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RELATIVE PREDICTABILITY OF FRESHMAN GRADE-POINT AVERAGES FROM SAT SCORES IN NEGRO AND WHITE SOUTHERN COLLEGES.

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A COMPARISON WAS MADE OF THE RELATIVE ACCURACY OF PREDICTION OF COLLEGE FRESHMAN GRADE POINT AVERAGES FROM SCHOLASTIC APTITUDE TEST (SAT) SCORES IN PREDOMINANTLY NEGRO AND PREDOMINANTLY WHITE SOUTHERN COLLEGES. DATA PUBLISHED BY A SOUTHERN STATE UNIVERSITY SYSTEM ON TESTS USED IN DETERMINING ELIGIBILITY FOR COLLEGE ADMISSION WERE ANALYZED AND EVALUATED. THE DATA ANALYZED SHOWED THAT TEST SCORES OF THE NEGRO STUDENTS WERE CLOSELY GROUPED AT THE LOW END OF THE SCALE. CORRELATION OF SCORES AND GRADES SHOWED MARKED INCONSISTENCIES WHICH SEEMED INEXPLICABLE. THE CONCLUSION OF THIS STUDY WAS THAT THERE IS A SIMILARITY OF PREDICTION OF ACADEMIC PERFORMANCE IN BOTH TYPES OF SCHOOLS. AN IMPLICATION WAS THAT VALIDATION OF THE PREDICTABILITY TESTS POINT OUT THE INADEQUACIES OF EDUCATIONAL FACILITIES IN NEGRO COLLEGES. THE SOLUTION PROPOSED INVOLVED REDUCING OR ELIMINATING DEFICITS IN EDUCATIONAL OPPORTUNITIES RATHER THAN DISCARDING THE TESTS AS NOT BEING VALID. (GD)

RELATIVE PREDICTABILITY OF FRESHMAN GRADE-POINT AVERAGES FROM SAT SCORES IN NEGRO AND WHITE SOUTHERN COLLEGES

RESEARCH AND DEVELOPMENT CENTER FOR LEARNING AND RE-EDUCATION

Technical Report No. 7

RELATIVE PREDICTABILITY OF FRESHMAN GRADE-POINT AVERAGES FROM SAT SCORES IN NEGRO AND WHITE SOUTHERN COLLEGES

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Based on a master's thesis

under the direction of

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PREFACE

This technical report is based on the master's thesis of Angela Biaggio. Thesis committee members were Julian C. Stanley, Chairman; Frank B. Baker; and Robert E. Grinder.

The primary goal of the Research and Development Center for Learning and Re-Education is to improve cognitive learning in children and adults, commensurate with good personality development. Knowledge is being extended about human learning and other variables associated with efficiency of school learning. This operation is being performed through synthesizing present knowledge and through conducting research to generate new knowledge. In turn, the knowledge is being focused upon the three main problem areas of the Center: developing exemplary instructional systems, refining the science of human behavior and learning on the one hand and the technology of instruction on the other, and inventing new models for school experimentation, development activities, etc.

One primary concern to the Center is better educational opportunity for the culturally disadvantaged. In this report, Mrs. Biaggio analyzes data published by a Southern state university system, refuting the charges of "not valid for culturally disadvantaged" for the particular test used in determining eligibility for college admission. The sharp restriction in range of the Negro students' scores, however, emphasizes the need for improved educational facilities, including instructional programs and organizations for instruction.

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ABSTRACT

In this study the accuracy of prediction of freshman grades in Negro versus non-Negro colleges was compared via SAT-verbal and SAT-mathematical scores. Correlations between predictors and freshman grade-point averages were compared through a three-factor analysis of variance singly-nested design.

Results showed that when the restriction of range in the Negro students' scores was taken into account and a correction applied, the prediction was better in the Negro colleges. However, when the restriction of range was disregarded, there were no significant differences in predictability among males, but the academic success of white females was predicted better. Standard errors of estimate were also analyzed, revealing larger errors for white colleges than for Negro colleges. College and year effects were also studied, as well as the interactions between race and year.

It appears that if Negro students had not such low scores, they would be better predicted than the whites. Even with this restriction of range there are no significant differences for males, although white females are being better predicted. The solution should be in eliminating deficits in the Negroes' educational opportunities rather than in discarding tests as "not valid."

I
INTRODUCTION

Purpose of the Study

The purpose of this study is the comparison of the relative accuracy of prediction of college freshman grade-point averages from Scholastic Aptitude Test (SAT) scores in predominantly Negro and predominantly white southern colleges.

In most colleges throughout the country, students' grades at the end of the freshman year can be predicted fairly accurately from the best-weighted linear composite of high school grades (or rank in high school graduating class) and scores on the two sections of the SAT, i.e., SAT-verbal and SAT-mathematical. Barrit, Chase and Ludlow (1964), for instance, report that the corrected reliability coefficient of grade-point average of Indiana University entering freshmen in 1961 was .84.

Since southern Negro students tend to score considerably lower on the SAT than whites do, it has been argued that SAT scores are not "valid" for these Negro students, thus implying that they do not predict academic achievement well.

It is well known that cultural factors may influence relative performance on verbal and non-verbal tests in many ways. Such factors can lower some forms of validity of a test, but it can be claimed that they will not necessarily decrease its predictive validity. For example, if a cultural group performs more poorly on a test due to a language handicap, this factor which lowered the test score might also be responsible for a handicap in the group's educational and vocational life, since the test is meant to be a behavior sample from which actual behavior can be predicted; and, therefore, predictive validity may not be affected (Anastasi, 1961).

Review of the Literature

Clark and Plotkin (1963) have questioned the validity of the SAT scores for predicting academic achievement of Negro students in integrated colleges. It seems, however, that the kind of Negro students who go to an integrated college, or the sense of competition with the whites there, might be factors causing the Negro students to overachieve, thus reducing the predictive validity of the predictors. Sociological conditions are likely to differ from all Negro to integrated colleges; therefore, predictability of grades might be different, too.

Fishman et al. (1964), even though not in agreement with those who claim that tests are not valid for culturally atypical groups, point out some difficulties in testing such groups:

a) tests may not provide reliable differentiation in the range of minority group scores;
b) their predictive validity for minority groups may be different from that of the standardization and validation groups;
c) the validity of their interpretation is strongly dependent upon an adequate understanding of the social and cultural background of the group in question (p. 130).

They also point out that making a test culture-fair may decrease its bias but it may also eliminate, or at least decrease, its predictive validity and that culturally unfair tests may be valid predictors of culturally unfair, but nevertheless highly important, criteria.

Few studies have been done on the specific problem of relative predictability of grade-point averages of culturally disadvantaged versus other students, via SAT or achievement test scores. Most of the studies reviewed here are preliminary reports or represent work still in progress. However, this limited amount of evidence seems to warrant the main hypothesis of the present study, that SAT scores could predict freshman grades equally well in colleges that enroll predominantly Negro students and in those that enroll predominantly white students.

Coffman (1964) states that SAT scores appear to be equally valid for groups where the average score is above 600 and for those whose average score is below 400, in colleges enrolling youths from quite homogeneous backgrounds and in those enrolling youths from a wide range of backgrounds.

Munday (1965) reports results of ACT scores and college grades for five predominantly Negro state institutions located in four southern states. These results are compared with national norms. High school grades for the Negro schools were consistent with national norms, ACT scores were considerably lower, and college grades are typical of national norms; but correlations between high school grades and college grades are much lower than the national norms. Munday suggests that this lower correlation might be due to less academic emphasis in Negro high schools. When the high school average and ACT scores were combined, the correlation coefficients did not depart significantly from national norms. Munday noted the problem of restriction of range of Negro students' ACT scores and applied a correction for this restriction. Although he mentions the limitations of generalization based on only five colleges, he points out that his results are consistent with other studies that have found grades for socially disadvantaged students to be usually as predictable as those for non-disadvantaged students when standardized measures of academic ability are used.

Olsen (1957) considers the validity of SAT scores for predicting Negro students' grades to be unquestionable. Roberts (1963), chairman of the United Negro College Fund Cooperative Intercollegiate Examination Program Research Committee, reports results of a preliminary analysis of 1962-1963 data, including correlations between SAT scores and freshman grade-point averages, for 15 predominantly Negro institutions. The median correlation coefficients in these 15 colleges were .55 for males on SAT-verbal, .52 for males on SAT-mathematical, .42 for females on SAT-verbal,

and .51 for females on SAT-mathematical. Although these results have not yet been further analyzed, they seem, on the average, to be consistent with Hills' findings, used in the present study.

McKelpin (1965) reported the correlations presented in Table 1.

TABLE 1

Correlations Between Pre-admission Indices and the First Semester Average Grades for Entering Freshmen at North Carolina College

	MALES			FEMALES		
Year	SAT-V	SAT-M	V, M, HSA	SAT-V	SAT-M	V, M, HSA
1961-62	.52	.44	.60	.52	.32	.66
1962-63	.49	.47	.64	.47	.55	.64
1963-64	.59	.41	.66	.48	.52	.67

Hills (1964b) recently published a study on prediction of freshman grades for all public colleges of the state of Georgia. He points out that SAT means and standard deviations in the predominantly Negro institutions are much smaller than those of the other institutions. However, restriction in range on SAT scores and curtailed distributions for some colleges did not appreciably affect the multiple correlations.

Further studies by Hills, Bush, and Klock (1964) dealt with the prediction of freshman grades beyond the freshman year of college. Using data for 16 colleges, involving 3,303 students, they found that SAT-verbal, SAT-mathematical, and high school average can be used to predict cumulative senior average grades with correlations averaging in the .60's. They conclude that one need not be concerned that predictors of freshman grades will be unrelated to later grades or later work.

