 Test		Gr. 12 Test			
	M	S.D.	M	S.D.	M	S.D.	M	S.D.	M	S.D.	M	S.D.	M	S.D.
G - Intelligence														
Boys	98.65	13.90	111.00	14.84	101.93	14.49	110.47	15.05	105.10	15.20	110.47	15.01	107.30	14.78
Girls	97.31	13.93	108.68	14.75	100.92	14.55	108.60	15.11	103.14	15.01	108.48	14.38	104.15	14.63
V - Verbal Aptitude														
Boys	93.20	11.97	102.79	14.49	96.60	12.83	102.12	14.21	98.70	13.57	101.59	14.22	100.19	14.01
Girls	95.55	12.16	105.94	14.95	100.03	13.47	105.91	14.85	102.93	14.11	105.86	14.80	103.38	14.67
N - Numerical Aptitude														
Boys	97.70	13.57	109.34	14.41	99.37	14.15	108.93	14.72	102.76	15.26	109.17	14.75	106.54	14.36
Girls	100.13	13.81	108.47	14.27	101.74	14.32	108.82	14.73	103.08	15.15	108.70	14.01	105.70	14.60
S - Spatial Aptitude														
Boys	104.99	17.15	114.52	19.05	107.70	17.68	115.00	18.98	109.91	17.95	115.80	18.83	109.52	18.85
Girls	99.15	16.15	109.52	17.30	101.35	16.44	109.15	17.24	103.09	16.98	109.95	17.18	102.34	16.64
P - Form Perception														
Boys	99.66	16.46	111.95	15.98	104.45	16.93	111.55	15.60	107.67	17.09	112.50	15.66	107.78	15.25
Girls	106.86	16.40	117.29	15.38	111.96	16.20	117.42	15.04	113.84	16.84	118.17	15.40	113.03	15.63
Q - Clerical Perception														
Boys	95.64	11.72	106.76	13.14	99.78	12.22	106.92	13.14	102.91	12.37	108.15	13.06	103.48	12.70
Girls	104.02	12.58	117.64	13.61	109.57	13.30	118.75	14.41	112.73	13.83	119.41	14.24	114.35	13.89
K - Motor Coordination														
Boys	93.37	16.65	110.61	17.05	98.69	16.41	110.76	16.80	102.91	17.29	111.68	17.39	104.73	17.02
Girls	101.41	15.43	119.22	15.59	107.10	15.55	120.63	16.10	112.68	15.79	121.48	16.54	114.15	15.64
F - Finger Dexterity														
Boys	90.10	18.35	107.65	19.28	93.01	18.54	107.09	18.73	96.48	18.59	109.17	18.55	98.37	18.91
Girls	96.86	18.02	116.15	19.33	100.89	18.18	115.53	18.61	103.82	19.10	117.44	19.25	105.74	18.38
M - Manual Dexterity														
Boys	97.09	19.33	120.02	21.00	100.38	19.53	119.48	20.61	104.68	19.57	119.33	20.54	107.12	19.89
Girls	97.62	19.06	118.80	20.54	101.33	20.00	118.81	20.24	105.13	19.91	118.49	20.98	106.74	19.68

Average Increases in Scores Attributable to Maturation and Practice Effects

Table 4 shows the differences between initial test means and retest means for each of the experimental samples. The gross increases, all statistically significant, are a function of maturation and practice effects. The technique used for dividing the total increase in mean score into that portion due to effects of practice and that due to effects of maturation is described under "Procedure." Since the differences in results for boys and girls were not large, they were averaged and graphs were prepared showing the average effects of practice (Figure 2) and maturation (Figure 3) for the three experimental samples.

The graphs in Figure 2 were based on differences between the mean scores of the twelfth grade sample and the twelfth grade retest mean scores of the ninth, tenth, and eleventh grade samples. The graphs show that the average effects of practice (or exposure to the initial GATB testing) were very similar for the three experimental samples. Length of time between initial testing and retesting had little relationship to size of practice effect. Finger Dexterity and Manual Dexterity showed the largest and Verbal Aptitude and Numerical Aptitude showed the smallest increases in scores attributable to practice. These findings apply equally to the results for the ninth, tenth, and eleventh grade samples and, as inspection of Table 4 will indicate, equally to results for boys and girls.

