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ABSTRACT

The present study is the fourth and last in a series that specifically deals with the nations' schools, student achievement, and students' attitudes toward life. This volume employs new methods and categories of analysis to re-examine certain earlier findings such as the lack of any appreciable relationship between achievement level and having a family from which neither parent is absent and the greater independent role of family background factors in a students' achievement. The role of two previously neglected variables -- that of sex and school attendance in either a metropolitan or non-metropolitan area -- in achievement and motivation is also explored. Earlier reported findings are seen to be substantially confirmed, extended, and made more specific in this report. The study shows that influences on student achievement tend to resolve themselves into attitudinal and motivational factors and social class factors, with the latter assuming the most importance. Neither ethnicity, sex, nor regional differences account greatly for the source of variance in student achievement. Ethnically related variations in achievement and motivation are not considered to arise from anything inherent in the ethnic groups themselves and the crucial factor suggested is each group's experiences as a group, including the school attended. The most important achievement of these studies is deemed to lie in the documentation and quantification of the entanglement of influences in a child's education. (Author/AM)

SPECIAL STUDIES OF OUR NATION'S STUDENTS

by
George W. Mayeske
Albert E. Beaton, Jr.
With a Foreword by Alexander M. Mood

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
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Virginia Y. Trotter, Assistant Secretary for Education

Office of Education
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Foreword

This fourth volume of analyses of the data obtained from the U.S. Office of Education's survey of educational opportunity brings to a conclusion a landmark scholarly endeavor. On the purely statistical side, I am acquainted with no other collection of data as large that has received anything approaching the careful analysis that this collection has received. The common practice among survey researchers is to put most of the available resources into data gathering. So few are then devoted to analysis that only a small fraction of the data's information potential is ever realized. In the normal course of events, that would have been the fate of the Equality of Educational Opportunity Survey. That course was upset by George Mayeske, who had the vision to see the potential of these data, and the dedication to carry through a most penetrating and sophisticated analysis of them. As a result, the cause of education has made important advances on a number of fronts. I shall use this foreword to indicate what some of those advances are.

In the first place, education now possesses some fundamental findings that it can depend upon. I shall not review them here because they have already been reviewed in the first and second chapters of this volume. I should say, however, that they are in a different league from most of the findings we are accustomed to read in education research journals because we can expect them to stand up: they have a massive data base and an extremely careful analysis to back them up. The truth is that the usual experimental or survey investigation in the field of education must depend on very limited resources, and hence on a very inadequate data base. Often, too, an investigation is unconsciously biased by the expectations of the investigator or by the so-called Hawthorne effect. As a result, we are accustomed to regarding educational findings as altogether tentative; indeed, we are not the least surprised to find that other investigations either fail to reduplicate or even contradict them. This is so because we are fully aware that education is terribly complicated, and that different sets of factors may be dominant in apparently similar situations.

It is impossible for me to conceive that Dr. Mayeske's findings will be contradicted in any significant sense. As a consequence, I believe that education has, at last, a few crude building blocks with which we can initiate a real science of education—a science that will be firmly anchored, that will grow, that will permit experimental findings to be calibrated and tested for consistency, that will enable reliable predictions to be made, and that will radically transform our educational practices from a tradition-bound art to an effective process. It will be a long, slow development because education is vastly more complex than chemistry, biology, or economics. But research like Dr. Mayeske's makes a coordinated contribution; it does not merely generate isolated, unconnected bits of information. In this way, noticeable progress will at last be made.

It seems to me not too optimistic to expect such progress, because these findings are more than well-founded results; they are also a key to interpreting a great many other results. In other words, they provide a means for judging how other results relate to the findings. They provide a selection of quantitative devices for adjusting other results to bring them into a configuration which will permit one to judge their consistency with the present study. This is the sine qua non for developing a sound theory. Every new result must have the potential either for supporting the theory or for suggesting modifications to it. This possibility cannot exist until the theory can put the result into its own context. To do that, the theory needs just the kind of quantitative tools that Mayeske's findings exemplify. In addition to the fundamental relationships of socioeconomic status, family process, motivation, attitudes, and expectations directed at various school outcomes, we also have in this latest volume some explorations of nonlinearities (chapter 5) and some very useful covariance analyses (chapter 8). These latter will further enable special investigations to be transformed into a context in which they can be compared with other findings, including the present study.

This study will also contribute greatly to the burgeoning development of accountability across the land. The accelerating cost of public education is stimulating a great wave of evaluation of educational progress. Taxpayers want information about what they are buying in the way of educational activities so that they can make decisions about where economies might be achieved. But when schools and districts gather achievement data and try to make judgments about these data by comparing them with data from other districts, there is much confusion because underlying conditions are not comparable in the various districts. The analyses of Mayeske and his colleagues are especially suitable for bringing order into this confusion, order that will make valid comparison and evaluation possible.

We have in chapter 3 a lucid discussion of the issue of whether ethnic groups differ in intelligence. The authors conclude that no evidence can be found to support such a hypothesis in the Equality of Educational Opportunity Survey. Since this is a very extensive set of data, the hypothesis should be definitely laid to rest except for the possibility of very small differences. Unfortunately, some true believers are so enamored of the genetic hypothesis that they will probably cling to it and continue creating utterly

pointless dissension. How pointless, the reader can judge from the following considerations. Suppose, for the sake of argument, that there were small ethnic differences attributable to the genetic pool, for example, that only 46 percent of white persons scored lower on a general intelligence index than the median black person, that 55 percent of Oriental-Americans had greater ability in purely logical reasoning than the median white person, that 52 percent of Mexican-Americans had more fertile imaginations than the median Oriental, that 54 percent of black persons had greater musical talent than the median white person, and so on. What conceivable payoff to public policy, or social activity, or individual decisions could result from the effort spent to establish such differences? And it would be essentially an impossible effort, in any case, because noncomparability of culture could never be controlled down to such levels. This is amply demonstrated in chapter 3 of the present study.

A very large contribution of all four volumes by Dr. Mayeske and his colleagues—particularly the third volume, *A Study of the Attitude Toward Life of Our Nation's Students*—has been to broaden the analysis of school outcomes to those outside the purely academic category. This broadening was initiated by James S. Coleman and his colleagues in what is now known as the Coleman Report (Coleman et al., 1966). These authors regarded educational motivation and aspirations for advanced education as, at least to some degree, school outcomes. Mayeske and his team have systematically treated these and other noncognitive variables, so far as the analysis is concerned, as on a par with cognitive achievement. As a result, a great many educational researchers now routinely think beyond cognitive outcomes. This is an especially happy development in view of the growing importance in the public mind of noncognitive goals in education. In a recent statewide goal-setting exercise in California, a sizable portion of districts put self-esteem ahead of many cognitive goals; some ranked it first among all goals. Examples of other such goals that are growing in importance are:

creativeness	social competence
confidence	sense of responsibility
integrity	ability to concentrate
ambition	enthusiasm
being observant	ability to reason
humanity	curiosity
self-discipline	conviction

Education is becoming aware that it badly needs programs for pursuing goals of this kind and technology for assessing progress toward them. Coleman, Mayeske, and their colleagues may be more responsible than anyone else for bringing about that awareness and demonstrating that it is not impossible to develop methods of evaluating progress toward such difficult goals.

Perhaps the most important achievement of these studies has been to thoroughly document and quantify the entanglement of influences in a child's education. A child learns from parents, peers, siblings, neighbors, teachers, numerous members of the community, television, radio, movies, newspapers, magazines, libraries, and so on. Of course the relative importance of these agencies varies enormously from child to child. Some children have parents who spend a great deal of time drilling them from an early age in the alphabet, spelling of simple words, counting, addition and subtraction, and the like. Other children have parents who do not speak English or who know so little English that they cannot give their children much help in becoming acquainted with it. For the former children, the family may be a much stronger educational force than the school; for the latter, the school may be a much stronger educational force than the family, although there are doubtless cases in which older brothers and sisters make the family a stronger force than the school. If all these children were given a vocabulary test midway along the first grade, say, one would find a wide range of vocabulary sizes. The mere numerical estimate of the size of a given child's vocabulary would obviously give one no clue at all as to how much of the vocabulary should be attributed to each of the many educational forces acting on the child. Even if one had a complete audiovisual record of the child's entire life from the moment of birth, there would be no way to deduce that a specific force or even a specific collection of experiences added the word "cat" to the child's vocabulary. The abstraction, "cat," changes in the child's mind as the child grows from the babbling stage to the first grade as a result of various encounters with the word. Various clues are supplied by each encounter; some of them are quite meaningful while others contribute little and still others are downright misleading. Most credit should go to the insightful ones, but how can we identify them? Somehow, out of the totality of their experiences, most children arrive at the first grade with a reasonably satisfactory "cat" in their vocabularies. We have always generally understood that all these influences were at work, but we have here for the first time good measurement of how extensively they overlap.

Another related insight that all of us will surely never lose sight of after these studies is the fact that any test is in reality a test of a child's intellectual power. Whatever the test purports to get at, it is actually engaging the knowledge structure in toto. That is evident when a variety of tests are given the same children; those who score high on one test usually score high on all tests and vice versa. There is no sense trying to cut up a child's knowledge structure into an arithmetic piece, an English piece, a science piece, a history piece, and so on. The intellectual power is a single integrated entity not to be confused with the arbitrary way schools happen to divide up knowledge into curriculums.

Finally, this series of studies has stimulated the first pioneering steps toward development of quantitative models of the educational process. This is the development that must take place if education is to become a science. These models are terribly primitive at the present time but a beginning has been made by Mayeske and Beaton in chapter 11 of the present volume, and by others such as H. M. Levin (1970) and S. Michelson (1971), who are making

excellent use in their own work of the data and analyses of the Equality of Educational Opportunity Survey.

There is no doubt that these studies of Mayeske and his colleagues, together with the original Coleman Report, are changing American education in deep and far-reaching ways. It is moving slowly but surely from confinement to traditional academic limits to development of the whole person, especially the skills in interpersonal relations that are so important in a highly organized society. At the same time, it is moving from the notion of the school to that of the whole society as the educating agent, from promotion of intense competition for grades to concern for children as human beings, and from hit-or-miss educational programs to demonstrably effective ones. The debt of education to these studies is already huge and it will continue to grow for years to come.

Alexander M. Mood

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Preface

In this monograph we have attempted to explore some of the findings from our earlier works. We have explored them in greater detail, by examining more refined groups and a greater number of grade levels, and in greater depth, by utilizing a number of more powerful analytic techniques. The results, both substantive and methodological, are intended primarily for researchers in the behavioral sciences who are concerned with such topics as: ethnic differences; differences by sex; geographic differences; and the role of family background, achievement, and school factors in each of these. It is a potpourri of analyses and, like any other potpourri, does not readily lend itself to a simple synthesis. Nevertheless, we have included in chapter 2 a brief summary that, we feel, may be of interest to those who are not researchers. A more detailed summary of the same findings will be found in chapter 12, and in the abstract that follows the table of contents.

It should be emphasized that we regard the findings more as hypotheses than as firm conclusions, and proffer them for further research through longitudinal and experimental studies. Undoubtedly, other survey researchers will want to use the relationships displayed herein for designing their own samples and developing their own indices. Moreover, the study is of some historical interest, since the relationships uncovered in it reflect a point in time just prior to the large-scale Federal involvement in aid to education.

The sequence of individual chapters reflects the order in which they were actually developed. Students were progressively differentiated in a variety of ways, according to their membership in different groups. In addition, a number of new analytic techniques were introduced as they became available. Had they been available earlier, the report might have been different in form and perhaps also in content.

We have delved deeply here into cultural and ethnic group differences insofar as they are reflected in the variables measured in this study. But we must caution against reifying cultural differences in intellectual attainment to the exclusion of other values. The life of a "culturally different" child may be rich in many ways not tapped by our measures. Also, we must not be led to believe, because we can statistically equate ethnic group differences, that they would be simple to equate in reality. As S. B. Sarason has noted, the different ethnic groups hold attitudes toward one another that are deeply rooted in their historical experiences, and are therefore not likely to disappear in the near term.[1]

This is the final monograph in this series of analytic publications sponsored by the U.S. Office of Education. A number of others were planned, but the appeal of newer data and the press of tasks with higher priority have decreed otherwise.

Like our earlier reports, this one represents the culmination of a team effort in which each member contributed according to his specialized interests and background. Without the efforts of Albert E. Beaton, Jr., the entire project would not have been possible. He directed the organization of these voluminous data so that we could perform unusually complex analyses in a remarkably economical manner. He also demonstrated a number of heretofore unknown properties of the commonality model, generalized it to other multivariate applications, and developed the procedures for detecting discontinuity and analyzing covariance. Kathryn Crossley, after an initial assist from Tetsuo Okada, conducted the data processing—a task of such volume and complexity that it staggers the imagination. The senior author is solely responsible for the techniques used, the content of the study, and its presentation.

The labors of this team could not have reached fruition without the initial impetus given to it by Alexander M. Mood when he was Assistant Commissioner for Educational Statistics, and the later support of the work by Joseph N. Froomkin and John W. Evans when the staff was transferred under the authority of the Assistant Commissioner for Planning, Budgeting, and Evaluation. We are particularly indebted to Carl E. Wisler, who as Division Director allowed this work to reach completion even though at times he had to assume undue administrative burdens. It has also benefited greatly from the thoughtful review and constructive comments of Alexander M. Mood. The organization and style of this report were improved through the editorial efforts of John M. Edwards. Shirley Stevens has worked with sustained effort over the years typing the manuscript. At times she received assistance from Leona Edwards, Eulene Hollis, Rhonda Lewis, and Barbara Gilliam. After the report had been edited for publication, it was entirely retyped by Elizabeth J. Ritter. Without the efforts of all these people this report would not have been possible.

George W. Mayeske

[1] S. B. Sarason, "Jewishness, Blackishness, and the Nature-Nurture Controversy." *American Psychologist*, November 1973, pp. 962-971.

Abstract

The previous three studies in this series dealt respectively with the nation's schools, with the achievement of its students, and with their attitude toward life. The present study, which is the fourth and last in the series, employed new methods and categories to reexamine certain earlier findings that had been judged to be of particular interest. Among these were: the lack, for nearly all students, of any appreciable relationship between achievement level and having a family from which neither parent was absent; the greater independent role in a student's achievement of family background factors as compared with school factors; and the tendency of each ethnic group's achievement, as measured by the group mean, to approach the same level as adjustment was made for more factors relating to the group's social background. In addition, the study explored the role in achievement and motivation of two previously neglected factors: whether the student was a boy or a girl; and whether he or she went to school in a metropolitan or nonmetropolitan area.

Reexamination of the earlier studies was considered desirable because of their methodological limitations, especially: their focus on students at a particular point in time (the data had all been collected in 1965, and so did not admit of longitudinal studies); their use of only four major geographic groupings; and their almost exclusive dependence on commonality analysis, a statistical technique developed by the authors in order to explore the overlap of certain factors not easily disentangled by standard techniques.

Despite these limitations, the earlier findings were substantially confirmed. In the process of confirmation, the findings were extended and made more specific. Thus it had already been noted that about 50 percent of individual student achievement could be explained in terms of a linear relationship between achievement, family background, area of residence, and type of school attended. Here, although the same relationship still existed, a point of discontinuity in it was found, such that, in the low range of variables influencing achievement, the relationship was much less pronounced than in the middle and high ranges. Ethnic group differences in achievement were also reexamined, with the result that, as increasingly more factors related to their differing social backgrounds were taken into account, their achievement scores tended to approach not only (as before) a common mean but a common distribution. Moreover, when school-related factors were brought into the analysis, the need for ethnicity as an explanatory variable was greatly diminished. Another variable that turned out to have even less explanatory power than ethnicity was sex. Despite certain small but persistent sex differences in study habits and educational plans, there was no ethnic group in which sex played an important role in either achievement or motivation.

The search for possibly neglected regional factors also proved fruitless, though the earlier hypothesis that the color-caste aspects of the social structure would have a greater impact on student achievement in the South was confirmed when this region was divided, for purposes of analysis, into Southeast and Southwest. However, nearly all the regional differences in achievement could be explained in terms of the regional averages for socioeconomic well-being, motivation, and type of school attended. Once again, ethnicity as such was not a factor, while school-related factors, as already mentioned, played less of a role everywhere than family background. Nevertheless, there was substantial overlap in most regions between these two types of influence, chiefly because students were being allocated to schools on the basis of their ethnicity and socioeconomic status. Moreover, the achievement level of minority students appeared more sensitive to school influences than that of whites. This was also the case with students in the South compared with students in other regions. In general, school-related variables tended to capture both ethnic group differences and geographic differences.

Overall, then, the study showed that influences on student achievement tended, when analyzed, to resolve themselves into attitudinal and motivational factors, on the one hand, and social class factors, on the other—and that the attitudinal and motivational factors were by far the more important. The considerable overlap between these two sets of factors indicated that the attitudinal and motivational variables might well be regarded as the behavioral correlates of social class membership, at least as they related to achievement. Moreover, when both achievement and motivation were treated as the joint product of social class and school, the role of these latter came out more nearly equal, the school factors being the more influential for minority students and social class factors for whites. Nor was ethnicity the source of the variation that most needed explaining. Indeed, the portion of student variation in achievement that was independent of ethnicity was generally larger than the portion associated with it. Finally, although the schools, at that period, were often ethnically homogeneous, or nearly so, there was always more variation within than among schools on the other student variables.

It was further concluded that commonality analysis, or some extension of it, was the most suitable technique for studying these highly overlapping relationships in which the appropriate causal model was often a matter of dispute. However, it was quite clear that ethnically related

variations in achievement and motivation did not arise from anything inherent in the ethnic groups themselves. The crucial factor, it was suggested, was each group's experience as a group, an experience that included the type of school attended. From this perspective, resort to genetic explanations was simply unnecessary, since the variation within each ethnic group was always greater than the variation among groups. This being so, it was proposed that group-based comparisons be largely abandoned in the grading of educational performance, and that a system be adopted in which there would be far greater individualization of both instruction and grading. It was also proposed that education be made far more relevant to probable future life experience, such as having and bringing up children, and that all future innovative programs in education should contain built-in experimental controls, so that their probable effectiveness can be scientifically evaluated

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PART 1: INTRODUCTION

Chapter 1

THE EARLIER STUDIES[1]

1.1. THE EQUALITY OF EDUCATIONAL OPPORTUNITY SURVEY

Title IV of the Civil Rights Act of 1964 required the Commissioner of Education to—

> . . . conduct a survey and make a report to the President and the Congress, within two years of the enactment of this title, concerning the lack of availability of equal opportunities for individuals by reason of race, color, religion, or national origin in public educational institutions at all levels in the United States, its territories and possessions, and the District of Columbia.

In response to this request the Equality of Educational Opportunity Survey was carried out by the National Center for Educational Statistics (NCES) of the U.S. Office of Education. The survey was directed by Alexander M. Mood. In addition to its own staff, NCES used the services of outside consultants and contractors. James S. Coleman of Johns Hopkins University had major responsibility for the design, administration, and analysis of the survey. Ernest Q. Campbell of Vanderbilt University shared this responsibility and, in the case of the college subsamples, assumed the greater part of it. Frederic D. Weinfeld served as project officer.

The survey addressed itself to four major questions:

1. To what extent are racial and ethnic groups segregated from one another in the public schools?
2. Do the schools offer equal educational opportunities in other respects?
3. How much can students be said to learn, judged by their performance on standardized achievement tests?
4. What kinds of relationship may be supposed to exist between the level of a student's achievement and the kind of school he attends?

Work was started on the survey in the spring of 1965 with a view to administering the questionnaires and tests that fall. Approximately 70 percent of the schools that were requested to participate in the study actually did so (the colleges were made the subject of a smaller and separate survey). This entailed testing and surveying some 650,000 students, together with their teachers, principals, and superintendents, in approximately 4,000 public schools throughout the country.

On the basis of competitive bids, the Educational Testing Service of Princeton, N. J. was awarded the contract for conducting the Equality of Educational Opportunity Survey, including test administration, test scoring, data processing, and data analysis. It also consulted on various aspects of the survey and convened an advisory panel to aid in its design and analysis.

The survey used a 5-percent sample of schools. This was a two-stage, self-weighting, stratified cluster sample. The primary sampling units (PSU's) in the first stage were counties and Standard Metropolitan Statistical Areas (SMSA's). The PSU's in the second stage were high schools. When one was drawn in the sample the elementary schools feeding into that school were automatically included in the sample as well. Since the Equality of Educational Opportunity Survey was primarily concerned with the children of minority groups, and since these groups constituted only about 10 percent of the total school population, the schools were stratified according to the percentage of nonwhite students contained by each. Thus strata with higher percentages of these students were given larger sampling ratios and so were sampled more heavily. The final result was that over 40 percent of the students in the survey were from minority groups.

Separate questionnaires were administered to teachers, principals, superintendents, and students at each of the grade levels studied. The teacher questionnaire contained some 72 items covering such topics as professional training, type of school and student preferred, opinions on issues and problems of integration (busing, compensatory education, etc.), and problems existing in the school. The final part of this questionnaire was a voluntary test consisting of 30 contextual vocabulary items; its purpose was to measure the teacher's verbal facility. However, the main source of information about the school was the 100-item principal questionnaire. It covered school facilities, staff, programs, racial composition, problems, curriculums, extracurricular activities, and many other school characteristics. Of course, there were also questions on the personal background and training of the principal and his opinions on problems of integration. The picture given by the teacher and principal questionnaires was further enlarged by the superintendent questionnaire, which consisted of 41 questions. These dealt not only with various aspects of the school system itself, including its expendi-

[1] Substantial portions of this chapter have already appeared in *A Study of the Achievement of Our Nation's Students* (Mayeske et al., 1973a) and in *A Study of the Attitude Toward Life of Our Nation's Students* (Mayeske, et al., 1973b). However, they have been reprinted here, with only minor revisions, because they provide background essential for understanding the present study, which is designed to stand by itself.

tures, but with the superintendent himself and his attitudes toward current educational issues. Finally, detailed factual and attitudinal data about the students were obtained in the same way. Since this report focuses on the students, let us describe the student questionnaires in some detail.

The act required that the survey be made "at all levels." For reasons of economy, it was decided to administer the tests to a selection of grades that would be representative of the entire range. The grades chosen were the 1st, 3rd, 6th, 9th, and the 12th, and different questionnaires were used for each grade level. In addition to questions on home background and on the usual personal and school characteristics, there were questions on attitude toward school, on race relations, and on life in general. Representative examples are: How good a student do you want to be in school? If you could be in the school you wanted, how many of the students would you want to be white? Good luck is more important than hard work for success (agree or disagree).

It had been decided that the yardsticks for measuring the detrimental effects of poor school facilities and characteristics were to be tests of the various school-related skills. Thus the survey's test battery was planned as an integral part of the entire research design. The objective was to obtain as much test data as possible within the limitations of time and available resources. Two of the basic skills chosen were reading comprehension and mathematical ability, since these two areas are common to all school curriculums and all grade levels. Another area deemed important was the student's general level of knowledge, regardless of its source. A general information test was therefore included in the test battery. Two other ability tests were used to measure the student's verbal and ratiocinative skills.

Following this survey a report entitled "Equality of Educational Opportunity," under the principal authorship of James S. Coleman, was submitted to the President and the Congress on July 2, 1966. This report has become known as the Coleman Report; the reader is referred to it for further details (Coleman et al., 1966).

The findings from the Coleman Report that are of particular relevance to this study can be summarized in a very general way as follows:

1. Family background is of great importance for achievement.
2. The relationship of family background to achievement does not diminish over the years of school.
3. Of the effect of variations in school facilities, curriculum, and staff upon achievement, only a small part is independent of family background.
4. Of the school factors, those that have the greatest influence on achievement (independently of family background) are the teacher's characteristics, not the facilities and curriculum.
5. The social composition of the student body is more highly related to achievement, independently of the student's own social background, than is any school factor.
6. Attitudes such as sense of control of the environment, or a belief in the responsiveness of the environment, were found to be highly related to achievement, but appear to be little influenced by variations in school characteristics.

In summary, the authors of the Coleman Report concluded that:

> ... the schools bring little influence to bear on a child's achievement that is independent of his background and general social context; and that this very lack of an independent effect means that the inequalities imposed on children by their home, neighborhood and peer environment are carried along to become the inequalities with which they confront adult life at the end of school. For equality of educational opportunity through the schools must imply a strong effect of schools that is independent of the child's immediate social environment and that strong independent effect is not present in American schools.[2]

1.2. A STUDY OF OUR NATION'S SCHOOLS

The Coleman Report was only the first analysis of these data, and it was planned to conduct further analyses. In order to accomplish this objective, a special analysis group was formed in the National Center for Educational Statistics (NCES). The first efforts of this group culminated in a report entitled "A Study of Our Nation's Schools" (Mayeske et al., 1972a), hereafter called the School Study. This report is summarized below; much of it is drawn upon in the present study.

The School Study addressed itself to the following question: How do the school's characteristics influence such things as the achievement level of all the students in the school? However, before an answer could be obtained to this question the following technical problems had to be dealt with:

1. How could discrete categorical variables such as "father's occupation" best be scaled so that they could be meaningfully interpreted and related to other variables of interest?
2. How could provision be made for nonlinear or curvilinear relationships that might otherwise remain obscured?
3. How could estimates be made of missing data, particularly when the very students who failed to provide an answer to a question were of great interest?
4. How could the more than 400 variables be reduced so that the task of data processing and analysis would become less complex?

To perform the kind of analysis required and at the same time resolve the above problems a number of logical steps were evolved and translated into the necessary computer programs (see appendix A). The statistical tools mainly used were regression analysis and partition of multiple correlation. As a result, we were able to distinguish between:

[2] Ibid., p. 325.

1. Percentage of school outcome associated with the distinguishable influence of the school's characteristics.
2. Percentage of school outcome associated with the distinguishable influence of the student's social background.
3. Percentage of school outcome that could just as well be associated with either one.

The conclusions that were obtained are stated below in the form of a series of hypotheses.[3] Some of the concepts and methods used to build these hypotheses are described in later sections of this chapter.

1. Very little of the schools' influence on their students can be separated from the influence of the latter's social backgrounds. Conversely, very little of the influence of the student's social background can be separated from the influence of the schools. The children who benefit most from this schooling are those who:
   (*a*) Come from the higher socioeconomic strata rather than from lower socioeconomic strata.
   (*b*) Have both parents in the home rather than only one or neither parent in the home.
   (*c*) Are white or Oriental-American rather than Mexican-American, Indian American, Puerto Rican, or Negro.
2. Until the 12th grade, the distinguishable influence of the student's social background, that is, the part of it that can be separated out, is usually larger than the distinguishable influence of the school. At the 12th grade, however, the distinguishable influence of the school is greater than the distinguishable influence of the student's social background for most of the motivational and attitudinal outcomes, while the opposite is true for achievement.
3. The common influence of the school's characteristics and the student's social background on the attitudinal and motivational outcomes differs for the different grade levels. For achievement, however, the common influence is consistently larger than either one alone. This common influence increases the longer the student stays in school.
4. Schools that perform well on one outcome tend also to perform well on other outcomes. These performances tend to facilitate and reinforce one another. For the attitudinal and motivational outcomes a school's generalized favorable performance has a large distinguishable influence. It also has a common influence with the student's social background. For achievement, the influence of a generalized favorable performance is manifested in common with the school's characteristics and the student's social background.
5. The school variables most heavily involved in school outcomes are those concerned with actual characteristics of the school's personnel, as distinguished from the school's physical facilities, pupil programs and policies, and even personnel expenditures, including teacher's salaries.
6. Chief among these characteristics of school personnel are ones that reflect experience in racially imbalanced educational settings. Most nonwhite teachers had attended predominantly nonwhite educational institutions and were teaching predominantly nonwhite students. Nonwhite educational settings, it was suggested, tend to have associated with them lower levels of achievement and motivation, as well as less favorable socioeconomic and family conditions. The result is less adequate preparation than that received in predominantly white institutions.

1.3. A STUDY OF THE ACHIEVEMENT OF OUR NATION'S STUDENTS

Unlike the School Study, the Achievement Study (Mayeske et al., 1973a) used the individual student as the unit of analysis. The following major questions were explored:

1. What roles do different aspects of the student's family background play in the development of his achievement?
2. What roles do different aspects of the school play in the development of individual student achievement when they are juxtaposed with family background factors?

These questions were explored for students in different geographic regions of the country, for students of different racial and ethnic group membership, and for boy-girl differences. Although this study made use of the same data as the previous two, it covered a greater number and variety of variables and a larger sample of students than the Coleman Report. However, it not only confirmed many of the Coleman Report's findings but also extended and refined them.

The main findings of the Achievement Study were as follows:

1. Average achievement is highest for whites, who are followed closely by Oriental-Americans, who are in turn followed by Indian Americans, Negroes, Mexican-Americans, and Puerto Ricans. The last four groups cluster fairly closely together. For all groups, this ordering is fairly consistent throughout the years of schooling.
   (*a*) Differences in average achievement among the groups is almost 5 times greater than differences between males and females within each group.
   (*b*) At times, the extent to which these groups differ across regions of the country approaches the extent to which they differ from whites.

[3] In these hypotheses, "student's social background" refers to the set of three student body social background variables known as Socio-Economic Status, Family Structure, and Racial-Ethnic Composition of the Student Body. "Characteristics of the school" refers to a comprehensive set of 31 school variables (Mayeske et al., 1972a). A subset of 10 of these that figured most prominently in school outcomes and in individual student achievement is described in chapter 2.

2. The highest proportion of the total differences among students in achievement that can be associated with their membership in one of the six racial-ethnic groups is 24 percent. After allowance is made for various factors that are primarily social in nature, this proportion drops to 1 percent. The factors in question are the family's social and economic well-being, the presence or absence of key family members, the aspirations that a child and his parents have for his schooling together with the activities in which they engage to support these aspirations, the region of the country lived in, and the type of school attended.
3. The presence or absence of key family members plays only a small role in achievement for Negroes and whites, but a much larger role for the other groups. This is true both before and after allowance has been made for the social and economic well-being of the family. It is also true for all the different regions of the country.
   (*a*) Boys' achievement levels are more likely to be affected by the presence or absence of key family members than girls'.
   (*b*) A family's social and economic well-being almost always plays a greater role in achievement than does the presence or absence of key family members.
4. The aspirations that both the student and his parents have for his schooling, the activities that they engage in to support these aspirations, and the student's own outlook on life—in short, the motivational aspects of family life—all play a greater role in his achievement than do either the family's social and economic well-being or the presence or absence of key family members.
   (*a*) There is, however, a considerable amount of overlap between the motivational aspects of family life and the others.
   (*b*) Among the motivational aspects of family life, the educational and occupational aspirations of boys play a somewhat greater role in their achievement than do the other aspects. For girls, the opposite is true.
5. When the role of all these family background factors[4] in achievement is compared with that of the type of school attended, the percentage of achievement that can be associated with each is: family background, 48 percent; and type of school attended, 10 percent. The remaining 42 percent is common to both sets of factors.
   (*a*) Among the aspects of the school attended, the achievement and motivational levels of the student body play a role in the individual student's achievement about 6 times greater than that of any of the remaining school characteristics.
   (*b*) Of the latter, the teaching staff's attributes are more influential than such attributes of the school as its facilities, policies, or kind of program offered.

[4] I.e., the motivational aspects of family life, the family's social and economic well-being, its ethnic group membership, and the presence or absence of key family members.

1.4. A STUDY OF THE ATTITUDE TOWARD LIFE OF OUR NATION'S STUDENTS

Throughout the Achievement Study it was noted that a student's beliefs about his ability to influence his life and to improve his lot by means of education figure importantly in his academic achievement. This is especially true of many minority group students. We therefore decided to investigate these beliefs in a separate study (Mayeske et al., 1973b). The major questions explored in this study were:

1. What roles do the various aspects of a student's family background and achievement play in the development of his attitude toward life?
2. What roles do the various aspects of the school play in the development of an individual's attitude toward life, as compared with an individual's family background factors and achievement?

As in the Achievement Study, we explored these questions for students of both sexes and six ethnic groups in the different geographic regions of the country. The chief variable of interest was a composite one that we called ATTUD (short for "Attitude Toward Life"). It included a number of measures that tended to reflect the student's attitude toward success—not just success in general, but success as a personal matter. Students who scored high on ATTUD rated their own chances of success quite favorably, and inclined toward a philosophy of life in which getting ahead depended on hard work, not luck. The Attitude Study, as it will be known here, yielded the following findings:

1. Students who identified themselves as white tended to score higher on ATTUD than students who identified themselves as belonging to some other group. Of these latter, Oriental-Americans scored on the average one-third of a standard deviation below whites, Puerto Ricans almost one full standard deviation below, and the remaining groups (Indians, Mexican-Americans, and Negroes) one-half a standard deviation below.
   (*a*) Scores on ATTUD also varied for the same ethnic group in different regions of the country. Some groups differed among themselves by region almost as much as, at the national level, they differed from whites. For Mexican-Americans, Puerto Ricans, and Negroes, this regional difference was two-thirds of the difference from whites, for Indians it was two-fifths, and for Oriental-Americans one-third.
   (*b*) For each of the six ethnic groups studied, females scored consistently higher on ATTUD than males. The difference, however, was only on the order of one-fourth of a standard deviation or less.

(c) Differences among the ethnic groups in their average ATTUD were about twice as great as were differences between the sexes within each group.

2. The extent to which ATTUD could be explained by family background factors and achievement tended to be smaller for whites than for any of the other groups.
   (a) At the ninth grade, slightly more than one-fourth of the difference in ATTUD among whites could be explained by differences in family background and achievement. For the other groups, the comparable figure was nearer to one-third.
   (b) Differences between the sexes on these variables were consistent at the national level, but not when broken down by ethnic, geographic, and grade-level groups.
3. The presence or absence of key family members in the home was found to have a low-to-moderate relationship with ATTUD, depending upon the group and grade level. However, after differences in the student's family background, achievement, and type of school attended had been allowed for, this relationship vanished.
4. The motivational aspects of family life,[5] as distinct from the structural or the socioeconomic aspects, were found to have a moderate-to-high relationship with ATTUD. This relationship persisted, though it decreased, even after allowance had been made for the student's socioeconomic status, family structure and stability, achievement, and type of school attended.
   (a) Roughly speaking, one-third to one-half of the differences among students in ATTUD that was associated with these motivational aspects was also associated with all the other variables just named.
   (b) The motivational aspects played a slightly greater role in the boys' ATTUD than in the girls', and the more immediate kinds of parent-child involvement, such as frequent discussions of schoolwork, made a larger independent contribution than any long-range aspirations.
5. Roughly 12 to 16 percent of the differences among students in their ATTUD was associated with a set of 10 school factors. However, after differences in family background and achievement had been allowed for, these values dropped to between 2 and 7 percent.
   (a) School variables were associated with ATTUD —that is, before other background factors had been allowed for—to a uniformly greater degree in the South than in the North.
   (b) Of the 10 school variables, the 5 pertaining to the student body's achievement and motivational level had a large role in ATTUD that was independent of the 5 teaching staff variables, while the latter had no independent role in ATTUD whatsoever.
   (c) The student body variable with the largest independent role in the individual student's attitude toward life was the attitude toward life of the student body as a whole. However, the role of the remaining student body variables was not inconsiderable.

[5] These were represented by a set of variables, called Family Process, that pertained to the attitudes and behavior of the student and his family, especially with regard to education. See section 2.3.

1.5. SUMMARY

The Equality of Educational Opportunity Survey, which was carried out by the U.S. Office of Education under the Civil Rights Act of 1964, attempted to determine: the extent of racial-ethnic segregation in the public schools; whether or not the schools offered equal educational opportunities in other respects; the amount that students could be said to learn, judged by their performance on standardized achievement tests; and the kinds of relationship that might be supposed to exist between a student's achievement and the school he attended. The study involved some 650,000 students, with their teachers, principals, and superintendents, in about 4,000 public schools throughout the country. For reasons of economy, only students in grades 1, 3, 6, 9, and 12 were included in the analysis.

The results of this survey were published in a report entitled "Equality of Educational Opportunity," which is better known, after its senior author, as the Coleman Report (Coleman et al., 1966). The authors' principal conclusion was that the public schools, as presently constituted, could not provide equality of educational opportunity. For this they blamed not so much inequality of schools, that is, differences in the schools' physical plant or teaching staff, as inequality of students. The teaching staff's characteristics did appear to have some effect on a student's level of achievement, but not nearly as much as his or her family background. Accordingly, the aspect of the school that most influenced its students' achievement was not anything it did to them in the way of formal education. Rather, it was the social mix of the entire student body. Thus the schools were unable to guarantee equality of educational opportunity because they were powerless to correct inequalities in the society.

The Coleman Report had shown that the schools exercised relatively little independent influence. They did exercise some influence, however, and more of it on some groups than on others. It was in order to examine the detailed workings of this process that the present authors undertook further analysis of the data already collected by the Equality of Educational Opportunity Survey. The first such analysis to be published was *A Study of Our Nation's Schools* (Mayeske et al., 1972a). Its general purpose was to distinguish the school's influence from all other influences. More specifically, it sought to distinguish the relative impact of that influence in each of its many aspects. The most influential characteristics of the school, it was discovered, were those connected with its staff. Moreover, schools that performed well in terms of one edu-

cational outcome were found to perform well on others. The children who benefited most from school influences were those who were white or Oriental-American and who came from well-to-do homes in which both parents were present. In this sense, then, the Coleman Report was confirmed, since it was clear that even such opportunities as the schools could provide were not equally available to all students.

Next to be published was *A Study of the Achievement of Our Nation's Students* (Mayeske et al., 1973a). Here, we wanted to find out which aspects of a student's family background were most closely associated with his or her level of achievement. On the whole, despite considerable variation by region, the highest levels were reached by white or Oriental-American students who came from well-to-do homes in which both parents were present. However, it was impossible to explain these differences as resulting simply from membership in one ethnic group rather than another. Indeed, when allowance was made for differences in the groups' socioeconomic backgrounds, a mere 1 percent of the difference in achievement could be explained in this way. And even without the allowance, only 24 percent could be. We were surprised to learn, because it had long been popular to believe otherwise, that the achievement of both white and Negro students was *less* affected by the presence or absence of key family members than that of other ethnic groups. Nearly as surprising, at least for economic determinists, was the role played by other aspects of a student's family background. For instance, taking a direct interest in a student's education, especially by reading to him and discussing his schoolwork, had more effect on his achievement than his family's socioeconomic status. This was true whether the adult who did these things was a parent or a parental substitute. In general, family background factors were nearly five times as important as school factors.

Thirdly, in *A Study of the Attitude Toward Life of Our Nation's Students* (Mayeske et al., 1973b) we concentrated on a set of variables that revealed the student's personal philosophy. We already knew that students who believed they could influence their own future tended to achieve more. The question was: What factors encouraged them to develop such a belief? We found that belonging to any ethnic group except the white tended to make students less likely—in the case of all but Oriental-Americans, far less likely—to believe in the chances of their own success. Counteracting this effect was the influence of those parents or parental substitutes who read to their children and talked to them about their schoolwork. However, we were unable to separate the effects of family background from those of the school, including the attitude toward life of the school's student body. This last-named factor was far more influential than any characteristic of the school's teachers; it even outweighed the impact on the student of his or her own school performance. We concluded that the minority group students' unfavorable estimate of their chances for success was essentially accurate. There were, however, various steps, from altering the schools' reward structure to instructing parents in how to motivate their children, that seemed likely to improve this situation.

Chapter 2

THE PRESENT STUDY

2.1. LIMITATIONS OF THE EARLIER STUDIES

Our earlier attempts at analysis had several major limitations. In particular, *A Study of the Achievement of Our Nation's Students* and *A Study of the Attitude Toward Life of Our Nation's Students* should be read with the following cautions in mind:

(1) *We concentrated on ninth-grade students.* The original data were cross-sectional, that is, they were collected from students of different grade levels at one point in time. If Coleman and his associates had had unlimited time and money, they would doubtless have chosen to keep on studying these same students as they progressed through their years of schooling. This, alas, was not possible. In our analyses, then, when we compared students at a higher grade with those at lower ones, we tried to avoid jumping to the conclusion that all or any of the differences between them necessarily showed some kind of trend over time.[1] Nevertheless, it is possible that we sometimes generalized too freely from the experience of one grade.

(2) *We used only four major geographic groupings.* For reasons of time and space, and in order to avoid complicating the analysis unbearably before we knew which findings would be worth detailed examination, we made geographic comparisons chiefly between four large groups of students: those in the nonmetropolitan North, the metropolitan North, the metropolitan South, and the nonmetropolitan South. As a result, there was still some reason to doubt our finding that certain attributes of students and their families varied hardly at all by region. Regional variations were of great interest to us because we had hypothesized that in regions where there was less caste-like segregation of people by ethnic group, personal attributes fostered by the family might play a greater role in a student's achievement.

(3) *We relied almost exclusively on a single analytic technique.* This technique, which is fully described in appendix A, was commonality analysis. Its chief advantage was that it enabled us to separate the effects of (or, more properly speaking, the variance associated with) two or more sets of variables into: (*a*) the proportion uniquely attributable to (or associated with) each set; (*b*) the proportion that two or more of the sets share in common. Its disadvantages, discussed by Alexander M. Mood in his foreword to the Attitude Study, were that it led to certain mathematical absurdities if applied mechanically. We felt that we had succeeded in avoiding such absurdities, but we were also well aware that the lack of accepted theoretical models in educational research made it unwise to rely on any one technique of statistical inference to the exclusion of all others.

[1] See appendix A for the techniques of inference that we used.

2.2. CONTRIBUTIONS OF THE PRESENT STUDY

We had reached the point, then, at which we had certain findings that we judged to be of particular interest. But would they hold up for students from a greater range of grade levels and regional backgrounds? What if we used new analytic techniques? And what of the areas, such as differences in motivation and achievement, that had been more or less neglected in our earlier reports? These were the questions that led us to undertake the present study.

It is hard to give a connected summary of a project devoted mainly to tying up the loose ends left by three earlier projects. It is also hard, at this stage, to say which findings were major and which minor, since we can fairly claim to have exhausted these data, and we cannot tell (though we can guess) what a new body of data might reveal. Accordingly, the findings we shall describe here are the ones that seemed important in relation to our earlier work. The reader will have to bear in mind that this work was originally undertaken to serve the educational policies and needs of the 1960s, and that as new needs appear, new policies will arise. In the rest of this section, the earlier findings are given first, then the ways (if there were any) in which the present study led us to revise them.

The earlier studies:—For students of all ethnic groups except Oriental-Americans, there was no appreciable relationship between achievement and having an intact family (i.e., a family from which neither parent was absent). In addition, most of the relationship that was observed could be accounted for by the family's socioeconomic status. In other words, since there was more family disruption among groups that were low on the socioeconomic scale, to take account of their low status was to take account of the relationship, such as it was, between achievement and family structure.

This study:—Since the institution of caste was more highly developed in some regions than in others, we wondered if there were any corresponding regional differences in the impact of family structure, particularly the father's presence or absence, on the student's level of achievement. We had found none in the earlier studies, and we found none in this one, even though we used a great many more regional groups (for which see section 2.3, below).

The earlier studies:—Reference has already been made to our hypothesis that, in regions where the institution of

caste was less highly developed, personal attributes fostered by the family might play a greater role in a student's achievement. From the entire range of personal attributes represented in the data, we picked out a set of variables that covered the attitudinal and motivational aspects of family life. These aspects could be summed up as the aspirations that both a student and his parents had for his schooling, the activities that they engaged in to support those aspirations, and the student's own outlook on life. We discovered that together they played a greater role in a student's achievement in the North than in the South, and that this was true regardless of the family's socioeconomic status. We therefore proposed the following general hypothesis:

> *Where social and economic stratification based upon race and ethnicity is pronounced, its effects upon achievement will be greater and more difficult to overcome than where it is less pronounced.*

This study:—We found that, when we used a greater number of regional groups, the results still clearly supported the hypothesis for two of the three grade levels studied. For the third, however, there were certain anomalies that made it somewhat less tenable.

The earlier studies:—The family background factors, as explained in chapter 1, played a much greater independent role in achievement than the school factors (both the student body's and the teaching staff's attributes).[2] However, the independent role of the school factors was greater in the South than in the North.

This study:—On the whole, the earlier results were confirmed. We found the same trend in each region that we examined, with the role for school factors greatest in the Southeast and Southwest.

The earlier studies:—Although the various ethnic groups differed widely in average level of achievement, the group averages tended to approach a common value as increasingly more factors relating to each group's social background were taken into account. This effect was observed in all the regions studied.

This study:—Precisely the same effect was observed in a much greater number of regional groups. But there was another, still more remarkable effect: the *distribution* of values for each ethnic group tended to approach a common distribution as the same background factors were taken into account. We therefore decided to find out if the same background factors seemed to affect each group's achievement to the same degree. We found that the only group not affected by each factor to about the same degree was the Oriental-Americans, and that even they were not a clearcut exception. We then examined the background factors in more detail. Groups that ranked low on one of these factors, it was evident, tended to rank low on all the others. As a result, any of a number of these factors could be used to explain the group differences in achievement. Among these factors were socioeconomic status (and everything it implies in the way of physical and mental well-being), belief in education and desire to improve their life chances through it, and type of school attended. The relative ordering of the groups on these variables, from highest to lowest, was about as follows: whites, Oriental-Americans, Indian Americans, Mexican-Americans, Negroes, and Puerto Ricans. Finally, we succeeded in isolating one group that seemed almost impervious to the influence of family background or school factors. This was the group whose achievement ranked about one and two-thirds to two full standard deviations below the average for all students. Below this point, the relationship between achievement and the aforementioned factors was but slight; above it, the relationship was linear. A relatively large proportion of this low-achieving group were members of nonwhite ethnic groups.