Other related factors that might affect predictability of grades are rejection rates and selectivity in admission. Hills (1964a) has studied fluctuation in rejection rates. It appears that when an institution raises or lowers the cutting point for admission, the grading standards shift considerably. For instance, if the institution becomes highly selective, a student who would be predicted to have an A average (prediction being based on the previous year's regression equation) might get only a B, since teachers tend to grade on a curve. Hills (1965) reports the lowering of standards due to a less selective admission policy in a particular college where new dormitories had been opened and had to be filled. These factors can make predictions inaccurate even though the regression equation was adequate for earlier classes. High selectivity may also lower the correlation between predictors and grades by restricting the range of scores on the predictors, and lowered selectivity may increase correlation coefficients. Klock and Hills (1964) reported that in the Georgia state college system, between fall 1963 and fall 1964, the rejection rates varied from college to college, the lowest rate being 1 percent at Savannah State College and the highest rate 39 percent at Georgia State College.

The lowest rate among white institutions was 5 percent at Valdosta State College. The rejection rate at all three Negro colleges averaged 4 percent.

Hypothesis .

It is hypothesized that SAT scores will predict freshman grades equally well in colleges that enroll predominantly Negro students and those that enroll predominantly white students.

II
PROCEDURE

Data

The data used in this study were published by Hills and others (Hills, Emory, & Masters, 1961, 1962; Hills, Klock, & Bush, 1964; Hills, Klock, & Lewis, 1963) of the Office of Testing and Guidance of the University System of Georgia. Such data were obtained in all of the public colleges of the state of Georgia, three of which are attended almost entirely by Negro students and 16 of which are attended almost entirely by white students. Eight of the predominantly white colleges are junior colleges. All three Negro colleges are four-year colleges.

In most cases, data for men were available from 18 colleges and for women from 17 colleges because not all institutions were coeducational. Occasionally, the data for one college were not available thus explaining the variation in degrees of freedom between college in the tables in the Appendix.

The data consist of:

(a) distributions for each college freshman class of scores on SAT-verbal, SAT-mathematical, and high school average;

(b) predicted freshman grade-point averages;

(c) correlations between predicted and actual freshman grade-point averages;

(d) regression equations on which predictions were based;

(e) standard errors of estimate of predictions;

(f) correlations between each predictor (SAT-verbal, SAT-mathematical, high school average, SAT-verbal and mathematical combined, and SAT-verbal, mathematical and high school average combined) with freshman grade-point average.

The College Entrance Examination Board SAT scores of 3,287 entering freshmen in the three predominantly Negro colleges and 25,674 entering freshmen in the predominantly non-Negro colleges indicate that the SAT, for which the lowest possible score is 200, is too difficult for many students in the three predominantly Negro colleges. Frequency distributions of the scores are graphed in Figures 1–8. A tabular presentation of the data appears in the thesis on which this report is based (Biaggio, 1965) and in Hills et al. (1961, 1962, 1963, 1964). In fact, in 1959, 6 percent of the students in the three perdominantly Negro colleges scored at the lowest possible scoring interval (200-219) on the SAT-verbal and 82 percent of them had scores below 300. In 1960, 14 percent scored between 200 and 219 and 81 percent scored below 300. In 1962, 21 percent of the students scored between 200 and 219 and 84 percent scored below 300. In 1962, 21 percent of the students scored between 200 and 219 and 83 percent scored below 300. In all four years there was only one student who scored above 500, obtaining a score between 520 and 539.

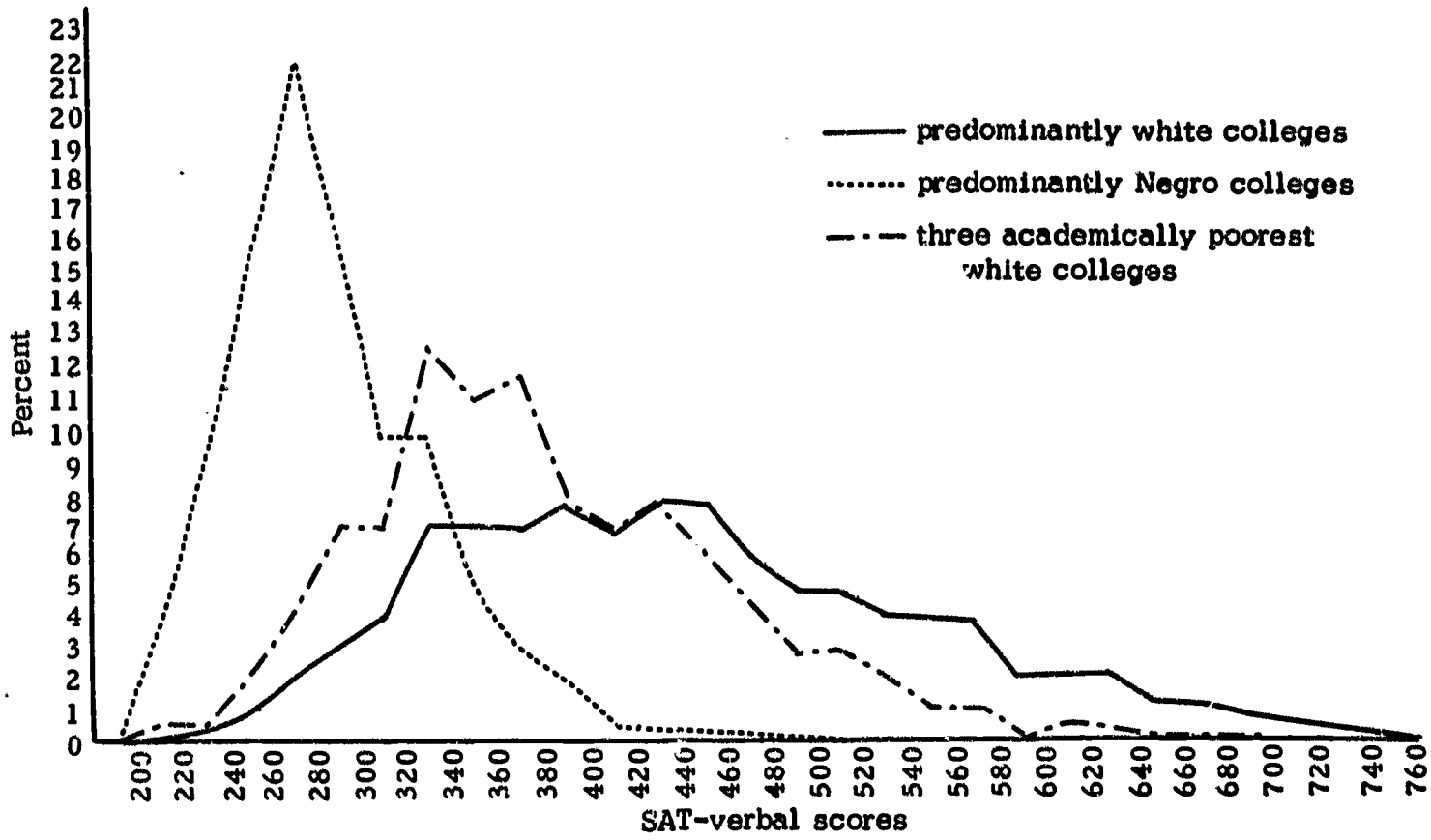

Figure 1. Distributions of SAT-verbal scores of entering freshmen in the three predominantly Negro colleges, in the 15 predominantly white colleges, and in the three academically poorest predominantly white colleges, 1959

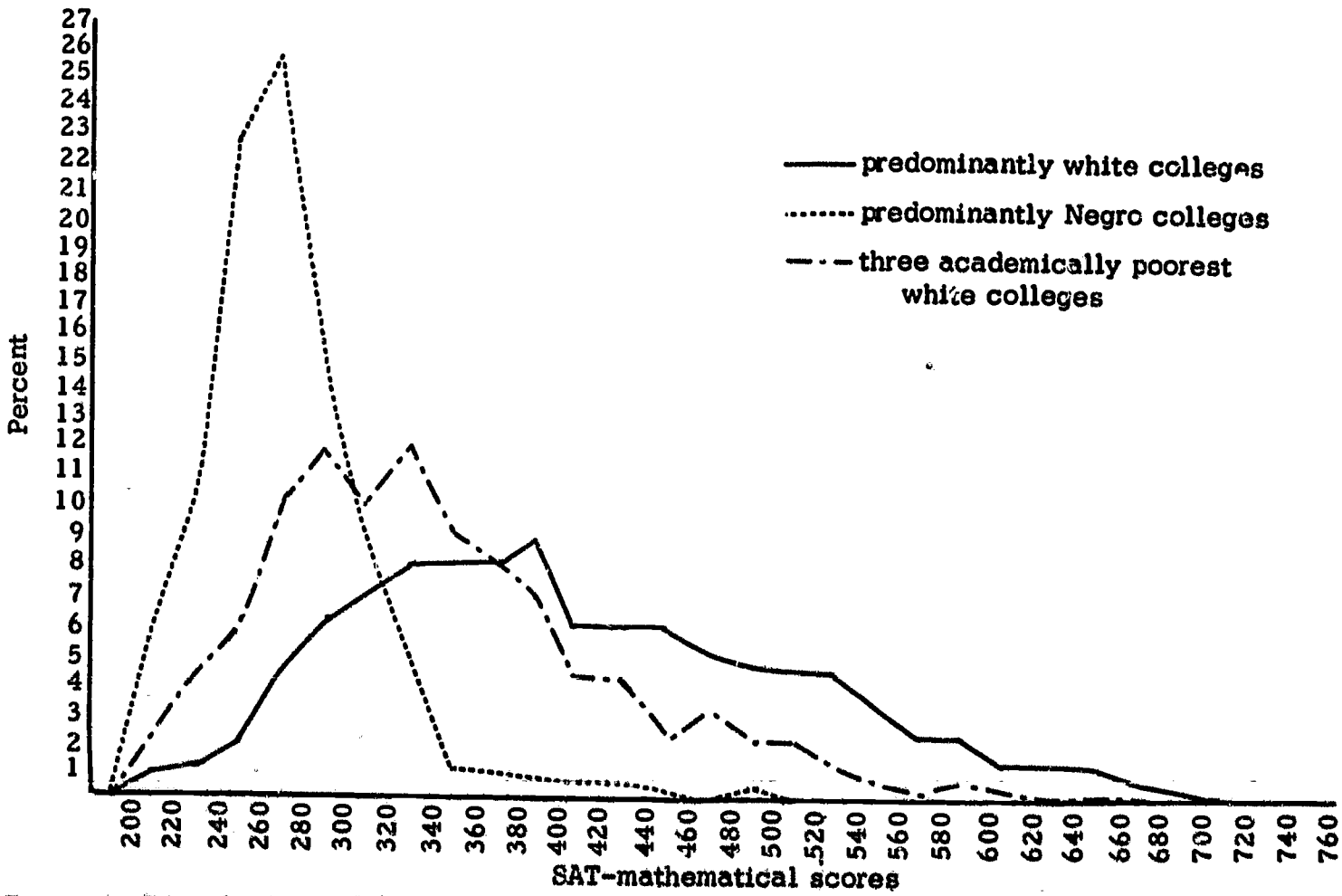

Figure 2. Distributions of SAT-mathematical scores of entering freshmen in the three predominantly Negro colleges, in the 15 predominantly white colleges, and in the three academically poorest white colleges, 1959