The graphs in Figure 3 were based on differences between mean scores of the twelfth grade sample and the means of the initial scores of the ninth, tenth, and eleventh grade samples. The pattern in Figure 3 (maturation) is quite different from that in Figure 2 (practice). Although the shapes of the profiles for the three experimental samples tend to be parallel in both figures, the profile levels vary quite noticeably in Figure 3, a reflection of cumulative effects of maturation processes from the ninth to the twelfth grade. Thus, maturation increases for all aptitudes were largest between the ninth and twelfth grades and smallest between the eleventh and twelfth grades, where the sizes of the increase due to maturation were quite small. Average maturation effects from the ninth to twelfth and from the tenth to twelfth grades were largest for Motor Coordination and smallest for Spatial Aptitude. As in the case of practice effects, inspection of Table 4 shows that the results relating to average effects of maturation were quite similar for boys and girls.

TABLE 4

MEAN SCORE INCREASES FOR THE APTITUDES OF THE GATB
(See Table 1 for Number of Cases)

Aptitude	Between Grades 9 and 12			Between Grades 10 and 12			Between Grades 11 and 12		
	Total ($M_{9R}-M_9$)	Practice ($M_{9R}-M_{12}$)	Maturation ($M_{12}-M_9$)	Total ($M_{10R}-M_{10}$)	Practice ($M_{10R}-M_{12}$)	Maturation ($M_{12}-M_{10}$)	Total ($M_{11R}-M_{11}$)	Practice ($M_{11R}-M_{12}$)	Maturation ($M_{12}-M_{11}$)
G - Intelligence									
Boys	12.3	3.7	8.6	8.6	3.2	5.4	5.4	3.2	2.2
Girls	10.7	4.5	6.2	7.6	4.4	3.2	5.3	4.3	1.0
Average	11.5	4.1	7.4	8.1	3.8	4.3	5.4	3.8	1.6
V - Verbal Aptitude									
Boys	8.6	2.6	6.0	5.5	1.9	3.6	2.8	1.4	1.4
Girls	10.4	2.6	7.8	5.9	2.5	3.4	2.8	2.4	.4
Average	10.0	2.6	7.4	5.7	2.3	3.4	2.9	1.9	1.0
N - Numerical Aptitude									
Boys	11.6	2.8	8.8	9.6	2.4	7.2	6.4	2.6	3.8
Girls	8.2	2.7	5.5	7.1	3.1	4.0	5.6	3.0	2.6
Average	10.0	2.8	7.2	8.4	2.8	5.6	6.0	2.8	3.2
S - Spatial Aptitude									
Boys	10.5	5.0	5.5	7.2	5.4	1.8	6.6	6.2	.4
Girls	10.4	7.2	3.2	7.8	6.8	1.0	8.4	7.6	.8
Average	10.4	6.0	4.4	7.6	6.2	1.4	7.5	6.9	.6
P - Form Perception									
Boys	12.3	4.2	8.1	7.1	3.8	3.3	4.8	4.7	.1
Girls	10.4	4.2	6.2	5.4	4.4	1.0	5.9	5.1	.8
Average	11.3	4.2	7.1	6.2	4.0	2.2	5.3	4.9	.4
Q - Clerical Perception									
Boys	11.0	3.2	7.8	7.1	3.4	3.7	5.2	4.6	.6
Girls	13.5	3.2	10.3	9.2	4.4	4.8	6.6	5.0	1.6
Average	12.2	3.2	9.0	8.1	3.9	4.2	5.9	4.8	1.1
K - Motor Coordination									
Boys	17.2	5.8	11.4	12.0	6.0	6.0	8.8	7.0	1.8
Girls	17.7	5.0	12.7	13.4	6.4	7.0	8.7	7.3	1.4
Average	17.4	5.4	12.0	12.7	6.2	6.5	8.7	7.1	1.6
F - Finger Dexterity									
Boys	17.4	9.2	8.2	14.1	8.7	5.4	12.6	10.8	1.8
Girls	19.2	10.4	8.8	14.6	9.8	4.8	13.6	11.7	1.9
Average	18.4	9.8	8.6	14.3	9.2	5.1	13.1	11.2	1.9
M - Manual Dexterity									
Boys	22.0	12.9	10.0	19.1	12.4	6.7	14.6	12.2	2.4
Girls	21.1	12.0	9.1	17.4	12.0	5.4	13.4	11.8	1.6
Average	22.0	12.4	9.6	18.2	12.2	6.0	14.0	12.0	2.0