2.2.1. New Topics

We pursued a number of new topics that related to whether a student resided in a metropolitan or nonmetropolitan location. Our principal finding here was that residence in this sense was not a major explanatory factor in achievement or motivation. This is not to say that it made no difference at all. However, the differences that could be attributed to it were small when compared to the full range of differences among students in these respects.

We examined regional trends in connection with numerous other topics. But since the topics themselves were not new, the results will not be described here.

We also made a far more detailed examination than before of boy-girl differences in achievement and motivation. The only significant differences we could find were in study habits, for which girls consistently showed a higher value than boys, and educational plans, for which twelfth-grade boys showed a higher value than twelfth-grade girls.[3] These differences were slight, but they persisted even after allowance had been made for the full range of background factors.

2.3. DEFINITION AND DESCRIPTION OF VARIABLES USED

This section contains a detailed description of the variables and sets of variables used throughout the present study. The weights used in constructing the indices are discussed in the School Study (Mayeske et al., 1972a).[4] The indices and variables have been divided into those that deal with individual students, with the whole student body, with the school (except for the student body), and with selected aspects of these categories. In addition, the geographic areas used in the present study are briefly described.

[2] See section 2.3, below, for the variables used.

[3] For the meaning of these variables, see section 2.3.

[4] Most of the student indices were more adequately represented at the higher grade levels (6, 9, and 12) than at the lower ones (1 and 3). This is because at the lower levels fewer questions were asked about the student's family, and, for many of the questions asked, the teacher, not the student, had to provide the information. In many cases, the teacher was unable to do so. In consequence, data from the lower grade levels were seldom used in this study.

INDIVIDUAL STUDENT INDICES AND VARIABLES

Socio-Economic Status (SES).—A student with a high score on this index has parents who come from the upper educational strata. His father is engaged in a professional, managerial, sales, or technical job, and there are two to three children in the family. They are more likely to reside in the residential area of the city or the suburbs rather than in the inner city, and their home is likely to have from 6 to 10 rooms. Intellectually stimulating materials such as books, magazines, newspapers, and television and radio programs are available in such a home.

Family Structure and Stability (FSS).—A student with a high value on this index has both parents in the home, his father's earnings are the major source of income, his mother works part time or not at all, and his family has not moved around much.

Racial-Ethnic Group Membership (RETH).—A student with a high value on this variable is white, a student with an intermediate value is Oriental-American, and a student with a low value is Puerto Rican, Mexican-American, Indian American, or Negro. In a society that discriminates on the basis of skin color, one's membership in a particular racial or ethnic group is a social category with many behavioral implications. Accordingly, an individual's value on this variable represents his membership not only in a physical category but in a social category as well.

Expectations for Excellence (EXPTN).—A student with a high value on this index says that his mother, father, and teachers want him to be one of the best students in his class, and that he also desires to be one of the best in his class.

Attitude Toward Life (ATTUD).—A student with a high value on this index feels that people who accept their condition in life are not necessarily happier; that hard work is more important for success than good luck; that when he tries to get ahead he doesn't encounter many obstacles; that with a good education he won't have difficulty getting a job; that he would not be sacrificing his personal identity or integrity to get ahead nor does he want to change himself; that he does not have difficulty learning nor does he feel that he would do better if his teachers went slower; and that people like him have a chance to be successful.

Educational Plans and Desires (EDPLN).—A student with a high value on this index says that his parents want him to go to college; that he himself both desires and plans to go to college and aspires to one of the higher occupational levels; and that he feels he is one of the brighter students in his class.

Study Habits (HBTS).—A student with a high value on this index has frequent (weekly or more) discussions with his parents about his schoolwork and was read to regularly as a child. He spends 1 to 3 hours a day studying and 1 to 3 hours a day watching TV, would make most any sacrifice to stay in school, and has seldom stayed away from school just because he wanted to.

Achievement (ACHV).—A student with a high value on this index or composite tended to score high on all of the tests that entered into that composite. For all grade levels the tests of verbal and nonverbal ability were used as part of the composite. In addition, at grades 6, 9, and 12, tests of reading comprehension and mathematics achievement were used, and at grades 9 and 12 a test of general information was included in the composite. This inclusion of more tests at the higher grade levels represents the nature of the educational process, in which basic skills are required in the early years and other skills and knowledge through the use of these basic skills. As shown in the School Study, these tests at each grade level were sufficiently highly correlated to be included in a single composite.

STUDENT BODY VARIABLES

When the values of a variable are averaged for each of the students in a particular grade level of a school, this results in what we have called a student body variable. Schools with a high mean or average on a student body variable tend to have a larger proportion of students with a high value on that attribute, while schools with a low mean or average tend to have a larger proportion of students with a correspondingly low value. The student body variables used in this study are:

Socio-Economic Status
Family Structure and Stability
Ethnic Group Membership
Expectations for Excellence
Attitude Toward Life
Educational Plans and Desires
Study Habits
Achievement

SCHOOL VARIABLES

In this study, to represent attributes of the schools *other* than student body variables, we used the following five indices and variables. A description of the meaning of each index and the variables that comprise it will be found in the School Study (Mayeske et al., 1972a). It should be noted that we did not have the same problems with the school variables at the lower grade levels as we had with the individual student variables.

Teaching Conditions.—A school with a high value on this index has many teachers who say that the students in their school try hard and are of high academic ability. The teachers also see the school as having few problems of any kind and as enjoying a good reputation with other teachers not employed by the school. They also report that they are currently teaching high-ability students, that they would not prefer to work in some other school, and that they would reenter teaching as a profession if they were to start all over again.

Preference for Student-Ability Level.—A school with a high value on this index has many teachers who say that they prefer to teach in an academic school that has a strong emphasis on college preparation and a student body con-

sisting of high-ability children of white collar and professional workers.

Training and Salary.—A school with a high value on this index has many high-salaried teachers with advanced degrees who have certification and tenure.

Verbal Skills.—A school with a high value on this variable has many teachers who attained a high score on our test of verbal skills.

Racial-Ethnic Composition.—A school with a high value on this variable has many teachers who say they are white, while a school with a low value has many teachers who claim membership in a minority group. The last two variables are included because we considered them closely related to interschool differences in the outcomes of schooling. For instance, they were shown to be related to the achievement and motivational levels of the student body before and after the school's social composition was taken into account (Mayeske et al., 1972a).

OTHER SETS OF VARIABLES

Throughout the chapters that follow, several other sets of variables are used recurrently. The variables that comprise each of these sets are described and analyzed in this section, and a rationale is given for including them in their respective sets.

Home Background (HB).—This label is applied to the set of variables that represent the human and material resources in the immediate home environment. When each of the ethnic and sex groups is kept analytically separate, Home Background consists of the student's Socio-Economic Status, on the one hand, and Family Structure and Stability, on the other. When these different groups are kept together, the variable called Racial-Ethnic Group Membership (RETH) is often introduced into the analyses under the same general label.

Family Background (FB).—This set is comprised of the Home Background and the Family's Process sets.[5] Thus Family Background covers virtually all aspects of the individual student's background. When analyses are run for each ethnic group, Home Background consists only of Socio-Economic Status and Family Structure and Stability, whereas when the ethnic groups are combined, Ethnic Group Membership is on occasion included as an aspect of Home Background. The relationships among these sets of variables are given in schematic form in figure 1.1.

There are in addition, two sets of variables at the school level.

School (SCH(10)).—This set consists of the 10 school variables. It is comprised of the following two subsets:

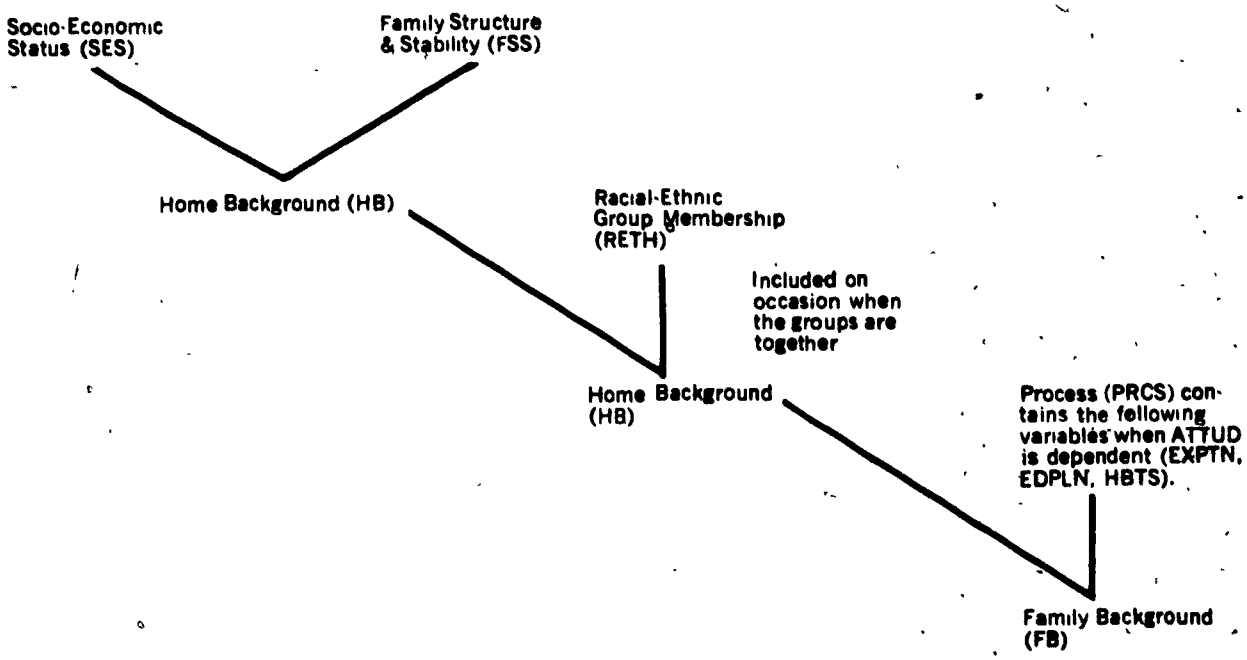
(a) *School Outcome (SO(5)).*[6]—This set consists of the five student body variables of Expectations for Excellence, Attitude Toward Life, Educational Plans and Desires, Study Habits, and Achievement.

(b) *Teaching Staff Attributes (T(5)).*—This set consists of the five teaching staff attributes of Teaching Conditions, Preference for Student-Ability Level, Training and Salary, Ethnic Composition, and Verbal Skills.

[5] Family Process was the name we gave to a set of variables, including Expectations for Excellence, Educational Plans and Desires, Attitude Toward Life, and Study Habits, that pertained to the attitudes and behavior of the student and his family.

[6] This set is called School Outcomes because it represents, in part, the aggregate effects of schooling. By virtue of its high correlation with the social composition of the student body, it is also a measure of the effects of residential and school segregation, schools being organized along residential lines.

FIGURE 1.1.—A Schematic Diagram of the Variables Included in the Different Sets



Geographic Groupings.—In a number of chapters analyses are conducted for different geographic groups. The seven regional groupings used and the States that comprise them are:

Region	State Composition
New England	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
Mid-Atlantic	Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania
Great Lakes	Indiana, Michigan, Ohio, Illinois, Wisconsin
Plains	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
Far West & Rocky Mountain	Alaska, California, Colorado, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming
Southwest	Arizona, New Mexico, Oklahoma, Texas
Southeast	Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia

For some analyses, belonging to one of these seven regions was coded as a quantitative variable. The lowest values were assigned to the Southeast and Southwest, intermediate ones to the Far West, and the highest ones to the remaining States (the last-named grouping was called North). This three-valued quantitative variable was called Regional Location. Another quantitative variable was developed to incorporate rural-urban differences. The highest values were assigned to large cities and their suburbs, intermediate ones to small cities and towns, and the lowest ones to rural areas. This variable was called Rural-Urban Location. When Regional Location and Rural-Urban Location were taken together they were called either Area of Residence or Residential Locale.

2.4. RECOMMENDATIONS

But what are the implications of this study? What can it tell us about what might be done to make the results of schooling more consonant with what we would all like them to be? In our earlier work we outlined a number of specific recommendations that grew directly out of the findings. We decided not to enlarge on these recommendations here. Rather, we have focused on three persistent themes, derived from our analytic work, that are not new but that we feel are worthy of sustained attention. We have called them *purposeful attainment, relevance,* and *disciplined diversity.* By stressing purposeful attainment we mean to imply that we view education as being a process of setting goals and specifying objectives. From such objectives, we feel, should flow a set of minimal standards that virtually *all* students could attain. This we would view as a fundamental change in the nature of instructional systems as we have known them historically. By relevance we mean that the content of education should not just reflect occupational entry requirements, but should relate more closely to the probable range of life circumstances and adjustments that the student will face. Last, by disciplined diversity we mean that schools need to break out of their traditional mold and try to attain their common goals and objectives in a number of different ways. At the same time, they should adopt accounting methods and systems that will allow them to more adequately assess the results of their efforts.

2.5. SUMMARY

In the present study we used the same body of data as in our earlier studies but subjected it to more detailed analysis and, on occasion, more powerful analytic techniques. We explored some of our earlier hypotheses in greater depth, and also examined a number of new topics. Most of our earlier findings were supported by these more refined analyses. However, we did find that the role of geographic locale was even less important in explaining student achievement and motivation than our earlier work had led us to believe. The same was true of sex: it made little difference whether the student was a boy or a girl. As in our earlier work, so too here did we find that differences in achievement between whites and nonwhites could be explained almost completely by differences in their social background conditions. We did find, however, that there was a "breaking point" in the relationship of achievement with social background conditions. In other words, below a given level of achievement there was very little relationship, whereas above that level achievement increased as the social background conditions became what one might interpret as increasingly favorable. As an outgrowth of this and our earlier work, we concluded that basic reforms were needed in the conduct and content of the instructional process. Also needed was increased willingness to try new approaches and attempts to learn from them.

PART 2: INTERPRETING GROUP VARIATIONS IN ACHIEVEMENT

Chapter 3

DO THE SAME THINGS AFFECT DIFFERENT GROUPS DIFFERENTLY?

There is no doubt that ethnic groups differ in educational achievement: the question is why. It should be obvious enough that the achievement level of one group does not necessarily result from the same causal processes as the achievement level of another. Even if the processes at work are likely, within the bounds of the same national culture, to be similar for all groups, they are just as likely not to be identical. And yet two major studies in recent years have made inferences about one group that were based upon either: (*a*) observations drawn from another, ethnically different group; or (*b*) differences among these and other groups. Thus Jensen (1969) sought to explain Negro American achievement levels by means of evidence drawn largely from studies of western Europeans and white Americans. He also attributed some of the differences between Negro Americans and these other groups to causal processes observed only in the latter. Moynihan approached the same problem in terms of aggregate differences between Negro and white Americans, a procedure that left him vulnerable to charges that, as far as Negroes were concerned, he equated difference with deviance (Rainwater and Yancey, 1967).

However, Moynihan later pointed out that although Negro families were less likely than white to be headed by a male, the relationship between Negro family structure and achievement level did not appear to be high (Moynihan, 1968). This observation was later confirmed by the present author and his colleagues: we noted that the role played by the quality of the relationship between child and parent or parental substitute nearly always exceeded that played by family structure as such (Mayeske et al., 1973a). This tended to be so for each separate ethnic group as well as for all groups combined. What we did not yet know was how similar the groups were in this respect.[1] We were especially uncertain about the impact of school factors on each group, particularly as compared with family background factors.

The body of data at our disposal was originally gathered by investigators deeply concerned about sociocultural factors in educational achievement. For this reason, it is easy to forget, when reviewing these data, that the difference between the highest and lowest achievement scores in any individual ethnic group is always greater than the difference between that group's average achievement score and the average scores of the other groups, taken singly or collectively. Our data, then, are not ideally suited to the analysis of within-group relationships. Nevertheless, they provide an opportunity to explore two related areas: (*a*) within-group relationships in one group that also hold good for other groups; (*b*) among-group relationships that also hold good for one group.

3.1. MEASURES OF SIMILARITY AND DIFFERENCE

Did these groups differ more in the way their achievement level was related to their family background or more in the way it was related to their schools? Were there, perhaps, no significant differences between them in either or both respects? These were the questions uppermost in our minds when we began the analysis described below. But we were also uncomfortably aware that the answers we obtained to these questions would depend very much on the way we asked them. We needed, then, to examine the statistical techniques we proposed to use, and decide how we would interpret the mathematical relationships they embodied. In studying processes about which so little is known, it is more than ever necessary to guard against the facility with which properties of a statistical measure may be taken for properties of the data.

It is also necessary to be quite conscious of what one thinks is going on, and not confuse it with any of the other things that may actually be going on. We started with the basic observation that an analysis in which the achievement variable (ACHV) was regressed on a variety of family background and school factors yielded a set of least-squares weights that maximized the relationship between it and the independent or regressor variables. For a given group, then, these weights reflected the relative emphasis given to those variables in estimating that group's achievement. This led us to our first question:

1. How similar would a group's regression analysis remain if some other group's least-squares equation were used?[2]

In order to answer this question, we made two separate estimates of ACHV and then correlated them. The first estimate, obtained from each group by means of its own least-squares equation, was designated A'_B, and the second obtained by means of some other group's equation, A'_O. We then gauged the similarity of these estimates by in-

[1] The usual procedure in such cases is to carry out a covariance analysis, using the *F* statistic to determine whether the null hypothesis should be accepted (Beaton, 1964; Wilson and Carry, 1969). But since we were dealing with very large samples, all comparisons made in this way would have led to rejection of the hypothesis.

[2] Assuming, of course, that the equation was different, that is, appeared to distribute the regressor variables' influence differently.

specting the magnitude of their correlation, $r_{A'_B A'_O}$: the higher the value, the more similar. Similarity analyses of this type were performed for several different kinds of equations (see sections 3.2 and 3.3.).

Our second question was:

2. How much of the variance in a group's ACHV would be lost if some other group's least-squares equation were used in lieu of the group's own?

We answered this question by comparing the difference between the following two correlational values:

RSQ(A'o).—This value was obtained by: (*a*) making an estimate of a group's ACHV by means of an equation other than the group's own; (*b*) correlating this estimate with the group's ACHV score; (*c*) squaring the result.

RSQ(A'B).—This value was obtained by: (*a*) making an estimate of a group's ACHV by means of its own least-squares equation; (*b*) correlating this estimate with the group's actual ACHV score; (*c*) squaring the result.[3]

Our measure of loss in explained variance was then obtained by forming the following measure of difference:

$$\Delta = RSQ(A'_B) - RSQ(A'_O)$$

This was our first kind of difference analysis. It was, as will be seen below, conducted for a variety of equations.

Our third major question was:

3. How are the factors that enter into ACHV related to the differences measured by Δ?

We answered this question by: (*a*) using partial correlation techniques to partial out the variance in ACHV associated with the other group's equation; (*b*) regressing the residual ACHV so obtained on family background and school factors. The chief advantage of this analysis was that it gave us an indication of the nature of the differences between two groups. The Δ analysis, on the other hand, indicated only the magnitude of these differences.

3.1.1. Factorial Analysis of the Structural Properties

Before proceeding further with our analysis, we had to recognize that the structural properties of the covariances among the variables used to estimate ACHV would play a large role in the results.[4] We therefore began by using factor analytic techniques to inspect these properties. These techniques have been exhaustively described by Horst (1965).

We performed comparative factorial analyses for each of seven ethnic groups and for two sets of variables. The groups were: Indian American; Mexican-American; Puerto Rican; Negro; Oriental-American; white; and all groups combined. The 2 sets of variables were a set of 6 family background (FB) variables and a set of 10 school (SCH) variables, plus 2 variables pertaining to one's region of residence. The first analysis focused on the FB variables, while the second focused on the FB, SCH, and residential variables combined. Since correlations were more readily interpretable than covariances, we decided to factor-analyze the correlation matrices. Similarly, since rotated factors were more readily interpretable than unrotated ones, we decided to use varimax rotation.[5] We limited our analysis to ninth-grade students since the measurements were most accurate at that grade level, that is, errors in estimating ethnic group membership were fewer and the indices were more comprehensively measured. At the same time, the dropout problem was not as severe as at the higher grade levels.[6]

For each group, two principal components were extracted. The percentage of variance each accounted for was: Mexican-American, 60; white, 61; Indian and Negro, 62; Puerto Rican and all groups combined, 63; and Oriental-American, 66. The rotated factors will be found juxtaposed in table 3.1 according to the similarity of their coefficients. It will be seen from the coefficients for "factor one" in this table that Socio-Economic Status (SES) and Family Structure and Stability (FSS), for almost every group, tended to have higher coefficients than did the other variables (the exceptions were for Oriental-American FSS and white SES). In fact, there was enough consistency from group to group to suggest that a similar (but not identical) phenomenon was at work in each. This phenomenon appeared to be, in essence, that SES and FSS were highly related. Moreover, the attitudinal and motivational variables—that is, the other sets of row variables in table 3.1—tended to have a low-to-moderate relationship with both of them. Since SES and FSS were, in general, more closely related to each other than to anything else, and since they represented more the structural than the behavioral aspects of the family, we decided to treat them here as one variable. The name we gave this composite variable was the same as the one used in the School Study, namely, Home Background (Mayeske et al., 1972a, p. 16).

As for "factor two," the attitudinal and motivational variables tended to have high values while SES and FSS had low ones. The major exception was the Oriental-American group, whose FSS showed quite a high value on the second factor. There was enough consistency in the variables that were high and low on this factor for us to conclude that the correlations it chiefly represented were those of the four attitudinal and motivational variables with each other. Since these four variables, in large measure, reflected different kinds of parent-child involvement, we collectively labeled them Family Process—as, indeed, we had done in the Achievement Study (1973a, p. 15).

[3] Since these are the group's own least-squares weights, the *RSQ* is the maximum correlation that can be obtained.

[4] Inspection of the formula for the correlation of two weighted sums shows that, when the rank of the matrix of independent variables is one (i.e., when there is only one principal component), two orthogonal equations can yield highly correlated estimates. But as the rank approaches the order of the matrix (i.e., the number of variables), decidedly different estimates can be obtained (Horst, 1966, p. 133). A more general formulation of the same phenomenon has been provided by Gulliksen (1950).

[5] All components having a root of one or more plus the next smaller component were subjected to varimax rotations. These routines were taken from Horst (1965). Unit diagonals were used.

[6] The numbers of students and schools used in the analyses in this chapter are given in appendix A.

Table 3.1.—Comparative Factorial Analyses of Family Background Measures for Students at the Ninth Grade

Variable	I	M	P	N	O	W	T
	Factor One: Home Background						
Socio-Economic Status (SES)	97	90	93	97	98	76	85
Family Structure and Stability (FSS)	98	99	99	99	41	99	99
Expectations for Excellence (EXPTN)	40	27	37	21	26	18	17
Educational Plans and Desires (EDPLN)	54	47	45	46	50	32	34
Study Habits (HBTS)	34	48	49	32	41	41	41
Attitude Toward Life (ATTUD)	−03	00	−01	−01	−02	−01	14
	Factor Two: Family Process						
Socio-Economic Status (SES)	23	43	37	24	19	66	53
Family Structure and Stability (FSS)	21	10	13	17	91	06	11
Expectations for Excellence (EXPTN)	92	96	93	98	97	98	99
Educational Plans and Desires (EDPLN)	84	88	89	89	87	95	94
Study Habits (HBTS)	95	88	87	95	91	91	91
Attitude Toward Life (ATTUD)	99	99	99	99	99	99	99

NOTE.—I = Indian, M = Mexican-American, P = Puerto Rican, N = Negro, O = Oriental-American, W = White, T = Total. All digits have been rounded to two places of decimals and leading decimal points omitted. The numbers of students from each group included in these analyses are: I, 2,877; M, 5,836; P, 3,702; N, 37,265; O, 1,675; W, 76,753; T, 128,108.

For the six FB variables, then, we found that although the structure of the intercorrelations was by no means identical for all groups, they were at least highly similar. It followed that similar kinds of structural interrelationship tended to obtain for each group no less than for all groups combined.

This structure changed somewhat when the residential and school variables were brought into the analysis. But it changed in a fairly predictable manner. The reason was that the data analysis model, in enabling us to incorporate variables from different levels of analysis in the same analytic framework, had also produced higher correlations between some variables at the same level than between variables at different levels. Measures obtained from the same or similar instruments normally tend to be highly correlated with one another, and to form a factor when entered into a factor analysis together. In other contexts (e.g., a test of metabolic rates), factors created in this way have been called "instrument factors" (Cattell, 1957). Here, on the other hand they are more likely to reflect different levels of analysis than different "instrumentalities." Because such factors do emerge when school and residential factors are brought into the analysis, we shall merely summarize their nature; to describe the many coefficients for each group would be to describe the same relationships over and over again.

We used two residential variables. One pertained to rural-suburban-urban location, and was scaled so that the higher the value, the more urban. The other pertained to region of residence, and was scaled high for the Northern states, intermediate for the Far Western states, and low for the Southern States.[7] In addition, we used five student body and five teacher variables; our earlier analyses had showed them to be related to individual student achievement and motivation. The five student body variables were the means, for each school's students, of: Expectations for Excellence; Attitude Toward Life; Educational Plans and Desires; Study Habits; and Achievement. The five teacher variables, also averaged by school, pertained to the teaching staff's: verbal skill mix; ethnic composition; training and salary levels; preference for working with students of different ability levels; and view of their teaching conditions. We were interested in two questions here, both of them subject to our previous criterion for the number of factors to be extracted and rotated.[8]

1. How many factors would be retained, and what percentage of the total variance did they account for?
2. What was their nature (or composition) after being rotated?

Table 3.2 answers the first of these questions for the 6 family background (FB) variables, both alone and in combination with the 12 residential and school (FAS) variables. The two sets of percentages in table 3.2 are not directly comparable, because one is based on more variables than the other. But comparison of the "number" columns provides valid indication of the dependence of FAS on FB. For example, if FAS were completely dependent on FB, then the number of factors for each group would not change appreciably from one set of analyses to the other. If the number increases, the extent of the increase is an indicator of the additional variance brought in by FAS.

[7] See chapter 2 for the States included in each group.

[8] Viz, one more than the number of factors that have a root of one or greater. Answers to the second question depended in part on the number of factors extracted, for the number and composition of factors were not independent.

Table 3.2.—Number of Factors, and Their Percentage of Variance, for Family Background, Residential, and School Factors

Group	FB[a] Number	FB[a] Percent	FAS[b] Number	FAS[b] Percent
Indian	2	62	7	76
Mexican	2	60	6	71
Puerto Rican	2	63	4	65
Negro	2	62	6	73
Oriental	2	66	6	71
White	2	61	7	69
Total	2	63	6	69

[a] Family Background. [b] Family Background, Area of Residence, and School.

It will be seen that there are some four to five factors more in the FAS analysis for each group except Puerto Ricans —an effect probably due to the fact that most of them live in the same area and therefore go to school mainly with each other. It will also be seen that although the factors from the FAS analysis account for a greater percentage of the variance, the percentage *per factor* is greater for the FB analysis. For example, the percentage per factor for all groups combined ("Total") is 31 for FB and 12 for FAS. This indicates a greater degree of dependence among the 6 FB measures than among the 12 FAS factors.

What kinds of factors did we obtain from the FAS analysis? The first one that could be readily identified for all groups comprised the six FB variables. We therefore called it Family Background. Two others were soon added: School Outcomes (the five variables relating to student body achievement and motivation), and Teaching Staff (usually, four of the five teaching staff variables).[9] Teaching Conditions, the fifth teacher variable, tended to be most highly related to School Outcomes.

The analysis showed clearly that each ethnic group was subject to a different pattern of influence. For some, the various residential variables tended to form a single factor, while for others each of these variable was a separate factor. Seldom was there much of a relationship between Residential Location and any of the other variables. The one exception was in the area of the teaching staff's level of training, and then the only groups affected (besides all groups combined) were whites and Puerto Ricans.

The remaining factors tended to be specific to the different groups. Thus for all groups combined, two specific factors emerged: (*a*) the individual student's SES and FSS, the student body's ACHV, and the teaching staff's view of their teaching conditions; (*b*) the rural-suburban-urban location of the school, the student body's educational plans, the teaching staff's ethnic composition, and their preference for working with students of different ability levels. For the individual groups, the specific factors tended for the most part to be either admixtures of the aforementioned variables or small variance factors of little interest.

In sum, our factorial analysis showed that:

1. With regard to the factorial composition of the six (individual) family background measures, the ethnic groups are highly similar but by no means identical.
2. There is a discernible degree of similarity among the groups with regard to some (but by no means all) the factors that emerge when the residential and school factors are brought into the analysis with the family background measures.

These results led us to expect that the ethnic groups would be found to differ most in the areas represented by the residential and school variables. However, we could not tell from the results of the factor analysis whether or not the group similarities would more than outweigh the group differences. For an answer to this question, we turned to a different type of analysis.

[9] For whites, the teaching staff's ethnic composition also tended to have an appreciable relationship with School Outcomes.

3.2. SIMILARITY ANALYSIS OF ETHNIC GROUP ACHIEVEMENT SCORES

In section 3.1, we described a type of similarity analysis in which an estimate of a group characteristic (in this case, its achievement) was obtained by means of the group's own least-squares equation, and then compared with an estimate obtained from the same group by means of another group's least-squares equation. To undertake this analysis, the following sets of variables and weights were used for the following groups.

SETS OF VARIABLES

Home Background (HB).—This variable consisted of the following family characteristics of the student: (*a*) Socio-Economic Status (SES); (*b*) Family Structure and Stability (FSS). It was called Home Background because it helped to locate the student's position in society from a structural point of view.

Family Process (PRCS).—This variable consisted of the following characteristics of the student's relationship with his family: (*a*) Expectations for Excellence (EXPTN); (*b*) Attitude Toward Life (ATTUD) (*c*) Educational Plans and Desires (EDPLN); (*d*) Study Habits (HBTS). It was called Family Process because it refers to the aspirations that the student and his parents have for his schooling, the activities that they engage in to support these activities, and the student's beliefs about his ability to improve his lot in life through the avenue of education.

Family Background (FB).—This variable consisted of Home Background and Family Process taken together.

Area of Residence and School (AS).—This variable consisted of 10 school factors and 2 residential factors. Of the school factors, five pertained to the student body's achievement and motivational mix and five to the teaching staff's training and salary levels, view of their teaching conditions, preference for working with students of different ability levels, ethnic composition, and verbal skills. The two residential factors pertained to whether the student lived in: (*a*) a rural, suburban, or urban area; (*b*) the North, Far West, or South. Details on both the school and the residential factors will be found in chapter 2.

Family Background, Area of Residence, and School (FAS).—This set of variables consisted of Family Background combined with Area of Residence and School.

SETS OF WEIGHTS

The weights employed in these analyses were the least-squares weights obtained by regressing Achievement (ACHV) against that particular set of variables for a given group. For example: when the HB set was used, the weights were those obtained from a two-variable regression analysis; when the FB set was used, the weights were those obtained from a six-variable regression analysis—and so on. Similarly, the weights for a given ethnic group,

such as whites, were applied to each of the other groups in turn. This procedure can be outlined in matrix form, as shown below. Here, the rows indicate the groups from which we have obtained weights (hence "FROM"), and the columns indicate the groups to which we are applying them (hence "TO"). Our purpose in each case was of course to compare (or correlate) the estimates obtained.

		To						
		I	M	P	N	O	W	T
From	Indian (I)	1	r_{I},M	r_{I},P	r_{I},N	r_{I},O	r_{I},W	r_{I},T
	Mexican (M)	r_{M},I	1	r_{M},P	r_{M},N	r_{M},O	r_{M},W	r_{M},T
	Puerto Rican (P)	r_{P},I	r_{P},M	1	r_{P},N	r_{P},O	r_{P},W	r_{P},T
	Negro (N)	r_{N},I	r_{N},M	r_{N},P	1	r_{N},O	r_{N},W	r_{N},T
	Oriental (O)	r_{O},I	r_{O},M	r_{O},P	r_{O},N	1	r_{O},W	r_{O},T
	White (W)	r_{W},I	r_{W},M	r_{W},P	r_{W},N	r_{W},O	1	r_{W},T
	Total (T)	r_{T},I	r_{T},M	r_{T},P	r_{T},N	r_{T},O	r_{T},W	1

In this matrix, the main diagonal elements are unity since they represent correlations of an estimate with itself. The correlations about this diagonal are not, however, symmetric, since the correlations for any two pairs of weights are based on a different covariance matrix. For example, the correlation for the weight pairs, r_{I}, M is obtained by applying the weights for Indians and Mexican-Americans to the Mexican-Americans' covariance matrix. But for r_{M}, I, the same weight pairs are applied to the Indian's covariance matrix.

Table 3.3 presents, for each group and set of variables, a summary of the frequency with which correlational values of different magnitudes were observed when all the other groups' weights were applied in turn to that group.[10] Under each set of column variables will be found first the highest correlational value (HI), then the median (MDN), then the lowest. Thus for Indians' Home Background, the highest correlational value that we observed was 99. The median, too, was 99—a very high concentration of values at the upper tail of the distribution—while the lowest was 86. Since the difference between the median and the lowest values was only 13 points, we would be inclined to conclude that the degree of similarity between A'_{B} and the other estimates was rather high. In other words, when the other groups' weights were used to estimate Achievement for Indians on the basis of their Home Background, the results were remarkably similar to those obtained with the use of their own weights.

For the other groups' Home Background, it will be noted that the highest observed values are all the same while the median values, except for Oriental-Americans, are practically the same. The lowest values, on the other hand, are for Negroes. The same type of distribution—concentration of values at the upper tail—was found for Family Process. But the tails of the distribution, as can be seen from the higher values in the "LO" column, did not stretch out as far. Consequently, we incline to the view that the groups are more similar with regard to estimates obtained from the Family Process set of variables than from the Home Background set.

The values for Family Background were also high, with only minor differences from the values for Home Background and Family Process. For Area of Residence and School, however, a new kind of distribution was observed. Both high and median values still tended to remain high, but the way in which the low values tailed off indicated that the weights for some groups were yielding estimates decidedly different from those obtained by means of each group's own weights. Finally, when Family Background was combined with Area of Residence and School, the correlational values tended to more nearly resemble those of the first three sets, though their absolute values were somewhat lower. As before, Oriental-Americans had lower if not the lowest values.

In summary, then, we are inclined to conclude that the estimates of greatest similarity were obtained for Family Process, with Home Background second, Family Background third, and the composite set of Family Background, Area of Residence, and School fourth. The estimates obtained from the Area of Residence and School set were the least similar of all. However, the *range* of values for this last-named set showed that for some group weights, the estimates obtained were highly similar. The one group for whom the other groups' equations tended to yield estimates markedly different from their own was the Oriental-American one, particularly for Area of Residence and School.

[10] These summaries include the observed values for grades 6, 9, and 12 but no distinction is made among them here.

Table 3.3.—Summary of Correlates of Achievement Estimated With Each Group's Own Equation and With the Equations of Other Groups

Group to Which Weights Applied	Sets of Variables to Which Weights Applied														
	Home Background			Family Process			Family Background			Area and School			Family Background, Area and School		
	Hi	Mdn	Lo	Hi	Mdn	Lo	Hi	Mdn	Lo	Hi	Mdn	Lo	Hi	Mdn	Lo
Indian	99	99	86	99	99	93	99	97	88	96	91	30	98	94	78
Mexican	99	98	92	99	99	95	99	97	92	98	94	61	98	96	90
Puerto Rican	99	98	84	99	98	92	99	95	87	97	93	49	98	95	81
Negro	99	97	78	99	98	94	98	96	89	97	92	42	97	95	80
Oriental	99	94	81	99	99	96	99	96	88	89	54	32	97	91	72
White	99	99	87	99	99	93	99	98	92	99	88	32	99	97	90
Total	99	99	91	99	99	94	99	98	93	99	94	35	99	98	91

NOTE.—HI = highest value, MDN = median, and LO = lowest value. Leading decimal points have been omitted. "Total" refers to total students, not column totals.

3.3. THE MAGNITUDE OF ETHNIC GROUP DIFFERENCES

In this section we introduce two additional groups and three additional sets of weights. Let us first deal with the groups.

In addition to the seven groups described in the previous section, we decided to include in our analysis two groups that we called Within (WN) and Among (A). The WN group was obtained by subtracting from each student's achievement score the mean score for his ethnic group, and then computing correlations and regressions with this residual score as the dependent variable. We expected these analyses to show how achievement (ACHV) was related to those family background and school factors that were independent of differences in ACHV that were correlated with ethnic group membership. As for the among-groups analysis (A), it consisted in taking, for each individual student, the mean ACHV score of his or her ethnic group, and then regressing it against the corresponding mean ACHV scores on the regressor variables. The composition of the dependent variable in this operation is described more fully below.

The three sets of weights we introduced at this point were ones from a within-groups analysis (*WN*), ones from an among-groups analysis (*A*), and a set of unit weights (*U*). We expected this last set of weights to give us an indication of what would happen when each variable was weighted equally.[11]

3.3.1. Reducing the Volume of Differences

Obviously, to compute and interpret deltas for every set of variables would have been more trouble than it was worth. We therefore made the following adaptation of the procedure already described in section 3.1. To reduce the sheer volume of these differences, we formed them for only two sets of variables: (*a*) the 6 family background variable (FB); (*b*) the 18 family background, area of residence and school variables (FAS). In this way we obtained the following measures of difference:

$$\Delta_{FB}=RSQ(FB)_B-RSQ(FB)_O$$

$$\Delta_{FAS}=RSQ(FB)_B-RSQ(FAS)_O$$

where the subscript *B*'s represent each group's own weights and the subscript *O*'s other group's. For example, for the FB factors for whites, there was one of these deltas for this ethnic group's weights when paired with each of the following other sets of weights: *I*, *M*, *P*, *N*, *O*, *T*, *WN*, *A*, *U*—a total of nine in all. Across 3 grade levels, then, there were 27 such values—and so on, for each of the other groups. This volume was doubled since we had results for both FB and FAS. Accordingly, in order to reduce the volume further, we averaged these deltas across grade levels to produce a kind of grade-level composite. In table 3.4 the deltas so obtained are portrayed on a scale running from zero, for maximum similarity, to some of the largest composite values observed (we chose this type of scale because we had no measure of maximum difference). Bracketed letters in the table represent values that tied with each other on our scale.

3.3.2. Analysis Among and Within Groups

Table 3.4 shows that, for each group, the largest dissimilarity value was observed for the *A* set of weights, that is, the set obtained from the among-groups analysis. This was so for both the FB and FAS variables. In fact, the values observed for the *A* set usually exceeded by a substantial amount the end-of-scale value of 12.[12] Obviously, then, the among-group weights gave a very different emphasis to these variables than did most of the other sets of weights. The reasons for this are discussed below. In addition, it is clear from table 3.4 that the scaled delta values are usually larger and more dispersed for FAS than for FB. The only exception, also discussed below, is for the group called among.

Let us now review the results in table 3.4 for each group in turn. For the first group, Indians, we can note that the estimates obtained by means of the group's own FB weights were most similar to those obtained by means of the Total (*T*) and Within (*W*) weights. They were least similar, by a substantial amount, to those obtained using the Unit (*U*) and Among (*A*) weights. For FAS, this similarity was greatest for the *T* weights and least for the sets of weights for Oriental-Americans (*O*), *U*, and *A*. If we were to single out from these many sets of weights the one ethnic group for whom these estimates were most similar to those obtained by means of the Indians' own weights, it would be whites. The one ethnic group to which the Indians, by these criteria, were most dissimilar was Oriental-Americans.

For Mexican-Americans, the estimates obtained with their own *FB* weights were most similar to those obtained with the Puerto Rican (*P*) weights and least similar to those obtained with the *U* and *A* weights. For the FAS variables, the Mexican-American group's estimates were most similar for the *T* weights and least similar for the *U* and *A* weights. There was no one ethnic group that was either most or least similar to Mexican-Americans for both sets of variables. For the *FB* set, they were most similar to Puerto Ricans and least similar to Negroes, whereas for the *FAS* set they were most similar to Indians and least similar to Oriental-Americans.

For Puerto Ricans, on the other hand, the *FB* estimates were most similar to those obtained from the weights for Mexican-Americans and least similar to those obtained from the *U* and *A* weights—and the same was true of the *FAS* estimates. Hence Puerto Ricans were most similar to Mexican-Americans (and only to them) on both counts. In contrast, they were most dissimilar to Negroes for the *FB* estimates and to Orientals for the *FAS* estimates.

Negroes showed most similarity for the *T* and *WN* weights and most difference for the *U* and *A* weights, for both FB and FAS. This was not surprising, since they were the second most numerous group in the sample

[11] Actually, since we were working with covariance matrices, application of the unit weights resulted in each variable being weighted according to its variance.

[12] There is no scale point for the A group, since the *A* weights represent that group's own least-squares equation.

Table 3.4.—Ordering of Groups According to Their Average Degree of Similarity With the Comparison Group

Group to Which Weights Applied	Variable Set	Groups From Which Weights Were Applied
Indian (I)	FB	[T,W_N]W[M,N] P O U A
	FAS	T [W,W_N]M NP O U,A
		0 1 2 3 4 5 6 7 8 9 10 11 12+
Mexican (M)	FB	PT,(W_N,O)(I,W) N U A
	FAS	TW_N(I,P) N O U A
		0 1 2 3 4 5 6 7 8 9 10 11 12+
Puerto Rican (P)	FB	M(I,O,W,T,W_N)N U A
	FAS	M,[N,T]I,W_N W O U,A
		0 1 2 3 4 5 6 7 8 9 10 11 12+
Negro (N)	FB	[T,W_N]I W,M [P,O] U A
	FAS	W_N T W M (I,P) O U,A
		0 1 2 3 4 5 6 7 8 9 10 11 12+
Oriental (O)	FB	M [P,W_N] W [I,T] N U A
	FAS	W_N[M,W] T NPI U,A
		0 1 2 3 4 5 6 7 8 9 10 11 12+
White (W)	FB	W_N T I,M,P[N,O] U A
	FAS	W_N,T N[I,M] O P U A
		0 1 2 3 4 5 6 7 8 9 10 11 12+
Total (T)	FB	(I,W,W_N)(N,M) P O A
	FAS	[W,W_N]M[I,N] P O U A
		0 1 2 3 4 5 6 7 8 9 10 11 12+
Within (W_N)	FB	W [I,T][M,N]P,O,U A
	FAS	W TN M I U P O A
		0 1 2 3 4 5 6 7 8 9 10 11 12+
Among (A)	FB	T N M [I,P] [U,W_N] [O,W]
	FAS	[N,W_N]W[I,O,U,T][M,P]
		0 1 2 3 4 5 6 7 8 9 10 11 12+

NOTE.—FB = Family Background; FAS = Family Background, Area of Residence, and School. Scale values represent the average delta values for grades 6, 9, and 12. U designates the set of unit weights. The brackets contain groups with the same value

(whites being the most numerous), and hence they could be expected to contribute substantially to both *I* and *WN*. As far as the other ethnic groups were concerned, for the FB variables the Negro estimates were most similar to the Indian ones and least similar to the ones obtained from Oriental-Americans. For the FAS variables, Negroes remained most dissimilar to Oriental-Americans, but were most similar to whites.

The estimates for Oriental-Americans also presented a mixed picture. For the FB variables, they were most similar to those obtained from the Mexican-American weights and most different from those obtained from the *U* and *A* weights. For the FAS variables, however, they were most similar to the estimates obtained from the *WN* weights and remained most different for the *U* and *A* weights. In group terms, the Oriental-Americans' FB estimates most closely resembled those obtained from the Mexican-Americans' weights and were most different from those obtained from the Negroes' weights. For the FAS variables, in contrast, the Oriental-Americans' estimates were most similar to those obtained from the whites' and Mexican-Americans' weights (which were tied values), and different from those obtained from the Indians (I).

The whites' estimates, for both the FB and FAS variables, were most similar to those obtained from the groups known as Within (WN) and Total (T), groups and most different from those obtained by means of the *U* and *A* weights. Since the whites were the most numerous group in the sample, their similarity to the WN and T groups is even less surprising than the Negroes'. When we compared the whites' estimates with the other groups', we found that, for both the FB and FAS sets of variables, the greatest difference existed between whites and Oriental-Americans. The greatest similarity, on the other hand, was between whites and Indians for the FB variables and between whites and Negroes for the FAS variables.

The estimates obtained for the group known as Total (*T*), for both sets of variables, most closely resembled the *WN* and white estimates and are most different from the *U* and *A* estimates. The statistical reasons for this have already been explained in connection with the results for Negroes and whites. For the same reason, the estimates for the whites' weights were most similar to those of the T group's own weights and most different from those for the Oriental-Americans' weights. Once again, this was so for both the FB and FAS variables. In addition, the Indians' and whites' estimates tied in their similarity to the T group's estimates for the FB variables.

We come at last to the two groups that were introduced at this stage in the analysis. For both FB and FAS, the group estimates we called "Within" were most like the ones for the whites' weights and least like the ones for the *A* weights. When we compared the ethnic groups, we found that the Within group's estimates were most like the whites' and least like the Oriental-Americans'.

In the case of the group we called "Among" (A) it may help to recall the nature of the analysis before reviewing the results. Here, the dependent variable consisted of the

group achievement means for the six ethnic groups. To obtain the *A* weights, these means were regressed against the group means on the FB and FAS sets of variables. For FB, there were six independent variables, and for FAS there were more variables than there were groups.[13] In such cases, the squared multiple correlation will approach or equal one. In our case, it happened to equal one for both FB and FAS. Since there were so few groups, applying another group's weights to these group means also tended to yield a high correlation. To form our deltas, then, we found that we were subtracting a high squared correlation from one, which was the value obtained from the least-squares analysis for the Among group. For FB, the estimates obtained by means of the other group's equations were less than one, though never less than 0.8. For FAS, however, as more variables were brought in, the estimates obtained by means of other groups' equations yielded correlational values that were closer to one, and the deltas got smaller. This is why the deltas were so much larger for FB than for FAS.