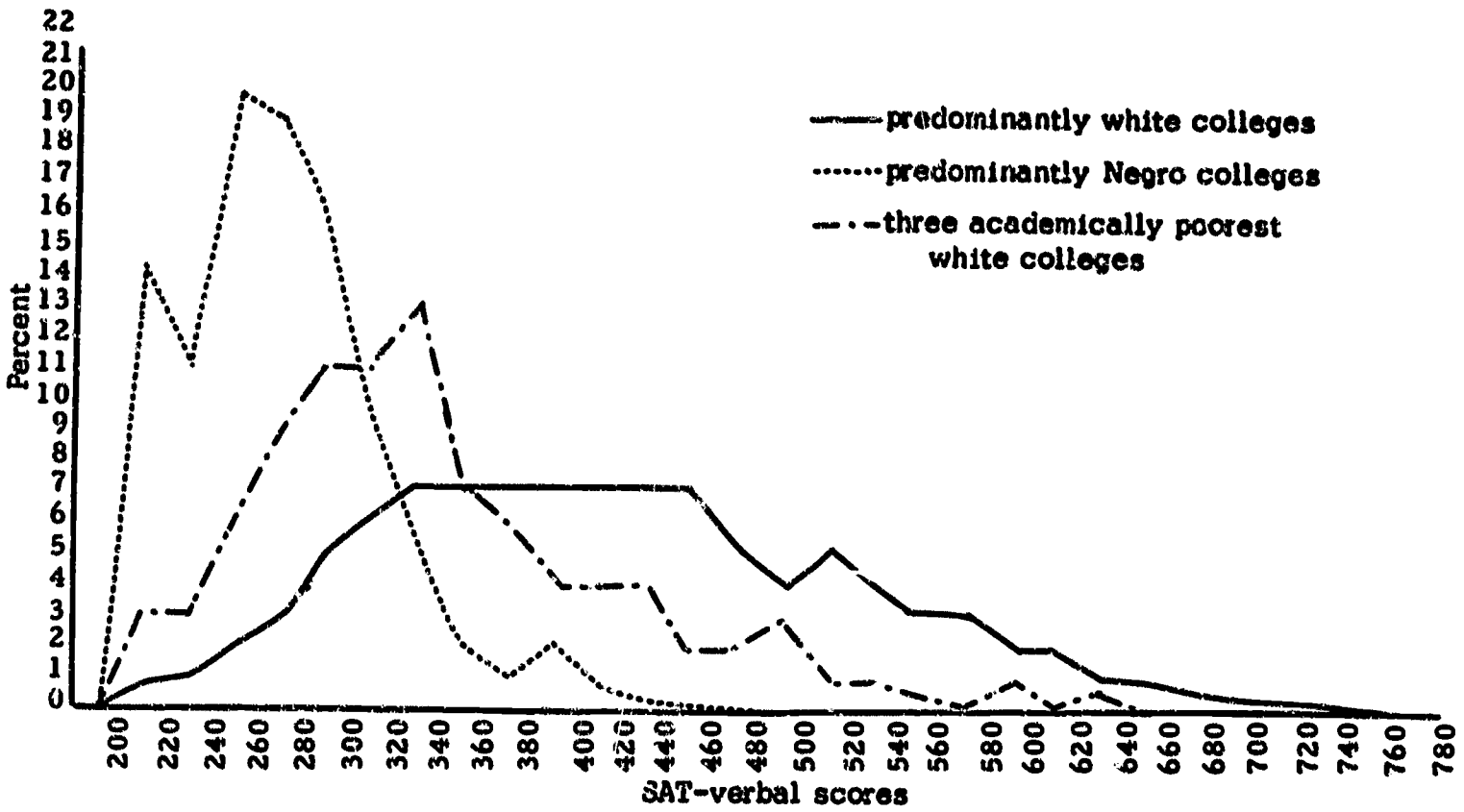

Figure 3. Distributions of SAT-verbal scores of entering freshmen in the three predominantly Negro colleges, in the 15 predominantly white colleges, and in the three academically poorest white colleges, 1960

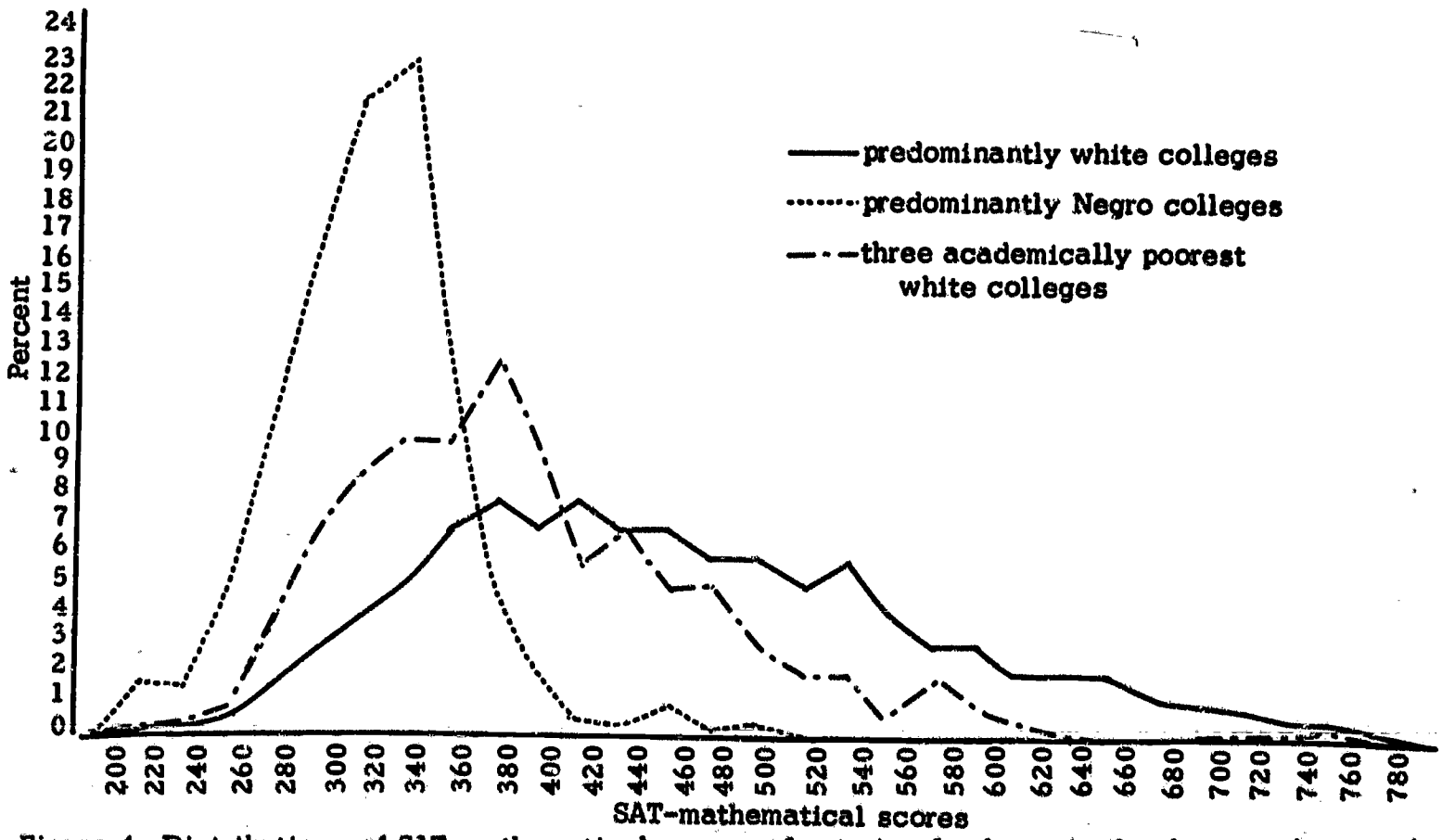

Figure 4. Distributions of SAT-mathematical scores of entering freshmen in the three predominantly Negro colleges, in the 15 predominantly white colleges, and in the three academically poorest white colleges, 1960