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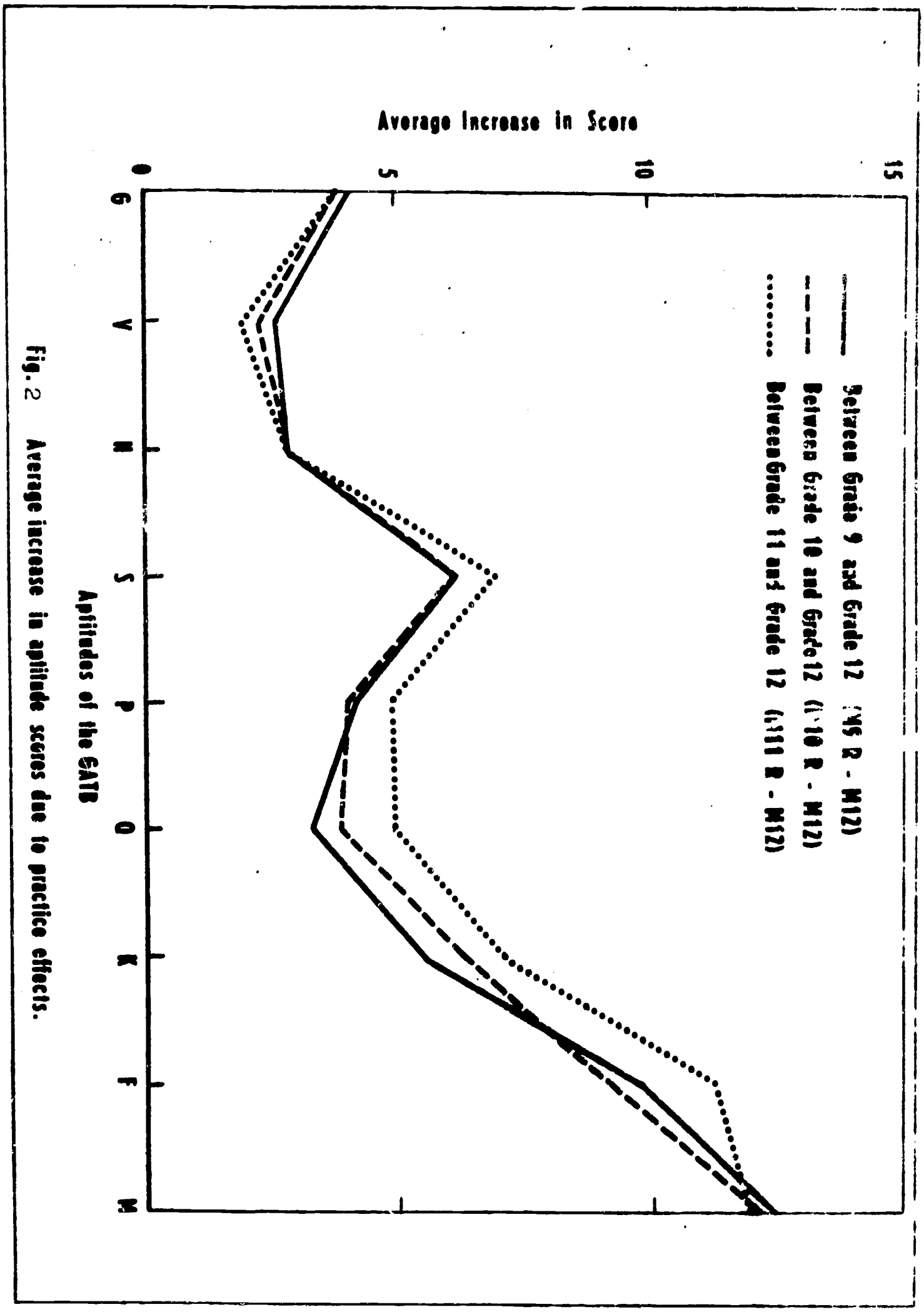


Fig. 2 Average increase in aptitude scores of the GATB Aptitudes due to practice effects.