We are now in a position to review the results for the Among group. The group's FB estimates most closely resembled those obtained from the Total weights and differed most from those obtained from the weights for whites and Oriental-Americans. For the FAS variables, all the estimates were quite similar. In comparing ethnic groups, we found that in the case of FB the "Among" estimates for the group's own weights were most like those for the Negroes' weights and most unlike those for the whites' and Oriental-Americans' weights. In the case of FAS, the estimates were most like the ones for the Negroes' weights and least like the ones for the Puerto Ricans' and Mexican-Americans' weights. Again, however, we should recall that these differences were very small.

3.3.3. Summary

We have seen that, for both the FB and FAS sets of variables, the estimates of achievement yielded by the Among group's weights are by far the most different from the one's yielded by each group's own weights. On occasion, the unit weights yielded the next largest differences. But it seldom equaled the one observed for the Among weights. On the other hand, when other groups' weights were applied to the six group means, the *FB* weights for the Total and Negro groups yielded estimates that were most similar to the Among group's own, while the ones for the white and Oriental-American groups yielded estimates that were most different.

For the FAS variables, however, the differences were very slight. They were smallest for the Within and Negro groups' weights, and largest for the Puerto Rican and Mexican-American groups'. In comparing ethnic groups, we found that, for the FB variables, the Indians' and Mexican-Americans' weights yielded estimates most similar to each group's own. The largest differences, on the other hand, were yielded by the Orientals' and Negroes' weights. For the FAS variables, the whites' weights most often yielded the most similar estimates, while the Oriental-Americans' weights yielded the most different ones.

[13] Our computer program was such that we were able to avoid dependence and singularity.

3.4. THE NATURE OF ETHNIC GROUP DIFFERENCES

We also attempted to learn more about the differences between ethnic groups by partialing out the variance in their Achievement (ACHV) that was associated with a given equation, and then performing commonality analyses of it. Consider, for instance, the white group's least-squares equation as applied to the Achievement of the group called Oriental-Americans. By means of this equation, we obtained an estimated ACHV score for each Oriental-American student. This estimated score was then subtracted from the observed score, and the remainder, which we called the residual ACHV score, could then be regressed against any of a number of variables. In this case, the residual ACHV score could be interpreted as the variance in ACHV for Orientals that was residual to the whites' equation—and so on, for each of the others' equations.

Since we had been using a total of nine equations, there were eight residual ACHV scores for each ethnic group. When these scores were regressed against other sets of variables, commonality analyses could be performed. Since, as we have just seen, intergroup differences on Family Background (i.e., Home Background plus Family Process) were very small, we performed these commonality analyses with two sets of variables: (*a*) Family Background (FB); and (*b*) Area of Residence and School (AS). The results were unitized so that the three coefficients (two unique and one common) summed to 100 percent. Comparisons were then made across grade levels of these relative percentage values. Although some grade-level differences were observed, it was especially noticeable that the percentage uniquely associated with AS consistently tended to exceed the corresponding percentage for FB. To a lesser extent, the percentage for AS also tended to exceed that for the common portion. However, since the groups appeared to differ most in terms of AS, we have chosen to summarize here, for each of the three grade levels, the number of times that the unique percentage value for AS exceeded that of FB (see table 3.5).

Table 3.5.—Summary of Commonality Analyses of Residual Achievement Variance for Family Background, Area of Residence, and School

Group	Group Equation to Which Variance is Residual								
	I	M	P	N	O	W	T	WN	A
Indian (I)	–	3	2	3	3	2	3	3	0
Mexican (M)	2	–	3	3	3	1	2	2	1
Puerto Rican (P)	2	3	–	2	3	3	3	3	1
Negro (N)	3	3	2	–	3	2	3	2	–
Oriental (O)	2	3	3	2	–	2	2	2	1
White (W)	2	1	2	0	3	–	1	0	0
Total (T)	2	2	3	3	3	2	–	3	0
Within (WN)	3	1	2	2	3	2	3	–	0
Among (A)	0	0	0	0	0	0	0	0	–

NOTE.—Cell entries represent the number of times that the unique coefficient for Area of Residence and School exceeded that for Family Background. The maximum value possible was 3 and the minimum 0.

It will be seen that most of the cells in table 3.5 have entries of two and threes. This indicates that, for a preponderance of the grade levels, the unique coefficient for AS exceeded that of FB. Another way of saying this is that Area of Residence and School accounted for a greater proportion of the residual variance more often than did Family Background. There were, however, some instructive exceptions for whites and the Among group.

For whites, the percentage of variance in the residual ACHV score that was accounted for by AS tended to exceed that accounted for by FB *less* frequently than it did for the other groups. Since the whites, being more numerous than any other group in the sample, played the largest role in the Total (T) and Within (WN) equations, we would expect the variance in ACHV that is residual to these equations to be spread more evenly here in its association with FB and AS, because of the aforementioned role of AS for whites. Similarly, more of the whites' variance in ACHV that is residual to the Negroes' equation is accounted for by FB than by AS. What these results, as well as those obtained when the other groups' equations are applied to the whites, suggest is that the other groups' equations (except the Orientals') give greater emphasis to the AS variables than does the whites' own equation. Consequently, there is less residual variance to ACHV that can be associated with the whites' AS.

The other notable exception was the Among group. When we computed this group's residual ACHV score for each of the other groups' equations and regressed it against FB and AS, we found that all of this residual variance could be explained, but that it was completely confounded. In other words, the R-squares for the residual variance were 100 in each case, but the unique percentages were zero and the common portions were 100. Similarly, when we first partialed out the residual ACHV scores within each group for the Among group's equation, we found that the AS set rarely accounted for more of the residual variance than did the FB set.

3.4.1. Summary

What these analyses showed was that more of the variance in each group's own achievement that was residual to the other groups' equations could be uniquely associated with their area of residence and school than with their family background. Since each group's residual variance in this respect was the variance that could *not* be associated with some other group's least-squares equation, it was used to indicate how much relations among the students in that group differed from those in the other groups. We concluded, then, that the groups tended to differ more from one another in area of residence and school than in family background—that is, insofar as these two sets of factors related to their level of achievement. This assertion, however, needed to be qualified somewhat for whites and did not apply at all to the differences among the groups. Finally, it was family background rather than area of residence or school that tended to account for the residual differences (residual, that is, to the among-group differences) among the students within each group.

3.5. SPECIAL TOPICS

The preceding analyses stimulated us to explore two special topics:

1. What results would be obtained if we used mixed sets of weights?
2. How similar would the results remain for a particular grade level if they were obtained by means of weights from some other grade level?

3.5.1. Analyses With Mixed Sets of Weights

The purpose of this analysis was to compare the loss in explained variance (that is, variance in ACHV), by substituting a number of mixed sets of weights for each group's own. The first such combination of weights was as follows:

	Family Background (FB)	Area of Residence and School (AS)
1.	Total (*T*)	Each group's own
2.	Unit (*U*)	Each group's own

How much loss in explained variance would there be if each group had the same FB weights but its own AS weights? The situation might be compared to one in which an investigator wants to assume a common least-squares equation for student background variables, but wants to fit an equation to each separate group on the basis of the different treatment they have received. We also ran these same analyses using the set of unit weights in lieu of the Total weights. If the loss was small, it indicated that an investigator might conserve on degrees of freedom by using the set of unit weights instead of fitting for the Total weights.[14]

	Family Background (FB)	Area of Residence and School (AS)
3.	Each group's own	Total (*T*)
4.	Each group's own	White (W)

How much loss in explained variance would there be if each group had its own least-squares weights for Family Background but some other set of weights for Area of Residence and School? We asked this question using both the Total (*T*) weights and those from the white group, the former because they represented the differences among all schools in the sample, and the latter because the whites' schools were considered by some to have better resources.[15] This second set of analyses might be compared to a situation in which students with a common school experience were treated differently by their families.

The resulting delta values were averaged across the three grade levels (table 3.6).[16] It will be seen that the

[14] These analyses were performed by first computing an estimated ACHV score with either the Total or the unit equation, and then entering this estimate into the regression analysis with AS.

[15] These analyses are performed in a manner similar to but the reverse of the earlier ones. In other words, an estimate of ACHV is obtained with the weights for Area of Residence and School, and is then entered into the regression analysis with the weights for Family Background.

[16] Analyses involving the Unit weights were performed only for the ninth grade.

loss in explained variance is rather small for most groups. In fact, for the first set of mixed weights (rows 1 and 2) the losses are large only for Oriental-Americans and Negroes (for the latter, only when the Unit weights are used). And even these losses are probably small enough to warrant use of a common equation for all students. For the second set of mixed weights (rows 3 and 4), the losses are roughly the same as for the first set, though with fewer extreme values. The whites' AS weights yield slightly larger losses for the Indian and Mexican-American groups. Overall, however, the differences between rows 3 and 4 are negligible. Whether or not it would be worth an investigator's while to perform such analyses would depend upon the particular circumstances involved. In the present case, the returns seem rather small.

3.5.2. Trends Across Grade Levels

Suppose that, for each grade level, we wanted to pick one equation for which the loss in explained variance was small. In other words, that equation could be used to characterize each ethnic group's achievement at that grade moderately well. What would this equation be and how might it compare with those obtained from other grade levels? This was the question that we asked ourselves at this stage in the analysis.

On the basis of our earlier analyses, as summarized in tables 3.3 and 3.4, we were inclined to choose the Total equation from each grade as being the one that represented each group most consistently. The major exception was the Oriental-American group, for which the Mexican-Americans' or whites' equation seemed to provide a better fit. Our next question was whether this equation described results for the other two grade levels well enough to be used in lieu of all the other equations. Accordingly, we performed delta analyses by obtaining estimates of achievement at each grade level for each of the three equations, and then comparing the variance in achievement that was explained by these estimates. At the sixth grade, for example, we obtained the difference between the R-squares for both the sixth and ninth grades' and the sixth and twelfth grades' equations. These delta values, as well as those for the other grade levels, are shown in table 3.7.

Table 3.6.—Average Loss in Percentage of Variation in Achievement Explained by Using Mixed Equations in Lieu of Each Group's Own Equation

Weights Used		Groups					
Family Background	Area and School	I	M	P	N	O	W
Total	Each Group's Own	2	2.5	2.5	1	4	2
Unit	Each Group's own	2	3	2	4	6	2
Each Group's Own	Total	3	2	3.6	2.6	3	1
Each Group's Own	White.....	3.3	2.3	3.3	2.6	3	–

Note.—I = Indian; M = Mexican; P = Puerto Rican; N = Negro; O = Oriental; W = White.

Table 3.7.—Loss in Percentage of Variation in Achievement Explained by Using Other Grade-Level Equations in Lieu of Each Grade-Level's Own Equation

	Grade Levels					
	Family Background			Family Background, Area of Residence and School		
Group's Weight	Sixth	Ninth	Twelfth	Sixth	Ninth	Twelfth
Sixth Total ...	–	3	4	–	3	4
Ninth Total ...	2	–	0	3	–	1
Twelfth Total..	4	0	–	5	1	–

It will be seen that the losses are smallest for the grade levels that are closest to one another. Thus for Family Background, both alone and when combined with Area of Residence and School, the losses are smallest for the sixth grade compared with the ninth grade, and the ninth grade compared with the twelfth grade. In contrast, the differences for the sixth grade compared with the twelfth grade are the largest observed. However, even these latter do not exceed 5 percent.

These results suggested to us that the equation we were looking for might well be the Total equation for the ninth grade. Its losses are quite small, as can be seen from the "Ninth" rows and columns in table 3.7.

3.6. SUMMARY AND CONCLUSIONS

In this chapter we investigated the degree to which two or more ethnic groups resembled each other in the way one of their characteristics, Achievement (ACHV), was related to two others, namely, the sets of variables called: (*a*) Family Background (FB); (*b*) Area of Residence and School (AS). For each ethnic group, regression analysis yielded a set of weights that maximized the relationship of ACHV with these other characteristics. The degree of similarity of resemblance between the ethnic groups was then studied by applying each group's weights to each of the others in turn. In this way we were able to compare: (*a*) the extent of intergroup similarity; (*b*) the extent of intergroup difference; (*c*) the nature of this difference.

3.6.1. Intergroup Similarity

The first kind of comparison was made by correlating one estimate of ACHV, obtained by means of each group's own least-squares equation, with another estimate, obtained by means of some other group's equation. Such analyses were performed for each ethnic group. We found that, for various subsets of FB, both separately and when they were combined with the residential and school variables, the correlational values usually ranged in the mid- to high 90's. To us, this indicated a high degree of similarity between most of the groups. For AS, however, the correlational values tended to be lower. This suggested to us that most of the difference between groups could be attributed to differences in their residential and school variables.[17]

[17] This line of reasoning was also supported by a factor analysis of FB and AS that showed a much greater degree of similarity across ethnic groups in the structure of the FB variables alone than when they were combined with the AS variables.

Table 3.8.—Other Groups' Weights Yielding Estimates of ACHV Most and Least Similar to Those Yielded by Group's Own Weights

Ethnic Group to Which Weights Applied	Ethnic Groups From Which Weights Applied: Family Background Most Similar	Family Background Least Similar	Family Background, Area and School Most Similar	Family Background, Area and School Least Similar
Indian (I)	W	O	W	O
Mexican (M)	P	N	I	O
Puerto Rican (P)	M	N	M	O
Negro (N)	I	O	W	O
Oriental (O)	M	N	N or W	I
White (W)	I	O	N	O
Total	W or I	O	W	O

[a] The ethnic group or groups whose least-squares equation explained a proportion of variance in ACHV that was most similar to the proportion explained by the group's own equation.

[b] The ethnic group or groups for which this same operation yielded the least similar proportion of explained variance in ACHV

3.6.2. Intergroup Difference

The next kind of comparison involved forming the difference between two squared correlational values (R-squares): (*a*) a value representing the proportion of variance in AHCV that could be explained by the group's own equation; (*b*) a value representing the proportion that could be explained by some other group's equation. The difference was formed both for FB alone and for FB in combination with AS. Analysis of such differences showed that the ethnic groups' least-squares equations gave remarkably similar results for all these factors. Their relative similarity and difference can be summarized in tabular form (table 3.8).

It will be seen from the "Least Similar" columns in table 3.8 that Oriental-Americans are the one ethnic group whose weights most frequently yield estimates of ACHV that differ most from those yielded by each group's own. Moreover, this tendency is most pronounced when both FB and AS are included in the analysis. No such tendency, however, is exhibited by the groups in the "Most Similar" column. For instance, the Indians' equation yielded the most similar results three times for FB but only once for FB and AS combined.

3.6.3. The Nature of Intergroup Difference

We also compared the roles of FB and AS in ACHV by computing a residual ACHV score from which the variance in ACHV associated with some other group's weights had been partialed out. This residual score was then regressed against FB and AS.[18] We found that, for each group, more of the residual variance could be associated with AS than with FB, although this was not quite so true of the white group as of the others. This, then, was yet another way of observing that most ethnic groups' weights differed from one another more in terms of their area of residence and school variables than in terms of their family background variables.

[18] We did not do this for FB alone, since the delta values were nearly always very small.

3.6.4. Intergroup Differences and Individual Differences Within Groups

Studies by other investigators, who had compared ethnic groups as if they were all subject to the same internal processes, led us to seek more meaningful bases for comparison. Two in particular seemed worth exploring:

1. The extent to which each group's mean ACHV, when regressed against its own family background, residential, and school factors, yielded weights that accounted for the variance in each of the other ethnic groups' ACHV. We called this "the among-groups analysis."
2. The extent to which the weights for each ethnic group accounted for the variance in ACHV among six ethnic groups.

We applied the weights from the among-groups analysis to each ethnic group in turn, and then compared the results to those obtained with the other weights (including that group's own). We found that the Among weights consistently yielded rather poor estimates—estimates that, indeed, were often two to three times worse than those obtained with the other weights. Similarly, when the variance in ACHV associated with the Among weights was partialed out, there was a tendency for more of the residual variance to be uniquely associated with FB than with AS. By these criteria, then, the students in each ethnic group would appear to differ more in the way their achievement relates to their family background than in the way it relates to their area of residence and school.

We next applied the weights for each separate ethnic group to the differences among the six ethnic groups, and compared the results with those obtained with the Among weights. We found that the estimates were still poor for FB alone but remarkably good for FB combined with AS. We attributed this latter result to the fact that there were more variables being weighted than there were groups on which observations were based. Consequently, much of the uniqueness attributable to a set of weights was offset. When we first partialed out the among-groups variance in ACHV that was associated with a given ethnic group's weights, we found there was complete confounding. In other words, the residual variance could not be uniquely associated either with one of the family background variables or with one of the residential and school variables.

We are inclined to conclude, on the basis of these comparisons, that weights derived from the differences among groups do not explain individual differences in achievement among the members of a particular ethnic group. These variations are far better explained by weights derived from differences among the members of any other ethnic group. Conversely, the among-group differences are not well explained by the weights for each separate ethnic group; if they seem to be, it is because of statistical redundancy, and because a group that ranks high on one variable tends also to rank high on the others. In other words, differences among groups do not explain individual differences in achievement within groups. However, in explaining differences among groups it makes little differ-

ence which variable one weights high and which low, because each variable is so highly correlated with the others.

3.6.5. Special Topics

We also examined the effect of using mixed sets of weights. For example, for one type of analysis a common set of weights was used for the students' family background variables but their own ethnic group's weights for the area of residence and school variables. These analyses yielded losses in explained variance that were usually as small or smaller than the ones observed when some other group's weights were used.

We also attempted to find a single least-squares equation that could be used for all ethnic groups and grade levels. The ninth grade's equation was found to meet these conditions moderately well for all groups except Oriental-Americans, for whom it provided a rather poor fit.

Chapter 4

IS GROUP ACHIEVEMENT SOCIALLY DETERMINED?

In the Achievement Study, we succeeded in demonstrating that, as more and more factors related to each ethnic group's social background were included in the analysis, the average group achievement scores came increasingly to resemble each other (Mayeske et al., 1973a, pp. 125-127). In this chapter we propose to find out if the same is true of several other points on the group achievement curve. The points in question are the 10th, 25th, 50th, 75th, and 90th percentiles.

Our major interest was in how the distribution of Achievement (ACHV) for whites compared with that for the other ethnic groups. We therefore computed the percentage of each ethnic group whose scores exceeded the above percentile points in the distribution of whites' scores. For example, we asked such questions as: What percentage of Indians exceeded the 10th percentile point for whites?[1] We performed these computations on each ethnic group's distributions both before and after making allowance for the relationship of ACHV with a number of social background variables. The sets of variables used to define each adjustment condition were the same as those used in the previous chapters.[2] They were entered into the analysis as follows:

None (N). Under this condition, the percentages were computed before the relationship of ACHV with any of the other background factors had been allowed for.

Home Background (HB). Under this condition, the percentages were computed after the relationship of ACHV with the two HB variables of Socio-Economic Status and Family Structure had first been allowed for.

Family Background (FB) Under this condition, the percentages were computed after the relationship of ACHV with the six FB variables had first been allowed for. These six variables were the two HB variables plus Expectations for Excellence, Attitude Toward Life, Educational Plans and Desires, and Study Habits.

Family Background, Area of Residence and School Attended (FAS). Under this condition, the percentages were computed after the relationship of ACHV with the 6 FB, 2 area of residence, and 10 school variables—a set of 18 variables in all—had been allowed for.

The term "allowed for," as used in this account of the adjustment conditions, means that we adjusted each student's observed ACHV score (Y) by subtracting from it an estimated ACHV score (Y'). In the case of Home Background, for example, this estimated score was obtained by weighting a student's scores on the Socio-Economic Status and Family Structure variables, then adding them up. The weights were obtained by regressing ACHV on these two variables. The distribution of these adjusted or residual scores, $Y-Y'$, was then computed for each separate ethnic group.[3] This affected not only the group ACHV means but also, as can be seen from table 4.1, the dispersion of the scores about their means.[4] Thus, as we can see from table 4.1, there was a progressive decrease in the magnitude of each group's dispersion as a function of the different adjustment conditions. After all the background variables had been allowed for (i.e., the adjustment condition known as FAS), the variances were about one-half to two-thirds their initial value (i.e., their value under the "None" adjustment condition. Since these changes were not of the same magnitude for each ethnic group, it occurred to us that the percentage of each ethnic group exceeding a selected white percentile point might not always decrease in a progressive manner as allowance was made for ever more background variables. And, as will be seen, this is what happened.

Table 4.1.—Variation in Achievement Scores for Each Ethnic Group Before and After Adjusting for Social Background Conditions: Ninth-Grade Students

Ethnic Group	Adjustment Conditions			
	None	HB	FB	FAS
Indian	10.48	9.38	8.02	6.99
Mexican	11.98	9.96	8.42	6.99
Puerto Rican	11.29	10.68	9.35	7.70
Negro	9.57	8.39	7.34	6.43
Oriental	13.41	11.20	8.89	9.15
White	10.71	8.45	6.84	6.31
Other[a]	17.52	17.19	16 38	11.87
Total	13.79	9.71	8.17	6.62

[a] The unweighted number of students who identified themselves as "Other" was 4,160. The number of students for the remaining groups is given in table 3.1.

It should be noted that table 4.1 includes a new group called "Other." This is the group of students who either identified themselves as belonging to some group other than the listed ethnic groups or who failed to indicate any

[1] The 10th percentile point for whites is the point on the distribution of their ACHV scores such that 90 percent of them exceed it and 10 percent fall below it.

[2] For definitions, see chapter 2.

[3] The weights and intercepts from a "Total" regression analysis (i.e., one that used all students combined) were used for each adjustment condition.

[4] The numbers of students included in these computations were the same as those in table 3.1.

ethnic group membership whatsoever. They are therefore a diverse group of unknown origin and, as such, useful to these analyses. Their achievement is also more variable at each grade level than the other ethnic groups'. However their proportional representation in the sample decreases from roughly 3 percent at the sixth grade to about 1 percent at the twelfth grade. Accordingly, the computations for this and all the other groups were based upon values to which the appropriate sampling weights had been applied.

A word of caution here concerning differences between grade levels. The rates at which students drop out of school are not constant across grade levels or ethnic groups. The incidence of dropouts is usually much greater for the nonwhite groups, especially Mexican-Americans and Indians. As a result, a Mexican-American, say, who remains in school through the twelfth grade may well belong to a group that is more select, in terms of factors that favor school attendance, than does his white counterpart. We therefore gave most of our emphasis to the average of these grade-level results.[5]

4.1. COMPARISONS AT WHITES' 10TH PERCENTILE

Table 4.2 shows what percentage of each ethnic group at each grade level exceeded the whites' 10th percentile point for achievement when the different adjustment conditions were applied. The way to interpret this table is to remember that if the point for the ethnic group being compared with the whites were completely coincidental with theirs, then 90 percent of them would exceed the whites' point. We can see from table 4.2 that before any background conditions have been allowed for (i.e., the "N" column), Oriental-Americans are closer to the whites' 90 percent than any other nonwhite group, especially at the ninth grade. Similarly, Puerto Ricans have the lowest percentages at grades 6 and 9, and Negroes at grade 12.

For each grade level, however, as more social background conditions are allowed for, the groups tend to approach 90 percent. But they do not do so in a uniform manner: for example, Puerto Ricans and Other are the only groups with percentages that increase with each additional condition of adjustment.[6] The remaining groups have percentage values that oscillate as they approach the final adjusted values (i.e., the "FAS" columns). After all the background variables have been allowed for, Puerto Ricans and Mexican-Americans have the lowest percentage values. They are about 10 percent lower than they would be if they coincided entirely with the whites' values. Next lowest are the values for Indians, while the values that come closest of all to the whites' are those for Negroes, Oriental-Americans, and the group called Other.

We can perhaps most readily summarize these results by forming the average differences between the whites' and nonwhites' percentages before and after all the adjustment conditions have been met.

In the following table, the "Before" columns correspond to the "None" condition and the "After" columns to the FAS condition, while the "Shift" column shows the differences. The "Before" and "After" values were computed by subtracting the average percentage for the "None" or FAS condition from that for whites, the latter being 90. The "Shift" values were obtained by taking the difference between those "Before" and "After" values.

	Percentage Differences				
Group	Before	Rank	After	Rank	Shift
Indian	24	2	6	4	18
Mexican	31	3	9	5	22
Puerto Rican	44	6	10	6	34
Negro	38	5	3	2	35
Oriental	10	1	3	2	7
Other	33	4	3	2	30

It will be seen from the "Rank" columns that Oriental-Americans are closest to whites before any adjustments

[5] The numbers of students and schools included in these analyses are given in table 6.1.

[6] The reader will note that in table 4.2 and those that follow, the percentages do not always increase or decrease in a progressive manner. But it is not a requirement of the analysis that they do so. A slight irregularity in a group's distribution or suppressor relationships can readily produce such variations, and some groups are more subject to these than others.

Table 4.2.—Percentage of Each Ethnic Group Exceeding the Whites' Tenth Percentile Point, Adjusted for Social Background Conditions

Ethnic Group	Grade Level	Adjustment Conditions N	HB	FB	FAS	Ethnic Group	Grade Level	Adjustment Conditions N	HB	FB	FAS
Indian	12	72	83	80	84	Negro	12	44	62	54	84
	9	72	74	81	84		9	57	55	64	87
	6	54	75	77	84		6	54	69	64	89
	Average	66	77	79	84		Average	52	62	61	87
Mexican	12	60	74	74	81	Oriental	12	79	85	82	84
	9	65	61	72	80		9	87	83	88	88
	6	52	68	69	81		6	75	83	83	88
	Average	59	68	72	81		Average	80	84	84	87
Puerto Rican	12	51	68	68	79	Other	12	64	83	83	86
	9	52	56	70	81		9	59	77	85	87
	6	34	58	63	80		6	47	79	80	88
	Average	46	61	67	80		Average	57	80	83	87

NOTE.—N = not adjusted for prior conditions, HB = adjusted for Home Background; FB = adjusted for Family Background, FAS = adjusted for FB, Area of Residence & School Attended.

have been made, but that after the adjustments have been made they share their position with Negroes and Other. Puerto Ricans, on the other hand, retain their same relative standing. However, the greatest "Shift" values occur for Negroes, Puerto Ricans, and Other, and the lowest for Oriental-Americans.

Group	Percentage Differences				
	Before	Rank	After	Rank	Shift
Indian	32	2	10	4	22
Mexican	39	4	15	5	24
Puerto Rican	51	6	17	6	34
Negro	49	5	8	3	41
Oriental	11	1	3	1	8
Other	35	3	5	2	30

4.2. COMPARISONS AT WHITES' 25TH PERCENTILE

In table 4.3 we can examine, with the same set of adjustments as before, the extent to which the nonwhites' percentages exceed the whites' 25th percentile point. In these analyses, then, if the members of each nonwhite group were just like the whites, then 75 percent of them would have scored above this point. We can see that before any background variables have been allowed for, Puerto Ricans and Negroes have the lowest average percentages while Oriental-Americans have the highest. There is some variation here by grade level, particularly for Indians and Puerto Ricans.

As the background variables are entered into the analysis, the separate group values tend to approach the whites' value, that is, 75 percent. But the tendency is not uniform. Thus, the values of all but the group called Other increase slightly and then decrease slightly, for at least one grade level, before finally increasing again. For Other, the values increase or stay the same but do not decrease. After all the background variables have been allowed for, it is the Oriental-American group that comes closest to (and, in one case, attains) 75 percent. It is followed closely by Other, which is followed in turn by Indians and Negroes. Lowest of all were the values for Mexican-Americans and Puerto Ricans. The results can be tabulated as in the previous section.

The "Rank" columns show immediately that, both before and after adjustment for the full range of background conditions, Oriental-Americans are most like whites and Puerto Ricans least like. The other groups, however, change their relative standing somewhat: Indians and Mexican-Americans move down, while Negroes and the Other group move up. By far the largest shift of this nature is for Negroes and the smallest, as already stated, is for Oriental-Americans. The other groups are closer together in value.

4.3. COMPARISONS AT WHITES' 50TH PERCENTILE

The pattern that emerges when the nonwhites' scores are compared in terms of the whites' 50th percentile point is, as can be seen from table 4.4, similar to the patterns already noted. However, there are also some notable departures from those patterns. Here, if the members of each nonwhite group were exactly like the whites, then 50 percent of them would have scored above this point. Oriental-Americans, on the average, come very close to matching the whites' 50 percent; at the sixth grade, indeed, they actually exceed it (see the "N" column). All the remaining ethnic groups have much lower absolute values: Indians and Other trail the Orientals by roughly 20 percentage points, and Mexican-Americans, Negroes, and Puerto Ricans (in that order) by still more. There are, however, some notable variations at grade level for all groups.

As in the previous analyses of this type, the percentages tend to increase (though sometimes irregularly) as more of the background variables are allowed for. The most noteworthy exception is the Oriental-American group at the sixth grade: its absolute value, as we have seen, is 55 percent, or 5 percent more than the whites'. For the HB and FB adjustments, these same sixth-grade Orientals fall short of the whites' percentage by five percent, while for the FAS adjustment they once more exceed it, though not by as much as before. This pattern is not found for Ori-

Table 4.3.—Percentage of Each Ethnic Group Exceeding the Whites' Twenty-Fifth Percentile Point, Adjusted for Social Background Conditions

Ethnic Group	Adjustment Conditions Grade Level	N	HB	FB	FAS	Ethnic Group	Adjustment Conditions Grade Level	N	HB	FB	FAS
Indian	12	50	64	60	64	Negro	12	24	37	31	62
	9	41	62	61	66		9	27	43	39	68
	6	38	54	55	64		6	28	43	39	70
	Average	43	60	59	65		Average	26	41	36	67
Mexican	12	39	52	53	61	Oriental	12	63	68	64	68
	9	37	50	51	59		9	69	75	71	74
	6	31	44	46	59		6	61	66	67	75
	Average	36	49	50	60		Average	64	70	67	72
Puerto Rican	12	32	47	46	59	Other	12	45	68	68	70
	9	24	41	48	60		9	36	69	69	72
	6	17	33	38	56		6	40	60	62	69
	Average	24	41	44	58		Average	40	66	66	70

NOTE.—N = not adjusted for prior conditions; HB = adjusted for Home Background, FB = adjusted for Family Background, FAS = adjusted for FB, Area of Residence and School Attended.

ental-Americans at the other grade levels; they, like the other groups, always end up with a higher percentage for the FAS adjustment than the one they began with, as can be seen from the following summary.

Group	Percentage Differences				
	Before	Rank	After	Rank	Shift
Indian	24	3	11	4	13
Mexican	31	4	19	6	12
Puerto Rican	38	6	17	5	21
Negro	37	5	10	3	27
Oriental	2	1	−1	1	3
Other	23	2	0	2	23

It will be seen that, once more, Oriental-Americans both start and remain relatively high, while their absolute value changes very little. In contrast, the group called Other stays in second rank while its absolute value changes considerably. Negroes show the greatest shift: their rank goes from 5 for the "Before" condition to 3 for the "After" condition. The other groups also show some change in their relative standing.

4.4. COMPARISONS AT WHITES' 75TH PERCENTILE

Table 4.5 extends our analysis to the whites' 75th percentile point. Since 25 percent of the Whites' distribution exceeds this point, this is the criterion by which the other ethnic groups will be judged like or unlike the whites.

Table 4.5 shows that, before any background variables have been allowed for, Oriental-Americans are the only ones who are much like whites. The group called Other is clearly second in this respect, while the remaining groups cluster rather more closely together. Less noticeable here are the irregularities for the "HB" and "FB" adjustments that we found at earlier stages in our analysis. The only noteworthy exception is for Oriental-Americans at the twelfth grade. After all the background variables have been allowed for, the percentages for Orientals and for Other exceed the whites' by about 5 points, while those for Indians, Negroes, and Puerto Ricans trail the whites' by 6 to 8 points and those for Mexican-Americans by about 10 points. The amount of difference made by these shifts can be seen in the summary.

It will be seen that the largest shift occurs for Other and the smallest for Indians. Oriental-Americans start high

Table 4.4.—Percentage of Each Ethnic Group Exceeding the Whites' Fiftieth Percentile Point, Adjusted for Social Background Conditions

Ethnic Group	Grade Level	Adjustment Conditions N	HB	FB	FAS	Ethnic Group	Grade Level	Adjustment Conditions N	HB	FB	FAS
Indian	12	31	38	36	40	Negro	12	9	17	15	38
	9	17	36	36	41		9	9	19	17	41
	6	31	31	30	36		6	20	18	16	40
	Average	26	35	34	39		Average	13	18	16	40
Mexican	12	16	29	30	37	Oriental	12	45	50	44	50
	9	17	26	28	34		9	43	52	49	51
	6	24	21	22	23		6	55	45	45	53
	Average	19	25	27	31		Average	48	49	46	51
Puerto Rican	12	15	26	27	36	Other	12	29	52	51	53
	9	9	23	26	36		9	18	48	48	50
	6	13	14	17	26		6	33	40	42	46
	Average	12	21	23	33		Average	27	47	47	50

NOTE.—N = not adjusted for prior conditions, HB = adjusted for Home Background, FB = adjusted for Family Background, FAS = adjusted for FB, Area of Residence and School Attended.

Table 4.5.—Percentage of Each Ethnic Group Exceeding the Whites' Seventy-Fifth Percentile Point, Adjusted for Social Background Conditions

Ethnic Group	Grade Level	Adjustment Conditions N	HB	FB	FAS	Ethnic Group	Grade Level	Adjustment Conditions N	HB	FB	FAS
Indian	12	12	19	20	20	Negro	12	3	6	6	19
	9	6	15	16	18		9	3	7	7	20
	6	6	13	24	16		6	2	6	5	17
	Average	8	16	20	18		Average	3	6	6	19
Mexican	12	5	12	15	18	Oriental	12	23	32	24	30
	9	5	11	12	15		9	21	30	27	30
	6	4	7	9	11		6	19	23	37	30
	Average	5	10	12	15		Average	21	28	29	30
Puerto Rican	12	5	12	15	22	Other	12	14	38	37	36
	9	3	10	12	18		9	8	31	33	31
	6	2	6	13	10		6	9	23	25	26
	Average	3	9	13	17		Average	10	31	32	31

NOTE.—N = not adjusted for prior conditions, HB = adjusted for Home Background, FB = adjusted for Family Background, FAS = adjusted for FB, Area of Residence and School Attended.

Group	Percentage Differences				
	Before	Rank	After	Rank	Shift
Indian	9	2	7	4	2
Mexican	20	4	10	6	10
Puerto Rican	22	5.5	8	5	14
Negro	22	5.5	6	3	16
Oriental	4	1	−5	2	9
Other	15	3	−6	1	21

and remain high, while the Other group starts in the middle and finishes highest of all. Puerto Ricans remain low throughout, while Mexican-Americans start from about the middle but end up at the bottom.

4.5. COMPARISONS AT WHITES' 90TH PERCENTILE

Table 4.6 shows what percentage of each ethnic group exceeds the whites' 90th percentile point. Since 10 percent of the whites' distribution exceeds this point, the closest one of the other groups comes to doing the same, the more it is like the whites.

Before any adjustments have been made, the group most like the whites—in the twelfth grade, exactly like them—is the Oriental-American one. It is followed by the Other and Indian groups; the remaining groups barely attain one percent. For the "HB," "FB," and "FAS" adjustments, the Oriental-American and Other groups come to exceed the percentage value for whites by a substantial amount, while the remaining groups approach but seldom attain it (the exceptions are Indians and Puerto Ricans, both at the twelfth grade only). The amount of differences made in each case by the "FAS" adjustment is shown below; it was calculated in the same way as before.

Group	Percentage Differences				
	Before	Rank	After	Rank	Shift
Indian	7	3	3	4.5	4
Mexican	9	5	4	6	5
Puerto Rican	9	5	2	3	7
Negro	9	5	3	4.5	6
Oriental	1	1	−5	2	6
Other	6	2	−10	1	16

4.6. SUMMARY AND CONCLUSIONS

We found in the Achievement Study that ethnic groups' mean Achievement scores tend to approach a common value as more and more aspects of the group members' social background are taken into account. In this chapter we carried the analysis further by examining other points on the groups' achievement curve. To do this, we compared the extent to which each ethnic group's distribution exceeded the whites' 10th, 25th, 50th, 75th, and 90th percentage points. If a group, we reasoned, had as large a percentage of its members above a certain point on the distribution curve as did the whites, then we could say that the two groups were similar at that point. Conversely, if its percentage was lower than the whites', then this provided a measure of its difference from them.

In order to allow for the social background variables, we distinguished four different kinds of adjustment conditions:

1. The group differences before any adjustment (called the "None" adjustment in the text).
2. The group differences after adjustment for the relationship of Achievement with Socio-Economic Status and Family Structure (called the "Home Background" adjustment in the text).
3. The group differences after adjustment for the relationship of Achievement with Socio-Economic Status and Family Structure plus Expectations for Excellence, Attitude Toward Life, Educational Plans and Desires, and Study Habits (called the "Family Background" adjustment in the text).
4. The group differences for the "Home Background" and "Family Background" adjustments, plus adjustment for the relationship of Achievement with 2 area of residence and 10 school variables (called the "Family Background, Area of Residence, and School Attended" adjustment in the text).

A new group, called Other, was included in these analyses. It consisted of students who either reported their ethnic origin as "Other" (in which case it may well have been mixed), or who did not report it at all. Because of its

Table 4.6.—Percentage of Each Ethnic Group Exceeding the Whites' Ninetieth Percentile Point, Adjusted for Social Background Conditions

Ethnic Group	Grade Level	Adjustment Conditions N	HB	FB	FAS
Indian	12	5	8	11	9
	9	2	6	6	7
	6	1	5	5	6
	Average	3	6	7	7
Mexican	12	1	5	6	8
	9	1	4	5	6
	6	1	3	3	4
	Average	1	4	5	6
Puerto Rican	12	1	7	8	12
	9	1	5	6	7
	6	1	2	2	4
	Average	1	5	5	8
Negro	12	1	2	3	8
	9	1	2	2	8
	6	1	2	2	6
	Average	1	2	2	7
Oriental	12	10	16	12	16
	9	8	15	12	15
	6	9	10	8	14
	Average	9	14	11	15
Other	12	6	26	28	27
	9	9	19	22	19
	6	3	13	15	14
	Average	4	19	22	20

NOTE.—N = not adjusted for prior conditions, HB = adjusted for Home Background; FB = adjusted for Family Background, FAS = adjusted for FB, Area of Residence and School Attended.

diversity, this group functioned to some extent as a control.

Our results are most easily summarized in terms of "Before" and "After," that is, before any adjustment for background variables had been made, and after adjustment had been made for all of them (the "Family Background, Area of Residence, and School Attended" adjustment). For example, some groups were behind the whites in "Before" analysis but ahead of them in the "After" analysis. We gave the name of "Shift" to the percentage change that occurred for each group as it moved from "Before" to "After." The results for each group were as follows.

4.6.1. Oriental-Americans

Oriental-Americans were the one ethnic group that closely resembled whites. Even before any background variables had been allowed for, they were seldom more than 10 percent below them. After, they sometimes exceeded the whites' percentile by as much as 5 percent. Since they started out so close to the whites, Oriental-Americans showed the smallest percentage change in moving to the "After" condition.

4.6.2. Other

This diverse group of unknown ethnic origin tended to rank third (behind Indians) in their similarity to the whites before any background variables had been allowed for. However, after all the background variables had been allowed for, the Others' values exceeded the whites' by as much as 10 percent and were exceeded by them by as little as 5 percent. Relatively speaking, they ended up tied with Oriental-Americans. In moving from "Before" to "After," they changed more than any other group except Negroes.

4.6.3. Negroes

Before any allowance was made for background variables, the only group that was farther behind whites was Negroes. For the "After" condition, however, they differed from whites by at most 10 percent. Since they started so low and ended so high, their percentage change was the largest of any group.

4.6.4. Indian Americans

For the "Before" condition, the Indian Americans' percentages fell short of the whites' by from 7 to 32 points, which made them the group next most like the whites. For the "After" conditions, however, they became the fourth most like the whites, although the range of difference was only about 10 or less. Since they, too, started out high their percentage change from "Before" to "After" was less than for most of the other groups.

4.6.5. Mexican-Americans

Mexican-Americans started out in fourth place behind whites, from whom they differed by from 7 to 32 percentage points. For the "After" condition, their position dropped to last, though the range of their differences from whites—from 4 to 19 percentage points—was not so great. Their percentage change from "Before" to "After" was third highest.

4.6.6. Puerto Ricans

Puerto Ricans started off farther behind whites than any other group; their differences from the whites ranged from 9 to 51 percentage points. For the "After" condition, the range of differences narrowed to from 2 to 17 percentage points, but their relative position improved by only one place. Their percentage change from "Before" to "After" was neither great nor small when compared with those of other ethnic groups.

4.6.7. Conclusions

We have seen that, after all the background variables available to us had been allowed for, Oriental-Americans and a group called Other came to equal or exceed the whites' 10th, 25th, 50th, 75th, and 90th percentile points on their achievement curve. Next closest to whites were Negroes and Indians, followed by Puerto Ricans and Mexican-Americans. Thus, through comparison of ethnic groups in terms of percentile points in the distribution of their achievement, we were able to confirm the trend already observed through comparison of their mean achievement scores. The trend can therefore be restated in the following words: As increasingly more factors related to the social background conditions of an ethnic group are allowed for, the distribution of its members' achievement increasingly comes to resemble that of all other ethnic groups.

Chapter 5

HOW CONSTANT ARE SOCIAL INFLUENCES?

Is it reasonable to assume that the relationship of achievement with social factors remains the same no matter how they change? Does more of a factor that helps achievement always help it to the same degree, or is there a point of diminishing returns? Does there come a point at which more of it would make no difference at all, or even prove harmful? Are there circumstances under which harmful factors become so harmful that the supposedly helpful ones do no good at all? Is there a limit to just how favorable conditions can become for achievement? Or just how unfavorable? To explain the achievement of groups that suffer from one or another type of social disadvantage, such questions must be asked.

In statistical language most of these questions reduce themselves to a common form, namely, whether the relationship between achievement and a given social variable or set of such variables is a linear one. By "linear" is meant a relationship that can be graphed as a straight line—a line expressing the fact that when the value of one variable increases or decreases, there is always the same amount of change in the other. It will be seen immediately that there is an inherent implausibility in applying a strictly linear model to the relation between achievement and any one set of social factors. For instance, there is obviously some point at which spending more money on teachers' salaries will cease to be matched by any corresponding increase in its students' achievement scores. However, it makes sense during a study's earlier stages, when so many relationships still await discovery, to use a statistical model that maximizes linearity. And this, in fact, is what we did when we relied on a technique called criterion scaling for our analyses in the School Study and elsewhere (Mayeske et al., 1969, pp. 339-343; Mayeske et al., 1972a, pp. 10-11). At this final stage, however, we felt it was appropriate to reexplore the data for possible departures from the linear model.

5.1. MEASURING NONLINEARITY

A relationship that ceased to be linear as the variables in it increased in value would be graphed by a straight line that ended in a "plateau." If, on the other hand, the loss of linearity occurred on the way down the line, it would be represented as a "valley." In the analysis that follows, we attempted to discover plateaus and valleys in the relationship of Achievement with Family Background, Area of Residence, and School.[1] Once again, we used these social background variables to make estimates of Achievement (ACHV), and then compared the estimates with reality. We reasoned that if a relationship over a certain range was nonlinear, then ACHV would have been either under- or overestimated throughout the extent of that range. Our procedure was as follows:

1. An estimate of ACHV, called E, was computed for each student by weighting his or her scores on each of the 18 background variables and then summing the weighted values. The weights were obtained by regression of ACHV on these 18 variables.
2. A residual score, called R, was computed by subtracting the estimated score, E, from each student's actual or observed ACHV score, O. Hence $R = O - E$.
3. Intervals of the distribution of "E" scores were formed, and the average R computed for each of these intervals.
4. These average values were then plotted by the E intervals to allow visual inspection of any departures from linearity.

The resultant plots for each grade are shown in figures 5.1 (grade 6), 5.2 (grade 9), and 5.3 (grade 12). The symbol "X" denotes the mean R for that interval of E, while the curved line represents the plot of a least-squares polynomial fitted to these points. This series of figures suggested to us that there were indeed systematic departures from the linear model, but that they were for the most part slight. It was also clear that those at the twelfth grade (figure 5.3) tended to differ somewhat from those at the lower grade levels. Let us examine the results for each grade level in turn.

In figure 5.1 (which should be read from right to left), the "R" values are high for high values of E. But they drop for the intermediate values, and then increase again, in a progressive manner, for the low values. If these were random departures from linearity, we would expect them to be manifested as a series of points arranged haphazardly above and below the E line. Here, the results appear to be systematic enough to be judged nonrandom. One reason why we fitted the polynomial function—represented by the curved line—was to help us decide just how random or nonrandom they were. For the sixth grade, a fourth-order polynomial accounted for 98 percent of the varia-

[1] There were, as explained in chapter 2, 6 family background, 2 area of residence, and 10 school factors. The set called Family Background consisted of two home background factors, Socio-Economic Status and Family Structure, and four attitudinal and motivational variables, called Family Process.

[2] The equation was of the form:

$$R' = -.02040 + .1240E' + .0363E^2 - .0082E^3 - .0007E^4$$

where R' was the estimated residual mean.

tion in R.[2] The "F" value associated with this percentage was exceedingly large, which was to be expected in view of our huge sample.[3] Hence, we judged these departures to be nonrandom. Whether or not they were meaningful, however, is a separate issue, to be discussed below.