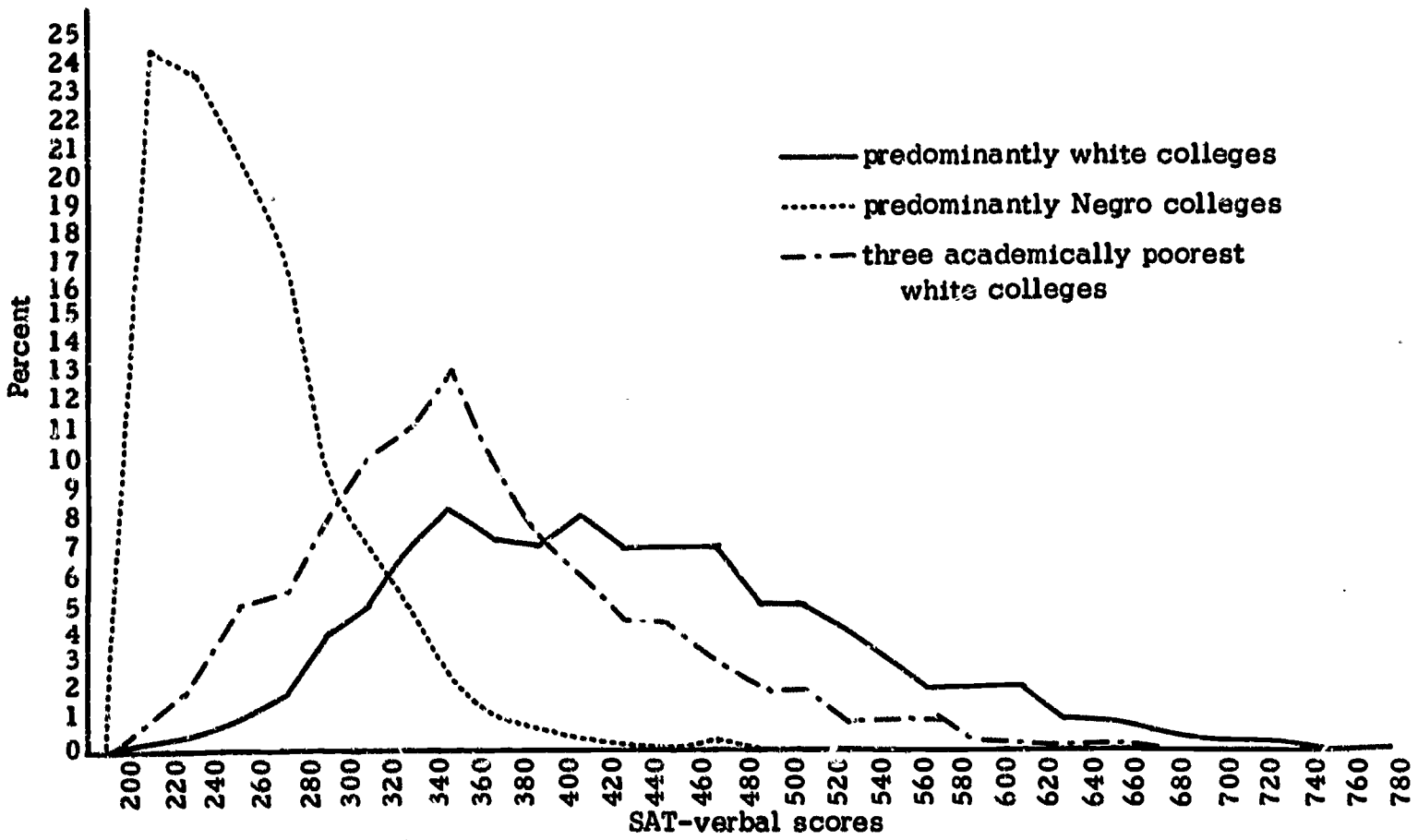

Figure 5. Distributions of SAT-verbal scores of entering freshmen in the three predominantly Negro colleges, in the 15 predominantly white colleges, and in the three academically poorest white colleges, 1961

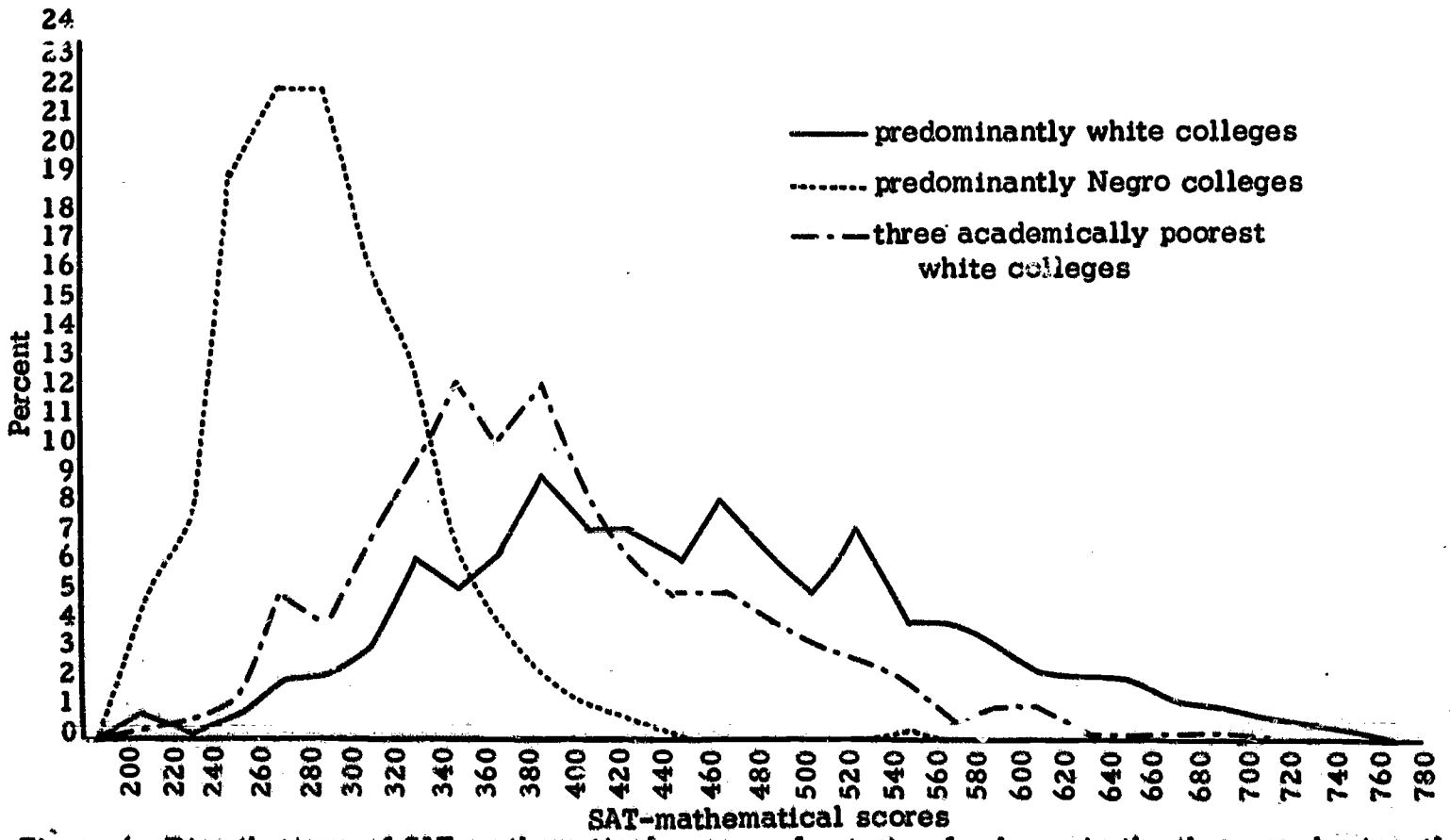

Figure 6. Distributions of SAT-mathematical scores of entering freshmen in the three predominantly Negro colleges, in the 15 predominantly white colleges, and in the three academically poorest white colleges, 1961

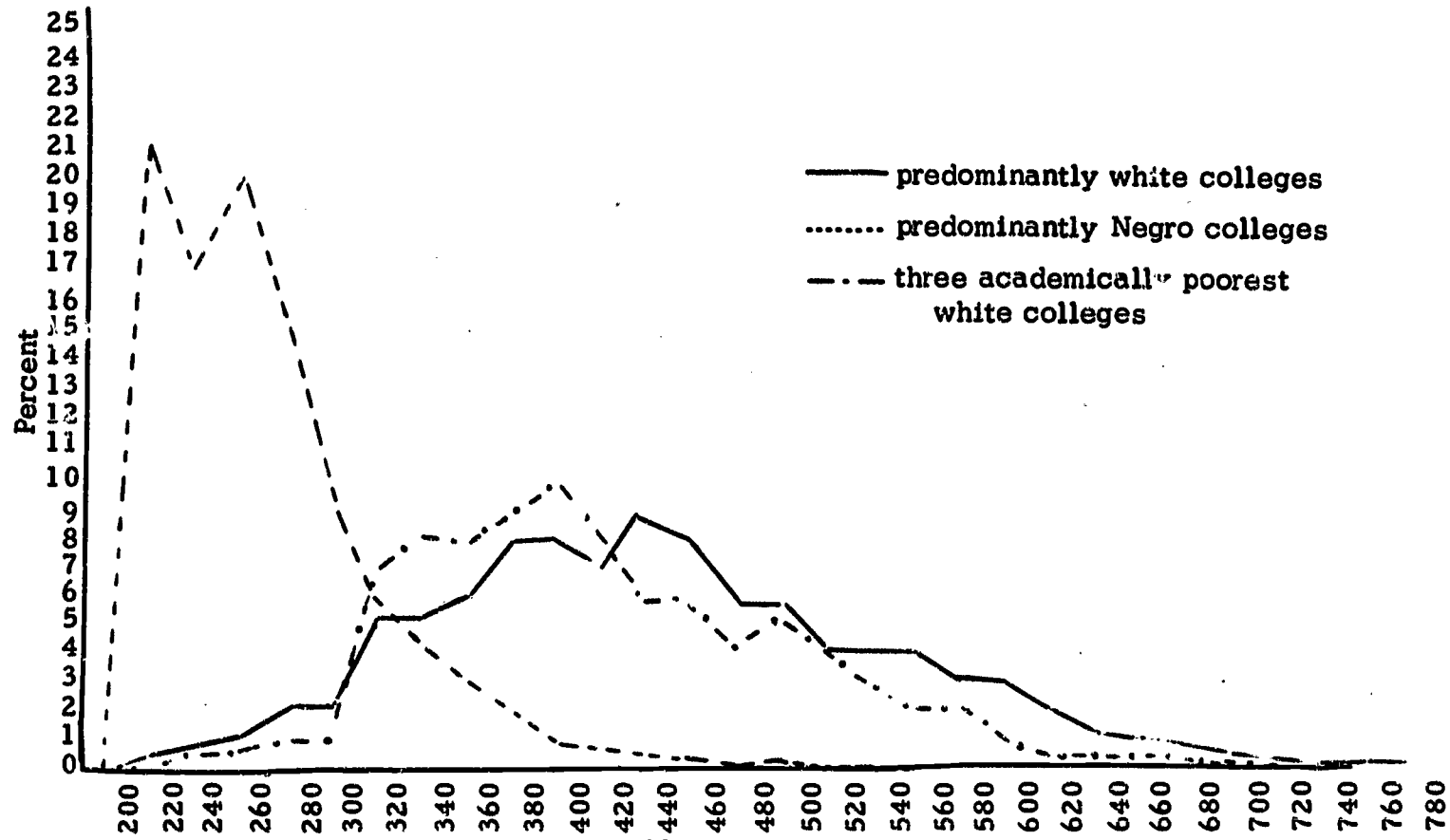

Figure 7. Distributions of SAT-verbal scores of entering freshmen in the three predominantly Negro colleges, in the 15 predominantly white colleges, and in the three academically poorest white colleges, 1962