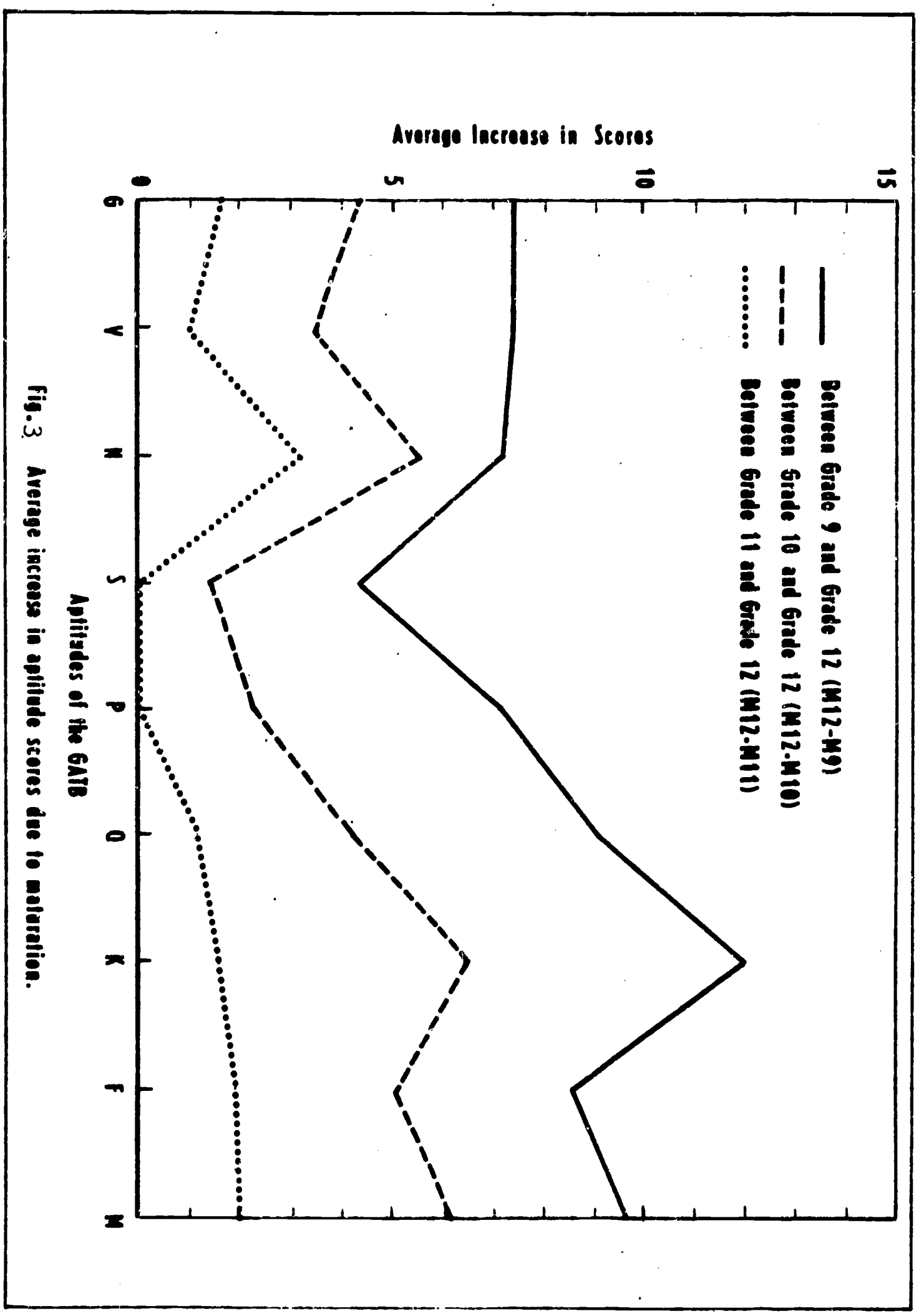


Fig.3 Average increase in aptitude scores of the GATB Aptitudes due to maturation.

Stability of Aptitudes and OAP's

Aptitude stability coefficients are shown in Table 5 and in Figure 4. These stability coefficients are the product-moment correlations between initial test scores in lower high school grades and retest scores in the twelfth grade. The following points should be noted:

1. The profiles of stability coefficients for the experimented samples are parallel. The coefficients for all nine aptitudes were highest for the eleventh grade sample and lowest for the ninth grade sample. Medians and ranges of stability coefficients were as follows:

	Median	Range
Ninth grade sample	.69	.56 - .80
Tenth grade sample	.72	.62 - .83
Eleventh grade sample	.75	.64 - .84

2. The aptitudes with the highest stability coefficients were Intelligence, Verbal Aptitude and Numerical Aptitude. The aptitudes with the lowest stability coefficients were Form Perception and Finger Dexterity. These findings were consistent, applying equally well to the results for the ninth, tenth and eleventh grade samples.