The "R" values for the ninth grade, given in figure 5.2, show a patterning similar to but somewhat more pronounced than the sixth grade's. They are also slightly more drawn out for low values of E. As at the sixth grade, a fourth-order polynomial accounted for 98 percent of the variation in R, and the departures from linearity were again judged to be nonrandom.[4] For the twelfth grade, however, the R's fall into a different pattern. For high values of E, as can be seen from figure 5.3, they start much lower. But then they increase, and thenceforth behave in much the same way as at the other grades. However, the polynomial fit—only 91 percent—is not as good here, nor do polynomial terms beyond the square of E yield any additional information; in fact, the equation does not yield a good fit for values of E beyond 5.[5] For the remaining values, however, the relationship is systematic enough to suggest the presence of some nonrandomness.

[3] And because the computations were done on the weighted numbers.

[4] The equation was of the form:

$$R' = -.3321 + .1191E + .0401E^2 - .0046E^3 - .0004E^4$$

where R' was the estimated residual mean.

[5] The resultant equation is of the form:

$$R = .1909 + .0141E + .0239E^2$$

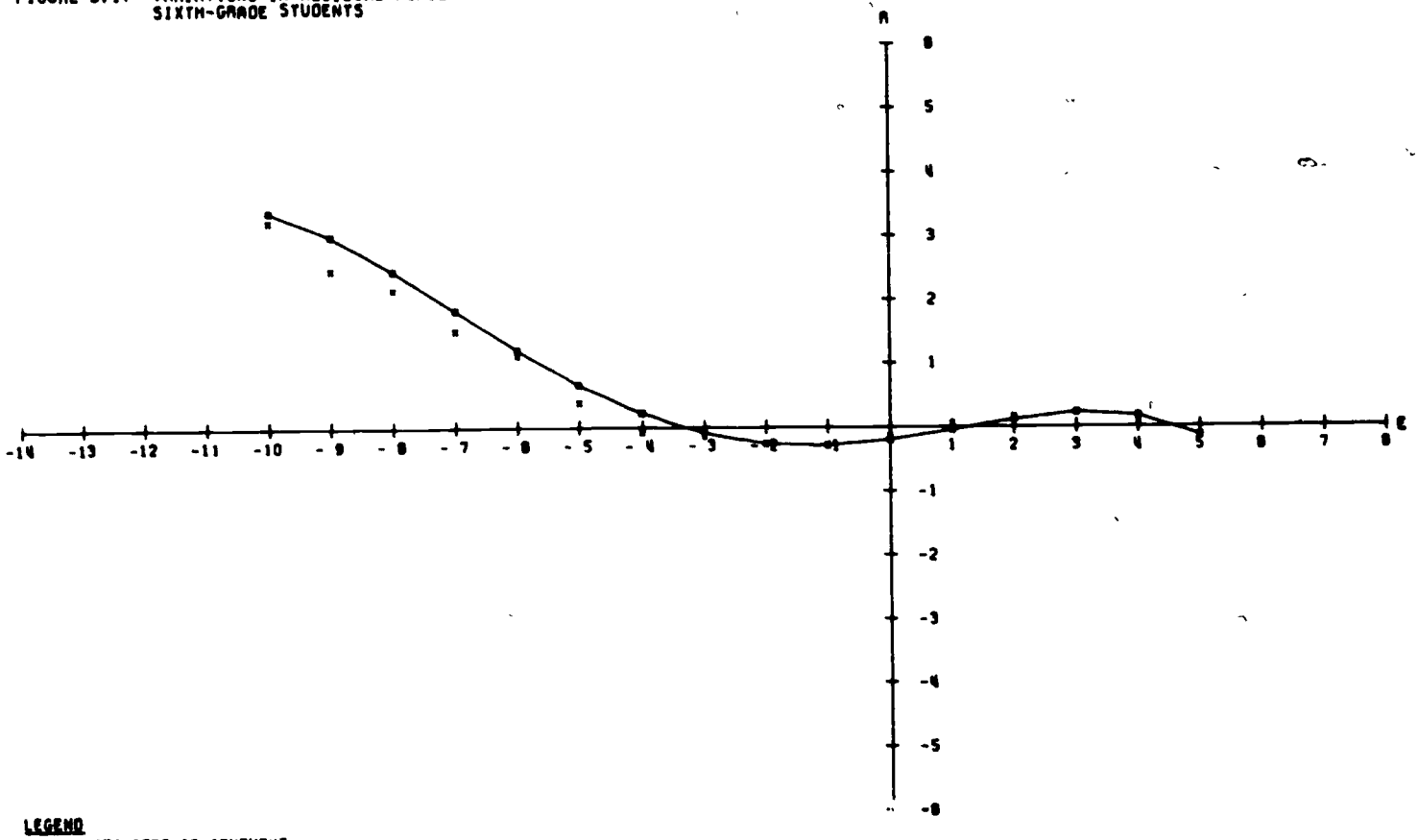
where R' was the estimated residual mean.

5.1.1. Selecting the Point of Discontinuity

Our next step was to select points of E for which the R's were either overestimated (i.e., fell above the E line) or underestimated (i.e., fell below the E line). We decided that the best way of doing this was to obtain deviatives and inflection points for our fitted polynomial functions by means of differential calculus. The results corresponded nicely to those obtainable from visual inspection. In short, the departures from linearity were systematic, but only one seemed large enough to warrant further investigation. This was the systematic increase in R for increasingly low values of E. What this trend suggested to us was that there existed a value of E below which the relationship of Achievement with these environmental factors almost ceased. We therefore used our best judgment in selecting such a value, i.e., one below which we thought that the slope of the regression line would shift so much that it could be viewed as a discontinuity. We then attempted to learn more about the nature of the discontinuity by computing the percentage of each ethnic group that fell below this point, as shown in table 5.1.

It will be seen that proportionately fewer whites fall below this point at each grade level than members of any other ethnic group. For the latter, the percentages differ markedly by grade level: at the lowest grade levels, for instance, the Indians', Mexican-Americans', Puerto Ricans' and Oriental-Americans' percentages all increase. Some of these differences may be accounted for by the fact

FIGURE 5.1.--VARIATIONS IN RESIDUAL ACHIEVEMENT(R) AS A FUNCTION OF ESTIMATED ACHIEVEMENT(E): SIXTH-GRADE STUDENTS



LEGEND
E = ESTIMATED ACHIEVEMENT
R = OBSERVED ACHIEVEMENT MINUS ESTIMATED ACHIEVEMENT
X = PLOTTED VALUES OF E AND R
O = FITTED FUNCTION

that almost twice as many members of the "Total" group fall below this point at the sixth and ninth grades than at the twelfth grade. Moreover, both Negroes and the group called Other have higher percentages at the ninth grade than at the other two grades (in the case of Other, much higher). Clearly, it is the nonwhite groups that preponderate below our point of discontinuity, though it is hard to single out any particular group except for Other. The remaining ones tend to vary more by grade level.

5.2. CORRELATES OF ACHIEVEMENT ABOVE AND BELOW THE POINT OF DISCONTINUITY

Having selected a point of discontinuity, we needed to test our assumptions about its nature. We did so by fitting separate regression lines above and below it, and by exploring the hypothesis that the results of the residual analysis were not due to a genuine discontinuity.

It will be remembered that the footnote to table 5.1 lists three points of discontinuity, one for each grade. Using these points, we formed six groups of students for whom complete data were available. The number of students in each group is shown in table 5.2. We used these groups

Table 5.1.—Percentage of Each Ethnic Group Below the Point of Discontinuity [a]

Ethnic Group	Grade Level		
	Twelfth	Ninth	Sixth
Indian American	1.2	2.7	3.6
Mexican American	3.0	4.2	6.4
Puerto Rican	4.8	9.0	11.0
Negro	5.9	7.3	4.0
Oriental-American	.5	2.0	4.4
White	0	.2	.5
Other	4.63	27.3	14.9
Total	1.02	2.4	2.2

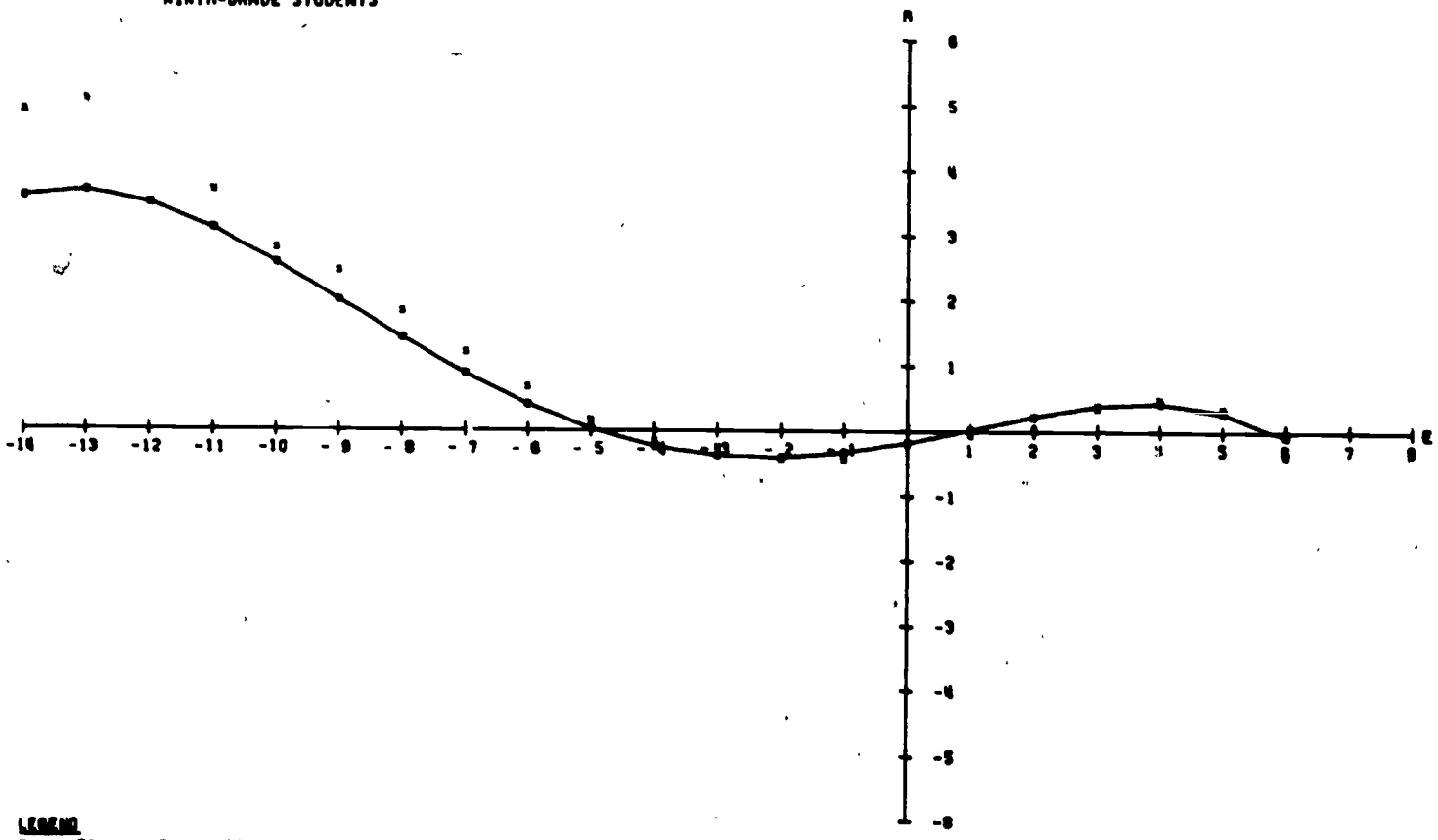
[a] The points of discontinuity were judged to begin at the following values of E: twelfth grade, −7.5; ninth grade, −6.5; sixth grade, −5.5.

Table 5.2.—Numbers of Students and Their Schools Included in Groups Above and Below the Point of Discontinuity, by Grade Level [a]

Discontinuity Group	Sixth Grade		Ninth Grade		Twelfth Grade	
	Students	Schools	Students	Schools	Students	Schools
Above	10,988	2,088	85,738	594	85,451	641
Below	4,808	731	4,660	360	2,363	226
Total	114,696	2,819	90,398	954	87,814	867

[a] Students for whom the data were incomplete were eliminated from these analyses. The totals are therefore not the same as in other chapters. There were 2,091; 596; and 640 schools included in these analyses for grades 6, 9, and 12, respectively. Since there is more than one student per school, the same school can appear in the "Above" and in the "Below" groups. As a consequence, the "Total" row reflects a greater number of schools than was observed in other analyses (e.g., there are 2,819 − 2,091 = 728 schools that appear in both groups for the sixth grade).

FIGURE 5.2.--VARIATIONS IN RESIDUAL ACHIEVEMENT(R) AS A FUNCTION OF ESTIMATED ACHIEVEMENT(E): NINTH-GRADE STUDENTS



LEGEND
E = ESTIMATED ACHIEVEMENT
R = OBSERVED ACHIEVEMENT MINUS ESTIMATED ACHIEVEMENT
X = PLOTTED VALUES OF E AND R
= FITTED FUNCTION

to perform a series of analyses, the first of which is summarized in table 5.3.

We first examined the magnitude of mean differences between the "Above" and "Below" groups. The differences were expressed in terms of standard deviation units of the "Total" group's distribution for that grade level. Such an analysis, it was thought, would help us pinpoint the variables on which these groups scored high or low. It will be seen from table 5.3 that, on almost all the social background variables, the two groups differ by one or more standard deviation units for at least two grade levels. There are only five variables for which this is not the case: Regional Location; Rural-Urban Location; Teaching Staff's Training and Salary Levels; Teaching Staff's Preference for Working with Students of Different Ability Levels; and Teaching Staff's View of Teaching Conditions. Grade-level trends are visible for several variables. For example, the following variables show smaller differences at the higher grade levels: Family Structure and Stability; Expectations for Excellence; Attitude Toward Life; Educational Plans and Desires; Study Habits; and Student Body's Study Habits. The remaining variables tend to oscillate somewhat by grade level. Most surprising of all, it was not in Achievement that the "Above" and "Below" groups differed most from each other—surprising, since this was the variable used to separate them. In fact, most of the family background variables (numbers 1 to 6 in table 5.3) differentiated among them to a greater extent than Achievement. The same was true of many school variables.

Our next step was to divide the variance of the "Above" group by that of the "Below" group. When the resulting ratio is greater than 1, the former group is more variable than the latter. If by "more variable" we mean "with a ratio greater than 1 for two or more grade levels," then it is clear from table 5.4 that the "Above" group is more variable than the "Below" group only on: Educational Plans and Desires; Achievement; Regional Location; Student Body's Achievement Level; Teaching Staff's Training and Salary Levels; and Teaching Staff's View of Teaching Conditions. The "Below" group's greater variability indicates that it tends to be more heterogeneous than the "Above" group even though it is a good deal less numerous (see table 5.2).

For which correlates of Achievement is the relationship with the "Above" group most different from the relationship with the "Below" group? From table 5.5 it appears that it is most different for the individual student's Family Background (variables 1-6). Thus for Socio-Economic Status, the relationship shifts from a positive one for the "Above" group to a negative or null one for the "Below" group. A somewhat similar trend can be observed for each of the other family background variables. For the area of residence and school variables, the correlates tend to be of the same sign but different in magnitude (the highest are usually for the "Above" group).

Table 5.3.—Mean Differences Expressed in Sigma Units of Groups Above and Below the Point of Discontinuity, by Grade Level

Variable.	Grade Level		
	Sixth	Ninth	Twelfth
1. Socio-Economic Status[a]	1.94	2.26	1.81
2. Family Structure and Stability	3.00	2.30	1.02
3. Expectations for Excellence	2.69	2.23	.86
4 Attitude Toward Life	3.59	2.96	2.83
5. Educational Plans and Desires	2.75	1.97	1.11
6. Study Habits	3.53	2.90	1.08
7. Achievement[b]	1.78	1.70	2.07
8 Regional Location	.67	.61	1.13
9. Rural-Urban Location	.11	−.01	.29
10. Student Body's Expectation for Excellence	2.06	1.20	−1.06
11. Student Body's Attitude Toward Life	2.30	2.00	2.22
12. Student Body's Educational Plans and Desires	1.07	1.18	.66
13. Student Body's Study Habits	2.21	1.62	.87
14. Student Body's Achievement Level	2.13	1.99	2.99
15. Teaching Staff's Training and Salary Levels	.35	.35	.99
16. Teaching Staff's Ethnic Composition	1.93	1.69	2.93
17. Teaching Staff's Verbal Skill Mix	1.87	1.05	2.81
18. Teaching Staff's View of Teaching Conditions	.97	.72	1.13
19. Teaching Staff's Preference for Student Ability Level	.99	.59	1.17

[a] The standard deviation for total number of students at each grade level was used as the base (see table 6.1 for the numbers of these students).

[b] The mean of the group below the point of discontinuity was 1.73, 1.66 and 2.04 sigma units below the grand mean of the achievement composite of all students for [illegible], 9, and 12, respectively.

Table 5.4.—Variance Ratios for Groups Above and Below the Point of Discontinuity, by Grade Level [a]

Variable.	Grade Level		
	Sixth	Ninth	Twelfth
1. Socio-Economic Status	.95	.51	1.18
2. Family Structure and Stability	.14	.14	.33
3. Expectations for Excellence	.25	.39	.75
4. Attitude Toward Life	.12	.65	.44
5. Educational Plans and Desires	1.86	.97	2.58
6. Study Habits	.11	.08	.14
7. Achievement	2.33	1.78	2.99
8. Regional Location	1.21	1.08	2.67
9. Rural-Urban Location	.76	.71	.92
10. Student Body's Expectations for Excellence	.18	.20	.45
11. Student Body's Attitude Toward Life	.16	.26	.32
12. Student Body's Educational Plans and Desires	.29	.50	.81
13. Student Body's Study Habits	.15	.13	.09
14. Student Body's Achievement Level	1.15	.70	1.65
15. Teaching Staff's Training and Salary Levels	1.04	1.04	1.27
16. Teaching Staff's Ethnic Composition	.73	.54	.77
17. Teaching Staff's Verbal Skill Mix	.40	.71	.32
18. Teaching Staff's View of Teaching Conditions	1.55	1.13	1.54
19. Teaching Staff's Preference for Student Ability Level	.84	.89	1.36

[a] The ratios are computed by dividing the "Above" group's variance by the "Below" group's variance.

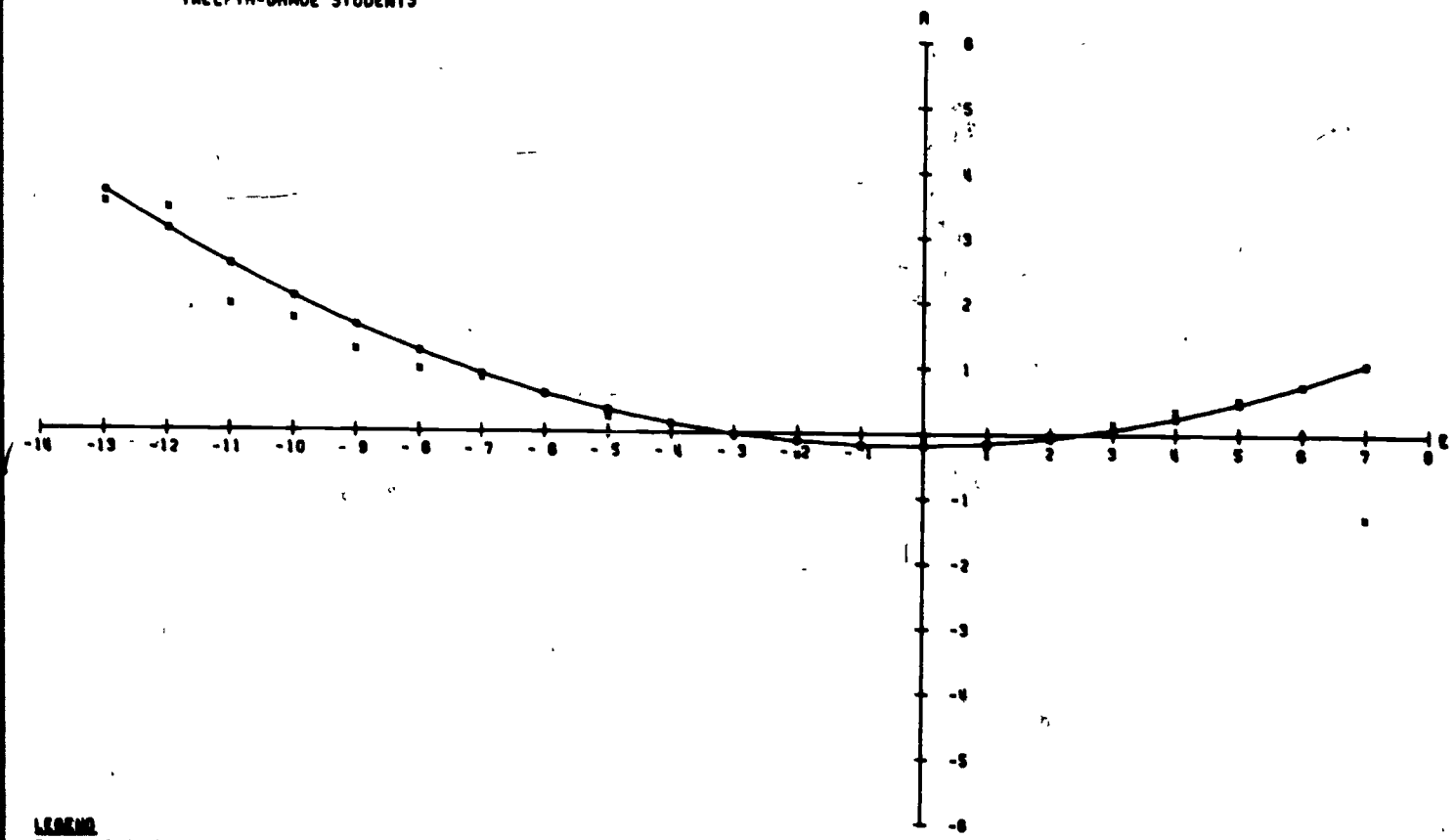
We went on to examine the squared multiple correlations obtained when increasingly more background variables were brought into the analyses. The purpose of these analyses, summarized in table 5.6, was to show how Achievement relates to these combinations of variables for the "Above" and "Below" groups. We found that Socio-Economic Status is associated with Achievement to a substantial extent for the "Above" group, but to a negligible extent for the "Below" group. The percentages did not change much when Family Structure was added to Socio-Economic Status to form Home Background. When the attitudinal and motivational indices were also brought into the analysis to form Family Background, the percentages increased substantially for the "Above" group but very

Table 5.5.—Correlates of Achievement for Groups Above and Below the Point of Discontinuity, by Grade Level [a]

Variable	Grade Level: Sixth A	Sixth B	Ninth A	Ninth B	Twelfth A	Twelfth B
1. Socio-Economic Status	47	−21	52	−08	46	0
2. Family Structure and Stability	27	−14	29	−11	22	−08
3. Expectations for Excellence	19	−16	35	−13	35	−12
4. Attitude Toward Life	32	−18	42	−10	39	−04
5. Educational Plans and Desires	44	−17	48	−12	48	−04
6. Study Habits	34	−22	32	−07	22	−03
7. Regional Location	17	29	16	18	19	20
8. Rural-Urban Location	−02	19	−02	11	01	20
9. Student Body's Expectations for Excellence	26	03	22	06	−11	−09
10. Student Body's Attitude Toward Life	34	04	35	18	30	04
11. Student Body's Educational Plans and Desires	36	11	32	15	21	−01
12. Student Body's Study Habits	32	00	32	10	18	−05
13. Student Body's Achievement Levels	53	51	50	34	48	32
14. Teaching Staff's Training and Salary Levels	07	28	04	15	12	23
15. Teaching Staff's Ethnic Composition	38	37	36	24	35	23
16. Teaching Staff's Verbal Skill Mix	33	32	16	16	30	22
17. Teaching Staff's View of Teaching Conditions	35	03	28	09	29	−09
18. Teaching Staff's Preference for Student Ability Level	22	19	15	16	23	06

[a] A designates "Above" and B "Below."

FIGURE 5.3.--VARIATIONS IN RESIDUAL ACHIEVEMENT(R) AS A FUNCTION OF ESTIMATED ACHIEVEMENT(E): TWELFTH-GRADE STUDENTS



LEGEND
E = ESTIMATED ACHIEVEMENT
R = OBSERVED ACHIEVEMENT MINUS ESTIMATED ACHIEVEMENT
X = PLOTTED VALUES OF E AND R
P = FITTED FUNCTION

little for the "Below" group. Finally, when the area of residence and school variables were brought in, there were substantial increases for both groups, especially for the "Below" group at the sixth grade. Clearly, for the "Below" group the area of residence and school variables play the biggest explanatory role, whereas for the "Above" group this role is shared by the family background and school factors.

We would have liked to present these results graphically in such a manner that differences in the slopes of the lines above and below the point of discontinuity could have been more readily displayed. However, with more than one regressor variable this becomes difficult. We therefore adopted a procedure that, although the slopes it produced were not based on each group's own least-squares equation, did allow us to display the fact that there are differential relationships. The procedure was as follows:

1. In order to obtain estimated ACHV scores ("*E*" scores), the regression equations from the original residual analyses were applied to each group.[6]
2. In each group, the observed ACHV score, *O*, was regressed on *E*.
3. The resulting equations were based on the goodness of fit of *O* with *E*.[7]

[6] The analyses in section 5.1 are concerned only with Family Background, Area of Residence, and School. Actually, many more residual analyses were conducted than we have presented in that section. The analyses summarized in table 5.7 use the weights derived from these analyses. For example, to obtain an estimate of Achievement from Socio-Economic Status (SES), we used a weight consisting of the least-squares weight when SES is the sole regressor.

[7] A fit that was often not as good as the one obtainable from each group's own least-squares equation.

These equations are given in table 5.7. Let us compare the squared multiple correlations (the R-squares) in this table with their counterparts in table 5.6 (the latter, it should be remembered, are based on each group's own least-squares fit). It will be seen that the "Total" equation for Socio-Economic Status provides an adequate fit for the groups above ("A") and below ("B") the discontinuity (viz, their respective R-squares are the same). However, as increasingly more variables are entered into the analysis, the two tables begin to differ, especially for the "Below" group. For example, for Family Background, Area of Residence, and School, the "Above" values at the sixth grade are 47 in table 5.6 and 38 in table 5.7, while the corresponding pair of "Below" values are 32 and 1. Thus it can be seen that the "Total" equation, the basis for the sigma units in tables 5.3 and 5.6, is a better estimator for the "Above" group than for the "Below" group.

Examination of the equations for the "Above" group in table 5.7 reveals that the intercepts tend to be at or near the origin, while the slopes, for the most part, hover closely around unity. For the "Below" group, however, the intercept values are always substantially below the origin, while the slopes, though usually negative, are often close to zero. Appreciable negative slopes seem to occur for the first three analyses at the sixth grade, and for the analyses for Family Background at the ninth grade. For Family Background, Area of Residence, and School, differences by grade level do emerge. We have chosen to present these latter results graphically, in figures 5.1 to 5.6. It is clear from these figures that there is indeed a point beyond which the relationship of Achievement with the back-

Table 5.6.—Percentage of Variation in Achievement Associated With Family Background, Area of Residence, and School, Above and Below the Point of Discontinuity, by Grade Level

Variable Set	Grade Level: Sixth Above	Sixth Below	Ninth Above	Ninth Below	Twelfth Above	Twelfth Below
1. Socio-Economic Status	22	5	27	1	21	0
2. Home Background	24	5	28	1	22	1
3. Family Background	33	8	40	3	36	2
4. Family Background, Area of Residence, and School	47	32	51	16	50	16

Table 5.7.—Achievement Regression Resulting From the "Total" Equation Applied to Groups Above and Below the Point of Discontinuity, by Grade Level

Variable Set		Sixth RSQ	Sixth I + S	Ninth RSQ	Ninth I + S	Twelfth RSQ	Twelfth I + S
1. Socio-Economic Status	A	22	.07 + 95E	27	− .02 + 1.01E	21	.01 + .96E
	B	5	−6.01 − .28E	1	−6.54 − .09E	0	−7.46 + 0E
2. Home Background	A	24	.04 + .99E	28	− .03 + 1.04E	22	.02 + .96E
	B	4	−5.97 − .18E	1	−6.57 − .08E	0	−7.52 − .02E
3. Family Background	A	25	.10 + .80E	38	− .10 + 1.08E	36	.01 + .97E
	B	6	−6.06 − .11E	2	−7.23 − .16E	1	−7.98 − .09E
4. Family Background, Area of Residence, and School	A	38	− .05 + .89E	50	− 07 + 1.06E	50	− .01 + 1.01E
	B	1	−5.65 − .05E	3	−2.96 + .40E	8	−2.33 + .59E

R-squares (RSQ) have been expressed as percentages.
E = I = intercept, S = slope, A = the group above the point of discontinuity; B = the group below it, E = the estimate obtained with the "Total" equation. The

ground variables becomes more pronounced.[8] The shift in slope is most pronounced at the sixth grade, where it goes from a virtually null relationship to a markedly positive one. The shift is less pronounced at the higher grades, but is still present. At the ninth grade, the shift is from a moderately positive slope to a steeper gradient. At the twelfth grade, on the other hand, both slopes are quite positive, the only difference being that one is steeper than the other. These differences by grade undoubtedly reflect differences in student composition for instance, there tend to be proportionately fewer low-achieving students at the higher grade levels.[9]

[8] The solid line in each of these figures encompasses a range of three sigma units above and below the mean E for each group. The dashed line is merely an extrapolation of the solid line; it extends beyond the range of the observed data.

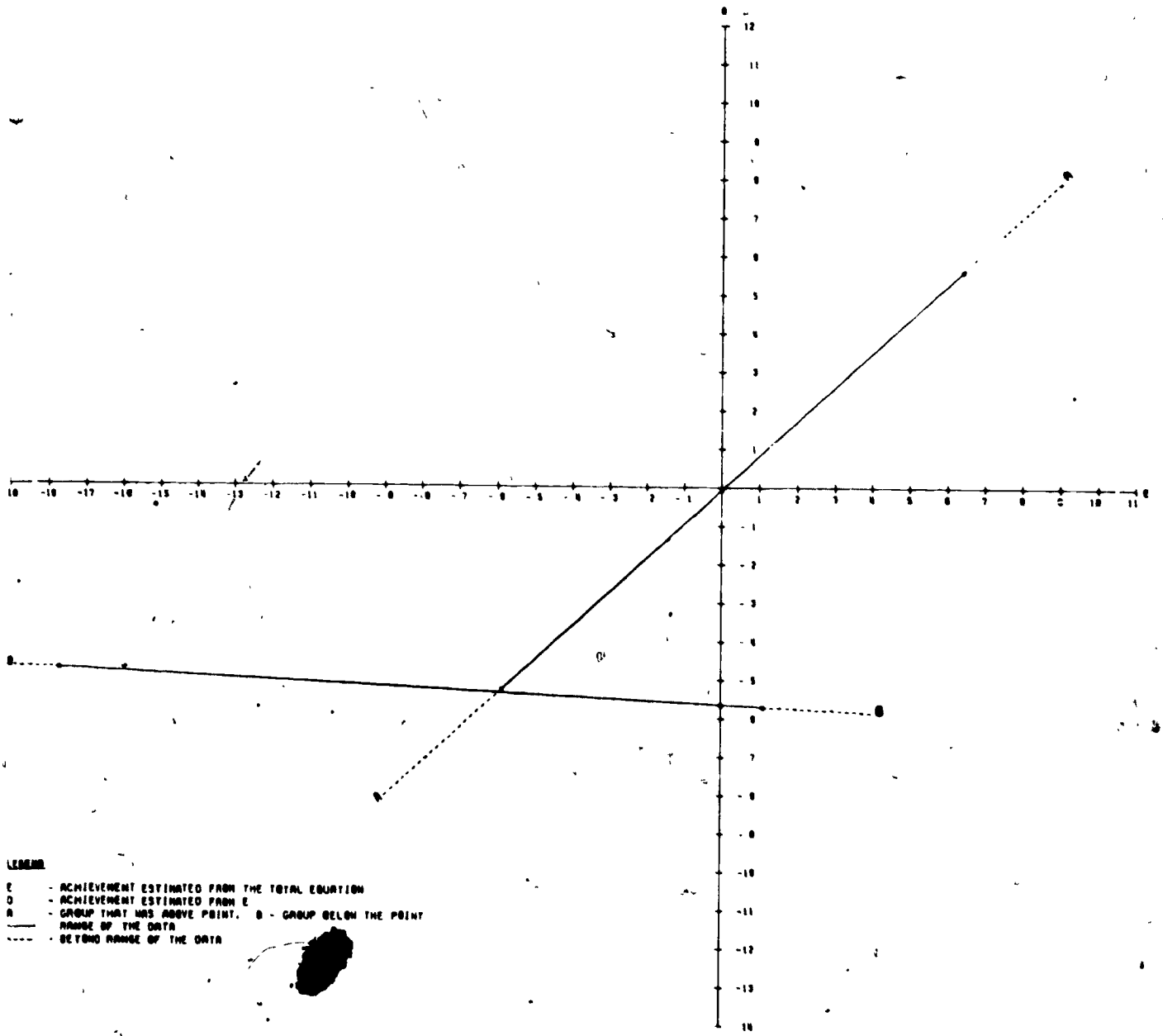
[9] See table 5.1 for some of the differences by grade between ethnic groups.

5.3. THE DISCONTINUITY: FACT OR ARTIFACT?

Past experience warns us that statistical nonlinearities and discontinuities are often ephemeral in nature; when sought for in another, independent body of data, they vanish. Let us, then, examine the null hypothesis that the results we have observed here are due to some peculiarity of the data we happened to be working with.

It might be argued that differential relationships with achievement should be expected for the different ethnic and socioeconomic groups, and that consequently, when they are all lumped into the same analysis, the resulting equation is bound to show a poor fit. As we shall see later, this criticism is not supported by the data. Nevertheless, we shall give it due consideration. Let us examine the residuals from the "Total" equation for each ethnic group separately. Each ethnic group shows a similar systematic departure from this equation: indeed, there are positive residual means at the low end for each grade level.

FIGURE 5.4.--DEPENDENCE OF ACHIEVEMENT ON FAMILY BACKGROUND, RESIDENCE, AND SCHOOL, FOR GROUPS ABOVE AND BELOW THE POINT OF DISCONTINUITY: SIXTH GRADE



These results, we feel, serve to dispose of this first objection.

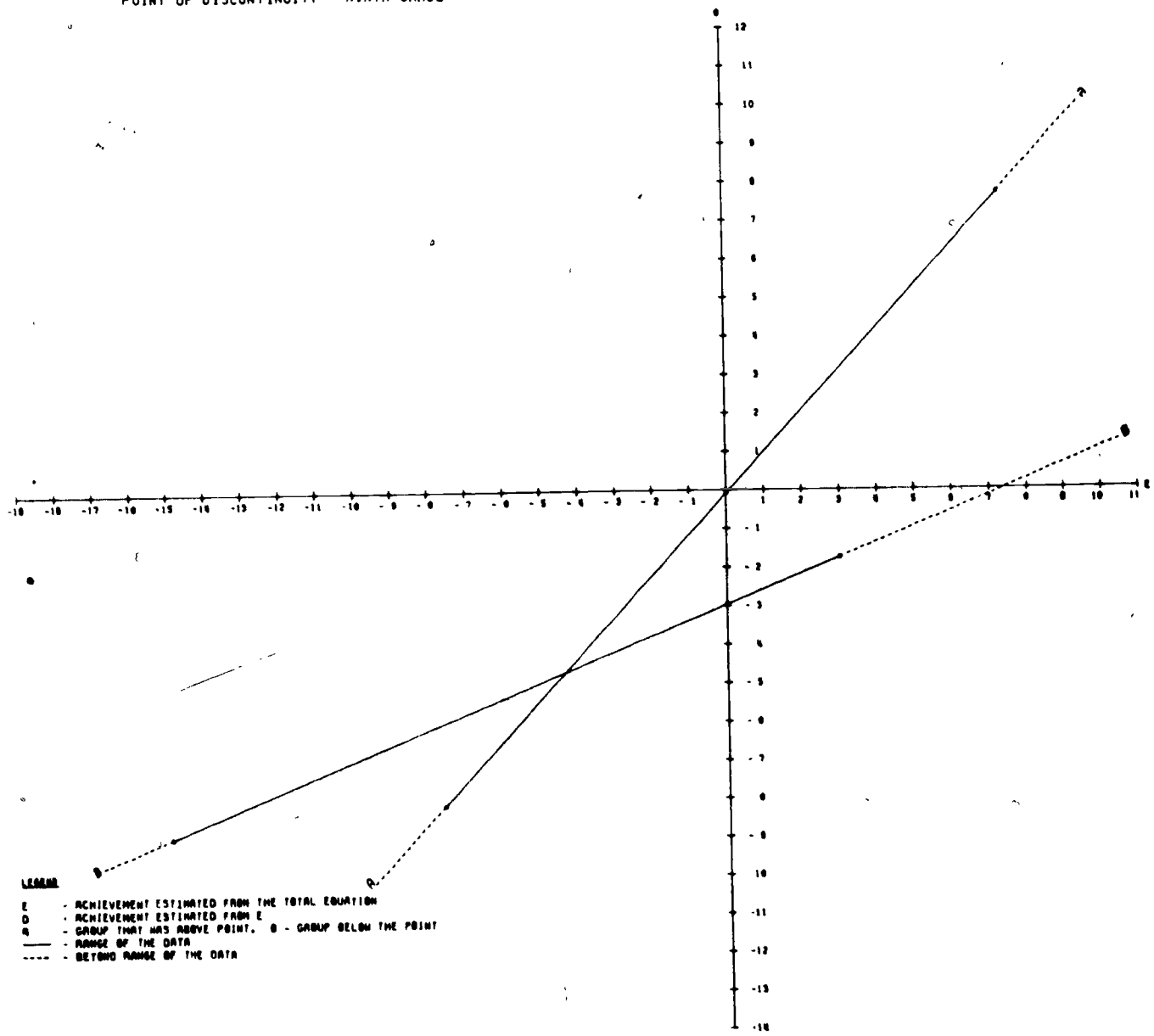
It might also be objected that the discontinuity is due merely to the use of such a large number of variables: Some of these variables, so the argument goes, might produce a slight but systematic nonlinear departure as a result of their peculiar interrelationships. To refute this objection, we examined the residuals for Home Background, Family Background, Area of Residence and School. For each of these three sets of variables we noted some differences at the upper end of the distribution of residual means. At the lower end, however, the residuals departed positively, and this was a consistent trend across the sets and for each of the separate ethnic groups. Hence, we are not inclined to the view that these departures are due merely to the use of a large number of variables.

But what about peculiarities of the data? wouldn't a so-called floor on the test scores produce a discontinuity? [10] Perhaps. But if all students below a certain point attained only a constant, why is there variance among the residuals in each of the low categories? A related objection might be that this discontinuity represents a point below which random test behavior occurs. But if this were the case, we would expect a wider scatter of residuals below this point, together with a more-or-less nonexistent relationship with Achievement. Neither, however, occurs; the scatter of residuals is systematic, and the variance among scores is systematically related to Achievement, as we have seen.

Another objection might be that these results are due in the main to our inclusion of the group called Other—a group of unknown origins. To this we would be inclined to retort that the Other group is not the only one below the point of discontinuity, and that when many of its members are eliminated, as was done in table 5.2 and the analyses based on it, a substantial portion of the students remain. Moreover, there is a strong possibility that many of the students who classified themselves as "Other" did not feel

[10] The existence of a "floor" means that it is impossible to score below a given level.

FIGURE 5.5.--DEPENDENCE OF ACHIEVEMENT ON FAMILY BACKGROUND, RESIDENCE, AND SCHOOL, FOR GROUPS ABOVE AND BELOW THE POINT OF DISCONTINUITY NINTH GRADE



that they belonged to any of the major ethnic categories. If this is the case, then they constitute a separate group.

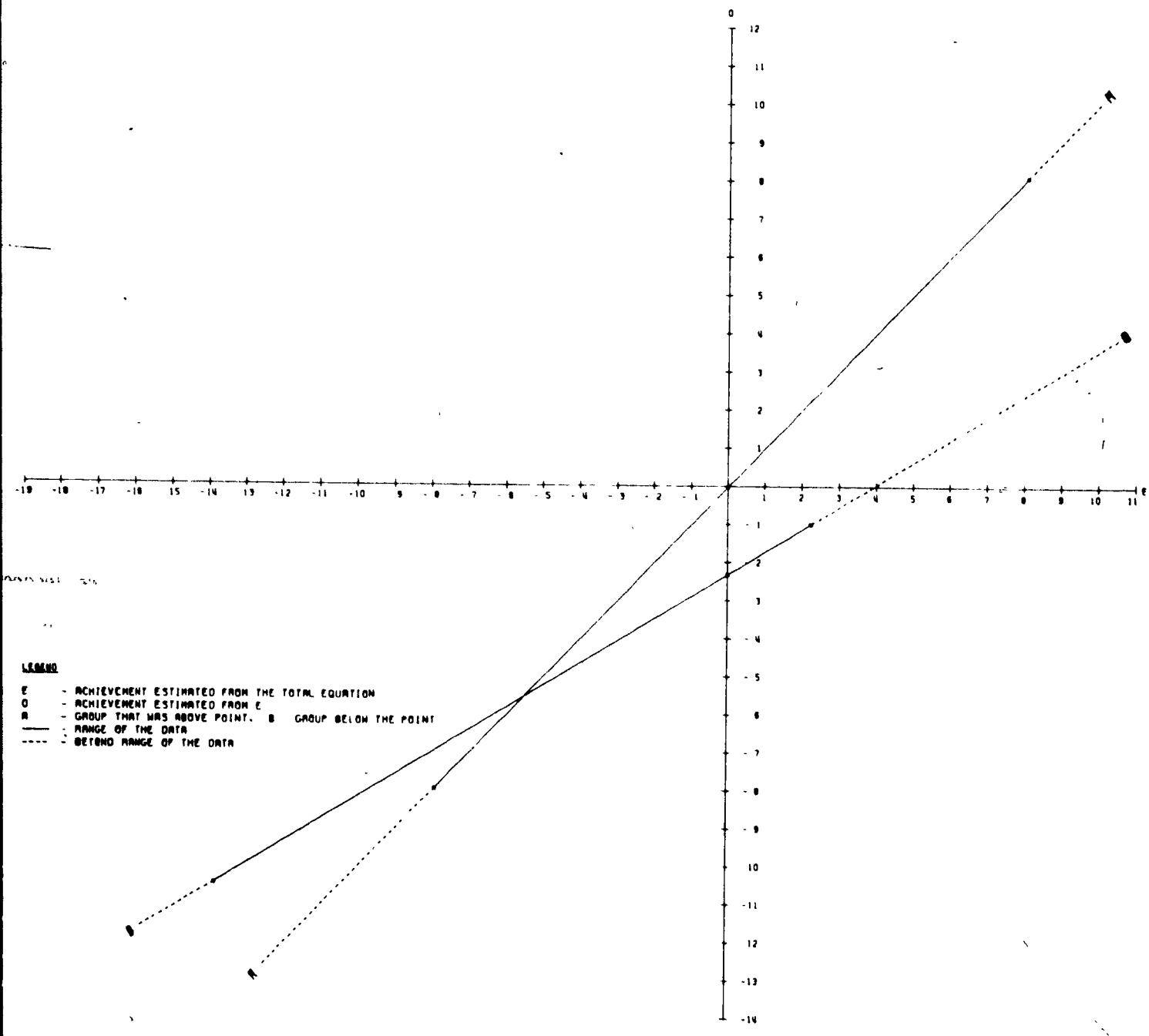
Finally, it might be objected that our results are an artifact of scaling the questionnaire items. This we would tend to discount strongly: the scaling procedure that we used was one that maximized the appropriateness of the linear model. These departures from linearity, then, are worthy of replication.

5.5. SUMMARY

In this chapter we examined the extent to which the relationship of Achievement with a range of environmental variables could be described in terms of linear relationships. We found that a single straight line served well throughout the high and middle ranges, but that at the lower end of the social continuum there came a point below which the relationship became nonlinear. Accordingly, the nature of the groups above and below this point of discontinuity was examined in some detail. The group below this point was found to be roughly one and two-thirds to two full sigma units below the mean of all students; it consisted of about 1 to 2 percent of all students, and was predominantly nonwhite.

Comparative analysis of the groups above and below the point of discontinuity showed that: (*a*) their means differed by 1 sigma unit or more on 11 of the 19 variables analyzed; (*b*) the group below the point was far more

FIGURE 5.6.--DEPENDENCE OF ACHIEVEMENT ON FAMILY BACKGROUND, RESIDENCE, AND SCHOOL, FOR GROUPS ABOVE AND BELOW THE POINT OF DISCONTINUITY: TWELFTH GRADE



heterogeneous than the group above it; (*c*) correlates of the background variables with Achievement tended to be smaller for the "Below" than for the "Above" group, with this difference being much more pronounced for the family background than for the residential and school variables; (*d*) a greater percentage of variation in Achievement could be accounted for by the background variables in the "Above" than in the "Below" group; (*e*) for the "Below" group, more of this variation could be attributed to residential and school variables, independent of family background, than for the "Above" group.

Linear regression equations were fitted separately for the "Above" and "Below" groups, with the result that a definite shift in the slopes of the two groups was noted. The "Below" group had either a slightly positive or a null slope, while the "Above" group had a marked positive slope. However, the extent of this shift was reduced at the higher grade levels.

Peculiarities of the data that might have given rise to these departures from linearity were considered and emphatically rejected. It was suggested instead that the existence of a point of discontinuity was a reasonable hypothesis, and one that should be investigated in future research.