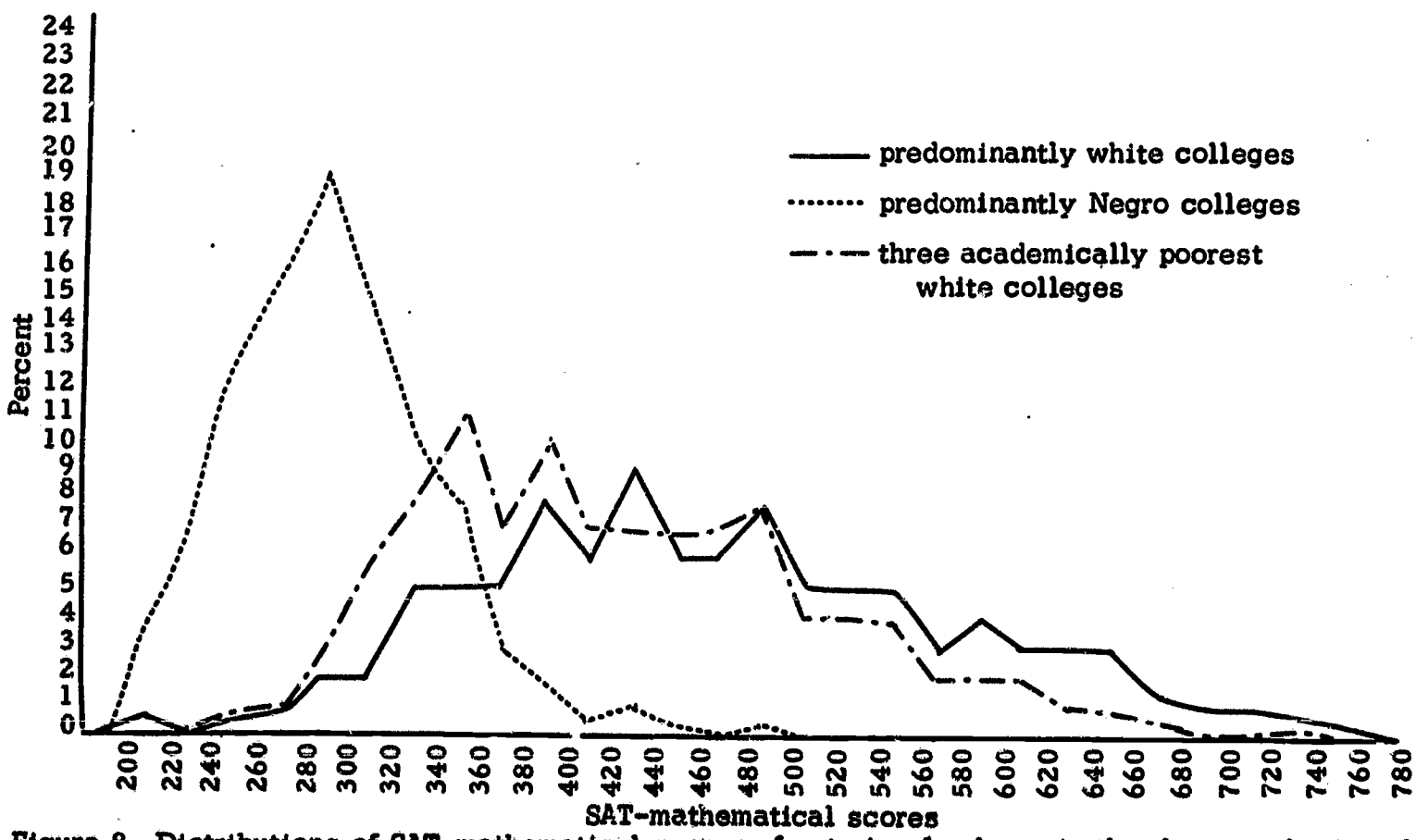

Figure 8. Distributions of SAT-mathematical scores of entering freshmen in the three predominantly Negro colleges, in the 15 predominantly white colleges, and in the three academically poorest white colleges, 1962

The scores were generally a little higher on SAT-mathematical, but still much lower than the scores at the predominantly white colleges of Georgia. In 1959, 4 percent of the students in the three predominantly Negro colleges scored between 200 and 219 on SAT-mathematical and 68 percent scored below 300. In 1960, 2 percent scored between 200 and 219 and 36 percent scored below 300. In 1961, 4 percent scored between 200 and 219 and 63 percent scored below 300. In 1962, 4 percent scored between 200 and 219 and 60 percent scored below 300. In all four years there were only two students who scored above 500.

Table 2 presents the mean, standard deviation, and variance of the SAT scores of students in the three predominantly Negro colleges, in all the predominantly white colleges, and in the three academically poorest white colleges. (The last group is defined as the three white colleges that had the lowest SAT scores in the four years that have been studied here; these colleges are all junior colleges.) It is easy to see from Table 2 that the means are much lower in the predominantly Negro colleges than in the three poorest white colleges. The variability in the predominantly Negro colleges is also much smaller as the comparison of standard deviations and variances in Negro versus non-Negro groups shows.

TABLE 2

Mean, Standard Deviation, and Variance of SAT Scores of Students in the Three Predominantly Negro Colleges (N), in all the Predominantly White Colleges (W), and in the Three Academically Poorest White Colleges (3pw)

	SAT-V			SAT-M		
	N	W	3pw	N	W	3pw
			1959			
$\bar{X}$	271	403	342	286	441	381
S.D.	38	97	79	44	103	76
VAR	1,444	9,400	6,241	1,936	10,609	5,776
			1960			
$\bar{X}$	268	417	346	312	450	384
S.D.	44	102	81	41	104	79
VAR	1,936	10,404	6,561	1,681	10,816	6,241
			1961			
$\bar{X}$	254	424	359	289	454	390
S.D.	47	97	79	44	102	82
VAR	2,209	9,409	6,241	1,936	10,404	6,724
			1962			
$\bar{X}$	260	437	364	291	469	395
S.D.	49	97	81	45	104	83
VAR	2,401	9,409	6,561	2,025	10,816	6,889

The positive skewness of the Negro scores distributions (Figs. 1-8) strikingly points out the compression of the Negro students' scores in the bottom of the distribution. It is also interesting to note that the means for all white colleges, and even for the three academically poorest white colleges rose, but for the Negro group the means dropped or fluctuated randomly. This might be caused in part by increasing integration of the more able Negro students at integrated colleges. Differential selectivity in white and Negro colleges might also be partly responsible for this phenomenon. Table 3 shows the mean differences between the three Negro colleges and the three academically poorest white colleges, for the four-year period.

TABLE 3

Mean Differences of SAT-V and SAT-M Scores Between the Three Negro Colleges and the Three Academically Poorest White Colleges (3pw - N), for Four Years

	SAT-verbal	SAT-mathematical
1959	71	95
1960	78	72
1961	105	101
1962	104	104

Table 4 shows correlation coefficients between SAT-verbal and college freshman grades, and between SAT-mathematical and college freshman grades.

TABLE 4

Median Correlations Between SAT-V and Freshman Grade-Point Average (FGPA), and Between SAT-M and FGPA, by Sex and Race
(Negro colleges' correlations not corrected for restriction of range)

		SAT-V		SAT-M	
		Non-Negro	Negro	Non-Negro	Negro
1959-60	Males	.39	.46[a]	.41	.40
	Females	.55	.43	.53	.40
1960-61	Males	.41	.38	.37	.23
	Females	.54	.41	.49	.25
1961-62	Males	.34	.40[a]	.38	.46[a]
	Females	.51	.51[a]	.51	.43
1962-63	Males	.38	.43[a]	.37	.39[a]
	Females	.46	.33	.45	.37

[a]Correlation coefficients for the Negro colleges at least as large as coefficient for the non-Negro colleges.

TABLE 5

Median Correlations Between SAT-V and FGPA, and Between SAT-M and FGPA, by Sex and Race
(Negro colleges' correlations corrected for restriction of range)

		SAT-V		SAT-M	
		Non-Negro	Negro	Non-Negro	Negro
1959-60	Males	.39	.68[a]	.41	.55[a]
	Females	.55	.75[a]	.53	.62[a]
1960-61	Males	.41	.66[a]	.37	.40[a]
	Females	.54	.71[a]	.50	.40
1961-62	Males	.34	.54[a]	.38	.64[a]
	Females	.51	.76[a]	.51	.70[a]
1962-63	Males	.38	.57[a]	.37	.51[a]
	Females	.46	.52[a]	.45	.60[a]

[a]Correlation coefficient for Negro colleges larger than coefficient for the non-Negro colleges.