3. The boy-girl differences in stability coefficients were quite small, and the findings in 1 and 2 above, which were based on averaged stability coefficients, applied quite well to the data for boys and girls separately.

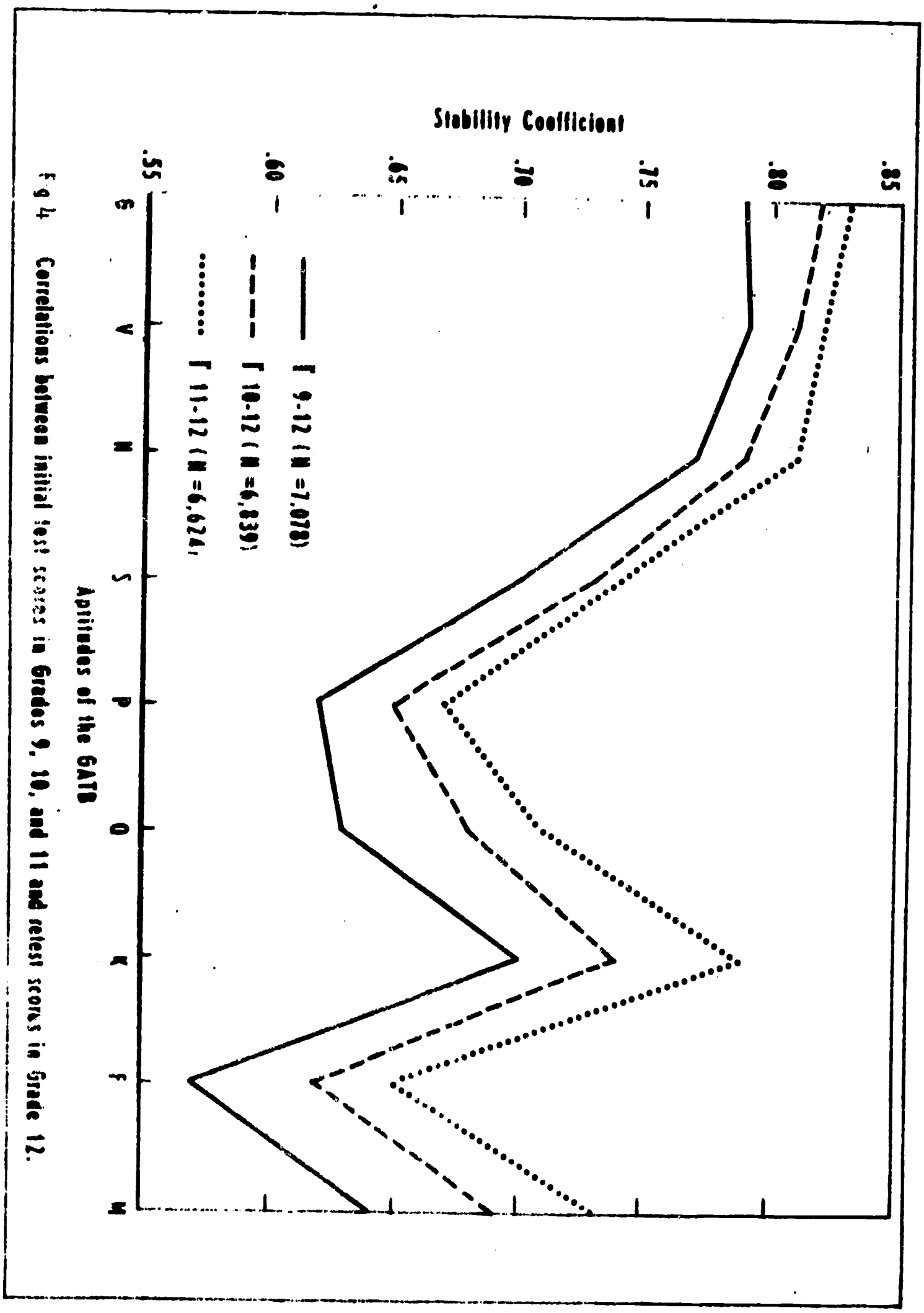
Twenty years of occupational research with the GATB have led to the development of validated Occupational Aptitude Pattern (OAP) norms for families of occupations requiring similar abilities (U. S. Department of Labor, 1962). The OAP norms consist of cutting scores for three significant aptitudes required by the occupations in the family. Thirty-six OAP's have been established and they cover about 850 occupations. To obtain information on stability of OAP's at the ninth, tenth and eleventh grade levels, OAP norms were applied to the initial and to the retest scores for each sample (after appropriate adjustments were made in the cutting scores for maturation and practice effects) and the relationships between pass-fail on initial test scores and pass-fail on retest scores were obtained. A summary of these results, in terms of the distribution of tetrachoric correlation coefficients between pass-fail on initial scores and pass-fail on retest scores is shown in Table 6.