PART 3: THE REGIONAL FACTOR

Chapter 6

HOW FAMILY AND SCHOOL INFLUENCE ACHIEVEMENT IN DIFFERENT REGIONS—I. WITH REGARD TO ETHNICITY IN GENERAL

The Achievement Study uncovered some interesting differences in the way that family and school, in combination with ethnic group membership, seem to influence students' achievement in the North and South. These differences warrant closer examination. In part 3 we propose to give them this in two ways: (*a*) by using a greater number of regional groupings; (*b*) by employing a number of new analytic techniques.

Table 6.1 gives the numbers of students and schools included in these analyses, by region.[1] It will be seen that although there are ample numbers of students in each group, the number of schools in the Northeast and Plains regions, particularly at the higher grade levels, is not as large as we might wish. In the discussions that follow, then, this factor should be kept in mind.

6.1. FAMILY BACKGROUND, SCHOOL, AND ACHIEVEMENT

Most of the analyses in this chapter depend on statistical manipulation of the variable that we used to indicate ethnicity. Its formal name, Racial-Ethnic Group Membership (RETH), is not an endorsement of "race," which we consider a wholly discredited concept, but an acknowledgment that American society is divided into caste-like groups with distinctive ethnic characteristics. Nor was there ever any intention on the part of the survey's original designers to tabulate anything in this highly controversial area except the student's own judgment on which racial-ethnic group he or she belonged to. The way in which this variable was scaled has been described in our earlier studies (Mayeske et al., 1973a, p. 6; Mayeske et al., 1973b, p. 11). When entered into the analysis, it proved to have a number of correlates, which should be reviewed here by region and grade level.

Table 6.2 shows that Socio-Economic Status (SES) is, on the whole, more highly correlated with RETH in the Mid-Atlantic, Southeastern, and Far Western regions, and least highly in the Northeastern. By grade level, of course, these trends reflect differential dropout rates, especially among Indians and Mexican-Americans. This may help to explain why, for all regions except the Southeast and Southwest, the correlation of SES with RETH is highest at the ninth and lowest at the twelfth grades. But they also reflect real changes in the composition of the indices, though it is not always clear to what degree.

Because of dropouts, it is particularly hard to interpret the general tendency for the correlational values in table 6.2 to be lowest at the twelfth grade, regardless of region.

[1] The States included in each regional grouping are listed in section 2.3.

Table 6.1.—Total Number of Students and Schools in Each Regional Group, by Grade Level

Region	Grade Level	Number of Students	Number of Schools	Region	Grade Level	Number of Students	Number of Schools
Northeast	12	4,280	20	Far West	12	14,959	85
	9	5,170	25		9	18,975	108
	6	4,965	97		6	16,191	308
	3	5,314	109		3	16,441	318
	1	2,935	54		1	10,080	177
Mid-Atlantic	12	23,039	87	Southwest	12	7,164	116
	9	35,066	135		9	10,030	125
	6	27,852	359		6	10,657	227
	3	29,477	391		3	11,308	234
	1	13,979	185		1	6,729	130
Great Lakes	12	13,497	69	Southeast	12	28,272	357
	9	17,360	88		9	40,019	389
	6	16,561	317		6	41,240	910
	3	18,508	329		3	42,587	912
	1	10,104	162		1	25,690	492
Plains	12	5,215	46	Total	12	96,426	780
	9	6,516	53		9	133,135	923
	6	5,840	151		6	123,305	2,372
	3	4,412	160		3	130,213	2,453
	1	4,412	98		1	73,929	1,302

Table 6.2.—Correlates of Ethnicity, by Region and Grade Level

Variable	Region											
	Northeast			Mid-Atlantic			Great Lakes			Plains		
1. Socio-Economic Status	26	29	21	39	44	32	32	36	25	32	36	27
2. Family Structure and Stability	33	30	22	31	39	29	29	34	23	28	35	20
3. Expectations for Excellence	15	14	06	14	21	03	16	16	04	11	14	04
4. Attitude Toward Life	21	24	14	23	34	25	21	26	25	17	20	14
5. Educational Plans and Desires	20	13	04	23	21	09	20	13	03	16	12	06
6. Study Habits	24	22	18	23	27	15	23	25	14	15	18	11
7. Achievement[a]	28	26	15	47	45	37	41	37	29	44	39	32
8. Multiple Correlation of 1-6	37	38	28	43	51	41	38	44	37	38	44	33
9. Multiple Correlation of 1-7	40	41	31	52	57	50	47	50	44	49	51	42
Grade Level	6	9	12	6	9	12	6	9	12	6	9	12

	Far West			Southwest			Southeast			Total		
1. Socio-Economic Status	38	42	34	33	37	34	35	40	38	37	38	34
2. Family Structure and Stability	24	33	23	21	24	27	32	35	29	30	30	26
3. Expectations for Excellence	16	22	08	16	16	−02	21	16	−03	17	12	−02
4. Attitude Toward Life	22	29	29	18	23	14	23	32	32	22	27	27
5. Educational Plans and Desires	23	23	16	20	17	02	22	11	04	22	13	05
6. Study Habits	23	28	17	17	18	05	21	22	11	22	18	10
7. Achievement[a]	45	46	41	44	42	44	55	53	55	49	46	45
8. Multiple Correlation of 1-6	40	46	41	36	41	44	42	51	52	41	48	46
9. Multiple Correlation of 1-7	50	54	50	47	49	57	58	62	66	53	56	57
Grade Level	6	9	12	6	9	12	6	9	12	6	9	12

[a] The correlates of Achievement and Racial-Ethnic Group Membership for grades 6 and 1 are, respectively by region: NE, 27, 18; GL, 38, 35; PL, 47, 38; FW, 40, 41; SW, 38, 40; SE, 39, 35; Total 41, 40. The correlate of Racial-Ethnic Group Membership was not computed for the Mid-Atlantic region for Achievement, it was 45. The numbers of students used in these analyses are given in table 6.1. Leading decimal points are omitted throughout the table.

Perhaps these intergroup differences really do narrow in the later years of schooling. However that may be, there are major differences across regions. Thus for Family Structure and Stability, the correlations tend to be highest in the Mid-Atlantic and Southeast, and lowest in the Southwest. For Expectations for Excellence, however, no region has a clear lead; in fact, the values across regions are rather similar.

The correlation of RETH with Attitude Toward Life tends to be highest in the Southeast, Mid-Atlantic, and Far West, and lowest in the Plains. Across regions there are some curious grade-level differences. In the Northeast, Mid-Atlantic, Plains, and Southwest, the values tend to rise at the ninth grade only to drop again at the twelfth. In the Great Lakes, Far West, and Southeast, however, they rise from the sixth to ninth grade and tend to stay high at the twelfth grade. These results suggest that, in these latter regions, the ethnically related differences among students who remain in school stay much the same, whereas in the former regions, they tend to become more blurred over time. Educational Plans and Desires tends to be more highly correlated with RETH in the Far West and this is true for each grade level. However, the differences across regions for this set of correlations are not great, and the values decrease consistently at the higher grade levels. Here, then, is another variable on which the students who stay in school tend to become more like each other over time, regardless of ethnicity.

For Study Habits, the correlational values are similar across regions but fluctuate somewhat by grade. By far the lowest value for the twelfth grade is in the Southwest. Achievement, as we would expect, is highly correlated with RETH.[2] But even here there are considerable regional variations: the values are clearly smallest in the Northeast and largest in the Southeast, with the other regions taking on intermediate values. Trends by grade level are also noticeable: the values decline at the higher grades except in the Far West, Southwest, and Southeast, where they remain more nearly the same. We can draw much the same conclusions about this as we did about Educational Plans and Desires.

The last three rows of table 6.2 yield some especially illuminating regional comparisons. For instance, examination of rows 7 and 8 allows one to gauge how predictable ethnic group differences are from Achievement as compared to how predictable they are from the six family background variables. Similarly, examination of rows 7 and 9 shows how much more predictable they become when these six variables are combined with Achievement. In the Northeast, Mid-Atlantic, Great Lakes, and Plains, ethnic group differences tend to be more predictable from the six family background variables than from Achievement alone. But we can see that these variables combined with Achievement have more predictive force in all regions. Finally, it can be inferred from the values in row 9 that RETH will have least predictive power in the Northeast and most in the Southeast.

6.1.1. Home Background

We noted in the Achievement Study that the presence or absence of key family members, as measured by Family

[2] We would expect Achievement to be more highly correlated with RETH than the other variables because in creating RETH we gave each ethnic group a weight based on its unadjusted achievement score.

Structure and Stability (FSS), played a moderate-to-small role in most groups' Achievement (ACHV). This role became even smaller after allowance had been made for differences among students in their Socio-Economic Status (SES). Some regional variations were noted, but they did not appear to be related in any systematic or obvious way to other known regional attributes. We wondered, then, if such relationships might appear if we used a more finely differentiated set of regional groupings. Accordingly, the first question we asked for these grouping was:

1. What is the magnitude of the role played in ACHV by FSS before and after allowance has been made for SES?

We answered this question by using commonality analysis.[3] Table 6.3 shows the results of unitized commonality analyses of these factors in ACHV for two conditions: (*a*) without adjustment of ACHV for any other factors; (*b*) after adjustment for RETH.

The values in the "RSQ(SES,FSS)" columns denote the level of ACHV variance explained, while those in the "Unique" and "Common" columns denote the magnitude of the explanatory role played by FSS as compared with SES. Let us compare the "RSQ(SES,FSS)" first. It will be seen that, for all regional groups, the percentage of variance in ACHV explained by SES and FSS is greater at the ninth than at sixth or twelfth grades. In addition, the percentages at the sixth grade tend to equal or exceed those at the twelfth grade. Too much importance should not be attached to these differences, since the indices were less comprehensively measured at the sixth grade, and since the impact of dropouts was greatest at the twelfth. For the same reasons, the higher values at the ninth grade are probably the most reliable ones. The most noteworthy regional differences here are between the Southeast and Mid-Atlantic, which have the highest unadjusted values, and the Northeast and Great Lakes, which have the smallest. The same trend prevails after the values have been adjusted for RETH.

After comparing the roles of FSS and SES, we concluded that:

1. The percentage role that can be assigned uniquely to FSS is always small. It is somewhat greater at the lower than at the higher grade levels, and somewhat smaller in the Northeast than in the other regions.
2. The explanatory role of SES relative to that of FSS is always large. It exceeds that of FSS by a factor of as much as 70 in the Northeast and of as little as 1 in the Southeast.[4]
3. A substantial percentage is confounded or at least cannot be assigned to SES with certainty. This common portion always exceeds the unique percentage for FSS.
4. The common portions tend to be smaller in the Northeast, Plains, and Southwest than elsewhere.
5. When adjustment is first made for the relationship of ACHV with ethnicity, both the common portion and the unique role for FSS tend to get smaller, while the unique role for SES tends to increase.

[3] For which see appendix A.

[4] These factors were calculated by dividing the unique percentage value for SES by that for FSS.

Table 6.3.—Commonality Analyses of Home Background Factors in Achievement, by Region and Grade Level

Region	Grade Levels	Unadjusted for Ethnicity				Adjusted for Ethnicity[b]			
		RSQ (SES,FSS)[a]	Unique SES	Common	Unique FSS	RSQ[a] (SES,FSS)	Unique SES	Common	Unique FSS
Northeast	12	19	86	14	0	17	89	11	0
	9	25	71	28	1	20	79	21	0
	6	19	75	24	1	15	87	13	0
Mid-Atlantic	12	21	76	23	1	15	88	12	0
	9	32	62	36	2	21	79	21	0
	6	29	63	30	7	18	74	21	5
Great Lakes	12	17	82	17	1	13	89	11	0
	9	23	59	37	4	15	73	25	2
	6	20	63	28	9	13	75	19	6
Plains	12	22	79	16	5	17	84	13	3
	9	24	67	28	5	16	81	17	2
	6	21	64	25	11	13	76	16	8
Far West	12	18	72	27	1	11	80	20	0
	9	26	56	29	5	15	66	30	4
	6	21	61	30	9	12	65	25	10
Southwest	12	18	78	16	6	10	91	7	2
	9	26	74	25	1	17	81	18	1
	6	23	70	20	10	15	75	15	10
Southeast	12	27	79	20	1	16	94	6	0
	9	32	65	32	3	20	82	17	1
	6	31	55	32	13	20	68	22	10
Total	12	23	78	21	1	15	90	10	0
	9	30	63	34	3	18	78	21	1
	6	27	61	30	9	16	72	20	8

[a] Leading decimal points omitted

[b] I.e., adjusted by means of partial correlation techniques

In addition, SES has a larger and FSS a smaller role at the higher levels.

Accordingly, it looks very much as if the role that FSS plays in ACHV is not separable from that played in it by SES. On the other hand, a large portion of the differences among students in their ACHV can be associated with their SES even after differences in their FSS have been allowed for. But there are no regional differences large enough to suggest that anything about any particular region, such as its distinctive customs or social structure, ought to be invoked as an explanatory theme in an inquiry of this sort.

6.1.2. Family Background

In the Achievement Study, we were able to group the student variables into two sets: (*a*) a set that reflected what we judged to be the location of a student's family in the social structure; (*b*) a set that reflected more the motivational and attitudinal aspects of family life. The former set contained SES and FSS, which together we called "Home Background (HB)," and the latter set the four attitudinal and motivational variables, which together we called "Family Process (PRCS)." In addition, our analyses showed that RETH, the variable denoting ethnicity, was more properly classified as a structural than as a motivational variable (Mayeske et al., 1973a, pp. 29–31). When we viewed the variables in this way, we noted that the motivational variables played a greater role than the structural ones in the North than in the South.[5]

[5] There were then only four regional groupings in our analysis: nonmetropolitan North, metropolitan North, nonmetropolitan South; and metropolitan South.

These results led us to suspect "that the color-caste aspects of the social structure, as represented by Racial-Ethnic Group Membership, had a greater impact on Achievement in the South, and would consequently be more difficult to overcome there through educationally related child-rearing activities" (ibid., p. 147). We examined this empirical generalization in greater detail here by asking, for each regional grouping, our second question:

2. When HB and PRCS are analyzed together, what is the magnitude of their respective roles in ACHV?

In order to answer this question we performed three kinds of analysis, each with a different use of RETH. Table 6.1 presents the results of all three. The first, labeled "Ethnicity Not Included," determined the relative percentage values for HB and PRCS when RETH was not entered into the analysis; the second kind included RETH as a home background variable; and the third kind adjusted ACHV for its relationship with RETH before ascertaining the relative percentage values for HB and PRCS.

The first column of R-squares in table 6.1 shows that the amount of variance in ACHV explained by these two sets of factors varies from a low of a little better than 25 percent in the Northeast (sixth grade), to a high of 46 percent in the Plains (twelfth grade). For regions other than the Southeast and Southwest, the percentages are somewhat lower at the sixth than at the other grades. The second column of R-squares shows that there is an increase when RETH is brought into the analysis, and that it is greatest in the Southeast and Southwest. The third column of R-squares is not directly comparable with the

Table 6.1.—Commonality Analyses of Family Background Factors in Achievement, by Region and Grade Level

Region	Grade Level	Ethnicity not Included: RSQ (HB,PRCS)[a]	Unique HB	Common	Unique PRCS	Ethnicity Included: RSQ (HB,PRCS)[a]	Unique HB	Common	Unique PRCS	Adjusted for Ethnicity: RSQ (HB,PRCS)[a]	Unique HB	Common	Unique PRCS
Northeast	12	40	4	42	54	41	6	40	54	40	4	39	57
	9	40	8	54	38	41	11	52	37	37	6	49	45
	6	28	24	43	33	30	29	42	29	24	25	36	39
Mid-Atlantic	12	42	8	43	49	47	19	37	44	39	4	35	61
	9	45	13	42	29	50	20	54	26	37	8	48	44
	6	37	27	51	22	43	38	45	17	28	22	44	34
Great Lakes	12	38	5	38	57	42	14	33	53	37	3	32	65
	9	36	12	52	36	40	21	47	32	30	7	44	49
	6	31	19	46	35	37	32	41	27	25	14	37	49
Plains	12	46	9	40	51	50	17	35	48	44	6	33	61
	9	39	12	50	38	44	21	44	35	34	6	31	53
	6	31	24	46	30	39	40	37	23	24	15	39	46
Far West	12	37	7	41	52	43	20	39	41	32	3	31	66
	9	38	12	56	32	44	24	50	26	29	7	43	50
	6	31	22	46	32	38	37	41	22	23	15	37	48
Southwest	12	30	24	35	41	41	44	22	34	27	5	30	65
	9	37	16	52	32	43	27	46	27	31	10	45	45
	6	33	23	49	29	40	37	42	21	25	18	41	41
Southeast	12	38	27	43	30	52	46	33	21	32	11	39	50
	9	42	23	53	24	52	38	44	18	33	13	47	40
	6	39	30	51	19	51	47	39	14	29	23	44	33
Total	12	38	17	43	40	47	32	35	33	34	7	36	57
	9	41	18	55	27	47	29	48	23	32	10	47	43
	6	36	27	49	24	44	41	42	17	26	21	41	38

[a] Leading decimal points omitted.

others, since their variance bases are different. It should be noted, however, that the values here are somewhat more uniform across regions.

As for the relative values of HB and PRCS for these different adjustments, it is clear that before ethnicity is brought into the analysis, the role for PRCS tends to equal or exceed that of HB. Moreover, for every regional group and grade level, the role of PRC increases at the higher grade levels and (except in the Southeast and Southwest) that of HB decreases. These trends can be attributed, in part, to the somewhat more comprehensive nature of the indices at the higher grades, as well as to the increasing numbers of dropouts. Similarly, the common portion is often quite large—for most groups, as large as 40 or 50 percent.

When ethnicity is brought into the analysis, relative values change considerably for some regions. At the higher grade levels, the role of PRCS continues to equal or exceed that of HB, except in the Southeast. At the sixth grade, however, the opposite is true in almost all regions. In the Northeast and Great Lakes, these percentages are more nearly equal, but elsewhere values for HB exceed those for PRCS by a factor of about 2 to 1. We offer the same reasons as before for these differences by grade level. For most regions, the common portions tend to be slightly smaller than before.

Finally, when adjustment is made for the relationship of ACHV with ethnicity, the values for PRCS come to exceed those for HB by as much as 22 to 1, in the Far West (twelfth grade) or as little as 1.1 to 1, in the Southeast (sixth grade). The common portions tend to be smaller for this kind of analysis than they were for the earlier two.

The earlier findings that prompted this inquiry were not only based on fewer regional groups; they dealt entirely with students at the ninth grade. The introduction of more grade levels makes our original generalization far less certain. If we are willing to accept that the Southeast and, to a lesser extent, the Southwest were the regions of the country in which the institution of caste was then (circa 1965) most highly developed, the generalization seems moderately well supported for the ninth and twelfth grades, but hard to sustain for the sixth grade. Among the factors that might be responsible for these anomalies are: dropout rates that differ by grade and by region; indices (particularly the attitudinal and motivational ones) that are less comprehensive at the sixth than at the higher grade levels; and the sheer concentration of students from minority groups in certain regions. Separating out the effects of these and other such factors from each other is not a task that can be undertaken here. In any case, the entire topic needs far more study at the community and neighborhood level. Only at this level would it be possible to tell how far the differences between the grades that were uncovered in our analysis are due to differences in the reliability of the indices at each grade.

6.1.3. Family Background and School

In our earlier work we also noted that, while the role of family background factors in Achievement often exceeded that of school factors to a considerable degree, the *independent* role of school factors tended to be greater in the South than in the North. In addition, there was often a greater confounding of family background and school factors in the South than in the North. In this subsection we shall explore the extent to which these same results were obtained with the larger set of regional groups.

Before we proceed further, it may be as well to examine the extent to which, in these various regions, students with similar family backgrounds and achievement scores attended school with one another. Table 6.5 shows the percentage of variation in each individual student attribute that was associated with the school mean for that same variable.[6] As our first example, let us examine the percentages for Socio-Economic Status. It will be seen that, for most regions, the association of a student's SES with that of his fellow students declines somewhat at the higher grade levels. Most of this, in our opinion, reflects the so-called feeder school effect, that is, the way in which, at the higher grade levels, students of dissimilar background tend to be channeled into the same schools. Naturally, this has the effect of reducing the variation among schools. Other sources of variation by grade level are differences in dropout rates, changes in the composition of indices, and differing sources of information about the student's background.[7]

The same trend is in evidence for Family Structure and Stability though the absolute level of association is lower and the exceptions more noteworthy. When we come to ethnicity, however, we find the percentages are so large that they dwarf those for any other variable. These percentages are largest by far in the Southeast and smallest in the Northeast. Further, the values for the Southeast and Southwest do not decline at the higher grade levels; for the Southwest, indeed, they actually dip at the middle grades. Over all grade levels, the magnitude of these values attests to the extraordinary degree of ethnic segregation that existed in U.S. public schools as of fall 1965. For Achievement, we can note that the absolute percentages are largest in the Southeast, and that this is the only area in which they do not decline at the higher grade levels. Expectations for Excellence also shows a declining trend at the higher grade levels. The results for Attitude Toward Life are not as clearcut: the percentages do increase somewhat from the sixth to ninth grades, but from the ninth to the twelfth they either decrease or stay about the same. This plateau at the higher grades is particularly evident in the southern regions, with the absolute value being greatest in the Southeast.

For Educational Plans and Desires, three distinct trends emerge across grade levels:

1. Increasing values at the higher grade levels in the Northeast and Mid-Atlantic.
2. Decreasing values in the Southeast, Plains, and (to a lesser degree) Great Lakes.

[6] For the data analysis model that generated these relationships, see appendix A.

[7] For grades 1 and 3 the students' teachers provided this information, for the higher grades the students themselves did.

Table 6.5.—Percentage of Variation in Individual Student Variables Associated With the Schools Students Attend, by Region and Grade Level

Region	Variable																			
	Socio-Economic Status					Family Structure and Stability					Ethnicity					Achievement				
Northeast	38	41	21	16	19	17	55	23	5	3	51	26	16	19	9	20	24	16	12	11
Mid-Atlantic	40	41	25	27	23	14	14	12	10	6	67	52	45	48	42	31	33	29	26	20
Great Lakes	28	32	19	16	17	11	12	15	6	3	70	57	50	42	38	26	24	22	14	9
Plains	36	34	24	27	19	12	13	11	11	6	76	66	58	56	33	27	29	23	18	11
Far West	27	32	20	20	15	11	9	9	9	4	56	46	43	41	37	23	25	22	18	12
Southwest	19	25	15	17	20	18	13	8	8	11	55	41	32	41	63	22	23	18	18	22
Southeast	38	37	28	32	33	12	23	19	17	12	91	78	73	79	84	32	37	43	37	41
Total	35	38	25	26	26	14	20	17	12	8	75	60	55	57	61	31	32	32	27	26
Grade Level	1	3	6	9	12	1	3	6	9	12	1	3	6	9	12	1	3	6	9	12

Region	Expectations for Excellence			Attitude Toward Life			Educational Plans and Desires			Study Habits		
Northeast	3	4	3	5	8	2	5	10	12	5	5	5
Mid-Atlantic	6	6	2	10	15	9	9	12	13	11	8	4
Great Lakes	7	3	2	11	9	6	8	4	6	14	4	3
Plains	6	3	2	6	6	4	8	7	4	8	6	3
Far West	6	6	2	8	12	9	7	7	5	9	9	3
Southwest	6	4	4	7	13	12	7	7	6	8	7	7
Southeast	13	9	5	17	24	25	14	10	8	18	16	11
Total	8	6	4	12	16	15	10	9	8	14	10	6
Grade Level	6	9	12	6	9	12	6	9	12	6	9	12

NOTE.—For the numbers of students and schools involved in these analyses, see table 6.1.

3. Relatively constant values for the remaining regions.

Educational Plans and Desires, unlike many of the other variables, does not show uniformly higher values for the Southeast.

For Study Habits, values tend to decline at the higher grade levels, while the absolute values tend to be greater in the Southeast. For almost every grade level and almost all the variables, the association of individual student attributes with those of their schoolmates tended to be greater in the Southeast than in the other regions. In addition, for all regions the magnitude of this association was far greater for ethnicity than for any of the other measures. This brings us to our third question:

3. When FB and SCH are analyzed together, what is the magnitude of their respective roles in ACHV?

FB, the set of variables that represents a student's family background, here consists of HB and PRCS combined, a set of six factors in all. SCH, the set that represents the school a student attends, consists of 10 school factors found to be most important in differentiating between schools.[8] As before, the status of RETH was varied. First excluded from the analyses, it was then included as an aspect of FB; finally, ACHV was adjusted for its relationship with it.

The resulting analyses are shown in table 6.6. Let us look first at the columns headed "RSQ(FB,SCH)" in the first two sets of analyses. Whether ethnicity is excluded or included, the values here are remarkably similar; indeed, they increase by only 1 or 2 percent in the latter case. The main exception to this is the Southeast, where the R-squares are identical in both cases. Once again, the values are largest in the Southeast. The Mid-Atlantic has the second largest values, while those for other regions tend to be more like each other. When ACHV is adjusted for ethnicity, the R-squares remain highest in the Southeast and become more like each other in the remaining regions. Some of these latter values are close to those observed in the Southeast.

Turning now to the columns that show the relative roles of FB and SCH, we find that, before ethnicity is included as an aspect of FB: (*a*) the role of FB exceeds that of SCH (in regions other than the South, this trend increases at the higher grade levels); (*b*) the confounding of FB and SCH (i.e., the common portion) is greatest in the Southeast and next greatest in the Mid-Atlantic (there is nothing much to choose among the other regions in this respect). When ethnicity is included, it will be seen that: (*a*) roughly half the percentage role of SCH moves over into the common portion; (*b*) the role of FB remains roughly the same. Finally, when ACHV is adjusted for its relationship with ethnicity: (*a*) the role of FB is increased (substantially, in most regions); (*b*) so is the role of SCH; (*c*) the common portion tends to be substantially reduced.

Thus, for almost every region and grade level, as well as for three types of analysis that vary the status of ethnicity, the role of family background exceeds that of school factors. There is, however, one major exception: the Southeast at grades 6 and 12. Moreover, for each type of analysis, the confounding of family background and school factors as they relate to ACHV is greatest in the Southeast, and the unique role of school factors tends also to be slightly greater there. Similar results, moderated

[8] Five variables pertaining to the achievement and motivational level of the student body, and five to the teaching staff's salary and training levels, ethnic composition, verbal skill levels, view of their teaching conditions, and preference for working with students of different ability levels. For a more detailed description of these variables, see chapter 2.

Table 6.6.—Commonality Analyses of Family Background and School Factors in Achievement, by Region and Grade Level

Region	Grade Level	Ethnicity not Included: RSQ (FB,SCH)	Unique FB	Common	Unique SCH	Ethnicity Included: RSQ (FB,SCH)	Unique FB	Common	Unique SCH	Adjusted for Ethnicity: RSQ (FB,SCH)	Unique FB	Common	Unique SCH
Northeast	12	43	76	18	6	44	76	18	6	42	77	17	6
	9	45	67	22	11	45	72	23	5	41	78	16	6
	6	35	55	24	21	36	56	26	18	31	59	19	22
Mid-Atlantic	12	50	61	23	16	51	62	30	8	43	74	16	10
	9	52	50	37	13	53	51	42	7	41	69	20	11
	6	48	40	37	23	50	42	46	12	35	58	20	22
Great Lakes	12	44	80	8	12	45	80	14	6	40	87	5	8
	9	43	66	16	18	44	66	25	9	35	84	2	14
	6	42	48	25	27	44	49	37	14	32	67	10	23
Plains	12	51	78	11	11	53	79	16	5	47	86	7	7
	9	46	61	24	15	48	63	29	8	38	75	14	11
	6	42	46	28	26	43	48	42	10	30	70	12	18
Far West	12	44	73	15	15	46	74	20	6	35	90	1	9
	9	45	60	24	16	47	61	33	6	33	86	3	11
	6	42	46	29	25	43	48	41	11	28	70	9	21
Southwest	12	44	49	19	32	46	51	39	10	33	75	8	17
	9	46	60	21	19	48	61	39	10	37	76	8	16
	6	41	55	25	20	44	58	33	9	30	73	11	16
Southeast	12	60	31	34	35	60	32	55	13	43	60	15	25
	9	57	35	39	26	57	35	55	10	41	64	18	18
	6	58	26	41	33	58	27	59	14	41	48	24	28
Total	12	52	50	24	26	54	51	37	12	42	72	10	18
	9	52	47	32	21	53	48	42	10	39	70	13	17
	6	50	35	37	28	51	37	50	13	36	56	19	25

by grade level and type of analysis, were observed for the Southwest. Accordingly, we are inclined to maintain our previous assertion that the role of school factors is greater in the South than in the North, though we must now qualify it by saying that this tendency is more marked in the Southeast than the Southwest. We have already suggested a number of reasons why this should be so.

6.2. SOCIAL CONDITIONS AND ETHNIC GROUP DIFFERENCES IN ACHIEVEMENT

Another of our earlier findings that needs to be reexamined is that, after a number of social conditions have been allowed for, the magnitude of the association of ethnicity with achievement dwindles to about 1 to 2 percent (Mayeske et al., 1973a, pp. 125-131; Mayeske, 1971). For our larger set of regional groups, then, we now ask our fourth question:

4. What is the magnitude of the association of ethnicity (RETH) with ACHV before and after various social conditions have been allowed for?

The social conditions in question are identified as follows:

None.—This denotes the association of ethnicity with ACHV before the relationship of ACHV with any other factors has been allowed for.

HB.—This denotes the association of ethnicity with ACHV after the relationship of ACHV with the student's Home Background (HB), as defined by SES and FSS, has been allowed for.[9]

FB.—This denotes the association of ethnicity with ACHV after the association of ACHV with the six FB factors (two HB and four PRCS) have been allowed.

FB, SCH.—This denotes the association of ethnicity with ACHV after the association of ACHV with FB and the 10 school factors, known as School (SCH), has been allowed for.

These percentages are presented graphically in figure 6.1. It will be seen that, for the "None" condition, the relationship of ACHV with ethnicity varies from a low of 2 percent in the Northeast (grade 12) to a high of 30 percent in the Southeast (grades 6 and 12). These two regions remain at either end of the observed range for all grade levels. The ordering of regional groups remains roughly the same for the "HB" and "FB" conditions. However, we can note that the absolute values decrease by as much as one-half to two-thirds for the "HB" condition, and by one or two percentage points for the "FB" condition. For the "FB, SCH" condition, however, the ordering changes: some of the lowest percentages now occur for the Northeast and Southeast, while the Plains, Southwest, and Far West usually have the largest ones. By comparing the "FB, SCH" with the "FB" condition, we can see that making allowance for the school factors reduces the "FB" values by an amount ranging from negligible in the Northeast to substantial in the Southeast. Hence the variation in educational achievement associated with ethnicity, although substantially larger in some regions than in others, can be almost completely accounted for by a number of variables that are related to the social conditions for these groups within each region.[10] Or, in statistical terms, the percentage of achievement that remains associated with

[9] The computational formula was: $U(RETH) = RSQ(S.RETH) - RSQ(S)$, where S represents the set of variables to be taken into account. For one type of analysis, S consists of the factors called HB, for the second type it consists of FB, and for the third type, it includes both FB and SCH.

[10] As of 1965.

Table 6.7.—Multivariate Commonality Analyses of Home Background and School Factors in Achievement and Motivation, by Region and Grade Level

Region	Grade Level	Ethnicity not Included				Ethnicity Included				Adjusted for Ethnicity			
		MRSQ (HB,SCH)[a]	Unique HB	Com-mon	Unique SCH	MRSQ (HB,SCH)[a]	Unique HB	Com-mon	Unique SCH	MRSQ (HB,SCH)[a]	Unique HB	Com-mon	Unique SCH
Northeast	12	57	57	18	25	59	58	20	22	54	57	19	24
	9	68	55	15	30	70	57	18	25	62	57	14	29
	6	58	53	12	35	61	54	14	32	53	54	9	37
Mid-Atlantic	12	71	39	18	43	74	42	30	28	58	46	16	38
	9	84	45	21	34	86	47	30	23	68	55	14	31
	6	74	41	25	34	76	42	33	25	60	51	16	33
Great Lakes	12	62	55	9	36	65	57	21	22	52	62	10	28
	9	73	54	10	36	75	55	20	25	60	60	18	32
	6	69	36	22	42	71	37	31	32	57	43	15	42
Plains	12	61	55	10	34	64	58	19	23	52	61	10	29
	9	61	47	16	37	64	50	24	26	51	52	24	34
	6	67	36	18	46	69	38	30	32	53	45	11	44
Far West	12	68	57	9	34	73	60	21	19	55	66	7	27
	9	72	51	16	33	75	52	27	21	56	62	9	29
	6	69	45	19	36	72	47	28	25	55	56	10	34
Southwest	12	77	30	10	60	79	32	32	36	57	38	9	53
	9	81	49	13	38	84	51	21	28	69	55	10	35
	6	60	45	18	37	64	49	25	26	49	53	11	36
Southeast[b]	12	117	25	14	61	118	25	41	34	86	33	13	54
	9	110	31	19	50	111	31	29	30	85	39	17	44
	6	98	28	27	45	100	29	42	29	78	38	21	41
Total	12	91	33	14	53	93	34	33	33	70	41	12	47
	9	91	39	18	43	93	40	21	29	73	48	13	39
	6	81	34	25	41	83	36	35	29	65	44	16	40

[a] Leading decimal points omitted.
[b] Decimal point omitted after first numeral

ethnicity for each grade level in each region is, after allowance has been made for these social factors, so small as to be of negligible explanatory value.

Nevertheless, there is a substantial amount of variation in achievement that we have not accounted for. This is the portion that is *not* associated with ethnicity. It can be determined in the present instance by comparing the "None" condition in figure 6.1 with the corresponding "RSQ" values for the "Ethnicity Included" condition in table 6.6. For example, for the Northeast at the twelfth grade, the percentage of ACHV that can be associated with FB and SCH when ethnicity is included in the analysis is 44 (table 6.6). For the same group, the percentage of variation in ACHV that can be associated with ethnicity when both FB and SCH have been allowed for is 2 (figure 6.1). For this group, then, the percentage of variation in ACHV that is independent of ethnicity is: 44 — 2 = 42. In general, when the family background and school variables have been allowed for, the amount of variation in achievement that is independent of ethnicity ranges from twice to twenty times the amount that can be associated with it.

6.3. SOCIAL CONDITIONS AND ETHNIC GROUP DIFFERENCES IN MOTIVATION

A student's level of achievement is in part a product of his motivation to achieve. But who supplies that motivation? Our data show that it is neither family nor school alone, but both together. How well the student might do in school, how much one's life can be improved through education, what one can aspire to and how one might set about fulfilling these aspirations—all these are questions to which both family and school will early provide answers. One fifth question, then, is to ask, for each regional group:

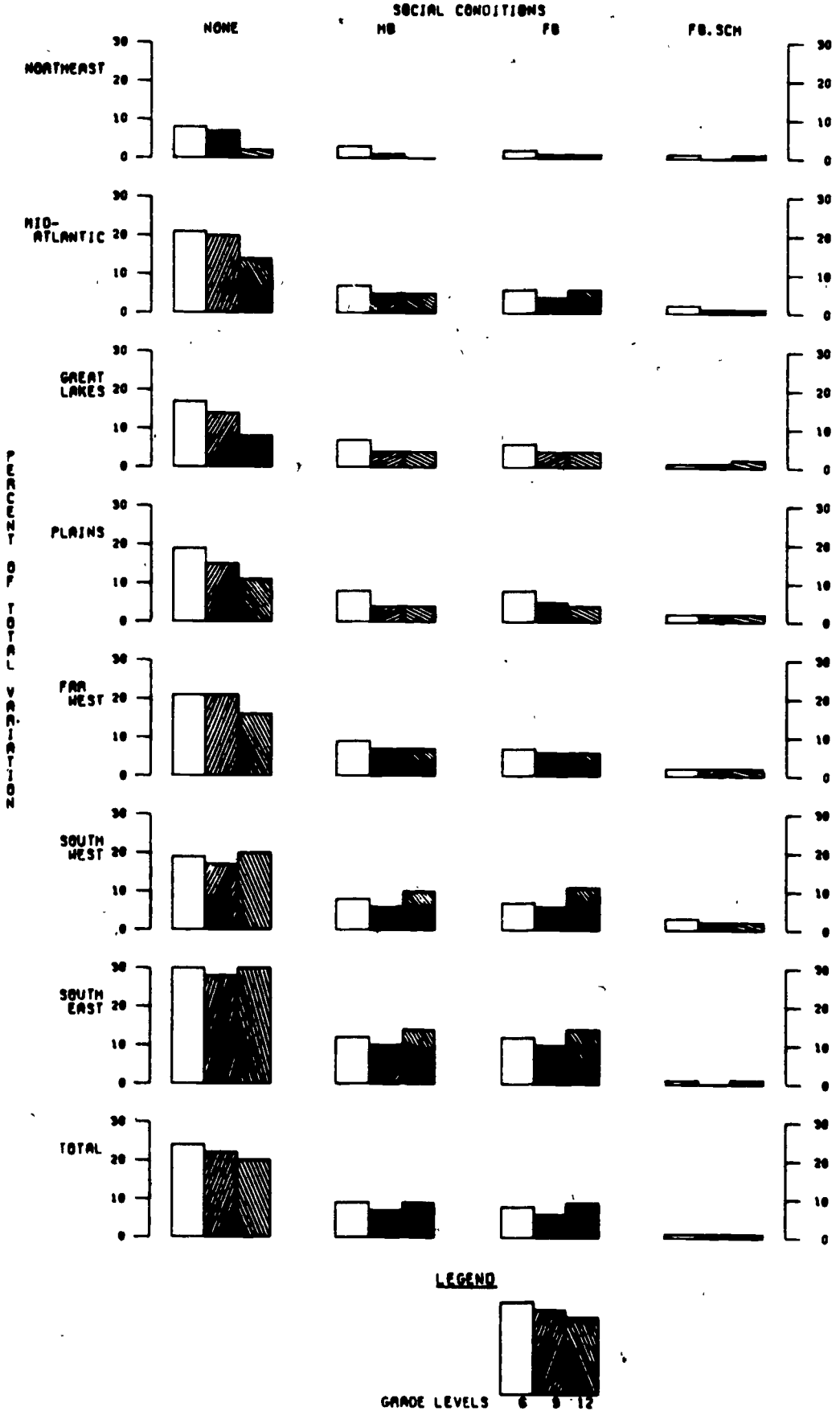
5. What is the magnitude of the roles played by HB and SCH in ACHV and the four motivational variables combined?[11]

To answer this question we used HB and SCH as the independent variables, varying the status of RETH as before. For the dependent set, we used ACHV and the four motivational variables known as Motivation (MTVTN). This type of analysis, in which more than one variable is treated as dependent, uses a special form of the commonality technique. Accordingly, a few words about the nature of this technique may be helpful at this point. What it does, essentially, is to transform the dependent variables into a set of orthogonal vectors, and compute the amount of variance in each vector accounted for by each different set of regressor variables. The resulting multivariate squared multiple correlations (MR-squares) are then used in a computational algorithm of the same form as is used in a commonality analysis with a single dependent variable. Since these MR-squares are actually percentages of the trace of this transformed matrix, they do not have unity as their upper limit.[12]

[11] The four motivational variables are: Expectations for Excellence; Attitude Toward Life; Educational Plans and Desires; and Study Habits. For a description of them, see chapter 2.

[12] A mathematical exposition of commonality analysis will be found in appendix A.

FIGURE 6.1.--PERCENTAGE OF TOTAL VARIATION IN ACHIEVEMENT ASSOCIATED WITH ETHNIC GROUP MEMBERSHIP AS A FUNCTION OF SOCIAL CONDITION VARIABLES, BY REGION AND GRADE LEVEL



The results of these multivariate analyses are given in table 6.7. They are noteworthy in a number of respects, particularly when compared with our earlier analyses: *(a)* the MR-squares are much larger than their univariate counterparts (this fact in itself is not surprising, but some of the values are); *(b)* the unique percentages for the school set of variables are larger than those seen heretofore; *(c)* the common portions are smaller, on the whole, than those seen heretofore. Let us examine, then, how these results vary by region.

When ethnicity is not included in the analysis, the MR-squares tend to be smallest in the Northeast and largest in the Southeast. Next largest in this regard are the values for the Southwest and Mid-Atlantic, with the remaining regions usually having smaller values. The ordering hardly changes when ethnicity is included as an aspect of Home Background (HB), though the magnitude of the MR-squares increases by some two to four percent. When adjustment is made for ethnicity, the MR-squares tend to remain largest in the Southeast but become smallest in the Plains instead of, as previously, in the Northeast. Most of the regional values for a given grade level tend to be closer together when ethnicity is adjusted for. The major exception is the Southeast.

The relative percentage roles for HB and SCH exhibit some definite trends by grade level. For instance, the common portions are nearly always greater at the lower than at the higher grade levels, and the unique percentage role of HB exceeds that of SCH for most regions most of the time. But there are some notable exceptions both in the extent to which the one exceeds the other and in the consistency with which it happens; indeed, only in the Northeast and Far West does the role of HB consistently exceed that of SCH for each grade level. In the Mid-Atlantic and Southwest, the role of HB exceeds that of SCH for grades 6 and 9, while the opposite is true at grade 12. Similar results obtain for the Great Lakes and Plains. In the Southeast, the role of SCH exceeds that of HB for each grade level by a factor that is not even approached by any other region except the Southwest.

When ethnicity is included as an aspect of HB, the common portion increases, the unique percentage for SCH decreases (often quite substantially), and the unique percentage of HB increases slightly or stays about the same. Here, the role of HB comes to exceed that of SCH for almost every region and grade level. The major exceptions are the Southwest and Southeast at the twelfth grade—and the other grade levels in the Southeast show HB and SCH on an almost equal footing. Hence, the inclusion of ethnicity tends to pull variance that was uniquely associated with SCH factors into their shared portion. In the Southeast more is pulled away from the SCH factors and into the common portion than in any other region.

When Achievement and the four motivational variables are first explicitly adjusted for their relationship with ethnicity, the role of HB tends to equal or exceed that of SCH for most regions and grade levels. Moreover, their common portion tends to recede to a magnitude closer to what it was before ethnicity was included. Major exceptions to this are found at each grade level in the Southeast and at the twelfth grade in the Southwest. Notable, too, are the more nearly equal roles for HB and SCH in the Great Lakes and Plains regions at the sixth grade.

To sum up: the role of SCH in these analyses has exceeded that of HB by a much greater margin than we have noted previously. It would seem desirable to go beyond these analyses in order to disentangle the roles played by the different aspects of SCH, that is, the five student body and five teaching staff variables. However, as we demonstrated in an earlier work, the teaching staff and other school variables are almost completely confounded with the student body variables (Mayeske et al., 1973a). Hence, such an inquiry would not be fruitful. In addition, much of the among-school variance in these student body variables can best be viewed as arising from the organization of schools along residential lines. We would tend to view many of the common factors as attributable to considerations of this kind rather than to the interplay of the two sets of variables. What does seem particularly noteworthy, however, is that a more comprehensive set of student outcome measures shows the school as having a larger role than appears for it on most single-outcome measures. We shall have more to say on this point in later chapters.

6.4. REGIONAL DIFFERENCES IN FAMILY BACKGROUND, ACHIEVEMENT, AND SCHOOL

In this section we shall undertake various ways of examining the nature of the differences among regions. The first is to ask a question that happens to be the sixth in our present series:

> 6. How much of the total variance among individual students on each of the family background and achievement variables is associated with their membership in the various regional groups?

One way of approaching this question is to form the ratio of *(a)* the variation among the seven regions on the variable to *(b)* the variation among all students on the variable. For example, for Achievement (ACHV) the equation would be:

$$\text{Total variance in ACHV associated with regional differences} = \frac{\text{Variation among regions in ACHV}}{\text{Variation among students in ACHV}}$$

The resulting percentages, for Achievement and for each of the six family background variables, are given in table 6.8. It will be seen that the value is never large for any variable; indeed, the only three for which it exceeds 1 percent are Achievement, Racial-Ethnic Group Membership, and Socio-Economic Status. From these figures we can conclude that the difference among regional means is not a major explanatory variable for individual students.[13]

[13] Whether or not this is so for the different ethnic groups is a matter that will be addressed in the next chapter.

Table 6.8.—Percentage of Total Variation in Individual Student Variables Associated With Regional Differences, by Grade Level

Variable	Grade Level			
	Twelfth	Ninth	Sixth	Average
Socio-Economic Status	4	3	3	3 3
Family Structure and Stability	1	1	1	1 0
Racial Ethnic Group	6	4	4	4 7
Expectations for Excellence	1	0	0	0 3
Attitude Toward Life	1	1	1	1 0
Educational Plans and Desires	1	1	1	1 0
Study Habits	0	0	1	0 3
Achievement.[a]	6	5	5	5 3

[a] Corresponding values for the third and first grades, based on 130,213 and 73,929 students respectively, are third, 3; first 1

However, before we conclude our analysis by regions, it is worth asking:

7. For Achievement and each of the family background variables, which regions score high and which low?

In order to answer this question we ranked the regional means at each grade level, averaged them over grade levels, and then reranked these averages so that a low rank indicated a high mean. The regional values were sufficiently consistent across grade levels to justify this averaging; for example, the regions' rank orders for Socio-Economic Status were almost identical for the three grade levels.[14] These ranks are given in table 6.9. Clearly, regions that are low on one of these variables tend to be low on most of the others. For example, the Southeast and Southwest are among the lowest on all variables except Expectations for Excellence, for which they rank near the top. However, the trend for the high-ranking regions is not nearly as consistent: the Northeast and Mid-Atlantic rank at the top on Socio-Economic Status, but not as high on several other variables. This suggested to us that we might be able to order these regional means in a number of distinctly different ways. We therefore asked three more questions, the first of which was:

8. What degree of interdependence exists among the regional ranks?

To answer this question we intercorrelated the regional ranks from table 6.9 and then subjected them to a principal components analysis. If the intercorrelations were very high, a single component would suffice to account for their relationships with one another. If, on the other hand, there were a number of distinct subgroupings of the variables, then more components would be required. The percentage of variance accounted for by successive principal components are given by grade level in table 6.10. This table shows that for each grade level, as well as for the three mean values, there is a first principal component that accounts for some 62 percent of the variance on the average, and is strongest at the sixth grade. Other components, however, up to a total of three, are also necessary to account for the regional interrelationships. With these three components, almost all the regional differences on these variables has been accounted for, as can be seen from the values in the "1, 2, 3" column.