When the 16 zero-order correlations between SAT-verbal and SAT-mathematical scores with freshman grade-point average for the three Negro colleges are corrected for restriction of range, to estimate the correlations that presumably would have been obtained if the SAT-verbal and SAT-mathematical scores of Negro students had been as variable as those of non-Negroes, we obtain the 16 comparisons between median correlations of SAT-verbal and SAT-mathematical scores with freshmen grade-point average (Table 5), out of which 15 are higher in the Negro group than in the non-Negro.

The standard errors of estimate[1] appeared to be smaller for the Negro colleges than for the non-Negro ones, as can be seen in Table 6, where out of 32 comparisons between median standard errors of estimate, 28 are smaller in the Negro colleges.

Statistically, if correlations are significantly larger and standard errors of estimate are smaller in the Negro group, it can be said that SAT seems to predict freshman grades better in the Negro colleges than in the non-Negro ones.

Method

In order to test the significance of differences, a three-factor analysis of variance design was used. Table 7 gives an illustration of this singly nested design. Main effects tested were race, year, and college (nested within race). The interaction effects tested were race × year and college × year (colleges being nested within race). The tables in the Appendix all show clearly these sources of variation and respective degrees of freedom.

[1] $s_{yx} = s_y\sqrt{1 - r^2_{xy}}$, where s_{yx} designates the standard deviation of the differences between the actual grades (Y) and the predicted ones (Y), predicted from the X variable, in this case SAT-V and SAT-M scores.

TABLE 6

Median Standard Errors of Estimate of Predictions Based on SAT-V, SAT-M, SAT-V and SAT-M Combined, and SAT-V, SAT-M and High School Average Combined, by Sex and Race

		SAT-V		SAT-M		V, M		V, M, HSA	
		N-N	N	N-N	N	N-N	N	N-N	N
1959-60	Males	59	45[a]	65	46[a]	59	51[a]	55	42[a]
	Females	58	49[a]	58	49[a]	54	46[a]	48	39[a]
1960-61	Males	59	60	66	67	59	60	53	56
	Females	59	55[a]	62	55[a]	57	54[a]	48	57[a]
1961-62	Males	65	35[a]	63	55[a]	61	52[a]	57	47[a]
	Females	62	52[a]	66	53[a]	60	48[a]	50	42[a]
1962-63	Males	61	54[a]	62	53[a]	59	52[a]	54	48[a]
	Females	57	51[a]	60	53[a]	54	50[a]	46	45[a]

[a]Means smaller standard errors of estimate for colleges that enroll predominantly Negro students (N) than for those that enroll predominantly non-Negro students (N-N).

TABLE 7

Analysis of Variance Design for Correlation Coefficients Between SAT-V and Freshman Grade-Point Average, for Males, over Four Years (Correlations not corrected for restriction of range)

Predominant racial composition of college	College	Academic Year			
		1959-60	1960-61	1961-62	1962-63
Negro	1	.12	.49	.29	.43
	2	.46	.38	.55	.50
	3	.53	.36	.40	.30
Non-Negro	4	.33	.34	.47	.54
	5	.39	.26	.21	.42
	6	.36	.45	.34	.36
	7	.40	.55	.50	.43
	8	.34	.39	.33	.33
	9	.58	.49	.28	.35
	10	.43	.41	.48	.38
	11	.30	.15	.24	.38
	12	.42	.34	.34	.25
	13	.37	.42	.29	.32
	14	.38	.50	.38	.41
	15	.36	.34	.18	.19
	16	.45	.44	.35	.29
	17	.64	.47	.54	.42
	18	.47	.25	.33	.41

This is a three factor mixed model. Race is considered fixed; i.e., the two levels (Negro and white) of the factor race are not conceptualized as random samples of a population, and no inferences are to be made about a hypothetical population of races. Factor year was also fixed, since there is

no intention to generalize differences to other years. Colleges (nested within race) are considered random; i.e., they are regarded as random samples of a population of similar colleges to which results are generalized, with the due limitations.

The linear model can be expressed as:

$$X_{rc_{(r)}y} = \bar{\mu} + \alpha_r + B_{c_{(r)}} + \gamma_y + (\alpha\gamma)_{ry} + [(B\gamma)_{c_{(r)}y} + \epsilon_{r\,c_{(r)}y}]$$

Factor race has 1, 2, ... R levels, where r = 2. Factor college (nested within race) has 1, 2, ... $C_{(R)}$ levels, where $\sum_{r=1}^{2} c_{(r)} = 3 + 15 = 18$. Factor year has 1, 2, ... Y levels, where y = 4. $X_{rc_{(r)}y}$ represents the observation X of the r^{th} race, in the c^{th} college, in the y^{th} year, in the population. This observation or score is composed of the terms that appeared in the formula above:

$\bar{\mu}_{...}$ = population grand mean

$\alpha_r = \bar{\mu}_{r..} - \bar{\mu}_{...}$ = main effect of the r^{th} race

$B_{c_{(r)}} = \bar{\mu}_{rc_{(r)}} - \bar{\mu}_{r..}$ = main effect of the c^{th} college (within race)

$\gamma_y = \bar{\mu}_{..y} - \bar{\mu}_{...}$ = main effect of level y of factor year

$(\alpha\gamma)_{ry} = \bar{\mu}_{r.y} - \bar{\mu}_{r..} - \bar{\mu}_{..y} + \bar{\mu}_{...}$ = interaction effect of the r^{th} race with the y^{th} year

$(B\gamma)_{c_{(r)}y} = \mu_{rc_{(r)}y} - \bar{\mu}_{rc_{(r)}.} - \bar{\mu}_{..y} + \bar{\mu}_{r..}$ = interaction effect of the c^{th} college (within race) with the y^{th} year

$\epsilon_{r\,c_{(r)}y}$ = error. This is not estimable from the data in this study, but it can be conceptualized.

Also note that:

$$\sum_{r}^{R} \alpha_r = \sum_{c_{(r)}}^{C_{(R)}} B_{c_{(r)}} = \sum_{y}^{Y} \gamma_y = 0 \text{ and}$$

$$\sum_{r}^{R} (\alpha\gamma)_{ry} = \sum_{y}^{Y} (\alpha\gamma)_{ry} = \sum_{c_{(r)}}^{C_{(R)}} (B\gamma)_{c_{(r)}y} = \sum_{y}^{Y} (B\gamma)_{c_{(r)}y} = 0$$

Expected mean squares are as follows (Winer, 1962):

$$E(MS)_{race} = \sigma^2 + 4\,\sigma^2_{c_{(r)}} + 4\left[\sum_{r=1}^{2} n_r - \frac{\sum_{r=1}^{2} n_r^2}{\sum_{r=1}^{2} n_r}\right]\theta_r$$

$$E(MS)_{college(within\ race)} = \sigma^2 + 4\,\sigma^2_{c_{(r)}}$$

$$E(MS)_{year} = \sigma^2 + \sigma^2_{[c_{(r)}y]} + 2\left[\sum_{r=1}^{2} n_r - \frac{\sum_{r=1}^{2} n_r^2}{\sum_{r=1}^{2} n_r}\right]\theta_y$$

$$E(MS)_{\text{college (within race)} \times \text{year}} = \sigma^2 + \sigma^2_{[c_{(r)}y]}$$

$$E(MS)_{(\text{year} \times \text{race})} = \sigma^2 + \sigma^2_{[c_{(r)}y]} + \left[\sum_{r=1}^{2} n_r - \frac{\sum_{r=1}^{2} n_r^2}{\sum_{r=1}^{2} n_r}\right]\theta_{(ry)}$$

where r represents race, c represents college, $c_{(r)}$ represents college nested within race, y represents year, and n_r represents number of colleges for the r^{th} race. This design was used for analyzing both correlations and standard errors of estimate. Correlation coefficients were corrected for restriction of range (McNemar, 1962) in the Negro group. All correlation coefficients were transformed into Fisher's z_r's in order to secure a more nearly normally distributed dependent variable (Ferguson, 1959). Standard errors of estimate were squared yielding variance errors of estimate, whose common logarithms were taken and used as the data for the analysis of variance (McLean, 1964).

III
RESULTS AND DISCUSSION

Tables 8 and 9 summarize significant effects obtained from analyses of variance. These results appear in detail in the Appendix and will be discussed later.

For purposes of comparison, an analysis of variance of standard errors of estimate themselves was also done, for SAT-verbal, SAT-mathematical, and SAT-verbal plus SAT-mathematical combined, for females. These were the cases found to be significant in the analyses of variance of common logarithms of variance errors of estimate (Appendix Tables 17 and 18). The race effect was found to be significant at the .05 level for SAT-mathematical, but not significant for SAT-verbal and SAT-mathematical combined. College effect was also found to be significant at the .05 level, for SAT-mathematical only.

TABLE 8

Summary of Significant Results Obtained from Analyses of Variance Performed on Transformed Correlation Coefficients

Source of variation	Significance levels for correlations corrected for restriction of range				Significance levels for correlations not corrected for restriction of range			
	SAT-verbal		SAT-math.		SAT-verbal		SAT-math.	
	Males	Females	Males	Females	Males	Females	Males	Females
Race (r)	.01[a]	.01[a]	.01[a]	.05[a]		.01[b]		.05[b]
College (within race)		.05	.05	.05		.05	.01	.01
Year (y)		.01		.01		.05		
r × y		.01		.01		.05		
[c](r) × y								

[a]Higher r's in Negro colleges.

[b]Higher r's in white colleges.

From Table 8 it can be seen that the race effect, which is the one with which we are mainly concerned here, is significant in all four cases, at the .01 level for SAT-verbal, both among males and among females, and for SAT-mathematical among males; and it is significant at the .05 level for SAT-

mathematical among females. Thus, we may say that when one takes into account the restriction of range that occurs in the SAT scores of students in predominantly Negro colleges, he finds significant differences between the correlations in the Negro colleges and in the non-Negro colleges, the Negroes' freshman grade-point averages being more accurately predicted from SAT-verbal and SAT-mathematical than the non-Negroes' freshman grade-point averages.