There was some variation in the distributions of tetrachoric correlations for boys and girls, but the medians were the same for the ninth and eleventh grade samples and only slightly different for the tenth grade sample. The distributions for boys and girls together are shown graphically in Figure 5. It is apparent that stability tended to be highest for the eleventh grade

TABLE 5

STABILITY COEFFICIENTS FOR THE APTITUDES OF THE GATB
(See Table 1 for Number of Cases)

Aptitude	$r_{9\ 9R}$	$r_{10\ 10R}$	$r_{11\ 11R}$
G - Intelligence			
Boys	.78	.82	.84
Girls	.80	.83	.83
Average	.79	.82	.83
V - Verbal Aptitude			
Boys	.79	.82	.82
Girls	.79	.81	.82
Average	.79	.81	.82
N - Numerical Aptitude			
Boys	.78	.80	.83
Girls	.76	.78	.80
Average	.77	.79	.81
S - Spatial Aptitude			
Boys	.72	.76	.75
Girls	.69	.71	.72
Average	.70	.73	.74
P - Form Perception			
Boys	.63	.65	.67
Girls	.62	.65	.67
Average	.62	.65	.67
Q - Clerical Perception			
Boys	.66	.70	.73
Girls	.60	.66	.68
Average	.63	.68	.71
K - Motor Coordination			
Boys	.68	.72	.75
Girls	.72	.76	.82
Average	.70	.74	.79
F - Finger Dexterity			
Boys	.56	.62	.64
Girls	.58	.62	.67
Average	.57	.62	.65
M - Manual Dexterity			
Boys	.63	.68	.71
Girls	.65	.69	.74
Average	.64	.69	.73



Correlations between initial test scores in Grades 9, 10, and 11 and retest scores in Grade 12.

TABLE 6

DISTRIBUTION OF TETRACHORIC CORRELATIONS BETWEEN PASS-FAIL ON INITIAL SCORE AND PASS-FAIL ON RETEST SCORE FOR THE 36 OAP'S

Interval	Grade 9 Sample			Grade 10 Sample			Grade 11 Sample		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
.90 - .94	0	0	0	0	0	0	1	1	2
.85 - .89	1	0	1	2	2	4	3	1	4
.80 - .84	2	5	7	8	5	13	8	8	16
.75 - .79	8	8	16	7	13	20	12	14	26
.70 - .74	8	6	14	11	8	19	10	6	16
.65 - .69	10	12	22	6	6	12	2	4	6
.60 - .64	7	5	12	2	2	4	0	2	2
Mdn.	.71	.71	.71	.74	.76	.75	.77	.77	.77

sample and lowest for the ninth grade sample. The medians for the ninth, tenth and eleventh grade samples were .71, .75, and .77, respectively.

Effect of Application of a Cutting Score Band on OAP Stability

A further inspection of the graphs in Figure 5 show the considerable variation in stability of OAP's for each sample. For some of the OAP's the stability is satisfactory even at a ninth grade level. On the other hand, other OAP's have unsatisfactory stability for use in counseling. This is particularly true at the ninth grade level where many of the OAP's have stability coefficients of less than .70. There is a serious question of whether OAP's with such low stability would be useful in counseling. Additional analyses of the data were made in an attempt to see whether it would be possible to improve OAP stability for a portion of the individuals. The objective of this analysis was to establish a "band" of cutting scores for each OAP which would identify individuals whose scores are close to the cutting scores for the OAP. These are the individuals for whom OAP instability is the greatest. The reason is that only slight changes in their test results are required for them to pass after failing initially, or to fail after passing initially. To the extent that establishing a score band is successful in identifying such individuals, it would be possible to increase stability when testing interpretation is limited to individuals who fall outside the band.