We next wondered to what extent the components could be meaningfully interpreted. We therefore asked:

9. Can the principal components be transformed to produce a meaningful description of the subgroups of variables?

For the average of the ranks, the first three components, or factors, were rotated to the positions in table 6.11 by means of a normalized varimax routine (Horst, 1965). It will be seen that on the first factor, Achievement, two of the four motivational variables, Study Habits and Attitude Toward Life, and both of the home background variables have very high coefficients (see column 1 in table 6.11). Accordingly, we shall think of this as reflecting a kind of general well-being, that is, a situation that includes relative affluence (high value on Socio-Economic Status), an intact family (high value on Family Structure and Stability), belief in one's ability to improve one's lot in life through education (high value on Attitude Toward Life), close parental (or parental surrogate's) involvement in the student's schooling plus the student's own application (high value on Study Habits), a high score on Achievement, and, to a more limited degree, aspirations for the higher occupations and continued schooling (high value on Educational Plans and Desires).

In the second factor (see column 2 in table 6.11), the variable most heavily involved is Educational Plans and Desires. Achievement and three of the four motivational variables are also involved, though to a lesser degree.[15] Let us think of this factor, then, as reflecting a belief in education and intent to affect one's future lot in life through it.

In the third factor, the variable most heavily involved is Expectations for Excellence. Socio-Economic Status and Achievement are also involved, this time to a much lesser degree.[16] Let us think of this factor, then, as reflecting more immediate concerns with schooling, as opposed to the type of belief outlined in connection with the second factor.

We wondered next what the relative status of the different regions might be on each of these factors. Hence we asked:

10. What is the relative status of each region on the factors obtained in table 6.11?

A rank for each region on each factor was computed by weighting the ranks shown in table 6.9, adding them, and then dividing by the total number of variables to obtain the averages shown in table 6.12. It will be seen that on our first factor, "general well-being," the Northeast and Plains rank highest and the Southeast and Southwest lowest. On our second factor, "belief in education and intent to affect one's future lot in life through it," the Plains and

[14] Table 6.8, of course, which gave us a basis for ranking them, shows that the differences among the means were never very large.

[15] Family Structure and Stability, on the other hand, shows a slightly negative coefficient.

[16] Family Structure and Stability is still negatively involved, though not as much as in the second factor.

Table 6.9.—Rank Order of Each Region on Individual Student Variables, Averaged by Grade Level

Variable	Regions						
	NE	MA	GL	PL	FW	SW	SE
Socio-Economic Status	1	2	3	4	5	6	7
Family Structure and Stability	3	4	1	2	7	5	6
Expectations for Excellence	7	5	3.5	1	6	2	3.5
Attitude Toward Life	2	3	4	1	5	6	7
Educational Plans and Desires	4	3	6	1.5	1.5	5	7
Study Habits	2	3	4	1	6.5	5	6.5
Achievement	1	4	3	2	5	6	7

NOTE.—NE, Northeast; MA, Mid-Atlantic; GL, Great Lakes; PL, Plains; FW, Far West; SW, Southwest; SE, Southeast. A low rank indicates a high mean.

Table 6.10.—Principal Components Analysis of Regional Differences in Individual Student Variables

Grade Level	Cumulative Percent		
	1	1, 2	1, 2, 3
Twelfth	65	83	97
Ninth	62	80	97
Sixth	74	94	98
Average	62	83	97

Table 6.11.—Varimax Rotated Principal Components of the Regional Intercorrelations

Variable	Factors		
	1	2	3
Socio Economic Status	82	05	56
Family Structure and Stability	91	-28	21
Expectations for Excellence	-06	04	99
Attitude Toward Life	91	40	08
Educational Plans and Desires	26	96	07
Study Habits	95	17	10
Achievement	94	19	25

Table 6.12.—Ranks of Weighted Average for Each Region, by Rotated Component

Region	Factors		
	1	2	3
Northeast	1	4	5
Mid-Atlantic	4	3	4
Great Lakes	3	6	2
Plains	2	1	1
Far West	5	2	7
Southwest	6	5	3
Southeast	7	7	6

Far West rank highest and the Great Lakes and Southeast lowest. On the third factor, "immediate concerns with schooling," the Great Lakes and Plains ranked highest and the Southeast and Far West lowest. There is a general tendency, then, for the Plains to rank highest or next to highest on each factor and for the Southeast to rank lowest or next to lowest. For most of the other regions, however, there is a greater shift from one factor to another.

We have seen that, although regional differences were not a major source of variation in student differences, meaningful differentiations among regions could be made along more than one dimension. In other words, a region's ranking on one variable was never an ideal predictor of its ranking on another.

6.4.1. Individual and Region

What happens to the different sets of variables when the analysis shifts from the individual to the regional level? We tried to answer this question by means of the following three types of analysis, the first and third by student and the second by region:

Total (T).—This was merely an analysis performed in terms of individual students. One example here is the regression of Achievement (ACHV) on Socio-Economic Status (SES) and Family Structure and Stability (FSS).

Among (A).—This was an analysis intended to shed light on the relationship between two or more variables for some level other than the individual one. Since, in this context, we were interested in regional differences on the individual student variables, our "Among" analysis consisted in regressing the regional means for ACHV on SES and FSS variables. By comparing the different results yielded by the "Total" and "Among" analyses, we were able to tell how the relationships between regions were affected by the allocation of students among regions. This was so because if the students had been allocated randomly, then we would not have expected to find a relationship among the regional means for two or more variables (for instance, a relationship of ACHV with SES and FSS).

Within (W).—This was an analysis in which analyses were run on the adjusted scores obtained by subtracting out the regional means. For example: the mean for students in the Northeast on ACHV, SES, and FSS was subtracted from their individual scores; a similar procedure was followed for each of the other regions; these adjusted scores for each region were then pooled; and a regression of ACHV on SES and FSS was then conducted. The results, when compared with those from the "Total" and "Among" analyses, showed us how much the behavior of these variables differed at the regional level.

We began by investigating the relationship between Achievement (ACHV) and the home background factors of Socio-Economic Status (SES) and Family Structure (FSS). As before, our variable denoting ethnicity (RETH) was systematically manipulated. An analysis that simply did not include RETH was called "unadjusted for ethnicity," while one in which allowance was made for it by means of partial correlation techniques was called "adjusted for ethnicity." These analyses are summarized in table 6.13.

The first thing to note here is the relative size of the values at each grade level in the "RSQ(SES,FSS)" col-

Table 6.13.—Commonality Analyses of Home Background Factors in Achievement for "Total," "Among," and "Within" Analyses, by Grade Level

Type	Twelfth Grade RSQ (SES,FSS)	Twelfth Grade Unique SES	Twelfth Grade Common	Twelfth Grade Unique FSS	Ninth Grade RSQ (SES,FSS)	Ninth Grade Unique SES	Ninth Grade Common	Ninth Grade Unique FSS	Sixth Grade RSQ (SES,FSS)	Sixth Grade Unique SES	Sixth Grade Common	Sixth Grade Unique FSS
Unadjusted for Ethnicity												
Total	23	78	21	1	30	63	34	3	27	61	30	9
Among	98	37	55	8	96	26	71	5	97	14	85	1
Within	21	78	20	2	28	63	34	3	25	61	29	10
Adjusted for Ethnicity												
Total	15	90	10	0	18	78	21	1	16	72	20	8
Among	75	83	9	8	65	99	−3	4	80	87	12	1
Within	14	89	11	0	18	77	22	1	16	71	21	8

umns for the condition called "unadjusted for ethnicity." These values show that, at the regional level ("Among"), almost all the differences among regions in their mean ACHV can be explained by SES and FSS, whereas at the individual level ("Total" and "Within") only about 25 percent of them can. In addition, the "Within" values are uniformly lower than the "Total" ones. Moving next to the relative percentage roles of SES and FSS at each level, we can note that they are remarkably similar at the individual level, but quite diverse at the regional level, where the common portion always exceeds the unique values. Accordingly, in explaining differences among regions in their ACHV, the roles of SES and FSS cannot for the most part be disentangled. However, to the extent that they can be disentangled, it will be noted that the role of SES greatly exceeds that of FSS.

For the "adjusted for ethnicity" condition, somewhat different relationships can be observed. First, the values in the "RSQ" columns are uniformly lower than they were for the "unadjusted" condition, although they are still much higher at the regional than at the individual level. Second, the role of SES is substantially increased, particularly at the regional level, while that of FSS tends to stay about the same, or decrease. As for the common portions, they are all reduced, but far more drastically at the regional than at the individual level. In summary, then, we can say that after interregional differences in ethnic composition have been set aside, the role of SES is augmented considerably, that of FSS remains roughly the same, and the extent to which the two can be disentangled is substantially reduced.

In the next set of analyses, we contrasted, for these same levels of analysis, roles of SES and FSS combined, called Home Background (HB), with that of the four motivational and attitudinal variables, called collectively Family Process (PRCS). The status of ethnicity (RETH) was again manipulated: an analysis from which RETH had been omitted was called "ethnicity not included"; one in which it had been included as an aspect of HB was called "ethnicity included"; and one in which it had been adjusted for was called "adjusted for ethnicity." These analyses are given in table 6.14.

When ethnicity is left out of the analysis, the results for HB and PRCS are very different at the individual and regional levels. It will be seen from the "RSQ" columns in table 6.14 that values at the individual level (both T and W) tend to be remarkably similar, while at the regional level (A), all the differences can be explained by HB and PRCS. Similarly, values at the individual level (T and W) are quite close to each other, with the unique value for PRCS roughly equal to or above that of HB. In contrast, at the regional level (A) their roles are almost completely intertwined.

The inclusion of ethnicity as an aspect of HB changes the magnitudes of the R-squares and the explanatory roles of HB and PRCS. But all the interregional differences are still accounted for in much the same way as before. It is interesting to see how, for both kinds of individual analy-

Table 6.14.—Commonality Analyses of Family Background Factors in Achievement for "Total," "Among," and "Within" Analyses, by Grade Level

Type	Twelfth Grade RSQ (HB,PRCS)	Twelfth Grade Unique HB	Twelfth Grade Common	Twelfth Grade Unique PRCS	Ninth Grade RSQ (HB,PRCS)	Ninth Grade Unique HB	Ninth Grade Common	Ninth Grade Unique PRCS	Sixth Grade RSQ (HB,PRCS)	Sixth Grade Unique HB	Sixth Grade Common	Sixth Grade Unique PRCS
Ethnicity Not Included												
Total	38	17	43	40	41	18	55	27	36	27	49	24
Among	100	2	96	2	100	3	93	4	100	3	94	3
Within	38	13	42	45	40	15	55	30	34	25	49	26
Ethnicity Included												
Total	47	32	35	33	47	29	48	23	44	41	42	17
Among	100	2	96	2	100	3	94	3	100	3	94	3
Within	46	28	45	37	46	27	48	25	42	40	41	19
Adjusted For Ethnicity												
Total	34	7	36	57	32	10	47	43	26	21	41	38
Among	100	1	74	25	100	6	59	35	100	20	60	20
Within	34	5	35	60	32	9	46	45	26	19	41	40

sis (T and W), the R-squares and the role of HB both increase, while the roles of PRCS and the common portion decrease.

When ACHV is adjusted for its relationship with RETH, the results are both like and unlike the earlier ones. For the individual analyses, the R-squares are lower than heretofore, while at the regional level they remain the same. In other words, even after the regional ACHV values have been adjusted for their ethnic composition, all the remaining interregional differences can still be accounted for by HB and PRCS combined. Despite a few changes in magnitude, the roles of these two sets are much the same as before, at all three grade levels. At the regional level, in other words, home background and the kind of motivation that derives from the family together account for all the interregional differences in achievement whether ethnicity is included in the analysis or not. This is not true, however, at the individual level. Here, the inclusion of ethnicity as a home background variable tends to increase the role of home background and decrease that of the motivational variables. But when allowance is made for the relationship between achievement and our ethnicity variable, the opposite happens.

We next compared the role of Family Background (FB), a set of six variables consisting of Home Background together with Family Process, and that of School (SCH), the set of ten school variables, called SCH. The status of RETH was systematically manipulated as before. It will be seen from the "RSQ" columns in table 6.15 that, at the regional level, all the interregional differences in mean ACHV can be accounted for by FB and SCH combined. At the individual level, however, these values cluster around 50 percent in both the "ethnicity not included" and the "ethnicity included" analyses, and range from about 30 to 40 percent in the "adjusted for ethnicity" analysis. Moreover, the relative roles of FB and SCH are very different at the individual and regional levels. At the latter level, they are completely intertwined regardless of the status of ethnicity. However, at the individual level the role of FB exceeds that of SCH by a factor that ranges from about 1.25 to almost 2.75. The relationship hardly changes when the "Within" analyses are substituted for the "Total" ones, or vice versa. When ethnicity is included as an aspect of FB, the role of FB comes to exceed that of SCH by a factor of from 3 to as much as 5, while their common portion increases somewhat. When ethnicity is adjusted for, the role of FB is substantially increased and that of SCH slightly increased, while that of their common portion is substantially decreased. Here, the role of FB comes to exceed that of SCH by a factor that ranges from 2.25 to almost 6, for both the "Total" and the "Within" analyses. At the regional level, then, all the regional differences in Achievement, as measured by the regions' mean ACHV scores, can be accounted for by either the family background or the school variables, without any resort to our ethnic group membership variable whatsoever. At the individual level, however, varying the status of this same variable does make a difference: whether it is included in the analyses or explicitly adjusted for, the role of the family background variables increases and that of the school variables increases. It is clear, then, that there are relationships between these variables at the individual level that are not visible at the regional level.

We next attempted to show how the magnitude of the role attributed to RETH, our variable that denotes ethnic group membership, differs at the regional and individual levels as more and more social conditions were allowed for. The way in which we gave operational meaning to four sets of social conditions has already been described in section 6.2. The same conditions -- "None," "HB," "FB," and "FB, SCH" -- were used here, and the same formula was used to compute HB. Table 6.16 gives the resulting analyses, which were carried out at both the individual and the regional levels. It will be seen that the results for these different levels are very different. At the individual level, the percentages range from 17 to 24 for the "None" condition, with slightly greater values at the "Total" level than at the others. At the regional level, however, almost all the differences in ACHV can be accounted for by ethnicity, as is clear from the range of 87 to 93 percent for the "Among" analysis.

For the "HB" condition, however, very different relationships emerge for the different levels of analysis. At the individual level ("Total" and "Within"), the percent-

Table 6.15 —Commonality Analyses of Family Background and School Factors in Achievement for "Total," "Among," and "Within" Analyses, by Grade Level

Type	Twelfth Grade RSQ (FB,SCH)	Unique FB	Common	Unique SCH	Ninth Grade RSQ (FB,SCH)	Unique FB	Common	Unique SCH	Sixth Grade RSQ (FB,SCH)	Unique FB	Common	Unique SCH
Ethnicity Not Included												
Total	52	50	24	26	52	47	32	31	50	35	37	28
Among	100	0	100	0	100	0	100	0	100	0	100	0
Within	49	56	20	24	49	51	30	19	47	39	34	27
Ethnicity Included												
Total	51	41	37	12	51	38	42	10	51	37	50	13
Among	100	0	100	0	100	0	100	0	100	0	100	0
Within	51	57	34	9	50	52	39	9	48	41	46	13
Adjusted for Ethnicity												
Total	42	32	10	18	39	70	13	17	36	56	19	25
Among	100	0	100	0	100	0	100	0	100	0	100	0
Within	40	77	9	14	38	74	12	14	34	60	17	23

Table 6.16.—Percentage of Total Variation in Achievement Associated With Ethnic Group Membership as a Function of Social Condition Variables for "Total," "Among," and "Within" Analyses, by Grade Level

Type	Social Conditions: None			HB			FB			FB,SCH		
Total	20	22	24	9	7	9	9	6	8	1	1	1
Among	93	91	87	1	1	0	0	0	0	0	0	0
Within	17	20	22	8	6	9	8	6	8	1	1	2
Grade	12	9	6	12	9	6	12	9	6	12	9	6

NOTE.—None = no adjustments made in ACHV. HB = ACHV adjusted for SES and FSS. FB = ACHV adjusted for HB and PRCS. FB, SCH = ACHV adjusted for FB and SCH.

ages are reduced by about 50 to 60 percent. But at the regional level, virtually all the differences in ACHV that were associated with ethnicity disappear after the relationship of ACHV with HB has been taken into account.

Turning to the "FB" condition, we find that the percentages either decrease or stay about the same at the individual level, whereas at the regional level they become zero for each grade level. Lastly, for the "FB, SCH" condition, the percentages at the individual level reduce almost to zero, while at the regional level they actually stay at zero.

In summary, it is obvious that here, too, the results for the two individual levels of analysis are about the same, and that they differ considerably from those at the regional level (the exception is the "FB, SCH" condition, for which they are much the same at both levels). Whether among regions or among individual students, virtually all differences in achievement that can be associated with ethnicity can be accounted for by variables related to the students' social background. In the case of regions, almost all of the differences in achievement that can be associated with ethnic composition can be accounted for by differences in relative affluence—that is, the relative affluence of the regions, as measured by their mean values for Socio-Economic Status and Family Structure. These same variables also go a long way toward accounting for the differences in achievement among individual students. However, the average achievement levels of these students' ethnic groups cannot be fully accounted for without additional variables—variables that relate to conditions of schooling and to the motivational aspects of family life.

Finally, we performed multivariate-commonality analyses at the individual and regional levels. It will be recalled from section 6.3 that, in these analyses, ACHV and the four motivational variables are treated as a dependent set and the two HB and ten SCH factors as independent. Since the results for the regional analysis ("Among") were always the same, they were not given in table 6.17 with the others. The "Among" results showed a complete confounding of the HB and SCH factors—so complete, in fact, that all the variance accounted for by these two sets was shared by them in common.[17] The results for the "total" and "Within" analyses show that the values of the MR-squares are from 3 to 8 percent larger for the former than for the latter, depending upon the grade level and the status of ethnicity. Although some differences can be noted in the roles of HB and SCH, they are seldom large. Usually, the unique role of HB is slightly greater for "Within" than for "Total," while that of SCH is slightly less. Similarly, the common portions are about the same (actually, slightly less) for "Within" than for "Total." Thus, when achievement and motivation are regarded as the joint product of possible home background and school variables, the relative roles of these two sets of variables behave in a similar manner at the individual level, but in a very different manner at the regional level. For the latter, indeed, their roles cannot be separated from one another.

6.5. SUMMARY

In this chapter we investigated regional differences in two ways: (*a*) we used a greater number of regional groups than heretofore in order to reanalyze our earlier findings on this subject; (*b*) we compared the relation-

[17] I.e., the unique coefficients for each set was zero and the common portion was 100 percent.

Table 6.17.—Multivariate-Commonality Analyses of Home Background and School Factors in Achievement and Motivation for "Total" and "Within" Analyses, by Grade Level

Type	Twelfth Grade: MRSQ (HB,SCH)	Unique HB	Common	Unique SCH	Ninth Grade: MRSQ (H3,SCH)	Unique HB	Common	Unique SCH	Sixth Grade: MRSQ (HB,SCH)	Unique HB	Common	Unique SCH
Ethnicity not Included												
Total	91	33	14	53	91	39	18	43	81	34	25	41
Within	83	36	13	51	85	42	18	40	77	36	24	40
Ethnicity Included												
Total	93	34	33	33	93	40	31	29	83	36	35	29
Within	85	38	31	31	87	43	30	27	79	38	34	28
Adjusted for Ethnicity												
Total	70	41	12	47	73	48	13	39	65	44	16	40
Within	65	45	12	43	68	51	13	36	62	46	15	39

ships among a number of family background and school-variables at the individual and regional levels.

6.5.1. Reanalyzing the Earlier Findings

In our earlier work we had used only four regional groups.[18] For these we observed that the relationship of Family Structure and Stability with Achievement was moderate to small, and that it became even smaller after we had allowed for differences among students in their Socio-Economic Status. In this study, we used seven regional groups: Northeast; Mid-Atlantic; Great Lakes; Plains; Far West; Southwest; and Southeast.[19] We wanted to find out whether, with this greater number of groups, the same results would prevail as before. We thought it possible that, if they did not prevail, some systematic relationship might emerge between the nature of the region and the degree to which its students' family structure was associated with their level of achievement. For example, we thought that in regions where there was less caste-like discrimination based on skin color, personal attributes fostered in the family might be more likely to play a role in achievement. In such regions, it seemed to us, family disruption might inhibit students' achievement more than in other regions.

What we actually discovered was that there were no systematic regional differences to which we could give a meaningful interpretation. We are therefore inclined to believe that our earlier conclusions, based on the four regional groups, are still valid. These conclusions were that Socio-Economic Status plays a much greater role in Achievement than Family Structure; that much of the observed relationship of Family Structure with Achievement, which is moderate to small, cannot be disentangled from its relationship with Socio-Economic Status; and that this result can be interpreted as reflecting the greater incidence of both family disruption and low achievement among the poorer socioeconomic groups

In our earlier work we classified some of our variables into one set that denoted the family's position in the social structure and another that denoted the nature of the family's involvement with the child in its schooling. We noted that, of the two sets, the latter played a greater role in the child's achievement in the North than in the South. This led us to generalize "that color-caste aspects of the social structure, as represented by Racial-Ethnic Group Membership, had a greater impact on Achievement in the South, and would consequently be more difficult to overcome there through educationally related child-rearing activities." When, in the present study, we tested this generalization with a more differentiated series of regional groups and a greater number of grade levels, we found that it had to be somewhat modified. For instance, if the southeastern and, to a lesser extent, the southwestern regions were treated as representing the South, the generalization was moderately well supported at the ninth and twelfth grades but not nearly so well at the sixth grade. We regarded most of the results at the sixth grade as being due to the less comprehensive nature of the four motivational indices for students at that level. However, these results led us to conclude that our generalization was in need of further testing by means of survey data that would provide a more detailed picture of local conditions.

We next examined the relative roles of family background and school factors in Achievement. In our earlier work we had noted that the independent role of family background factors exceeded that of school factors to a considerable degree, but that it was greater in the South than in the North. In these analyses, as in our earlier ones, we found that, for every region, the unique role of the six family background factors exceeded that of ten variables selected to represent the influence of the school.[20] We also found that the unique role of these school factors remained greater in the South than in the other regions. Although it was somewhat greater in the Southeast than in the Southwest, we regarded this as a confirmation of our earlier findings.

Another earlier finding was that although the association of ethnicity with achievement level varied by region (for instance, it was higher in the South than in the North), virtually all group differences of this type could be accounted for by differences in the students' social background conditions. We also noted that much more of the difference among students in their achievement level could be explained by factors that were not part of racial-ethnic group membership than by factors that were. We obtained similar results for the regions studied here. The initial association of ethnicity with achievement level was greatest in the Southeast and smallest in the Northeast. However, after all the social background factors available to us had been allowed for, these percentages dropped to near zero.[21] It follows that here, too, virtually all the differences in achievement at the regional level can be explained by regional differences in social conditions. However, a substantial and usually larger portion of the corresponding differences at the student level was independent of the students' racial-ethnic group membership.

Next, in the last investigation that grew directly out of our earlier work, we treated both achievement and motivation as the possible joint product of home background and school influences. In order to do this, we generalized our commonality model to the multivariate case. We found that the percentage of achievement and motivation that could be uniquely associated with the school factors was much greater than we had observed in our previous analyses.[22] For some regions, the role of the school factors came to equal or exceed that of the home background factors. This was particularly evident in the Southeast. Although we could not disentangle the role of the teaching staff and other school variables from that of the student body vari-

[18] Nonmetropolitan North, metropolitan North, nonmetropolitan South, and metropolitan South.

[19] The States that make up each group are listed in chapter 2.

[20] Five relating to the achievement and motivation of the student body as a whole, and five to various attributes of the teaching staff.

[21] The largest remainders, viz, those in the Southwest, were only about 3 percent.

[22] I.e., those with only Achievement as the dependent variable, and with the motivational variables as an aspect of Family Background.

ables, we were impressed by the fact that a more comprehensive set of student outcome measures yielded a larger role for the latter.

6.5.2. New Type of Analysis

We also performed several types of analysis not found in our earlier work. Here, too, we were concerned with differences by region. We first ascertained the extent to which differences among individual students could be associated with their membership in one of our seven regional groups. We found that these regional differences were never large.[24] We noted that these results might differ for some of the ethnic groups separately, that is, when all students were not, as here, combined in the same analytic framework. We noted, too, that the rank orders of the regional means on achievement and the six family background measures were fairly consistent across grade levels, and that the two southern regions ranked low if not lowest on most of the variables. Greater variation by grade, however, was noted for the regions that ranked high across these same variables.

Since three principal components were required to account for the intercorrelations of these regional ranks, they were clearly not completely interdependent. A meaningful interpretation could be given to these rotated components. They were labeled: (*a*) "general well-being"; (*b*) "belief in education and intent to affect one's future through it"; (*c*) "immediate concerns with schooling." The first of these was the most powerful in terms of variance accounted for.

Finally, we examined the roles of the different sets of variables at the individual and regional levels. In statistical terms, what we did was to compute a commonality analysis using the same sets of variables in three different ways: (*a*) with the individual students as the unit of study (the "Total" analysis); (*b*) with the regional means as the unit of study (the "Among" analysis); (*c*) with the individual students as the unit of analysis after the regional means had been subtracted from their scores (the "Within" analysis). The results of these analyses showed, for the most part, that the role played in Achievement by the sets of variables under consideration was highly similar for the two kinds of individual analyses ("Total" and "Within") but quite different for the regional analysis. For example:

1. The roles of Socio-Economic Status and Family Structure were more highly confounded at the regional than at the individual level. For all levels, however, the former played a greater role in Achievement than the latter.
2. In the case of Home Background and Family Process, when analyzed at the individual level, the common portion exceeded both unique portions, and the unique portion for Family Process exceeded that of Home Background. But at the regional level, the roles of these two sets were almost completely intertwined.
3. Family Background played a greater role than School at the individual level but was completely confounded with it at the regional level.
4. At the individual level, we needed the full range of social background factors (some 16 in all) to completely account for ethnic group differences in Achievement. In contrast, at the regional level we needed only Socio-Economic Status and Family Structure, which were both home background factors.
5. When Achievement and Motivation (MTVTN) were taken together as a set of dependent variables, the roles of the home background and school factors were quite similar at the individual level, but were completely confounded at the regional level.

[24] They were about 5 percent for both Achievement and Racial-Ethnic Group Membership, and about 3 percent for Socio Economic Status. For the remaining variables, they were 1 percent or less.

Chapter 7

HOW FAMILY AND SCHOOL INFLUENCE ACHIEVEMENT IN DIFFERENT REGIONS—II. BY ETHNIC GROUP

As we saw in the previous chapter, it is not too difficult to uncover regional differences in the relationship of achievement with family background and school. Interpreting these differences, however, is another matter; both the nature of our data and the limitations of present knowledge compel our efforts in that direction to be extremely modest. In this chapter, then, we attempt to make a series of distinctions that, though not in themselves interpretive, are at least more finely tuned than any offered in our earlier studies. Such distinctions, we hope, may also serve as material for interpretation in the more intensive studies that should be undertaken at the regional and local level.

Our strategy here was to conduct analyses for an ethnic group only when census data indicated that a sufficient number of its members could be expected within a given region. Of course, there also had to be a sufficient number of students in our sample who identified themselves as belonging to it. The complete set of analyses will be found in appendix B; for this chapter, we summarized them by averaging the results across grade levels. This had the effect of eliminating certain grade-level trends that did not always lend themselves to interpretation. Consider, for example, the following reasons why different grades might show different results on the same index: (*a*) this index, like many of the others, is more comprehensively measured at the ninth and twelfth than at the lower grades; (*b*) the dropout rate becomes higher with the higher grade levels, but more so for some regions and ethnic groups than others; (*c*) children at the lower grade levels are more apt to make mistakes when they report that they belong to this or that ethnic group; (*d*) the samples of schools are small for many of the ethnic groups at the higher grade levels; (*e*) the samples of students are small in some of the regions. Because of these and similar considerations, we relied for the most part on the grade-level averages. However, when we felt undue reliance on the average would be misleading, we said so. In order to have a basis for comparison with chapter 6, we continued to make what in that chapter we called "Total" analyses.[1] The variable denoting "Ethnicity" was not included in these analyses, the results of which were averaged across grades. Our procedure for computing such averages was as follows. For the percentages, we took a simple average of the grade levels in question and rounded it to the nearest whole number. For the commonality analyses, we took a simple average of each unique portion and then, to obtain the common portion, added up the two unique portions and subtracted them from 100.

7.1 FAMILY BACKGROUND, SCHOOL, AND REGION

Our first question could just as well have been asked at the beginning of chapter 5 (or appendix B). It is: What percentage of variation in Achievement is accounted for by Family Background and School combined?

In order to avoid capitalizing too much on the properties of small samples, we used only one of the 10 school factors: the student body's achievement level. It will be seen from table 7.1 that, in almost every region, the "Total" percentages exceed those of the separate groups. The only exception is the Southwest, where the percentage for Indian Americans is slightly higher than the one for "Total." These larger values for "Total" are the result of introducing the differences among the separate ethnic groups into the analysis. Within each region, whites have more of the variance in their Achievement accounted for

[1] That is, analyses performed in terms of all individual students together.

Table 7.1.—Average Percentage of Total Variation in Achievement Accounted for by Family Background and School, by Region and Ethnic Group

Region	Ethnic Group						
	T	W	N	M	I	O	PR
Northeast	41	40	36				
Mid-Atlantic	50	41	35			46	32
Great Lakes	43	38	28				
Plains	46	40	33				
Far West	44	35	28	33	35	35	
Southwest	44	32	31	36	47		
Southeast	58	41	39				
Total	51	39	38	32	38	37	32

NOTE.—T = Total; W = White, N = Negro, M = Mexican, I = Indian, O = Oriental; PR = Puerto Rican

by family background and school factors than do Negroes. This also tends to be so for about half the other groups shown in the table. For example, the percentage for whites exceeds that for Puerto Ricans in the Mid-Atlantic, equals or exceeds those for Mexican-, Oriental- and Indian Americans in the Far West, but is exceeded by those for Oriental-Americans in the Mid-Atlantic and for Mexican- and Indian Americans in the Southwest. It would have been nice if these results had supported some kind of easily made generalization about the explanatory power of these variables. Unfortunately, there is nothing about these groups and their regions that bears any obvious relationship to the fluctuating values for them in table 7.1.

Our next question, which is identical with question 1 in the previous chapter, was:

1. What is the magnitude of the role played in ACHV by FSS before and after allowance has been made for SES?

The results will be found in table 7.2. It is clear from the high values in the "Common" column for the first set of "Total" analyses that the role of Family Structure and Stability (FSS) is mostly confounded with that of Socio-Economic Status (SES). Meanwhile, the percentage of Achievement in these analyses that can be uniquely associated with FSS is very small, in contrast to the percentage that can be uniquely associated with SES, which is quite large. Despite some variations, this is true of every region, for whites as well as Negroes. In most regions, however, the role of SES for these two groups

Table 7.2.—Average Percentage of Common Variation in Achievement Explained by Family Background and School, by Region and Ethnic Group[a]

Home Background Factors

	Total			White			Negro			Mexican			Indian			Oriental			Puerto Rican		
Region	Unique SES	Common	Unique FSS	Unique SES	Common	Unique FSS	Unique SES	Common	Unique FSS	Unique SES	Common	Unique FSS	Unique SES	Common	Unique FSS	Unique SES	Common	Unique FSS	Unique SES	Common	Unique FSS
Northeast	77	22	1	83	16	1	51	38	11												
Mid-Atlantic	67	30	3	85	13	2	77	18	5							20	25	55	51	25	24
Great Lakes	68	27	5	80	15	5	73	17	10												
Plains	70	23	7	82	13	5	86	10	4												
Far West	63	32	5	77	18	5	64	24	12	47	26	27	63	17	20	55	25	20			
Southwest	74	20	6	89	10	1	84	12	4	55	16	29	71	16	13						
Southeast	66	28	6	87	11	2	88	8	4												
Total	67	29	4	84	13	3	84	12	4	51	21	28	68	15	17	36	30	34			

Family Background Factors

	Total			White			Negro			Mexican			Indian			Oriental			Puerto Rican		
Region	Unique HB	Common	Unique PRCS	Unique HB	Common	Unique PRCS	Unique HB	Common	Unique PRCS	Unique HB	Common	Unique PRCS	Unique HB	Common	Unique PRCS	Unique HB	Common	Unique PRCS	Unique HB	Common	Unique PRCS
Northeast	12	46	42	11	43	46	15	35	50												
Mid-Atlantic	16	51	33	11	42	47	16	35	49							17	44	39	12	38	50
Great Lakes	12	45	43	8	37	55	12	29	59												
Plains	15	45	40	8	38	54	13	32	55												
Far West	14	47	39	9	37	54	11	32	57	12	36	52	17	34	49	9	37	54			
Southwest	21	45	34	10	38	52	18	27	55	8	35	57	38	40	22						
Southeast	27	49	24	13	45	42	22	32	46												
Total	21	49	30	11	42	47	22	33	45	10	37	53	29	38	33	10	40	50			

Family Background and School Factors

	Total			White			Negro			Mexican			Indian			Oriental			Puerto Rican		
Region	Unique FB	Common	Unique SCH	Unique FB	Common	Unique SCH	Unique FB	Common	Unique SCH	Unique FB	Common	Unique SCH	Unique FB	Common	Unique SCH	Unique FB	Common	Unique SCH	Unique FB	Common	Unique SCH
Northeast	66	21	13	73	20	7	72	16	12												
Mid-Atlantic	50	33	17	69	22	9	65	19	16							73	14	13	67	13	20
Great Lakes	65	16	19	82	9	9	81	5	14												
Plains	62	21	17	79	15	6	81	7	12												
Far West	60	21	19	84	10	6	88	3	9	72	15	13	60	19	21	97	1	2			
Southwest	55	21	24	83	10	7	76	7	17	58	21	21	54	34	12	.....					
Southeast	31	38	31	66	23	11	46	22	32												
Total	44	31	25	72	18	10	52	19	29	67	17	16	56	26	18	94	3	3			

[a] The percentage of total variation accounted for respectively by SES and FSS can be found in appendix B.

tends to be larger and that of the common portion smaller than for the "Total" group. For all the remaining groups, the unique role for FSS is larger and that of SES tends to be smaller.

When these values are examined by grade, as they are in appendix B, the most noteworthy trend that emerges is for the role of FSS to decline at the higher grade levels, usually in a progressive manner. But even this was more often the case for whites and Negroes than for the other groups. For whites and Negroes, then, the independent role of Family Structure and Stability in Achievement—independent, that is, of Socio-Economic Status—is relatively small. On the other hand, the independent role of Socio-Economic Status is large for almost all groups, although greater for whites and Negroes than for the others. Further, the percentages here exhibit no clear-cut regional trend.

Our next question was:

2. When HB and PRCS are analyzed together, what is the magnitude of their respective roles in ACHV?

The results, averaged across grades, are given in the portion of table 7.2 headed "Family Background Factors." For the "Total" group, the unique role of Family Process (PRCS) exceeds that of Home Background by at least two to one except in the Southeast, where their roles are more nearly equal. Their common percentage is quite substantial; on occasion, it almost equals or actually exceeds that of the sum of their unique portions. This same trend, in a somewhat more pronounced form, also occurs for the whites, Negroes, Mexican-Americans, Oriental-Americans and Puerto Ricans in each region, and for Indian Americans in the Far West.[2] The most consistent trend by grade level, especially for "Total," whites, and Negroes, was for the role of PRCS to increase at the higher grade levels. As before, tabulations by grade are given in appendix B. The dominant trend, however, is clearly for the unique role of PRCS to exceed that of HB, but for these two sets to have an appreciable portion in common. We are inclined to regard this portion as reflecting the motivational and attitudinal correlates of class membership; certainly, it would be more likely to belong somewhere in the area covered by our home background variables. But, as we said at the beginning of this chapter, there is no easy interpretation to be made of the regional differences uncovered by these analyses.

Nevertheless, there are instances in which it is possible to generalize about the *type* of interpretation made possible by these data. A case in point is that of school influences. In our earlier studies, we established that students usually attend school with other students who are similar to them in family background and achievement. Table 7.3 shows the extent to which this is true for each of our seven regions (the percentages shown here have been averaged across grade levels). It will be seen that the values are greatest for Achievement and Socio-Economic Status, and lowest for Expectations for Excellence. Although some deviations do occur, the dominant trend is for the values to be greater for the "Total" group than for the separate ethnic groups and for these "Total" values to be greatest in the Southeast. However, the Southeast is not markedly different from many of the other regions when it is examined over the entire range of ethnic groups. Again, the most consistent trend by grade level is for the values to decline at the upper grades. We are therefore inclined to conclude that this streaming of students into schools is most strongly reflected in the values for the "Total" group of students. This effect (if we may use such causal language) is most pronounced for Socio-

[2] For some reason, the opposite was true of Indians in the Southwest.

Table 7.3.—Average Percentage of Variation in Individual Student Variables Associated With the Schools Students Attend, by Region and Ethnic Group

Region	Socio-Economic Status							Family Structure and Stability							Achievement							Expectations for Excellence						
	T	W	N	M	I	O	PR	T	W	N	M	I	O	PR	T	W	N	M	I	O	PR	T	W	N	M	I	O	PR
Northeast	27	27	19					21	19	24					17	14	11					3	3	2				
Mid Atlantic	31	25	11			9	3	11	4	2			6	1	28	14	12			13	11	5	3	3			2	2
Great Lakes	22	18	3					9	3	1					19	9	5					4	2	4				
Plains	28	22	13					11	5	5					22	11	7					4	2	4				
Far West	23	16	3	15	16	7		8	5	2	7	4	2		20	8	3	15	14	1		5	3	3	5	6	2	
Southwest	19	9	11	11	25			12	3	3	4	10			21	7	7	10	21			5	2	5	2	6		
Southeast	34	25	15					17	5	2					38	16	21					9	4	6				
Total	30	22	13	13	21	7	3	14	6	2	7	7	2	1	30	13	17	11	17	2	11	6	3	5	3	7	2	2

Region	Attitude Toward Life							Educational Plans and Desires							Study Habits							Average						
	T	W	N	M	I	O	PR	T	W	N	M	I	O	PR	T	W	N	M	I	O	PR	T	W	N	M	I	O	PR
Northeast	5	4	4					9	9	3					5	4	5					12	11	10				
Mid-Atlantic	11	5	8			9	7	11	10	6			1	3	8	4	6			8	5	15	9	7			7	4
Great Lakes	9	4	6					6	5	3					7	3	6					11	6	4				
Plains	5	4	4					6	6	5					6	6	3					12	8	6				
Far West	10	4	6	15	15	3		6	4	3	5	8	1		7	3	4	7	8	3		11	8	3	10	10	3	
Southwest	11	7	11	6	11			7	5	7	4	4			7	4	6	5	7			12	5	7	6	12		
Southeast	22	8	16					11	8	8					15	5	8					21	10	11				
Total	14	6	12	10	14	4	7	9	8	6	4	6	1	3	10	4	7	6	8	4	5	16	9	9	8	12	3	4

NOTE: T—Total, W—white, N—Negro, M—Mexican, I—Indian, O—Oriental, PR—Puerto Rican

Economic Status and Achievement, especially in the Southeast.

Our next question was:

3. When FB and SCH are analyzed together, what is the magnitude of their respective roles in ACHV?

It will be seen from the section of table 7.2 headed "Family Background and School Factors" that the unique school percentages (averaged, like the other percentages, across grade levels) are greater for the "Total" and minority groups than for whites.[3] The most notable exception to this is for Oriental-Americans in the Far West, for whom the school factors play a negligible role and the family background factors an exceptionally large one. School factors exhibit the greatest unique percentages and common portions in the Southeast; for Negroes, this percentage is quite substantial. We are inclined to relegate an unknown part of the common portion to Family Background; the remaining portion more likely reflects the interplay of Family Background and School on Achievement.

The most discernible trend by grade level was the way in which the unique role of the school factors declined at the higher grade levels for whites, but oscillated somewhat (depending on the region) for the remaining ethnic groups (see appendix B). In general, we are inclined to conclude that the school factors have a greater role to play in accounting for differences in minority group students' Achievement than in white students'.[4] This appears to be true both before and after the family background factors have been taken into account.

Our next question, not asked before, was:

4. When ACHV and PRCS are taken together as a dependent set, how large is the role played by HB and SCH?

The percentages for these sets of variables, averaged across grade levels, are given in table 7.1. It will be recalled that Home Background consists of Socio-Economic Status together with Family Structure and Stability, and School of five student-body and five teaching staff factors. The MR-squares were not averaged across grade levels, since as of this writing we knew of no upper limit to the total variance that might be explained. However, it will be seen that, for every group except whites and Oriental-Americans, the unique percentage for School exceeds that for Home Background by a factor of 1.3 to almost 2.0.

By grade level, the most consistent trend was that the unique percentage for School increased at the higher grade levels. Even this, however, did not always occur in a progressive manner: at the twelfth grade, for example, the values for whites and Puerto Ricans tended to increase and those for Orientals and Indians to decrease (see appendix B for these analyses). Similar analyses were conducted by region at the sixth grade, for which there was usually a sufficient number of schools. For the "Total" and white groups, the role of school factors exceeded that of home background factors only in the Great Lakes, Plains, and Southeast. For Negroes and Mexican-Americans, however, the role of home background factors exceeded that of school factors only in the Far West, while for Indians and Oriental-Americans the role of the school factors was greater for both the regions studied. On the basis of these results, we are inclined to believe that school factors play a greater role in the achievement and motivation of minority group students than of whites.

[3] It should be recalled that, in this series of analyses, we used only one school factor, viz, Student Body's Achievement.

[4] The major exception was the Oriental-American group in the Far West.

Table 7.1.—Average Percentage of Common Variation in Achievement and Motivation Explained by Home Background and School, by Ethnic Group

Ethnic Group	Unique HB	Common	Unique SCH
Total	35	19	46
White	44	16	40
Negro	31	10	59
Mexican-American	37	12	51
Indian-American	30	17	53
Oriental-American	47	4	49
Puerto Rican	43	16	51

7.2. ACHIEVEMENT, ETHNICITY, AND REGION

In this section we introduce a new set of analyses. They were not included in chapter 6 because they dealt with separate ethnic groups not ethnicity in general. Nor did they belong to appendix B, because the analyses there deal with each ethnic group as a separate entity. We therefore decided to introduce them here.

Two related questions led to these analyses:

5. How large is the mean difference in ACHV between whites and each of the selected ethnic groups in each region?
6. How large is this difference after the relationship of ACHV with FB and SCH has been taken into account?

We expressed these differences in terms of S units. The term S is short for "sigma," which indicates that the means—in this case, the mean achievement of each ethnic group—are expressed in terms of their deviation from a mean. Here, we departed from our earlier practice and took the difference between the mean ACHV for whites and that for each of the other ethnic groups. By dividing this difference by the standard deviation of ACHV for all students, we obtained the S units referred to. For example, in the Northeast we took the mean ACHV for whites, subtracted it from the mean ACHV for Negroes, and divided the difference by the standard deviation of ACHV for all students in the Northeast.

For question 6, we obtained an estimated mean achievement score A', for each ethnic group in each region, using the regression equations developed as a byproduct of the analyses in chapter 6. We then subtracted it from the observed achievement score, A, thus producing an adjusted mean score that, as previously explained, we expressed in

terms of the standard deviation of the observed scores. The regression equations used in each case were those for the "Total" group in that region.[5]

The values in table 7.5 are *S* units.[6] They were computed for the following adjustment conditions:

None.—This denotes that no background conditions have been allowed for.

HB.—This denotes that allowance has been made for the relationship of Achievement with Socio-Economic Status and Family Structure and Stability, the two variables that make up Home Background.

FB.—This denotes that allowance has been made for the relationship of Achievement with Family Background, which consists of Home Background together with the four motivational variables that make up the set we called Family Process.

FB,SCH.—This denotes that allowance has been made for the relationship of Achievement not only with Family Background but with the set of 10 school background factors that we called School.

Most of the *S* units in table 7.5 are negative because we subtracted the white group's mean from those of the other groups. The main exception is the Oriental-American group, whose mean was, on occasion, greater than the whites'. Such exceptions are denoted in the table by a plus sign. Since these analyses have not been presented before, we have included the results by grade level as well as their averages.

[5] The computational rationale was:

$$\frac{O - W}{S}$$

Where
W = the white group's mean achievement
O = the other ethnic group's mean achievement score
S = the standard deviation of all the students' achievement scores
and each of these three values is from a particular region

After the means had been adjusted for the relationship FB and SCH with ACHV, the computational rationale was

$$\frac{O_1 - W_1}{S}$$

Where the subscript 1 denotes the *adjusted* mean achievement score for each group, and the adjustment is based on that region's total regression equation.

[6] Based on the full number of students who identified themselves as belonging to one of the ethnic groups (see appendix B).