However, we must not overlook the fact that the correction for restriction of range leads us into a hypothetical situation; that is, the Negroes would be better predicted than the non-Negroes <u>if</u> their scores on the SAT were not so compressed to the bottom of the distribution.

The analysis of variance of the original correlations, not corrected for restriction of range, shows a better prediction for <u>non</u>-Negro females, both when predictions are based on the SAT-verbal and on the SAT-mathematical. For males, however, there are no significant differences between these non-corrected correlations for Negro and non-Negro colleges. It is interesting to note that females in the general population are usually more predictable than males. Higher correlations between predictors and criteria have been found, perhaps because females are usually more conformist and grade-oriented than males (Seashore, 1962).

The year effect was found significant for females only, for SAT-verbal and SAT-mathematical (correlations corrected for restriction of range) and for SAT-mathematical (non-corrected correlations), thus revealing significant variability from year to year among females, whereas males seemed to be more stable, on the average.

The average intraclass correlation coefficient, $\bar{r}$, was generally low, ranging from .20 to .32 for correlation coefficients and .26 to .59 for variance errors of estimate, suggesting that there was little stability within colleges from year to year.

The intraclass correlation, $\bar{r}$, represents the average correlation between each year and each other year; for example, in this study it represents the average correlation between 1959 and 1960, 1959 and 1961, 1959 and 1962, 1960 and 1961, 1960 and 1962, and 1961 and 1962; $\bar{r}$ approximately represents the arithmetic average of these six possible correlations, pooled together for Negro and white colleges. The computational procedure for finding one of the six correlations is shown below.

Let us represent the years 1959 and 1960 by 1 and 2.

$$r_{12} = \frac{\sum_{c=1}^{3} x_{1N} x_{2N} + \sum_{c=4}^{18} x_{1W} x_{2W}}{\sqrt{\left(\sum_{c=1}^{3} x_{1N}^2 + \sum_{c=4}^{18} x_{1W}^2\right)\left(\sum_{c=1}^{3} x_{2N}^2 + \sum_{c=4}^{18} x_{2W}\right)}}$$

where x represents deviation of each score from the mean, i.e., $(X - \bar{X})$.

In the same way r_{13}, r_{14}, r_{23}, r_{24} and r_{34} can be computed. The arithmetic mean of these 6 r's is approximately the intraclass correlation, for which a simple computational formula (Stanley, 1957) was used in this study:

$$\frac{MS_{c_{(r)}} - MS_{[c_{(r)}y]}}{MS_{c_{(r)}} + 3MS_{[c_{(r)}y]}} \doteq \bar{r}$$

It is interesting to note that r cannot be significantly different from zero if $MS_{c(r)}$ is not significant, therefore no figures are given for $\bar{r}$ in Appendix Table 1.

In Figure 9, we see, for females, the interaction pattern of race and year of corrected correlation coefficients between SAT-verbal scores and college grades. Figure 10 depicts interaction pattern (race × year) of corrected correlation coefficients of SAT-M with college grades, for females. Figure 11 shows the interaction pattern of non-corrected correlation coefficients between SAT-verbal and college grades, for females.

TABLE 9

Summary of Significant Results Obtained from Analyses of Variance Performed on Transformed Variance Errors of Estimate
(Where V, M represents SAT-verbal and SAT-mathematical combined, and V, M, HSA represents SAT-verbal, SAT-mathematical and high school average combined)

Source of Variation	SAT-V		SAT-M		V, M		V, M, HSA	
	Male	Female	Male	Female	Male	Female	Male	Female
Race		.05[a]		.05[a]		.05[a]		
College	.01	.01	.05	.05	.01	.01	.01	.01
Year				.01				
r × y								
c × y								

[a]Race effect significance meaning larger variance errors of estimate in non-Negro colleges.

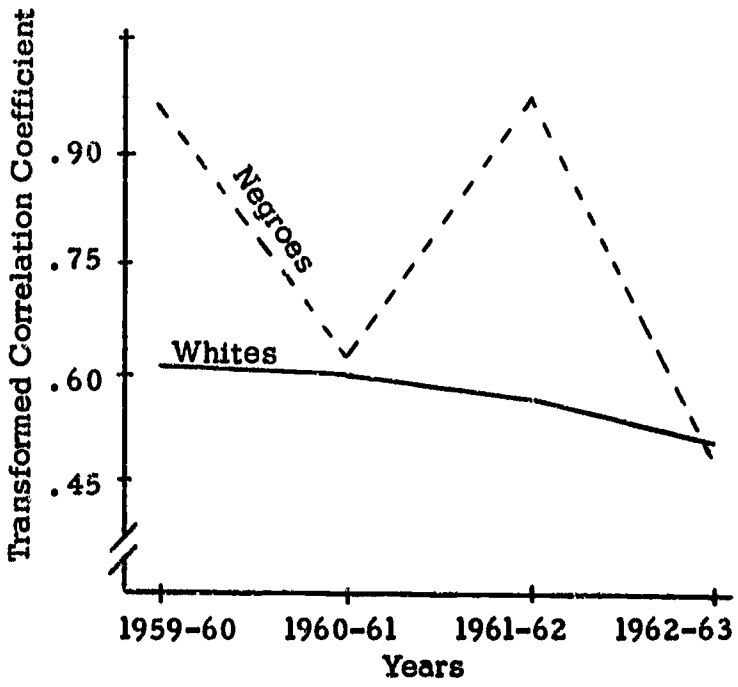

Figure 9. Interaction pattern (race × year) of corrected correlation coefficients between SAT-verbal and college grades, for females.

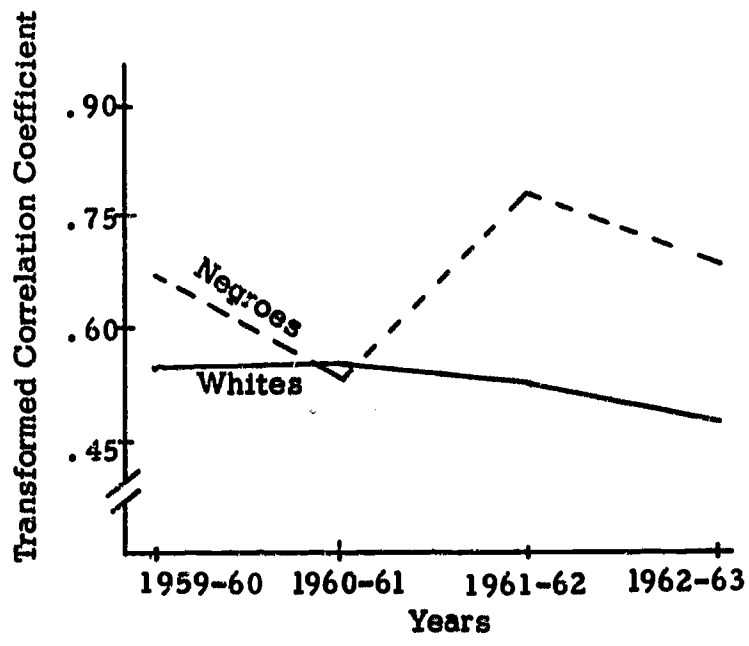

Figure 10. Interaction pattern (race × year) of corrected correlation coefficients between SAT-mathematical and college grades, for females.

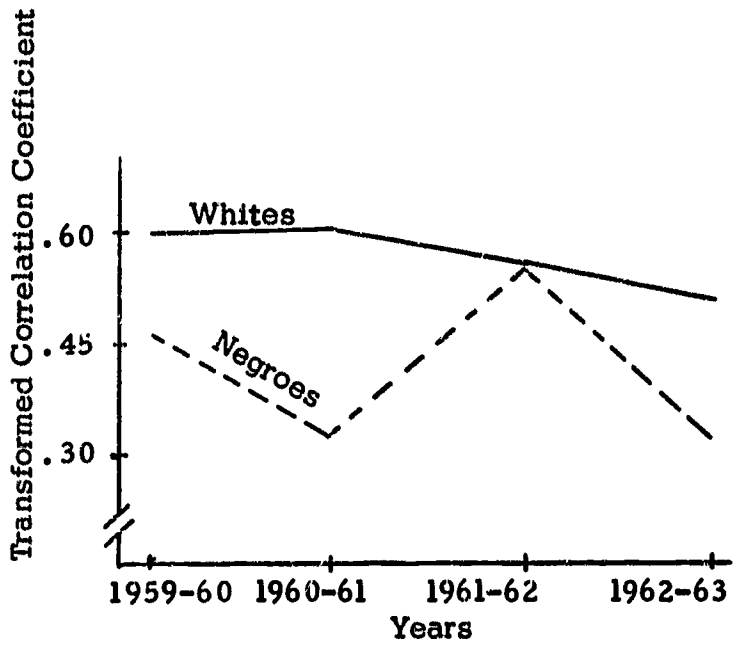

Figure 11. Interaction pattern (race × year) of non-corrected correlation coefficients between SAT-verbal and college grades, for females.

It is easy to see that the pattern is very similar in all three cases. The non-Negro correlations seem to be fairly consistent, being represented by an almost straight line, showing a slight decline from 1959 to 1962. The Negro students, however, present a very marked drop in 1960, followed by an increase in 1961 and another sharp drop in 1962.

The reasons for this inconsistency in the Negroes' correlations have not been investigated yet. Perhaps political and social events associated with Negroes' rights and school integration might have affected students' lives, causing them to neglect studies or to study harder, thus affecting prediction and lowering the correlations for 1960 and for 1962. However, males were not affected. Changed selectivity for females might be one factor, but both males and females show a similar trend: SAT-verbal means decrease from 1959 to 1961 and increase again in 1962; SAT-mathematical means drop in 1960, rise in 1961, and drop again in 1962. For the moment the inconsistency in the Negroes' correlations seem inexplicable.