The bands around OAP cutting scores were based on the standard errors of measurement for each aptitude as computed separately for the ninth, tenth, and eleventh grade samples. Thus, the width of the band around the cutting score for each aptitude in the norms for a particular OAP is equal to one standard error of measurement. This basis for the band width was chosen after some preliminary tryouts on small subsamples.

The band widths are shown in Table 7. The differences were not great for the three samples but, where differences exist, the ninth grade band widths were highest and the eleventh grade band widths were lowest. The aptitudes with the greatest band widths were Finger Dexterity and Manual Dexterity, the aptitudes with the lowest stability coefficients. Table 8 shows the results of the application of the band in the case of OAP 1 for ninth grade boys.

The three aptitudes in OAP 1 are Intelligence, Numerical Aptitude, and Spatial Aptitude. The four-way table for the total group shows that OAP 1 had relatively high stability. (The tetrachoric correlation for this table was .82). Another, and perhaps more meaningful, way of judging stability is on the basis of the proportion of incorrect predictions--individuals in the upper left and lower right cells of the four-way table. For the total group this proportion was .12, indicating that 12 per cent of those tested initially change from a pass to fail status or from a fail to a pass status when retested as twelfth graders. The four-way table for the within-band group shows that, for this portion of the total group, the proportion

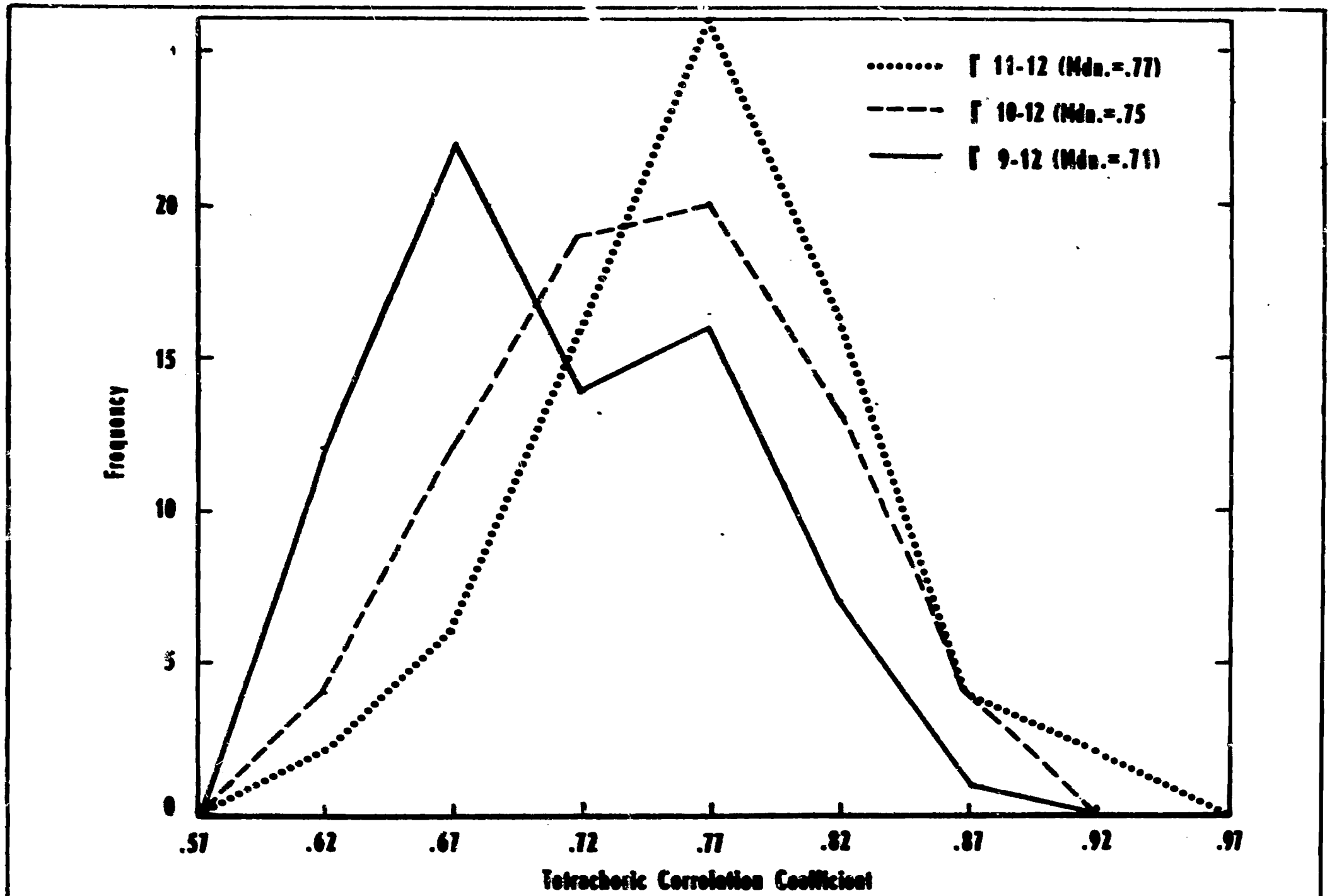


Fig 5 Distributions of tetrachoric correlations between pass-fail on initial scores and pass-fail on retest scores for the 36 OAP's

TABLE 7

WIDTH (±) OF BAND AROUND OAP CUTTING SCORES

Aptitude	Grade 9	Grade 10	Grade 11
G - Intelligence	3	3	3
V - Verbal Aptitude	3	3	3
N - Numerical Aptitude	3	3	3
S - Spatial Aptitude	5	4	4
P - Form Perception	5	5	5
Q - Clerical Perception	4	4	4
K - Motor Coordination	5	4	4
F - Finger Dexterity	6	6	6
M - Manual Dexterity	6	6	5

TABLE 8

RELATIONSHIP BETWEEN PASS-FAIL ON INITIAL SCORE AND PASS-FAIL ON RETEST SCORES FOR OAP1 (ADULT NORMS G-125, M-115, S-115) FOR GRADE 9 BOYS

Total Group
Retest Scores

Initial Test Scores	Fail	Pass	Total
Pass	74(b)	144(a)	218
Fail	2856(d)	324(c)	3180
Total	2930	468	3398

$\frac{b+c}{N} = .12$

Within "Band"

	Fail	Pass	Total
Pass	46	45	91
Fail	887	197	1084
Total	933	242	1175

$\frac{b+c}{N} = .21$

Outside "Band"

	Fail	Pass	Total