The *S* units, then, express the magnitude of the mean difference in Achievement between the whites and whatever group they are being compared with. It will be seen immediately that, before any background conditions have been allowed for, these values are largest for Puerto Ricans and Negroes, and smallest for Oriental-Americans. Indian Americans fall somewhere in between, while Mexican-Americans are closer to Puerto Ricans and Negroes. Some grade-level trends are in evidence, but they must be treated with caution. Although exact figures are not available, it is known that the dropout rates are very high for many of the minority groups, and certainly much higher than for the whites. For Indian and Mexican-American students, these rates are said to be high even at the twelfth grade. In consequence, we should not make inferences of the type that some groups are "getting better than others," or are "getting closer to the whites" at one grade when compared with another. Rather, we should recognize that the groups differ at the different grade levels. At the higher grade levels, it is in general likely that the group will be a more select one, in terms of all the characteristics that make for school attendance, than at the lower grade levels. And this, because of varying background conditions, applies more strongly to some groups than to others. Both considerations, then, should weigh rather heavily in the interpretation of such results as the tendency of the *S* units to decline by roughly one-tenth of a unit per grade as the grade levels get higher. Similarly, there is no easy interpretation of the fact that Negroes, for whom there is a slight increase at the twelfth grade, are an exception to the trend.

In any case, it is remarkable how much the *S* units decline for the "FB,SCH" adjustment condition. Except for Negroes and Oriental-Americans, this condition reduces the *S* units to from one-third to one-fourth their original value. The values for the Oriental-American group even surpass the whites'. In short, once the "FB, SCH" adjustment has been made, the different grade-level values become remarkably homogeneous for any single group.

Table 7.6 presents analyses of the same type for selected ethnic groups in each region. Here we need to remind ourselves that, in the Northeast, there are comparatively few Negro students at the twelfth grade, and that, in the Mid-

Table 7.5.—Ethnic Group Differences in Achievement by Grade Level, Before and After Adjustment for Social Background [a]

Ethnic Group Difference	Grade Level	Adjustment Conditions [a] None	HB	FB	FB,SCH
Indian American	12	6	3	.2	1
versus	9	.8	3	.3	2
White	6	.9	.4	.4	.2
	Average	.8	.3	3	2
Mexican-American	12	9	5	.4	.2
versus	9	9	.5	.4	.3
White	6	1.1	6	.6	.3
	Average	1 0	.5	.5	.3
Puerto Rican	12	1 1	.6	.5	3
versus	9	1.2	.6	.5	.3
White	6	1.4	.8	.7	.4
	Average	1 2	7	.6	3
Negro	12	1/3	.8	.8	.2
versus	9	1.1	.6	.6	.1
White	6	1.1	7	5	.1
	Average	1.2	7	.6	.1
Oriental-American	12	.2	0	.2	0
versus	9	.2	0	0	+.1
White	6	.4	.1	1	+.1
	Average	.3	.0	.1	+.1

[a] All entries are negative unless otherwise indicated

Atlantic, the same is true of Oriental-Americans at the sixth and twelfth grades. In order to reduce the number of comparisons, which would have been very considerable, we eliminated the "HB" and "FB" adjustment conditions.

For Negroes, comparison with the whites produces *S* units that tend to be slightly smaller in the Northeast and Mid-Atlantic than in the other regions. However, the regional trends are not consistent across grade levels. Here, the units increase at the higher levels in the Southeast and Southwest, decline in the Northeast and Great Lakes, oscillate in the Plains, and stay roughly the same in the Mid-Atlantic and Far West. After adjustments have been made for the relationship of ACHV with FB and SCH, it will be seen that the units decline, on the average, least in the Northeast and most in the Southeast.

Turning now to the Puerto Ricans, we can note that they tend, on the average, to be the farthest behind of any regional group. In addition, there seems to be no consistent trend by grade level. After adjustment for FB and SCH, the *S* units were reduced by a factor of about 6.

For Oriental-Americans, there are some distinct regional differences. In the Mid-Atlantic, they are about 0.8 of a unit below the whites—a distance that is reduced by some 30 to 50 percent after allowance has been made for FB and SCH. The trends by grade level are not consistent: the units are smaller at the lower than at the higher levels both before and after adjustment. In the Far West however, the values for Oriental-Americans are nearly as large as the ones for whites and, after FB and SCH have been allowed for, come to exceed it by about 0.2 of a unit. Hence, the performance of students who identify themselves as Oriental-Americans is very different, relative to that of whites, in the Far West as compared to the Mid-Atlantic.

The performance of Indian Americans also differs somewhat by region. In the Far West, the values for Indians are about 0.8 of a unit below those for whites, but 0.6 of a unit in the Southwest. After allowance has been made for FB and SCH, the values are reduced by a factor of about 1 in the Far West and 6 in the Southwest. The progressively lower values for the upper grade levels may, as we already suggested, reflect the high Indian dropout rate.

Similarly, the values for Mexican-American students, as measured in terms of *S* units, tend to be slightly farther behind the whites' values in the Far West than in the Southwest. After adjustment, however, the units are more nearly equal, as can be seen from the smaller differences in the "FB, SCH" columns.

To sum up: it is clear from these analyses that most, if not all, the differences between the whites and the other ethnic groups in each region can be accounted for by various social background factors. There is however, another way of looking at such regional variations, and that is to see how the members of each ethnic group differ among themselves. For example, we may observe that whites in the Northeast have a higher average achievement level than whites in the Southeast. How large is this type of regional difference, relative to the total differences among white students? To this subject we now turn.

7.3. FAMILY BACKGROUND, SCHOOL, AND REGION

Our first question here is:

7. What percentage of variation in individual students' FB and ACHV can be associated with their regional location?

It will be seen from table 7.7 that these percentages (averaged here across grades) are never large. The largest ones in most cases, are for Achievement, Socio-Economic Status, and Family Structure and Stability, and

Table 7.6.—Selected Ethnic Group Differences in Achievement by Region and Grade Level, Before and After Adjustment for Social Background Conditions [a]

Ethnic Group Difference	Grade Level	Northeast		Mid-Atlantic		Great Lakes		Plains		Far West		Southwest		Southeast	
		None	FB,SCH	None	FB,SCH	None	FB,SCH	None	FB,SCH	None	FB,SCH	None	FB,SCH	None	FB,SCH
Negro	12	9	5	1 1	3	9	.3	1 3	4	1 1	.4	1.3	.2	1.2	.1
versus	9	1 1	4	1 0	.2	1 1	.2	9	.2	1.1	.2	1.2	.2	1.0	0
White	6	1.1	4	1 0	.2	1.2	.2	1 0	.1	1 2	.3	1 1	.3	1.0	0
	Average	1 0	4	1 0	.2	1.1	.2	1 1	2	1 1	3	1.2	.2	1.1	0
Puerto Rican	12			1.4	.2										
versus	9			1.2	.1										
White	6			1.3	.3										
	Average			1.3	.2										
Oriental-American	12			1.1	.6					.1	+.1				
versus	9			.6	.1					0	+.2				
White	6			.7	.2					.1	+.3				
	Average			.8	.3					.1	+ 2				
Indian American	12									.6	.1	.5	0		
versus	9									.9	.2	.4	.2		
White	6									.8	2	3	.2		
	Average									.8	.2	6	.1		
Mexican-American	12									.8	.2	.7	.1		
versus	9									.9	.2	.7	.3		
White	6									.9	.3	.9	.4		
	Average									.9	.2	.8	.3		

[a] All entries are negative unless otherwise indicated.

Table 7.7.—Average Percentage of Variation in Individual Student Variables Associated With Regional Location, by Ethnic Group

Variable	Ethnic Group						
	T	W	N	M	I	O	Average
Socio-Economic Status	3 3	2 3	3 3	3	1 3	.7	1.9
Family Structure and Stability	1 0	3	.0	1 3	2.7	5 3	1 9
Expectations for Excellence	3	3	0	0	1 3	1 3	5
Attitude Toward Life	1 0	3	1 0	0	3	7	6
Educational Plans and Desires	1 0	7	.6	0	7	3 0	1 0
Study Habits	3	.0	.6	.7	2 3	2 3	1.0
Achievement	5 3	2.0	5 3	.0	.7	5 3	3.1
Average	1 7	.9	1.5	.3	1.3	2 7	

NOTE.—T = Total, W = white, N = Negro, M = Mexican, I = Indian, O = Oriental.

the smallest ones for the four motivational and attitudinal variables. For the ethnic groups, the percentages are largest, on the average, for Oriental-Americans, the "Total" group, Negroes, and Indian Americans, and smallest for Mexican-Americans and whites. The trends by grade level vary considerably. For whites, there is virtually no increase or decrease over the grades, whereas for the "Total" group, Negroes, and Oriental-Americans, the percentages for Achievement and Socio-Economic Status go up as the grades get higher. For Oriental-Americans, the same is true of Educational Plans and Family Structure and Stability. For Indian and Mexican-Americans, the percentages usually increase at the ninth grade and then decrease again.

Although these associations with region were never very strong, we decided to ask:

8. Which regions rank high and which low on these variables, for the different ethnic groups?

As will be seen in appendix B, where these analyses are presented, the only two groups for which we had values on each variable in each region were whites and Negroes; for the remaining groups, we had only two such values, and were therefore unable to conduct as many analyses for them—a problem already encountered in section 6.4., above, where for the same reason we were forced to concentrate on the "Total" group. Here, by intercorrelating the regional ranks of whites and Negroes on these variables, we were able to isolate a number of subgroups in each region. For whites, there were the following three:

1. "*General well-being.*" Here the Plains ranked highest and the Southeast lowest.
2. "*Immediate concerns with schooling.*" Here the Plains again ranked highest and the Southwest lowest.
3. "*Belief in education and intent to affect one's future lot in life through it.*" Here the Mid-Atlantic ranked highest and the Southwest lowest.

For Negroes, we discovered four rather different subgroups—different, because the variables were combined differently from the whites':

1. "*Achievement—specific.*" Here the Northeast ranked highest and the Southeast lowest.
2. "*Affective well-being.*" Here the Plains ranked highest and the Far West lowest;
3. "*Economic well-being, with intent to affect one's future lot through education.*" Here the Plains ranked highest and the Southeast lowest.
4. "*Intact family situation and its correlates.*" Here the Plains ranked highest and the Southwest lowest.

The other ethnic groups, as explained, have to be dealt with rather more briefly. Mexican-Americans in the Southwest ranked higher on Family Structure and Study Habits than Mexican-Americans in the Far West, whereas the reverse was true for Socio-Economic Status. Indian Americans in the Far West ranked higher on both Socio-Economic Status and Achievement than they did elsewhere, but the ones in the Southwest ranked highest on the remaining variables. Oriental-American students in the Far West ranked consistently higher on each of the variables than did their counterparts in the Mid-Atlantic. It is clear, then, that no region can be ranked higher than another in any absolute sense; it all depends on the ethnic group and variable under consideration.

It remains for us to ask: What is the magnitude of the role played in ACHV by FB and SCH at the individual compared with the regional level?

As in section 6.4.1, we used two kinds of individual analysis ("Total" and "Within") and one kind of regional analysis ("Among"). Table 7.8 shows the results, averaged across grade levels, for the only three groups for whom such analyses were statistically feasible, viz, "Total," whites and Negroes. Let us first examine the "R-square" columns, which indicate the respective roles of Socio-Economic Status (SES) and Family Structure and Stability (FSS) at each level. At the individual level (the "Total" and "Within" values), the range is from 27 to 13 percent of ACHV explained, the former for the "Total" group and the latter for Negroes. However, at the regional level ("Among"), from 87 to 100 percent of the variation in ACHV is explained by these two variables.

The relative roles of SES and FSS, when examined at these levels of analysis, resemble each other more when whites are compared with Negroes than when either is compared with the "Total" group. For the last-named group at the regional level, the largest role belongs to the common portion, and to SES at the individual level. For whites and Negroes, however, SES has the largest role at both levels. For all three groups, then, Socio-Economic

Table 7.8.—Average Percentage of Variation in Achievement Explained by Family Background and School for "Total," "Among," and "Within" Region Analyses, by Ethnic Group

Home Background

Type	Total				White				Negro			
	RSQ (SES,FSS)	Unique SES	Common	Unique FSS	RSQ (SES,FSS)	Unique SES	Common	Unique FSS	RSQ (SES,FSS)	Unique SES	Common	Unique FSS
Total	27	67	29	4	18	84	13	3	15	84	12	4
Among	97	26	70	4	87	80	10	10	90	74	15	11
Within	25	67	28	5	18	84	13	3	13	82	13	5

Family Background

Type	Total				White				Negro			
	RSQ (HB,PRCS)	Unique HB	Common	Unique PRCS	RSQ (HB,PRCS)	Unique HB	Common	Unique PRCS	RSQ (HB,PRCS)	Unique HB	Common	Unique PRCS
Total	38	21	49	30	35	11	42	47	24	22	33	45
Among	100	3	94	3	100	10	77	13	100	5	85	10
Within	37	18	48	34	35	10	41	49	26	17	33	50

Family Background and School

Type	Total				White				Negro			
	RSQ (FB,SCH)	Unique FB	Common	Unique SCH	RSQ (FB,SCH)	Unique FB	Common	Unique SCH	RSQ (FB,SCH)	Unique FB	Common	Unique SCH
Total	51	44	31	25	40	72	16	12	39	50	18	32
Among	100	0	100	0	100	2	98	0	100	0	100	0
Within	48	49	28	23	39	76	14	10	36	58	14	28

Status can be used to account for virtually all the regional differences in Achievement. Only for the "Total" group is it possible to use Family Structure and Stability for the same purpose.[7] Some variations in these results can be noted for the specific grades, but they do not affect the general nature of these conclusions.

Turning now to the "Family Background" section of table 7.8, we find that the R-squares, which measure the relative roles of Home Background and Family Process, range from 24 percent at the individual level to 100 percent at the regional level. For the "Total" and "Within" analyses, the highest value is 38 percent (the "Total" group) and the lowest 24 percent (Negroes). For the "Among" analysis, however, all variance in Achievement can be accounted for by the two sets of variables.

The percentage values for the two sets show that, at the individual level, the unique role of PRCS exceeds that of HB. This effect is somewhat more marked for whites and Negroes than for the "Total" group, and for the "Within" than for the "Total" level. At the "Among" level, however, most of the variation in Achievement can be accounted for nearly as well by either the HB or the PRCS set, since their roles are so extensively confounded. The results by grade level are consistent with this conclusion.

Finally, the "Family Background and School" section of table 7.8 shows that, at the two individual levels, the percentage of variation in Achievement that can be accounted for by these two sets of variables ranges from 36 percent (for Negroes) to 51 percent (for the "Total" group). At the regional level, however, they account for 100 percent. Almost as impressive is the regularity with which the role of FB exceeds that of SCH, though it does so most for whites at the individual level. At the regional level, the roles of these two sets almost completely overlap. Again, the results by grade level follow the same pattern.

7.4. SUMMARY

In this chapter we conducted analyses for separate ethnic groups in seven regions.[8] Groups were included in an analysis only if they were adequately represented both in the census data and in our sample for the region being studied. We were able to obtain results for whites and Negroes in all seven regions, for Mexican-Americans and Indian Americans in the Southwest and Far West, for Oriental-Americans in the Mid-Atlantic and Far West, and for Puerto Ricans in the Mid-Atlantic. In this chapter, the results from the individual grade levels, given in appendix B, were summarized by averaging across them. For the most part, only grades 6, 9, and 12 were used.

We first examined the role of Family Structure and Stability in Achievement, before and after allowance had been made for Socio-Economic Status. We found that, for Negroes and whites in all regions, it had hardly any role that was independent of Socio-Economic Status, and not much more for the remaining ethnic groups. On the other hand, Socio-Economic Status evidently played a large role in the Achievement of all groups, especially whites and Negroes. There did not seem to be any clear regional trend in these results.

We then examined the role played in Achievement by Home Background and Family Process, when analyzed together. We found that, for almost all the ethnic-regional groups, the motivational variables represented by Family

[7] For the "Total" group, SES accounts for 96 percent, or 70 + 26, of the common variance and FSS for 74, or 70 + 4, percent.

[8] The seven regions were: Northeast; Mid-Atlantic; Great Lakes; Plains; Far West; Southwest and Southeast.

Process played a greater role than the socioeconomic factors represented by Home Background, but that there was substantial overlap between them. There were some regional trends, but they defied interpretation.

We went on to perform similar analyses for our sets of family background and school factors. In our earlier works, we had found that although the role of Family Background exceeded that of School, we had found individual differences in Achievement among minority group members showed a greater association with school factors, both before and after allowance for family background factors, than they did among whites. Moreover, this effect seemed to be more pronounced in the South than in the North. Here, with a greater number of regional groupings, we found much the same results as before. The one major exception was the Oriental-American group in the Far West, for whom School played a very small role and Family Background a very large one.

We had observed in chapter 6 that, for all students combined, the role of school factors was much greater than that of home background factors when the dependent variable included Family Process than when it was confined to Achievement. Here, we found that the same was true of each minority group treated separately, although less so of Oriental-Americans than of the others. For whites, however, the role of home background factors exceeded that of school factors. These results tended to prevail for a majority of the regions, although it should be borne in mind that our analyses were conducted only for the sixth grade.

Our concluding series of questions focused on Family Background, a set of variables that consisted of Family Process combined with Home Background, and on School, a set of 10 school-related variables. We began by comparing the difference in average Achievement between whites and selected other ethnic groups in each region, both before and after the relationship of Family Background and School factors within that region had been allowed for. We found that, in almost all the regions, minority group students were, on the average, about one full standard deviation below the whites in Achievement. This difference, however, was greatly reduced or even eradicated after Family Background and School factors had been taken into account. The major exception was the Oriental-American group in the Far West, which was very close to the white group initially, and came to surpass it after this adjustment had been made.

We then examined the role of regional location in Achievement and Family Background, and found that it was never large. It was greatest for the Achievement, and for the family background factors of Socio-Economic Status and Family Structure. Oriental-Americans, Indians, and Negroes were the ones most affected in these respects by their regional location, but it could not be said in any absolute sense that one region was more favorable to Achievement than another; it all depended on the ethnic group and variable under consideration.

Finally, we compared the role of Family Background and School at the individual and regional levels. Only whites and Negroes appeared in enough numbers for enough regions to make such an analysis worthwhile. For both groups we found that, at all levels, most of the variation in Achievement could be accounted for by the simple variable of Socio-Economic Status, and that very little independent influence could be ascribed to Family Structure and Stability. At the regional level, moreover, the role of Family Process was almost completely intertwined with that of Home Background, though it continued to appear as the more influential of the two at the individual level. Similar statements could be made about the roles of Family Background and School. Hence the regional differences in Achievement were never large and, for whites as for Negroes, could be accounted for in great part if not in full by a large variety of background factors, both singly and in combination.

Chapter 8

HOW FAMILY AND SCHOOL INFLUENCE ACHIEVEMENT IN DIFFERENT REGIONS—III. BY METROPOLITAN AND NONMETROPOLITAN AREAS

Differences between inner-city and suburban schools are often referred to as if geographical location were in itself a major determinant of educational quality. A moment's reflection will show that, as long as schools can be constructed in an area, this is not or at least need not be the case. It may be, however, that certain geographical distinctions, particularly that between inner city and suburb, are useful indicators of social and economic differences that affect educational achievement independently of the ones dealt with so far in this report.

Already in the Achievement Study, where all the States were distributed, in most of the analyses, among the two regional groups of North and South, we found that the distinction between metropolitan and nonmetropolitan, as defined in terms of standard census tracts, did yield certain variations in Achievement and its correlates (Mayeske et al., 1973a, chapters 3 and 4). Here, with our seven regional groupings, we found that the distinction still had its uses. But they were not nearly as great as those of the other variables, particularly the school ones. We reached this conclusion by means of the same statistical techniques that we used in the previous two chapters. However, in order to apply them to such a large number of groups, we had to devise a special analytic framework, which will have to be described before we go on to discuss the results.

8.1. A SYSTEMATIC FRAMEWORK FOR ANALYZING GROUP DIFFERENCES

Suppose we have a very large sample and want to determine whether or not certain subgroups in it are different enough to keep separate. We decide to break it up and find out. But how? In the present case, we can classify students as to whether they reside in one of the seven regions. Within each region, they can be further classified as to whether they reside in a metropolitan or a nonmetropolitan area. For these 14 groups, we may then ask: How powerful an explanatory role do these 2 classifications play with regard to our set of dependent variables? In other words, do they add enough to the explanation of our dependent variables to make us want to keep the groups separate? Or shall we disregard them, thereby sacrificing some explanatory power in return for the increase in convenience that will result from working with fewer groups? It would be a relatively simple matter to conduct such analyses if all we were interested in were the group means, and not the way in which one set of variables relates to another, that is, in regression analysis. But since we are, we need to ask the following questions:

1. *How much of the variation in the set of dependent variables can be associated with each of the slope factors?*[1] There will be a slope factor for each classification, one for each of their possible interactions, as well as one for the grand slope (i.e., the slope of slopes). If we note that one or more of the classifications accounts for a substantial portion of the variance in the set of dependent variables, then we need go no further, since we will want to use each group's own slope and intercept. However, if it looks as if the grand slope will do just as well, then we have to ask a second question:
2. *How much of the variance in the set of dependent variables can be associated with each of the intercept factors?*[2] By "each" we refer to the fact that each of our two classifications will have not only its own intercept factor but one for each of its possible interactions. If a substantial portion of the variance is associated with one or more of the intercept factors, then we may want to use the same slope but a different intercept for each of these classifications. If this is not the case, however, then we will decide to use a common slope and a common intrecept for each of these classifications. This is tantamount to saying that we do not need these group distinctions at all.

The usual method of determining whether or not the groups are different is to apply a test of statistical significance. However, with large samples and sizable subgroups, trivial differences can yield statistical significance. Consequently, we shall have to depend on a variance-accounted-for framework. This technique involves examining the percentage of variance in the set of dependent variables that is independently associated with each of these slope and intercept factors.[3]

In order to show how the technique works, let us proceed with a specific example from one of our analyses. We shall examine the relationship of our Achievement com-

[1] In a regression equation of the standard form:

$$Y' = B_0 + B_1X_1 + B_2X_2 + \ldots + B_nX_n$$

B_0 is referred to as the *intercept* and the other B values as the *slopes* (more correctly, *partial slopes*).

[2] There is no factor for the grand intercept, since it is merely a constant for the grand slope. In other words, only one grand intercept is needed.

[3] In our earlier framework of unique and common variances, we examined only the variance independently associated with each factor. It is also possible to examine the higher-order commonalities for these factors, although we have not done so here (for further details, see Beaton, 1973b).

posite (ACHV) with our Socio-Economic Status (SES) index, for the 14 groups mentioned earlier (7 regions multiplied by 2 types of area). The slope and intercept factors, and the total variance in ACHV accounted for by these factors (the "Total R-square"), are as follows:

Source of Variation		Unique Percent
Intercepts	Met nonmet	1
	Region (R)	5
	MR Interaction	1
Slopes	Z (Grand Slopes)	42
	MZ Interaction	0
	RZ Interaction	0
	MRZ Interaction	0
Total R-square		31

It will be seen that, if we focus on the relationship of ACHV with SES (or "use SES as a covariate," as many statisticians would say), only 31 percent of the variance in ACHV (the "Total R-square") can be associated with the stratifying factors. The unique percentages in the body of the table have been divided by this value to make them represent the percentage of common variance that can be uniquely associated with each factor. Reading this table from bottom to top, we can observe that the interaction factors for the slopes are all zero, whereas the percentage associated with the grand slope is as large as 42. These results indicate that a common slope will suffice for the different groups. Proceeding to the intercepts, we find that both the "MR Interaction" and the "Metropolitan-Nonmetropolitan" percentages are negligible, while the "Region" percentage is large enough to suggest that it might be a good idea to use a different intercept for each region. In closing we may note that 49 percent, the sum of these values, indicates how much of the common variance is accounted for by these factors uniquely. In other words, 51 percent (100 - 49) is confounded among them or, in more technical language, lies in the higher-order commonalities.

We performed such analyses in a sequential manner, gradually increasing the number of covariates for each ethnic group separately, and for selected regions when ethnicity was included as a criterion of classification. These analyses are shown in appendix C. Whether we used ACHV alone as the dependent variable or combined it with the motivational variables, the analyses showed that the slope interaction percentages were almost always negligible or zero, or, in other words, that a common slope would suffice for each of the groups. When the ethnic groups were kept separate, these same analyses showed that a separate intercept for both region and area, might be desired on occasion, depending upon the particular ethnic group. But when we brought the school variables into the analysis, we found that separate intercepts were not needed. However, when ethnicity, as defined by our ethnic groups, was included in the same framework as a criterion of classification, the analyses showed that a separate intercept *was* warranted for each ethnic group—but not for the regional or metropolitan classifications. Intercepts for each separate ethnic group were also needed less as the school variables were brought into the analysis.

What these results suggested to us was that the school variables as it were picked up both ethnic group and regional differences. For this reason, we shall concentrate here on relationships of this type. But first, let us illustrate the preceding remarks with some analyses in which a common slope is used for all 14 groups. By systematically enlarging the set of regressor variables to the point at which, finally, we bring the school variables into the analysis, we shall be able to examine the diminishing need for separate intercepts. In order to capture the ethnic group intercepts, we shall carry along our variable that denotes ethnicity, called Racial-Ethnic Group Membership (RETH). It will be recalled from chapter 2 that this variable captures the mean differences among ethnic groups by assigning to each student the mean ACHV value for members of his ethnic group. Since a common slope will suffice for the different geographic and ethnic groups, this means that RETH will pick up the equivalent of differences in the group intercepts. As for the dependent variable, sometimes it will be ACHV alone, and sometimes ACHV combined with the motivational variables. For both types of analysis, the sets of covariates are:

Regressor sets when the dependent set is:

Achievement

1. Ethnicity (RETH)
2. Ethnicity and Socio-Economic Status (RETH and SES)
3. Ethnicity and Home Background (RETH and HB)
4. Ethnicity and Family Background (RETH and FB)
5. Ethnicity, Family Background, and School (RETH, FB, and SCH)

Achievement and Motivation

1. Ethnicity (RETH)
2. Ethnicity and Socio-Economic Status (RETH and SES)
3. Ethnicity and Home Background (RETH and HB)
4. Ethnicity, Home Background, and School (RETH, HB, and SCH)

It will be seen from the "Total R-square" row of the "Achievement" section in table 8.1 that from 23 to 24 percent of the total variance in ACHV is accounted for by ethnicity and the stratifying factors. Ethnicity and Home Background account for some 19 percent more, and Ethnicity and Family Background for another 10 percent. Finally, when Family Background and School are brought into the analysis, over 50 percent of the variance is ac-

Note. Home Background consists of Socio-Economic Status together with Family Structure and Stability (FSS). Family Background consists of Home Background together with Motivation. We were able to use more covariates here than in appendix C because we were dealing with a smaller number of interaction factors. For the sample, see table C.1 of appendix C.

Table 8.1.—Percentage of Variation in Achievement and Motivation Associated With Family Background and School, by Region and Metropolitan Location: Total Students

Source of Variation		Dependent Set: Achievement														
		Ethnicity			Ethnicity and Socio-Economic Status			Ethnicity and Home Background			Ethnicity and Family Background			Ethnicity, Family Background and School		
Intercepts	M	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0
	R	6	5	7	2	2	3	2	2	3	2	2	2	0	0	0
	MR	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0
Common Slope		79	79	71	85	86	80	86	87	81	88	90	87	90	90	88
Total R-square		24	24	23	35	37	34	36	38	34	43	49	50	49	53	54
Grade Level		6	9	12	6	9	12	6	9	12	6	9	12	6	9	12

Source of Variation		Dependent Set: Achievement/Motivation											
		Ethnicity			Ethnicity and Socio-Economic Status			Ethnicity and Home Background			Ethnicity, Home Background and School		
Intercepts	M	0	1	2	0	0	1	0	0	1	0	0	0
	R	2	5	5	2	4	5	2	4	5	0	0	0
	MR	1	1	1	0	1	1	0	1	1	0	0	0
Common Slope		23	24	24	40	52	49	50	58	52	71	79	75
Total MR-square		85	86	87	88	90	90	89	91	90	92	93	93
Grade Level		6	9	12	6	9	12	6	9	12	6	9	12

counted for. For the unitized percentages (i.e., the ones with the "Total R-squares" divided out), which are in the body of the table, we can note that the common slope accounts for increasingly more variance as more variables are brought into the analysis. In addition, the small percentages for geographic location (viz, the ones for "M" and "R") get progressively smaller as more variables are brought into the analysis, finally reaching zero with the school factors. This means that, for a comprehensive set of covariates, such as Ethnicity, Family Background, and School, separate intercepts are not needed; a common slope and a common intercept will suffice for all 11 groups.

Results similar to these were obtained for the multivariate analyses, in which Achievement and Motivation were taken together as the dependent set. That is, the "Total MR-squares" can be seen to increase as more variables are brought into the analysis.[4] The unitized percentages in the body of the table show that the percentage accounted for by the common slope increases progressively as more variables are brought into the analysis. In similar manner, the percentages for the geographic intercepts ("M," "RR," and "MR") tend to decrease, finally attaining zero with Ethnicity, Home Background, and School. Hence, for Achievement taken either alone or together with Motivation, we can use a common slope and a common intercept as far as these 11 geographic groups are concerned. In the next section, then, we shall try to find out if we can dispense with these groups altogether.

8.2. GEOGRAPHIC AND ETHNIC CORRELATES OF SCHOOL DIFFERENCES

Because differences among schools tended, as we said in the previous section, to pick up both ethnic and regional differences, we decided to find out if the former could be made to do duty for the latter in our analysis. As our criteria of differences among schools we used the counterparts at the school level dependent variables, viz, Student Body's Achievement instead of individual student Achievement and Study Body's Achievement and Motivation instead of the individual student achievement and motivational variables. For ethnic group differences we used RETH, and for regional differences a variable that classified northern States as high, western ones as intermediate, and southern ones as low.[5] Finally, we introduced a variable that allowed for a finer degree of differentiation between metropolitan and nonmetropolitan areas. This variable, which we called Rural-Urban Location, was coded so that inner-city and suburban schools received a high value, while small-town and rural schools received a low one.

Correlates of school and ethnic group differences are given in table 8.2.[6] Here, the "Achievement" column shows the percentage of variance in Student Body Achievement that is associated with the geographic location of the school and the five teaching staff attributes. The second column presents the percentage when Achievement and the four motivational variables are the dependent set. To make these multivariate percentages comparable to the univariate ones, they have been converted to an upper limit of one through division by the number of dependent variables (in this case, five). Comparing these two columns we can see that Achievement tends to be more highly associated with these variables alone than when combined with the motivational set. Although the geographic variables (num-

[4] To convert to an upper limit of one, simply divide these percentages by the total number of dependent variables, which in this case is five (Beaton, 1973a).

[5] For the States that made up these groupings, see chapter 2.

[6] We used sixth-grade students and their schools in these analyses because this maximized the number of schools.

Table 8.2.—Percentage of Variation in Geographic and School Variables Associated With Student Body and Ethnic Group Differences, for Sixth-Grade Students and Their Schools[a]

Geographic and School Variables	School Difference in Student Body: Achievement	Achievement Motivation	Individual Student Ethnicity
1. Regional Location	12	3	3
2. Rural-Urban Location	0	2	2
3. 1 and 2[b]	13	5	5
4. Teaching Staff's Teaching Conditions	42	9	19
5. Teaching Staff's Preference for Student Ability Level	19	4	10
6. Teaching Staff's Training and Salary Levels	2	2	0
7. Teaching Staff's Ethnic Composition	56	12	40
8. Teaching Staff's Verbal Skill Mix	45	9	19
9. 4-8[b]	75	12	45
10. Student Body's Achievement	..	..	38
11. Student Body's Expectations	..	..	14
12. Student Body's Attitude Toward Life	..	..	18
13. Student Body's Educational Plans	..	..	15
14. Student Body's Study Habits	..	..	15
15. 10-14[b]	.	..	40

[a] There were 123,305 students, with their 2,372 schools, included in these analyses.
[b] Squared multiple correlation for the variables designated.

bers 1 through 3) tend to be associated with school differences, the magnitude of this association is small relative to that of the teaching staff variables. Highest by far are the percentages for the teaching staff's view of their teaching conditions (number 1), their ethnic composition (number 7), and their verbal skill mix (number 8).

The final column of table 8.2 gives the percentage of variance for these same variables that is associated with RETH, our variable denoting ethnicity. Here the student body variables become relevant. As before, the association of the geographic variables (numbers 1 through 3) tends to be small, while that of Teaching Staff's Ethnic Composition and Student Body's Achievement level is high. These results serve to illustrate the reciprocal relationship that existed in 1965 between school and geographic differences, on the one hand, and school and ethnic group differences, on the other. They help us to understand why it was that, when school variables were brought into the analysis, geographic intercepts were not needed. For the same reason, when ethnic group differences were introduced, whether as a criterion of classification or a quantitative variable, they tended to "soak up" some (though not all) these geographic differences. Since the association of these geographic variables with school and ethnic group differences was so small, we did not concern ourselves with them further. We did, however, go on to explore student differences in some detail, both among and within schools and among and within ethnic groups.

8.3. DIFFERENCES IN STUDENT ACHIEVEMENT AND MOTIVATION AMONG AND WITHIN SCHOOLS AND ETHNIC GROUPS

We next examined, for sixth-grade students and their schools; (*a*) the percentage of variance in achievement and Motivation that lay among and within schools and ethnic groups; (*b*) the percentage of variance for each of these levels that could be explained by a regression analysis. Let us examine these percentages in table 8.3 before proceeding to the regression analyses. The figure 100 at the

Table 8.3.—Percentage of Total Variation in Achievement That Lies Among and Within Ethnic Groups and Schools at the Sixth Grade

Schools	Ethnic Groups: Among	Within	Total
Among	21	11	32
	E_1: All	E_1: Sixty-nine	E_1: Seventy-nine
	E_2: All	E_2: Seventy-six	E_2: Eighty-six
Within	3	65	68
	E_1: Nine	E_1: Nine	E_1: Nine
Total	24	76	100
	E_1: Ninety-nine	E_1: Seventeen	E_1: Twenty-seven

NOTE.—There were 123,305 students, with their 2,372 schools, included in these analyses.

bottom right-hand corner of the table signifies that the total variance in Achievement has been set equal to 100 percent. Reading down the right-most column, we can note that 32 percent of student difference in Achievement lies among schools, and the remaining 68 percent within schools. The bottom row indicates that, in similar fashion, 24 percent of the total variance in student Achievement lies among ethnic groups, and the remaining 76 percent within them. In the intersections, then, of the "Among" and "Within" rows and columns, we have the percentage of variance in total Achievement located at that level. The upper left cell indicates that 21 percent of the total lies among both schools and ethnic groups, while the cell below it indicates that 3 percent of the ethnic group differences in Achievement lies within schools. From the "Within" column, we can see that 11 percent of the variance among students that is independent of their ethnic group membership can be found among schools. The cell directly below this shows us that fully 65 percent of the total variance among students is independent both of their ethnic group membership and of the type of school they attend.

Clearly, then, the variance at the within-school/within-ethnic-group level considerably exceeds that at any of the other three levels. One conclusion we can draw from this is that there should be more studies of what goes on inside the school. Another is that when ethnic group differences are brought into the analysis, they bring much of the difference among schools (roughly two-thirds, in fact) along with them. Finally, when differences among schools are brought into the analysis, so are most of the differences among ethnic groups. For these 1965 data, it appears, ethnic group differences may not be needed as an explanatory variable once school differences have been incorporated into the analysis.

We have seen how the total variance is distributed among these different levels. How much of the variance at each level can be explained by a given set of variables? There were only two regressor variables common to all these levels: Socio-Economic Status, and Family Structure and Stability—either the students' or the student body's, as the case might be. In tables 8.3 and 8.4, the percentage

Table 8.4.—Percentage of Total Variation in Achievement and Motivation That Lies Among and Within Ethnic Groups at the Sixth Grade

Schools	Ethnic Groups		
	Among	Within	Total
Among	4	6	10
	E_1: Forty	E_1: Twenty-one	E_1: Twenty-three
	E_2: All	E_2: Twenty-six	E_2: Thirty
Within	1	89	90
	E_1: None	E_1: Four	E_1: Four
Total	5	95	100
	E_1: Forty	E_1: Six	E_1: Eight

NOTE.—There were 123,305 students, with their 2,372 schools, included in these analyses.

of variance in Achievement explained by these two variables at each level is prefaced by the expression "E_1." It has been spelled out in order to avoid confusion with the percentage that forms its variance base, which is given just above. For the among-school analyses, we also conducted a second regression analysis that included the two previous variables plus the two geographic and five teaching staff variables, as listed in table 8.2. The results of this second analysis are prefaced "E_2." To sum up:

Regressors for:

E_1
1. Socio-Economic Status
2. Family Structure and Stability

E_2
1. Socio-Economic Status
2. Family Structure and Stability
3. Two geographic variables
4. Five teaching staff variables

In table 8.3, the among-school analyses (top three rows, "Total" column) show that some 79 (E_1) to 86 percent (E_2) of the variance in Achievement among schools can be accounted for. To the left, in the "Within" column, it will be seen that some 69 (E_1) to 76 (E_2) percent of the variance in Achievement that lies within ethnic groups and among schools can be accounted for by these same factors. Finally, the "Among" column shows that all the variance that lies both among schools and among ethnic groups can be accounted for by either the E_1 or the E_2 set of regressor variables. Clearly, then, most of the variance among schools can also be accounted for by them.

Turning to the two "Within" rows, we find that, in contrast, only 9 percent of the variance that lies within schools, both among and within ethnic groups (i.e., the "Within" row) can be accounted for by this same E_1 set. But for the "Total" school analyses (i.e., the last row of table 8.3), almost all the variance in Achievement among ethnic groups can be explained by the E_1 set. This is true neither for the analyses within ethnic groups (only 17 percent accounted for) nor for the total variance (only 27 percent).

Similar analyses for Achievement and Motivation combined are given in table 8.4. In order to make these analyses comparable with those in table 8.3, we converted the multivariate achievement and motivation variance to 100 percent by dividing the multivariate squared correlation by the total number of dependent variables (in this case, five). We shall not dwell on this table as much as the previous one. But it is worth pointing out that most of our prior conclusions hold to an even greater extent for the multivariate case. The following observations seem particularly noteworthy:

1. The variance among schools and ethnic groups is very small.
2. The group percentages for the within-school, within-ethnic-group, and within-school/within-ethnic group analyses are all very large.
3. When differences among schools are brought into the analysis, almost all the differences among ethnic groups are brought in, too.
4. More of the variance among schools can be explained by our regression analyses than of the variance within schools.
5. The same is true of the variance among ethnic groups.

For both analyses, then, we are inclined to conclude that most of the variance in achievement and motivation lies within schools and within ethnic groups. Similarly, most of the variance among ethnic groups in achievement and motivation is distributed among schools, and much of the variance among schools in the achievement and motivational levels of their students is distributed among ethnic groups. In consequence, *virtually no inferences can be made about the effects of ethnic group membership that are independent of the type of school a student attends.* Admittedly, somewhat more can be said about the percentage of a school's effect on its students that is inde-

pendent of their ethnic composition. But even this is relatively unimportant when compared with the tremendous variation among students that is to be found within schools and within ethnic groups.

8.4. SUMMARY

In this chapter we used a new analytic technique to explore the possible effects of geographic location on motivation and achievement. This technique allowed us to ascertain the extent to which 14 geographic groups—7 regional groups stratified into metropolitan and nonmetropolitan—differed in the ways that school and family seemed to influence the achievement and motivation of ethnic groups, both singly and in combination. We found that the degree of relationship could be considered similar —that is, a common regression slope could be used—for these diverse groups, but that their intercepts tended to differ somewhat, depending on the kind and number of variables included in the analysis.

We also found that, as increasingly more family background variables were included in the analysis, the need for these geographic group intercepts was diminished, and that it usually disappeared altogether when school factors were brought into the analysis. The need for separate ethnic group intercepts was also reduced for these same conditions, although they were seldom completely expendable.

Differences among schools were related to differences among geographic and ethnic groups, slight though the latter were. But the school differences, when entered into the analysis, absorbed all the explanatory power of the geographic differences and virtually all that of the ethnic group differences. We therefore decided that geographic differences were not useful in such an analysis, and that ethnic group differences contributed very little additional information.

Additional analyses showed that almost all the ethnic group variance in achievement and motivation lay among schools. Most of the variation among students, on the other hand, was independent both of their ethnic group membership and of the type of school attended. The fact that most of the variation among ethnic groups was distributed among schools meant that no inferences could be made concerning the independent effect of ethnic group membership on Achievement and Motivation. In short, the differences we were trying to explain were to be found mainly within schools and within ethnic groups. We shall return to this subject in our final chapter.

PART 4: SPECIAL TOPICS

Chapter 9

ACHIEVEMENT AND MOTIVATION IN BOYS AND GIRLS

The different educational outcomes of boys and girls are too well known to need comment here. Unfortunately, the present study throws very little light on the origins of these differences. Indeed, the differences between the boys and girls in our sample were very small; at this educational level, with the variables available to us, sex was not a major explanatory factor. All the same, they were persistent differences, and we found that some of them, at least, repaid closer examination.[1] Bearing in mind, then, that our results suggest more than they establish, we shall first review the correlates of these differences and then go on to see which of our variables help most in accounting for them. Finally, we shall compare the roles of sex, ethnicity, and school in achievement and motivation.

[1] It will be seen in appendix D that we conducted extensive analyses to ascertain whether or not separate regression equations were needed to explain boy-girl differences in the relationship of the achievement and motivational variables with the other student background and school factors. The results indicated that, almost without exception, they were not needed. However, they also indicated that, for some grade levels, separate intercepts (i.e., means) might be warranted for some of the differences.

9.1. CORRELATES OF SEX DIFFERENCES

Table 9.1 shows the correlations obtained when: (*a*) girls were given a high and boys a low score; (*b*) this score was related to each group's score on other variables, singly and in different combinations. For the single variables, a positive sign for the correlation indicates that girls score higher than boys: the greater the difference, the larger the correlational value. Similarly, a negative sign indicates that boys score higher than girls. It should be noted, however, that when a multiple correlation is computed with this boy-girl dichotomy as the dependent variable, only positive values will result.

Before examining these correlations in detail we must bear in mind that the data have a number of shortcomings, any one of which might serve to obscure the results. First, the frequency with which students misreport their ethnic group tends to be greatest at the sixth grade. As a result, the ethnic groups at that grade may appear more like each other, as far as relationships between boys and girls are concerned, than they really are. We attempted to deal with this problem by bringing in the higher grade levels, for which this type of error is less of a problem. Second, the

Table 9.1.—Correlates of Sex Differences, by Ethnic Group and Grade Level [a]

Variables	Indian American			Mexican-American			Puerto Rican			Negro		
1. Socio-Economic Status	−03	01	−01	−04	02	−03	−01	−04	−05	−02	−03	−03
2. Family Structure and Stability	03	03	02	07	03	02	05	02	05	03	02	00
3. Expectations for Excellence	00	−03	00	00	−01	−06	04	−04	01	03	−05	02
4. Attitude Toward Life	05	04	−08	04	08	04	07	06	09	06	11	10
5. Educational Plans	08	04	−17	06	−02	−14	07	02	−15	09	08	−02
6. Study Habits	13	11	14	11	09	13	12	08	10	12	11	11
7. Achievement	11	01	−13	03	04	−07	10	04	−04	05	02	−03
8. Multiple Correlation 1-7	20	15	32	17	15	24	16	15	27	15	15	15
9. Ten School Variables	07	14	15	08	09	12	07	18	31	04	01	06
10. Multiple Correlation 1-7, 9	21	21	34	19	18	28	19	22	35	17	16	18
Grade Level	6	9	12	6	9	12	6	9	12	6	9	12

Variables	Oriental-American			White			Total			Total (A)[b]		
1. Socio-Economic Status	09	02	09	−01	01	00	−01	00	−01	−01	00	00
2. Family Structure and Stability	07	03	07	01	02	−01	02	02	00	02	02	00
3. Expectations for Excellence	−04	02	06	−04	−01	−02	02	01	−01	−02	01	−01
4. Attitude Toward Life	03	11	11	00	08	08	02	08	07	01	08	08
5. Educational Plans	14	04	09	−01	−07	−15	−02	−04	−14	−01	−04	−14
6. Study Habits	03	06	13	16	15	17	04	13	15	04	13	15
7. Achievement	11	03	05	06	05	−06	06	04	−06	07	04	−06
8. Multiple Correlation 1-7	25	12	16	21	23	30	19	19	26	19	19	26
9. Ten School Variables	04	15	13	02	01	08	03	01	08	03	01	07
10. Multiple Correlation 1-7, 9	26	19	20	21	24	31	20	20	28	20	20	28
Grade Level	6	9	12	6	9	12	6	9	12	6	9	12

[a] The numbers and percentages of students and schools by ethnic group are given in table D 1

[b] "Total (A)" denotes adjustment for ethnicity (i.e., for the relationships among ethnic groups).

twelfth grade has the highest dropout rate, and most of those who drop out are low achievers, which has an effect on the nature of the relationships observed. Here, we brought in the ninth and sixth grades, which have lower dropout rates (though it should be remembered that most of the dropouts at these grades are members of minority groups, especially Indians and Mexican-Americans). Third, some students simply failed to indicate whether they were boys or girls. But such students amounted to less than one percent of the total at each grade level, and the staitstical effects were slight. Fourth, our measure of achievement may not adequately reflect boy-girl differences because it is a composite of all the measures available to us. Thus, it may well be that boys score higher than girls in mathematics while girls score higher than boys in the verbal areas (especially at the higher grades, where students are allowed to specialize). As a result, the relationships that can be observed must be interpreted with extreme caution.