The analyses of variance of logarithms of variance errors of estimate showed that errors in prediction are usually smaller in Negro colleges, when SAT-verbal, SAT-mathematical, and SAT-verbal plus SAT-mathematical combined were used as predictors, this applying only to females. In the remaining cases, i.e., when high school average, and high school average plus SAT-verbal plus SAT-mathematical combined, were used as predictors for females and when any of the predictors were used for males, there were no significant differences. These results support our hypothesis that standard errors of estimate are smaller for predictions in Negro than in non-Negro colleges, or at least not significantly different (Table 9).

As a conclusion, it can be said that the results permit one to believe that SAT-verbal and SAT-mathematical would predict freshman grade-point averages better for Negroes than non-Negroes if

the Negro scores were not so restricted in range. Even with this restriction of range, there is no significant difference in predictability for non-Negro males, although non-Negro females are being better predicted than Negro females in the present situation.

The reasons why things happen this way have not been investigated. Perhaps the higher correlations among Negroes might be explained by the use of textbooks which are far too difficult for the Negro disadvantaged students. This would make the criterion of academic grades in reality merely another measure of verbal and mathematical aptitude. Another possible explanation might be that the low academic level of some of these colleges permits the student to go through hardly learning anything. In this case also the criterion of academic grades would be a measure of verbal and mathematical aptitude, thus explaining the higher correlations.

The apparent similarity of prediction in Negro and non-Negro colleges should not be taken as justification for the present inequality in educational facilities. It seems that these disadvantaged youths are being fairly accurately predicted probably because, as it was stated earlier, a test is a behavior sample which should predict how these students will get along in the future. The solution seems to be in reducing or eliminating deficits so that they will score better on the tests, rather than in discarding the tests as not being "valid."

The limitations of generalizing from these findings to other situations should be kept in mind, since only a special geographic group with special characteristics was used in this study. The results do not permit decisive conclusions about predictions in other southern Negro colleges or about Negroes in non-segregated colleges, although they are in agreement with the findings of other such studies in predominantly Negro institutions.

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APPENDIX

TABLE 1

Analysis of Variance of Transformed Correlation Coefficients, between SAT-V and FGPA for Males, over Four Years (Correlations corrected for restriction of range)

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	6925.67	1	6925.67**
Between college (within race)	4584.73	16	286.54
Year	730.37	3	243.46
Race × year	621.68	3	207.23
College (within race) × year	8276.20	48	172.42
TOTAL	21,138.65	71	

** $p < .01$

TABLE 2

Analysis of Variance of Transformed Correlations between SAT-V and FGPA for Females, over Four Years (Correlations corrected for restriction of range)

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	3833.85	1	3833.85**
Between college (within race)	3876.09	15	258.41*
Year	2307.12	3	769.04**
Race × year	3369.18	3	1123.06**
College (within race) × year	4831.70	45	107.37
TOTAL	18,217.94	67	

* $p < .05$

** $p < .01$

$\bar{r} = .26$

TABLE 3

Analysis of Variance of Transformed Correlations between SAT-M and FGPA for Males, over Four Years (Correlations corrected for restriction of range)

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	3306.34	1	3306.34**
Between college (within race)	5009.40	16	313.09**
Year	281.38	3	93.79
Race × year	786.27	3	262.09
College (within race) × year	6162.60	48	128.39
TOTAL	15,545.99	71	

**p < .01

$\bar{r}$ = .26

TABLE 4

Analysis of Variance of Transformed Correlations between SAT-M and FGPA for Females, over Four Years (Correlations corrected for restriction of range)

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	1847.41	1	1847.41*
Between college (within race)	5806.97	15	387.13*
Year	433.92	3	144.64**
Race × year	1103.84	3	367.95**
College (within race) × year	6316.49	45	140.37
TOTAL	15,508.63	67	

*p < .05

**p < .01

$\bar{r}$ = .30

TABLE 5

Analysis of Variance of Transformed Correlations between SAT-V and FGPA for Males, over Four Years (Correlations not corrected for restriction of range)

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	81.23	1	81.23
College (within race)	4413.90	16	275.87*
Year	342.27	3	114.09
Race × year	204.12	3	68.04
College (within race) × year	5608.36	48	116.84
TOTAL	10,649.88	71	

*p < .05

$\bar{r}$ = .25

TABLE 6

Analysis of Variance of Transformed Correlations between SAT-V and FGPA for Females, over Four Years (Correlations not corrected for restriction of range)

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	2528.00	1	2528.00**
College (within race)	2983.97	15	198.53*
Year	1003.59	3	334.53*
Race × year	954.85	3	318.28*
College (within race) × year	4417.06	45	98.16
TOTAL	11,887.47	67	

*p < .05

**p < .01

$\bar{r}$ = .20

TABLE 7

Analysis of Variance of Transformed Correlations between SAT-M and FGPA for Males, over Four Years (Correlations not corrected for restriction of range)

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	35.47	1	35.47
College (within race)	5101.10	16	318.82**
Year	334.15	3	111.38
Race × year	644.63	3	214.88
College (within race) × year	549.97	48	114.17
TOTAL	11,595.32	71	

** $p < .01$ $\bar{r} = .31$

TABLE 8

Analysis of Variance of Transformed Correlations between SAT-M and FGPA for Females, over Four Years (Correlations not corrected for restriction of range)

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	2418.20	1	2418.20*
College (within race)	5414.86	15	360.99**
Year	492.06	3	164.02
Race × year	619.18	3	206.39
College (within race) × year	5585.76	45	124.13
TOTAL	14,530.06	67	

* $p < .05$ $\bar{r} = .32$

** $p < .01$

TABLE 9

Analysis of Variance of Logarithms of Variance Errors of Estimate of Predictions Based on SAT-V, for Males, over Four Years

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	1569.03	1	1569.03
College (within race)	5999.40	15	399.96**
Year	145.03	3	48.34
Race × year	771.98	3	257.33*
College (within race) × year	3711.24	45	82.47
TOTAL	12,196.68	67	

*p < .05

**p < .01

$\bar{r}$ = .49

TABLE 10

Analysis of Variance of Logarithms of Variance Errors of Estimate of Predictions Based on SAT-V, for Females, over Four Years

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	1671.65	1	1671.65*
College (within race)	3971.47	15	264.76**
Year	190.99	3	63.66
Race × year	160.83	3	53.61
College (within race) × year	2429.93	45	54.00
TOTAL	8,424.87	67	

*p < .05

**p < .01

$\bar{r}$ = .49

TABLE 11

Analysis of Variance of Logarithms of Variance Errors of Estimate of Predictions Based on SAT-M, for Males, over Four Years

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	1385.20	1	1385.20
College (within race)	5823.30	15	388.22*
Year	548.75	3	182.92
Race × year	575.83	3	191.94
College (within race) × year	7161.75	45	159.15
TOTAL	15,494.83	67	

*$p < .05$ $\bar{r} = .26$

TABLE 12

Analysis of Variance of Logarithms of Variance Errors of Estimate of Predictions Based on SAT-M, for Females, over Four Years

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	1725.63	1	1725.63*
College (within race)	3112.43	15	207.50*
Year	346.00	3	115.33
Race × year	254.67	3	84.89
College (within race) × year	3914.33	45	86.98
TOTAL	9,353.06	67	

*$p < .05$ $\bar{r} = .26$

TABLE 13

Analysis of Variance of Logarithms of Variance Errors of Estimate of Predictions Based on SAT-V + M + HSA, for Males, over Four Years

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	1199.03	1	1199.03
College (within race)	4430.10	16	276.88**
Year	278.05	3	92.68
Race × year	465.46	3	155.15
College (within race) × year	3179.24	48	66.23
TOTAL	9,551.88	71	

** $p < .01$

$\bar{r} = .44$

TABLE 14

Analysis of Variance of Logarithms of Variance Errors of Estimate of Predictions Based on SAT-V + M + HSA, for Females, over Four Years

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	921.17	1	921.17
College (within race)	3530.89	15	235.39**
Year	79.22	3	36.41
Race × year	560.99	3	187.00*
College (within race) × year	2383.54	45	52.97
TOTAL	7,475.81	67	

* $p < .05$

** $p < .01$

$\bar{r} = .46$

TABLE 15

Analysis of Variance of Logarithms of Variance Errors of Estimate of Predictions Based on SAT-V + M, for Males, over Four Years

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	911.43	1	911.43
College (within race)	4925.56	14	351.82**
Year	85.55	3	28.52
Race × year	423.26	3	141.09
College (within race) × year	2211.94	42	52.66
TOTAL	8,557.74	65	

** $p < .01$

$\bar{r} = .59$

TABLE 16

Analysis of Variance of Logarithms of Variance Errors of Estimate of Predictions Based on SAT-V + M, for Females, over Four Years

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	1424.47	1	1424.47*
College (within race)	4688.47	15	312.56**
Year	216.16	3	72.05*
Race × year	292.42	3	97.47
College (within race) × year	2884.17	45	64.09
TOTAL	9,505.69	67	

* $p < .05$

** $p < .01$

$\bar{r} = .49$

TABLE 17

Analysis of Variance of Standard Errors of Estimate of Predictions
Based on SAT-V + M, for Females, over Four Years

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	565.63	1	565.63
College (within race)	1962.40	15	130.83**
Year	94.71	3	31.57
Race × year	101.55	3	33.85
College (within race) × year	1161.24	45	25.80
TOTAL	3,885.53	67	

** $p < .01$ $\bar{r} = .50$

TABLE 18

Analysis of Variance of Standard Errors of Estimate of Predictions
Based on SAT-M, for Females, over Four Years

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Race	785.71	1	785.71*
College (within race)	1480.67	15	98.71*
Year	198.88	3	66.29
Race × year	114.96	3	38.32
College (within race) × year	2006.66	45	44.56
TOTAL	4,586.88	67	

* $p < .05$ $\bar{r} = .23$