Pass	28	99	127
Fail	1969	127	2096
Total	1997	226	2223

$\frac{b+c}{N} = .07$

Total Group

	Fail	Pass	Total
Pass	28 / 46	99 / 45	218
Fail	887 / 1969	197 / 127	3180
Total	2930	468	3398

misclassified was .21, considerably higher than the .07 proportion for the outside band four-way table shown next.

This means that stability of OAP 1 can be improved if the counselor restricts his interpretation on OAP 1 to the individuals whose initial scores are outside the band for this OAP.

Similar results were obtained with other OAP's. The medians and ranges of the proportions of incorrect predictions for the 36 OAP's were as follows for the total group and for the group outside the band:

	Range		Median	
	Total	Outside	Total	Outside
Ninth grade	.06 - .43	.03 - .39	.20	.14
Tenth grade	.06 - .42	.03 - .39	.19	.13
Eleventh grade	.05 - .43	.03 - .39	.18	.13

DISCUSSION

There are remarkably few inconsistencies and irregularities in the results. The similarities in practice effects for the three experimental samples are striking, and the major findings apply equally to boys and girls. We find the expected increases in mean scores attributable to maturation; there are no inconsistencies when results for the three experimental samples are compared; and the increases for boys and girls are quite similar. The profiles of stability coefficients are parallel, corresponding to parallel profiles of mean scores. Again, the boy-girl differences are quite small. It is reasonable to conclude that in terms of average effects of maturation and practice on GATB aptitude scores of high school students, we have about as good information as we can get. The results provide a good basis for making adjustments in aptitude scores (or aptitude norms) for effects of maturation or practice.

But the problem of individual differences in rates of maturation or ability to benefit from practice remains. The results show clearly that these individual differences have an adverse effect on aptitude stability, with some individual aptitudes and some OAP's having stability coefficients that are too low to be considered useful in counseling in lower high school grades. Additional research may provide a basis for increasing aptitude stability through additional testing or combining aptitude measures at the lower high school grade levels. Use of the band principle makes increased stability of measurement possible for OAP's when the interpretation is restricted to individuals whose scores fall outside the band.

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