Let us return now to table 9.1. We shall not discuss any relationships that fall below an absolute value of 0.09, i.e., about 1 percent or less of variance accounted for. By this criterion, most of the correlates of Socio-Economic Status and Family Structure and Stability for the different groups must be adjudged negligible or null. The exception is the Oriental-American group, for which girls have a slightly higher value than boys on Socio-Economic Status. Are Oriental-American girls really better off than Oriental-American boys, or are they just more likely to say so? We would be more inclined to believe the latter.

In examining boy-girl differences for the motivational variables, we can note that the correlates of Expectations for Excellence never even reach our cutoff value of 0.09. For Attitude Toward Life, it is reached only by Puerto Ricans at the twelfth grade and exceeded (though not by much) only by Oriental-Americans at the ninth and twelfth grades. For Educational Plans and Desires, however, there is a moderate difference between boys and girls in every group except Negroes: at the twelfth grade, boys have a higher rating than girls except for Oriental-Americans, for whom the reverse is true. In contrast, the figures for Study Habits, most of which exceed our cutoff point, show that girls at all grade levels have a somewhat higher rating than boys. Finally, the correlates for achievement tend to be low; in fact, they exceed our cutoff value only for Indian Americans at the sixth and twelfth grades and for Puerto Ricans and Oriental-Americans at the sixth grade. None of these departures can be called large.

When boy-girl differences are taken as the dependent variable and the first seven variables in table 9.1 as the regressors, the results range from a high of 0.32 (i.e., about 9 percent of the variance), for Indian Americans at the twelfth grade, to a low of 0.12 (i.e., about 1 percent of the variance), for Oriental-Americans at the ninth grade. These figures undoubtedly reflect the tendency of boys and girls to answer the same types of questions differently, though of course they also reflect real differences in their standing on the separate variables.

For the 10 school variables the multiple correlations range from a high of 0.31 (i.e., about 9 percent of the variance), for Puerto Ricans at the twelfth grade, to a low of 0.01 (i.e., roughly none of the variance), for whites and the "Total" group at the ninth grade. These values reflect the same characteristics of the sample as the previous set of correlations, plus differences between schools in their dropout rates. They are clearly greater at the higher grade levels than the lower ones, and for most of the minority groups than for whites. For all students, however, these effects are negligible (see the "Total" and "Total (*A*)" results).

Row 10 of table 9.1 contains the multiple correlations for the 10 school variables and the first 7 variables combined. By comparing the squared values for rows 8 and 10, we can see that the school variables seldom contribute much more information than was contained in the first 7 variables—usually, less than 1 percent.

These results, as well as those in appendix D, show that the differences between boys and girls on these variables were never large or even appreciable in a variance-accounted-for framework. However, a few values, namely, those for Educational Plans and Desires at the twelfth grade, and for Study Habits at all three grades, seemed to indicate differences large enough to warrant further analysis.

9.2. SEX DIFFERENCES IN EDUCATIONAL PLANS AND STUDY HABITS, ADJUSTED FOR BACKGROUND DIFFERENCES

We have seen that boys and girls seem to differ most in their study habits and (at the twelfth grade) their educational aspirations. What happens when allowance is made for the relationship of these outcomes with the range of background and school variables available to us? Let us take educational aspirations as an example—or, to use our variable's technical name, Educational Plans and Desires (EDPLN). The first column of table 9.2 shows how much of the variance in EDPLN was associated with being a boy or a girl before the association of EDPLN with any other variables had been taken into account.[2] The second column, labeled "After," shows how much variation in EDPLN is associated in each case with being a boy or girl after EDPLN has been adjusted for its relationship with: (*a*) Socio-Economic Status, with Family Structure and Stability; (i.e., Home Background); (*b*) the ten school variables described earher; (*c*) Achievement; (*d*) the three motivational measures of Expectations for Excellence, Attitude Toward Life, and Study Habits.[3]

[2] Being a boy or girl was treated as a simple dichotomous variable on which girls were scored high and boys low. The "Before" values are merely the squared correlations from the appropriate entries of table 9.1, rounded up.

[3] The computational rationale for these unique variances, as we often call them, was:

$$U(S) \quad RSQ(S, O) \quad RSQ(O)$$

Where
S = sex, i.e., being a boy or girl
O = all other variables
RSQ = the squared multiple correlation for the set that follows it in parentheses.

Table 9.2.—Percentage of Total Variation in Educational Plans and Desires and Study Habits Associated With Sex, Before and After Adjustment for All Background Variables

Ethnic Group / Dependent Variable:	Educational Plans				Study Habits			
	Before	After	Before	After	Before	After	Before	After
Indian-American	3	3	2	1	1	1	2	4
Mexican-American	2	2	1	1	1	1	2	2
Puerto Rican	2	2	1	0	1	0	1	0
Negro	0	0	2	1	1	0	1	1
Oriental-American	1	0	2	1	0	0	2	0
White	2	2	3	3	2	2	3	3
Total	2	2	2	2	2	1	2	2
Total (A)[a]	2	2	2	2	2	1	2	2
Grade Level:	Twelfth		Sixth		Ninth		Twelfth	

[a] "Total (A)" denotes adjustment for ethnicity (i.e., for the relationships among ethnic groups).

If we compare the entries in these two columns, we can see that the percentages are low for the "Before" condition, and that at most grades they remain unchanged for the "After" condition. The value for Oriental-Americans even drops, from 1 to 0 percent, whereas that for Negroes remains at 0 throughout. Hence, whatever it was that might have given rise to the boy-girl differences in EDPLN at the twelfth grade, the differences are slight and tend *not* to be explained by the variables available to us. As a consequence, boys tend to rank slightly higher than girls for both conditions.

Our next variable, Study Habits (HBTS), was treated in much the same manner as Educational Plans. The "Before" column shows the squared correlation of sex with HBTS, and the "After" column the variance in sex that is uniquely associated with HBTS after the relationship between it and all the other variables has been allowed for. By "all the other variables" we mean the 2 home background and 10 school variables described above, plus Achievement and the three motivational variables—a set of 16 variables in all. It will be seen that, for nearly all groups, the percentages are small for the "Before" condition and tend to stay about the same or decline slightly for the "After" condition. The groups that, more often than not, decline across grade levels are Puerto Ricans, Negroes, and Oriental-Americans. Indian Americans show a slight increase for the "After" condition at the twelfth grade—an increase that can be attributed to the interaction of Study Habits with the other motivational variables for this group. For the remaining groups, the "Before" and "After" values are virtually identical, or, in other words, the differences between boys' and girls' study habits persist even when allowance is made for other background factors. It is difficult for us to say anything about this persistence except that our variables do not account for it.

9.3. SEX AND ETHNICITY IN ACHIEVEMENT AND MOTIVATION

In this section we examine the relative explanatory power of sex and ethnicity for achievement and each of the motivational variables. For each of these variables we asked: How great an explanatory role does sex play relative to ethnicity, and how much of the variability is left unexplained by either? Table 9.3 shows the "Among" and "Within" variances for sex and ethnicity, as well as the marginal totals at each grade level.[4] It will be seen from the upper left-hand portion of table 9.3 that there is no variability in Expectations for Excellence that can be associated with sex. Reading down the "Among" column, we can note that at grades 9 and 6, only 2 percent of the variability among students is associated with ethnicity, which leaves 90 to 100 percent of the variability lying within groups. Hence, although the explanatory role of ethnicity exceeds that of sex, it is insignificant when compared with the unexplained portion.

Much the same is true of Attitude Toward Life: a mere 1 percent of the sex differences is independent of ethnic group membership, and some 3 to 7 percent of ethnic group differences lies within the sex groups. Once again, however, well over 90 percent of the student variation lies within the ethnic and sex groups, i.e., there is far more variation within these groups than among them. Hence, with regard to Attitude Toward Life, ethnicity explains more than sex, but both explain very little compared to what remains unexplained. Virtually identical comments apply both to Educational Plans and Desires and to Study Habits. Not surprisingly, then, when the four motivational variables are taken together as a dependent set, some 95 to 97 percent of the student variability remains unexplained by sex and ethnicity.

For Achievement, the picture changes somewhat: ethnicity assumes 20 to 22 percent of the explanatory power, while differences associated with sex are zero or close to it. However, this still leaves some 78 to 80 percent of the student variability unexplained by either factor. When Achievement and the motivational variables are taken together as the dependent set, sex accounts for 1 percent of the variability that is independent of ethnicity (see the "Among" rows under the "Within" columns), while ethnicity accounts for 5 percent of it that is independent of sex (see the intersection of the "Within" rows and the "Among" column). This leaves 94 percent of the student variability unexplained, or not much less than for the motivational variables alone.

[4] The computations in this table are based on a smaller number of students than those in the previous chapter. Accordingly, the percentages reported here are slightly lower.

Table 9.3.—Percentage of Total Variation in Achievement and Motivation That Lies Among and Within Groups Classified by Sex and Ethnicity

		By Ethnicity											
		Expectations for Excellence			Attitude Toward Life			Educational Plans and Desires			Study Habits		
	Levels, Grade	Among	Within	Total	Among	Within	Total	Among	Within	Total	Among	Within	Total
	Among 12	0	0	0	0	1	1	0	2	2	0	2	2
B	9	0	0	0	0	1	1	0	0	0	0	2	2
y	6	0	0	0	0	0	0	0	0	0	0	2	2
	Within 12	0	100	100	7	92	99	0	98	98	1	97	98
S	9	2	98	100	7	92	99	2	98	100	3	95	98
e	6	2	98	100	3	97	100	3	97	100	3	95	98
x	Total 12	0	100	100	7	93	100	0	100	100	1	99	100
	9	2	98	100	7	93	100	2	98	100	3	97	100
	6	2	98	100	3	97	100	3	97	100	3	97	100

		By Ethnicity								
		Motivation			Achievement			Achievement/Motivation		
	Levels, Grade	Among	Within	Total	Among	Within	Total	Among	Within	Total
	Among 12	0	2	2	0	0	0	0	1	1
B	9	0	1	1	0	0	0	0	1	1
y	6	0	1	1	0	0	0	0	1	1
	Within 12	2	96	98	20	80	100	5	94	99
S	9	2	97	99	21	79	100	5	94	99
e	6	4	95	99	22	78	100	5	94	99
x	Total 12	2	98	100	20	80	100	5	95	100
	9	2	98	100	21	79	100	5	95	100
	6	4	96	100	22	78	100	5	95	100

If the boys and girls within each of the ethnic groups differed at all substantially in their scores on any of our variables (perhaps as a result of different cultural expectations directed at each sex), we might expect some of these differences to show up at the "Among" group level for both the among-sex and the among-group classifications. Inspection of the appropriate cells—i.e., those at the intersection of the "Among" rows with the "Among" columns—shows that only zero values occurred. We can conclude, then, that as far as these variables are concerned, there is little or no interaction between sex and ethnicity.

In the last set of analyses in this section, we introduced the set of ten school variables along with sex and ethnicity and asked: What percentage of student variability in Achievement and the three motivational variables lies: (*a*) within ethnic groups; (*b*) within sex groups; (*c*) within schools? In order to simplify the discussion we have presented, in table 9.4, only the percentage of total variation on those measures that is unexplained by differences in sex, ethnicity, and school characteristics.[5] It will be seen that these percentages range from 96 for Expectations for Excellence (grade 12) to 67 for Achievement (grade 6). Hence, the percentage left unexplained for Achievement was the lowest for any of the seven sets of variables, even though it was still substantial in an absolute sense.

Table 9.4.—Percentage of Total Variation in Achievement and Motivation That Lies Within Schools, Ethnic Groups, and Groups Classified by Sex

	Grade Levels		
Variables	Sixth	Ninth	Twelfth
Expectations for Excellence	94	94	96
Attitude Toward Life	91	83	83
Educational Plans and Desires	92	91	89
Study Habits	88	90	93
Motivation[a]	94	93	90
Achievement	67	69	70
Achievement/Motivation[b]	89	88	86

[a] "Motivation" designates the four motivational measures taken together as a dependent set

[b] "Achievement Motivation" designates the four motivational measures and Achievement, taken together as a dependent set.

9.4. SUMMARY

The topics addressed to this chapter grew out of another set of analyses, described in appendix D, which showed that, almost without exception, separate regression equations were not needed for boys and girls in each ethnic group. Accordingly, in this chapter we used a variance-accounted-for framework to compare the mean values for boys and girls. The differences were never large, and seldom warranted further consideration. One exception was for Educational Plans and Desires, on which the boys at the twelfth grade ranked slightly higher than the girls. The other exception was Study Habits, on which the girls tended to rank higher than the boys at all three grade levels. Each of these exceptions involved no more than about 2 percent of the total variance. However, these differences between boys and girls tended to remain even after allowance had been made for the full range of background variables available to us.[6] Hence, whatever influences were

[5] These percentages were obtained by subtracting from 1 the squared multiple correlation obtained when the regressor set consisted of sex, ethnicity, and the ten school variables.

[6] The main exceptions to this were Puerto Ricans on Study Habits and Oriental-Americans on both Study Habits and Educational Plans and Desires.

operating to produce them yield negligible-to-null relationships and the relationships that did exist tend *not* to be explained by our sets of variables. This is not to deny that there might be profound boy-girl differences on other variables not measured in this study. But it is certain that none were observed here, even though we would have expected to observe them. More will be said on this point in chapter 12.

Last, the relative explanatory roles of sex and ethnicity were examined for Achievement and each of the motivational variables. The role of ethnic differences always exceeded that of sex differences. Neither factor however, had more than an insignificant role compared to the student variability with sex and ethnic groups. These within-group percentages ranged from a high of 100 for expectations for Excellence to a low of 78 percent for Achievement. When differences among schools were also introduced into the analyses, the within-group percentages (viz, the percentages within sex, within ethnic group, and within school) ranged from a high of 96 for Expectations for Excellence to a low of 67 for Achievement. Percentages as large as these indicated an important source of variability among students that had yet to be explained. This, too, is further discussed in chapter 12.

Chapter 10

DOES CHANGING THE METHODOLOGY CHANGE THE RESULTS?

In this chapter we pursue what by now will be some rather familiar questions by means of various analytic techniques not used in our earlier studies. It will be seen that, although such techniques may enable us to pose the same questions in a far more sophisticated form, the results are always consistent with the previous ones. We refer to such questions as: To what extent are differences among students associated with differences among schools? Which seems to play a great role in students' achievement, their social background or the schools they attend? Do students get the schools their abilities merit or the schools to which they are predestined by other, less educationally relevant attributes? With our new techniques, we were able to explore such subsidiary questions as the role of the subsets of student body variables, and the difference made by using individual students' background characteristics as stratifying variables. Our chief substantive concern in all this was to see if there was any technique of data analysis that might give school characteristics a greater independent role than they had so far been found to possess.

These substantive concerns tended to merge with a number of purely methodological ones. As in all discussions of methodology, the issues at stake may appear somewhat esoteric. We should emphasize, then, that the overriding issue here was whether our major findings would hold up if the data were subjected to some other method of analysis. For instance, was the technique of commonality analysis, used throughout this study, really the appropriate one for data of this type? Was there, indeed, something about our data that made any one method of analyzing them inherently more productive than any other? In addition, we felt that it would be in order to speculate how far our results lent themselves to causal interpretation. Were there causal models that could be extracted from the associations between variables that we had uncovered? To some of these questions we were able to offer firm answers, to others only tentative ones.

10.1. HOW MUCH DIFFERENCE DO SCHOOLS REALLY MAKE?

In chapters 6 and 7 we examined, for each student variable separately, the extent to which an individual student's score was associated with that of the students he went to school with.[1] In those analyses, the higher the percentage values in each case, the more pronounced we adjudged the so-called streaming effect. For this section, we examined these same kinds of relationship, but for the multivariate case. This led us to ask: To what extent can differences among individual students in a set of attributes be associated with the schools they attend?

We were able to ask this question because a way of determining the upper limit to the MR-square, or multivariate R-square, had become available to us. Briefly, this consisted in dividing the MR-square by the total number of independent or dependent variables, whichever was less, to give an upper limit of one (Beaton, 1973a). For example, given an MR-square of 1.20, a set of five dependent variables, and a set of eight independent variables, we would divide 1.20 by 5 to obtain 0.24. We would interpret this result as indicating that 24 percent of the total differences among individual students on this set of attributes can be accounted for by the same attributes of the students they go to school with.

We used the following individual student variables, with their school mean counterparts:

1. Socio-Economic Status
2. Family Structure and Stability
3. Racial-Ethnic Group Membership
4. Expectations for Excellence
5. Attitude Towards Life
6. Educational Plans and Desires
7. Study Habits
8. Achievement

Percentages for these sets of variables are given in table 10.1, where the column headed "1-3" refers to variables 1 to 3 in the above list, and so on. Thus, for the analyses summarized in the "1-3" column, the individual student variables 1-3 form the dependent set while their school mean counterparts for that grade level form the independent set.[2] It will be seen that these values, which are greater at the lower grade levels and smaller at the upper ones, are all in the neighborhood of 30 percent. In table 6.4, which shows what happened when these variables were analyzed separately, the percentages were greatest for ethnicity (variable 3). Much of the combined relationship, then, was produced by the pronounced relationship of ethnicity.

[1] I.e., the extent to which it was correlated with the mean score of the students in that school for that same variable. See tables 6.4 and 7.3.

[2] We used only the school mean counterparts of each dependent variable because, as previously explained, they capture the maximum amount of school differences for that variable. Thus, when included in the analysis with other school variables, they account for as much of the variation among schools as possible.

Table 10.1.—Multivariate Percentage of Variation in Individual Student Variables Associated With the Schools Students Attend, by Grade Level

Grade Levels	Groups of Variables (1-3)	(4-8)	(All)
Twelfth	29	12	15
Ninth	26	11	14
Sixth	26	11	13
Third	32	—	—
First	36	—	—
Average	30	11	14

The analyses for variables 4-8 show how closely individual students' achievement and motivation is associated with that of their fellow students. These percentages, available only at the three highest grade levels, average only about 11 percent. Again, it should be recalled from table 6.4 that when these variables were analyzed separately, Achievement had a much larger percentage than did any of the motivational variables, which shows that it played a role in the combined relationship comparable to that of ethnicity.

Finally, in the "All" column, we have the results of treating the complete set of eight individual student variables as dependent and their school mean counterparts as independent. These percentages are slightly greater than the ones for variables 4-8 but still much smaller than the ones for variables 1-3. We therefore concluded that:

1. It is in the nature of this multivariate association to be much greater for the social background variable (numbers 1-3) than for the outcome variables (numbers 4-8).
2. The size of these associations changes very little throughout the years of schooling.
3. As more individual student variables are brought into the analysis, the percentages tend to decrease and differences among schools account for less and less of the variance. Correspondingly, differences among students within schools (obtained by subtracting the observed percentage from its upper limit of one) account for more and more.

Having established this, we were in a position to ask: What proportion of the individual student differences can be accounted for by subsets of the student body variables? The first three columns of table 10.2 show the results obtained when variables 1-3 were subjected to commonality analysis and then unitized.[3] Here, the student body variables were divided into two subsets: Student Body's Home Background (SBHB), containing the school mean counterparts of variables 1 and 2; and Student Body's Racial-Ethnic Composition (SRETH), containing the school mean counterpart of variable 3. It will be seen that although these percentages fluctuate somewhat over the grade levels, they tend to hover near 35—somewhat below it for SBHB, and somewhat above for the common portion. If we had to assign the common portion to one or the other set, we would probably decide in favor of SRETH, since table 6.4 showed it to be the primary sorting variable.

For variables 4-8, the student body variables were divided into two more subsets: Student Body's Achievement Level (SACHV), the school mean counterpart of variable 8; and Student Body's Motivation (SMTVTN), containing the school mean counterparts of variables 4-7. The relative percentages for these sets fluctuate somewhat more over the grade levels than the ones for SBHB and SRETH; the trend is for the role of SACHV to decrease with the higher grades and that of SMTVTN to increase. It seems likely, however, that some of these grade-level differences are due to the way in which the indices differ at each level. We are, therefore, inclined to use the average, which shows that SMTVTN plays a greater role in individual student achievement and motivation than SACHV.

For the "All" analyses—i.e., when all eight individual student variables were treated as dependent—the student body variables were divided into our last pair of subsets: Student Body's Social background (SBSB), containing the school mean counterparts of variables 1-3; (SBSB), and School Outcomes (SO(5)), containing the school mean counterparts (in the aggregate) of variables 4-8. Here,

[3] I.e., the percentages were divided by the converted MR-square so that they summed to 100.

Table 10.2.—Multivariate Commonality Analyses of Student Body and Individual Student Variables, by Grade Level

Grade Level	Groups of Variables (1-3) Unique SBHB	Common	Unique SRETH	(4-8) Unique SACHV	Common	Unique SMTVTN	(All) Unique SBSB	Common	Unique SO(5)
Twelfth	29	38	33	25	29	46	24	53	23
Ninth	28	43	29	27	27	46	23	55	22
Sixth	28	39	33	39	23	38	31	46	23
Third	36	31	33		—			—	
First	30	32	38		—			—	
Average	30	37	33	30	27	43	26	51	23

the unique percentages are somewhat smaller and the common portion somewhat larger than for the two previous analyses. On the average, each set accounts for roughly 25 percent of the explained differences, while the remainder lies in the common portion. If we were to assign this common portion to one of the sets we would be inclined to choose SBSB, since we believe this set reflects the factors that have most influence on the way students are assigned to schools.

We repeated our two questions for each of the seven regional groups. The results for the first question are presented in table 10.3, which is therefore similar in structure to table 10.1. It will be seen that, for most regions, the percentages in the "1-3" columns tend to be greater at the lower grade levels. The most notable exceptions occur in the Southeast, where the values tend to be more similar across grade levels. On the average, they tend to be greatest in the Southeast, Plains, and Great Lakes. For variables 4-8 the percentages are smaller, so that the regional differences become less pronounced. Here, the most notable trend is for the values to be greatest in the Southeast. Finally, when the eight variables are combined (the "All" columns), regional differences become quite hard to find, although for each grade level the Southeast clearly still has the highest values.

Proceeding now to regional analysis of the subsets of student body variables, we find in table 10.4 that in some of the regions (e.g., the Northeast) the percentages vary by grade level in what appears to be a nonsystematic way. Consequently, we shall concentrate on the regional averages. The easiest way of summarizing these results is to say that each set accounts for roughly one-third of the explained variance with another third being shared (or in the common portion). When departures from this trend occur, they usually take the form of a larger role for SRETH combined with a smaller one for SBHB and a

Table 10.3.—Multivariate Percentage of Variation in Individual Student Variables Associated With the Schools Students Attend, by Region and Grade Level

Region	Groups of Variables (1-3)					Groups of Variables (4-8)					Groups of Variables (All)				
Northeast	33	37	16	12	10	22	6	6	5	6	9	7	6	7	
Mid-Atlantic	35	29	21	23	21	26	9	9	9	9	11	11	11	11	
Great Lakes	33	28	23	19	19	24	7	7	6	7	12	10	9	10	
Plains	35	32	26	27	19	28	8	6	5	6	13	12	9	11	
Far West	26	23	20	20	18	21	8	7	6	7	10	10	9	10	
Southwest	28	22	15	19	28	22	7	8	11	9	8	10	14	11	
Southeast	41	39	33	36	38	37	14	15	18	16	17	18	20	18	
Grade Level	1	3	6	9	12	Average	6	9	12	Average	6	9	12	Average	

Table 10.4.—Multivariate Commonality Analyses of Student Body and Individual Student Social Background Variables, by Region and Grade Level

Region	Grade Level	Groups of Variable (1-3) Unique SBHB	Common	Unique SRETH
Northeast	12	69	8	23
	9	47	11	42
	6	56	24	20
	3	67	17	16
	1	48	13	39
	Average	57	15	28
Mid-Atlantic	12	35	41	24
	9	28	53	19
	6	27	44	29
	3	38	34	28
	1	35	30	35
	Average	33	40	27
Great Lakes	12	34	29	37
	9	27	47	26
	6	27	35	38
	3	31	37	32
	1	29	25	46
	Average	30	31	36
Plains	12	42	25	33
	9	30	47	23
	6	26	44	30
	3	29	45	26
	1	28		40
	Average	31	39	30

Region	Grade Level	Groups of Variables (1-3) Unique SBHB	Common	Unique SRETH
Far West	12	31	24	45
	9	29	40	31
	6	24	47	29
	3	30	42	28
	1	29	32	39
	Average	29	37	34
Southwest	12	24	46	30
	9	28	36	36
	6	27	44	29
	3	34	37	29
	1	33	23	44
	Average	29	37	34
Southeast	12	26	41	33
	9	26	40	34
	6	26	37	37
	3	33	30	37
	1	26	42	32
	Average	27	38	35

larger one for the common portion. The major exception is the Northeast, where the unique role of SBHB exceeds that of SRETH by a factor of 2, while their common portion is remarkably small. For variables 1 to 3 (i.e., the individual student differences in social background), the Northeast differs considerably from the other regions, while the latter are more like each other than not. The relative percentage roles for these regions are roughly one-third for each set and for their common portion.

Regional analyses for the remaining sets of variables are given in table 10.5. For variables 4 to 8, we can note a tendency in most regions for the role of SACHV to decrease and that of SMTVTN to increase over the grade levels, though not always progressively. Exceptions occur in the Plains and Southwest. Overall, however, the role of SMTVTN in individual student achievement and motivation exceeds that of SACHV by a factor of roughly 1.5 to 1. For the "All" set, the unique roles of SBSB and SO(5) tend to decrease slightly at the higher grades, while the role of their common portion increases. As a general rule, roughly one-fourth of these individual student differences are accounted for by SBSB and slightly less than one-fourth by SO(5), while better than half is shared by these two sets. Again, we would be inclined to relegate most of this common portion to SBSB, because it reflects the factors principally involved in assigning students to schools.

We did not conduct similar analyses for the ethnic groups because we believed that the most appropriate framework for making inferences about the role of the school was one in which all students and their schools were included in the analysis together.

In summary, we have seen for the multivariate case that:

1. The association of an individual student's social background with that of the students he goes to school with is about two to three times stronger than the association of his achievement and motivations with his fellow students' achievement and motivation, regarded as aggregate qualities.
2. The strength of these associations changes vary little throughout the years of schooling.
3. As more individual student variables are brought into the analysis, differences among schools account for increasingly less and differences among students within schools for increasingly more.
4. These associations tended to be stronger in the Southeast than elsewhere.
5. Of the variation explained by these two sets of variables, one-third was accounted for by the student body's ethnic composition, another one-third by its socioeconomic composition, and the remainder by both factors together.
6. This tended to be so in every region except the Northeast, where the student body's socioeconomic composition played a much greater role.
7. In the individual student achievement and motivational variance that could be accounted for in terms of student body characteristics, the student body's

Table 10.5.—Multivariate Commonality Analyses of Student Body and Individual Student Variables, by Region and Grade Level

	Groups of Variables (4-8)				Groups of Variables (All)			
Region	Grade Level	Unique SACHV	Common	Unique SMTVTN	Grade Level	Unique SBSB	Common	Unique SO (5)
Northeast	12	17	36	47	12	19	59	22
	9	26	16	58	9	19	59	22
	6	38	20	42	6	46	30	24
	Average	27	24	49	Average	28	49	23
Mid-Atlantic	12	16	38	46	12	22	59	19
	9	20	38	42	9	20	62	18
	6	35	31	34	6	30	50	20
	Average	24	35	41	Average	24	57	19
Great Lakes	12	18	25	57	12	24	59	17
	9	27	24	49	9	22	58	20
	6	39	13	48	6	33	43	24
	Average	28	21	51	Average	26	54	20
Plains	12	33	19	48	12	24	63	13
	9	27	32	41	9	26	60	14
	6	40	14	46	6	30	48	22
	Average	33	22	45	Average	27	57	16
Far West	12	22	30	48	12	21	64	16
	9	27	30	43	9	18	67	15
	6	37	23	40	6	29	47	24
	Average	29	27	44	Average	23	59	18
Southwest	12	41	10	49	12	20	57	23
	9	38	12	50	9	27	46	27
	6	39	18	43	6	32	41	27
	Average	39	14	47	Average	26	48	26
Southeast	12	27	27	46	12	21	57	22
	9	29	24	47	9	20	59	21
	6	40	22	38	6	28	49	21
	Average	32	24	44	Average	23	56	21

motivational level played a greater role than did its achievement level, and this tended to be so in each region.

8. Of the total variation among individual students that could be accounted for in these terms, roughly one-fourth was accounted for by the student body's social background, a little less than one-fourth by its achievement and motivational levels, and slightly more than half by both sets of variables together.
9. This tended to be so for most regions.

10.2. IS ACHIEVEMENT MORE CLOSELY RELATED TO SCHOOL CHARACTERISTICS THAN OUR STUDIES HAVE SHOWN?

In this section we try to assess the degree to which the relationship of achievement with school factors changes when students are divided into separate groups on the basis of their social background and upbringing. It will be remembered from chapter 6 that the sets of variables we called Home Background, Family Process, and School tended to be moderately associated in their relationship with Achievement. It occurred to us that some of this interdependence could be a byproduct of our methodology, and might therefore be reduced by statistical means. One such means open to us was to use these individual student factors as stratifying variables.

Our first step was to make Home Background and Family Process as unrelated as possible. We therefore subjected the former set's two variables and the latter's four to a principal components analysis. This analysis yielded two components, which were then subjected to a varimax rotation (for which see Horst, 1965). The results of these analyses, already given in table 3.1, showed that the two components could be meaningfully interpreted. This first rotated component reflected what we have called Home Background. Of the variables in which it consisted, both Socio-Economic Status and Family Structure and Stability had high coefficients and the remaining variables much lower ones. In a similar manner, of the variables that made up the second component the ones we called Family Process all had high coefficients while the ones we called Socio-Economic Status and Family Structure had much lower coefficients. Accordingly, we used these aggregate coefficients (viz, those for all students combined) as weights to obtain a score for each student on each component. The distribution of scores for each component was then split into three approximately equal parts ("High," "Medium," and "Low") to produce a total of nine groups. The numbers of students and schools in these nine groups are given in table 10.6. The reader who adds up the row values for students in this table will find that we were moderately successful in separating them into nearly equal groups. However, a fairly strong relationship between Home Background and Family Process still persists, as can be seen from the way in which the highest numbers are concentrated along the diagonal that runs from lower left to upper right. On the other hand, only 120 students are both high in Home Background and low in Family Process, and the opposite is true of only 544.

Table 10.6.—Number of Ninth-Grade Students and Their Schools, by Home Background and Family Process

Home Background		Family Process: Low	Medium	High
High	Students	120	6,082	34,398
	Schools[a]	47	504	765
Medium	Students	8,206	30,131	9,496
	Schools[a]	736	877	780
Low	Students	26,699	10,132	544
	Schools[a]	883	772	210

[a] Since a school can be represented in more than one statum, the marginal sums of schools exceed the number actually observed at the ninth grade.

We next inquired how successful our stratification procedure was in eliminating the proportion of Achievement associated with Home Background and Family Process. The more successful it was, the greater (we reasoned) would be the role of school factors in Achievement. Table 10.7 shows the results of commonality analysis for each cell in which the different aspects of the school and its possible effects were represented by the set we called SO (5) in earlier chapters.[4] To these we added the two family background variables of Socio-Economic Status and Attitude Toward Life. We did this because we recognized that our stratification procedure did not completely eliminate family background as a source of variation. These two sets of variables are denoted as SCH and FB, respectively, in table 10.7. We found that the percentage of variation in Achievement accounted for by these 7 variables ranged from 13 for students with a high rating on Home Background and a medium one on Family

[4] Viz, Expectations for Excellence, Attitude Toward Life, Educational Plans and Desires, Study Habits, and Achievement.

Table 10.7.—Commonality Analysis of Family Background and School Factors in Achievement, by Home Background and Family Process: Ninth-Grade Students

Home Background	Family Process: Low RSQ (FB,SCH)	Low Unique FB	Low Common	Low Unique SCH	Medium RSQ (FB,SCH)	Medium Unique FB	Medium Common	Medium Unique SCH	High RSQ (FB,SCH)	High Unique FB	High Common	High Unique SCH
High	31	7	9	84	13	9	10	81	23	46	15	39
Medium	20	2	19	79	27	18	25	57	30	18	14	68
Low	28	17	24	59	35	19	22	59	34	7	15	78

NOTE.—Family Background (FB) contains Socio-Economic Status and Attitude Toward Life, while School (SCH) contains the five variables pertaining to the student body's achievement and motivational levels.

Process to 35 for students with a low rating on Home Background and a medium one on Family Process. Most of the values ranged from the mid-20's to the mid-30's. For almost every cell, the unique percentage for School factors (SCH) exceeded the one for Family Background (FB), while their common portion tended to be smaller than many we had seen for these sets of variables in earlier chapters. However, for students who had high ratings on both Home Background and Family Process, the role of Family Background exceeded that of School. Hence, for most cells, our stratification scheme was successful in reducing the dependence of ACHV on HB and PRCS, but failed to eliminate it.

The indications of differential relationships for the different cells made us wonder if such relationships might exist among the student body variables as they relate to Achievement. In order to find out, we conducted two kinds of analysis:

1. Commonality analyses of individual Achievement with Student Body's Achievement (SACHV) and Student Body's Motivation (SMTVTN), that is, the four student body variables excluding SACHV, before Achievement had been adjusted for its relationship with any other factors (the "U" rows in table 10.8).
2. These same analyses, after the relationship of Achievement with Socio-Economic Status and Attitude Toward Life had been partialed out (the "A" rows in Table 10.8).[5]

It will be seen that, in table 10.8, the unique percentage for Student Body's Achievement Level (SACHV) exceeds the one for Student Body's Motivational Level (SMTVTN) to a substantial extent for most of the cells. The roles of these two sets tend to overlap more in cells on or below the main diagonal (lower left to upper right) than above it. Even for these latter, however, the role of SACHV is still quite substantial. This trend alters very little when adjustments are made for SES and ATTUD. What usually happens is that the percentage for SMTVTN increases slightly, while the common portion decreases. The greatest role in individual student Achievement, then, is played by Student Body's Achievement, although at times much of this role is shared with that of Student Body's Motivation.

Using the framework described in chapter 8, we can test to see whether the stratum based on Home Background or one based on Family Process is the more useful. Or are the two so interrelated that their roles cannot be separated? Table 10.9 shows that the latter is more often the case. That is, when the five student body variables are used alone, the "P" stratum, representing Family Process, accounts independently for 1 percent of the difference (viz, 1 percent of 50), while the grand slope, *Z* accounts for another 1 percent. When the two family background variables, Socio-Economic Status and Attitude Toward Life, are also included in the analysis (the "FB, SCH" column of table 10.9), only the grand slope, *Z*, accounts independently for any variance. In other words, the remaining variance is confounded with the two strata factors and can be accounted for just as well in terms of either.

Table 10.9.—Percentage of Variation in Achievement Associated With Family Background and School Factors, by Home Background and Family Process: Ninth-Grade Students[a]

Source of Variation[b]	Regressors	SCH	FB, SCH
Intercepts	H	0	0
	P	1	0
	HP	0	0
Slopes	Z	1	1
	HZ	0	0
	PZ	0	0
	HPZ	0	0
Total R-square		50	54

[a] The percentages are expressed as a portion of the Total R-square (i.e., in the first column, 1 percent relates to a base of 50)
[b] H = Home Background, P = Family Process.

In summary, we attempted to reduce the dependence of Achievement on Family Background by doing our best to eliminate the relationship between Home Background and Family Process. We did so by means of factor analytic techniques. By using the scores on these factors, we made stratifications on three levels of Home Background and three of Family Process, to produce a total of nine groups.

[5] The R-squares for these analyses are not given, since they can be retrieved readily from table 10.7. For example, for students with high ratings on Home Background and low ones on Family Process, 93 percent of the common variance (i.e., 9 + 84) can be accounted for and 84 percent by SCH after adjustment for SES and ATTUD. For each cell, the percentage of total variance accounted for can be obtained by multiplying these percentages by 31, the latter being the percentage of total variance accounted for by both FB and SCH factors.

Table 10.8.—Relative Roles of School Factors in Achievement, by Home Background and Family Process: Ninth-Grade Students

Home Background		Family Process: Low Unique SACHV	Low Common	Low Unique SMTVTN	Medium Unique SACHV	Medium Common	Medium Unique SMTVTN	High Unique SACHV	High Common	High Unique SMTVTN
High	U	52	25	23	68	14	18	52	39	9
	A	42	30	28	73	5	22	60	24	16
Medium	U	71	14	15	51	43	6	42	52	6
	A	78	5	17	60	32	8	45	49	6
Low	U	45	51	4	47	49	4	43	52	5
	A	59	32	9	52	44	4	43	52	5

Note.—U = unadjusted for Socio-Economic Status and Attitude Toward Life. A = adjusted for Socio-Economic Status and Attitude Toward Life.

Although we found some evidence of a differential relationship between achievement level and school factors, it was never an appreciable one in terms of our framework. We concluded that our stratification procedure had failed in its purpose, viz, to reduce the confounding of Socio-Economic Status and Attitude Toward Life as they related to Achievement. Moreover it failed to turn up any differential relationships worth pursuing.

10.3. DOES GENERALIZING THE COMMONALITY MODEL TELL US MORE THAN FACTOR ANALYSIS?

The commonality model, described below in appendix A, can be generalized so that each variable in turn is treated as dependent. We shall first dwell on the nature of this extension and then on some of the reasons why one might want to use it.

Suppose we are interested in the manner in which each variable in a set is related to each of the others, both singly and in combination. A technique commonly used for explaining such relationships is known as factor analysis. There are many variations on this technique but they all involve bringing in a lesser number of components with known mathematical properties as an aid to understanding a set of variable interrelationships. Commonality analysis, on the other hand, enables one to deal with the variables themselves rather than with a set of hypothetical components. For instance, given three variables, X_1, X_2, X_3, one can perform a commonality analysis in which each variable in turn is treated as dependent and the remaining two as independent. The results of these three analyses might be organized as follows:

Order		X_1	X_2	X_3	Sum %
Residual	X_i	a	e	i	a+e+i
First	$U(X_1)$	—	f	j	f+j
	$U(X_2)$	b	—	k	b+k
	$U(X_3)$	c	g	—	c+g
Second	$C(X_1X_2)$		—	l	l
	$C(X_1X_3)$	—	h	—	h
	$C(X_2X_3)$	d	—	—	d
Sum %		1	1	1	3

The entries in each column result from a single commonality analysis. The entries in the "Residual (Xi)" row are merely the unexplained variances for that particular commonality analysis (viz, $a = 1 - RSQ\ (X_2X_3)$, when X_1 is dependent, etc.). In the first column, the entries associated with the rows labeled "$U(X_2)$" and "$U(X_3)$" are the portions of the total variance for X_1 that can be uniquely associated with X_2 and X_3 respectively (viz, $b = RSQ\ (X_2X_3) - RSQ(X_3)$, etc.). In the same column, the entry associated with $C(X_2X_3)$ is the portion of total variation in X_1 that is confounded with both X_2 and X_3 (viz, $C(X_2X_3) = RSQ(X_2X_3) - U(X_2) - U(X_3)$). The column entries sum to one in each case, which is to say that all of the variation in each variable is completely accounted for in the table. The sum of the column entries across columns is equal to three, which is the trace of the total correlation matrix. The last column, which contains the sum of each row's entries, indicates where the major portions of variation lie for the full set of variables. For example, the first row sum indicates the percentage of the total matrix variance that is residual. Similarly, the next three entries indicate the portion of total matrix variance that is uniquely associated with each of variables X_1, X_2 and X_3.

When should this technique be used? At least three possible applications suggest themselves:

1. *To analyze the relationship among a number of dependent variables.* — For instance, one might want to select a subset of variables that would capture as much of the total matrix variance as possible. To do this, one would add to each column sum the other row entries that involve that variable as a subscript. Thus if we were to select variable X_1, then the total matrix variance accounted for by that variable would be 1, plus the row entries $U(X_1)$, plus those for $C(X_1X_2)$ and $C(X_1X_3)$. If similar sums were formed for the other variables, we could then decide which single variable accounted for the most variance. If no single variable was outstanding in this respect, we could proceed from the best subset to the second best subset, and so on.
2. *To analyze relationships among variables or sets of variables that represent different domains.* For example, one might have measures of a given attribute that were obtained by means of different kinds of measuring instruments (paper-and-pencil tests, say, as opposed to interview reports).
3. *To analyze the relationships among variables that have both been measured differently and been drawn from different domains of content.* Thus one might want to do this before combining them as a set of multivariate dependent variables.

As an example of the first application, let us inquire into the relationships among the five measures of achievement at the ninth grade. In our earlier work, these were combined into a single achievement index by means of factor analysis (Mayeske et al., 1972a). The results, which have been unitized, are given in table 10.10. The fact that the unitized elements sum to only 95 indicates that there were many values too small to be worth including. Without any loss due to such fractionally small values or to rounding error, each column sum would equal 20 percent. It will be seen that the smallest values are for "Reading" (i.e., the reading comprehension test) and the largest for "General Information." If 20 percent is the maximum possible value for each variable, then, as the "Residual" row indicates, there is less confounding (i.e., a greater residual) for the nonverbal test than for any of the other measures. The greatest confounding exists for the verbal and general information tests. The sum of these residuals shows that 35 percent of the total variance is residual. By adding up the entries in the "Sum" column for the different orders of coefficients (i.e., all those for the first order, all those for the second-order, etc.), we can tell where most of the total variance lies. The sums are: 9 for the

Table 10.10.—Generalized Commonality Analyses of Ninth-Grade Student Achievement Measures

Order		1 Nonverbal	2 Verbal	3 Reading	4 Mathematics	5 General Information	Sum %
Residual	(X1)	11	4	7	8	5	35
First	U(1)		0	0	1	0	1
	U(2)	0		1	0	2	3
	U(3)	0	1		0	0	1
	U(4)	1	0	0		0	1
	U(5)	0	2	0	1		3
Second	C(12)			0	0	0	0
	C(13)		0		0	0	0
	C(14)		0	0		0	0
	C(15)		0	0	0		0
	C(23)	0			0	2	2
	C(24)	0		0		1	1
	C(25)	0		2	1		3
	C(34)	0	0			0	0
	C(35)	0	2		0		2
	C(45)	0	1	0			1
Third	C(123)				0	1	1
	C(124)			0		1	1
	C(125)			1	1		2
	C(134)		0			0	0
	C(135)		1		0		1
	C(145)		0		0		0
	C(234)	0				2	2
	C(235)	1			2		3
	C(245)	1		2			3
	C(345)	0	2				2
Fourth	C(1234)					6	6
	C(1235)				5		5
	C(1245)			5			5
	C(1345)		6				6
	C(2345)	5					5
	Sum %	19	19	18	19	20	95

first order; 9 for the second; 15 for the third; and 27 for the fourth. Hence, most of the nonresidual variance lies in the fourth and third orders, respectively. By forming column sums according to the procedure described under application 1, we find that some 62 percent of the total matrix variance can be accounted for by the "Verbal" measure alone. The measure that comes closest to it, after allowing for the "Verbal" measure, is "Mathematics."

Our next analyses focused on the relationships between Achievement, the composite formed of the five achievement measures in table 10.10, and Motivation. The results are given in table 10.11. It will be seen immediately that more variance is residual here and that the higher-order portions are much smaller than for the separate achievement measures. In fact, roughly 75 percent of the variation in Achievement is residual, but only 50 percent of the variation in Attitude Toward Life and Study Habits.[6] The "Sum" column shows that 60 percent of the total matrix variance is residual. The remaining variance is distributed among the different orders of coefficients as follows: first, 13 percent; second, 6 percent; third, 11 percent; and fourth, 5 percent.[7] Attitude Toward Life and Study Habits each account for 40 percent of the total matrix variance. No other variable comes anywhere near matching their performance, but if we had to choose a runner up it would be Educational Plans and Desires.

In the last of these generalized commonality analyses, we combined the four motivational measures into a single set called Motivation, kept the five-variable composite called Achievement, and brought in the set called Home Background, which consists of Socio-Economic Status, Family Structure and Stability, and Racial-Ethnic Group Membership. But first we had to decide how the results of multivariate and univariate commonality analyses could be incorporated into a common framework. Our procedure was as follows. In each column, the results for the univariate or multivariate commonality analyses were entered as before. For a univariate analysis, the sum of each set of residuals and higher-order coefficients was of course 1, since this was each variable's total variance. For a multivariate analysis, the corresponding sum in each case was also to the upper limit of variance, but this in turn was equal to the number of dependent variables, which was always greater than one. Once all the entries had been made in the table, they were divided by the total number of variables in the matrix. This had the effect of making the total variance for the matrix equal to one (within rounding error). The variance of a single set of variables was then merely the number of variables in that

[6] These percentages are obtained by dividing the residual values by the maximum value of 20 percent.

[7] These percentages are obtained by summing the percentages in each order's "Sum" column.

Table 10.11.—Generalized Commonality Analyses of Ninth-Grade Student Achievement and Motivational Measures

Order		1 Expectations for Excellence	2 Attitude Toward Life	3 Educational Plans	4 Study Habits	5 Achievement	Sum %
Residual	(X1)	13	10	12	10	15	60
First	U(1)		1	0	0	0	1
	U(2)	1		0	3	0	4
	U(3)	1	0		0	2	3
	U(4)	0	3	1		0	4
	U(5)	0	0	1	0		1
Second	C(12)			0	1	0	1
	C(13)		0		0	0	0
	C(14)		1	0		0	1
	C(15)		0	0	0		0
	C(23)	0			1	0	1
	C(24)	1		1		0	2
	C(25)	0		0	0		0
	C(34)	0	1			0	1
	C(35)	0	0		0		0
	C(45)	0	0	0			0
Third	C(123)				2	0	2
	C(124)			1		0	1
	C(125)			0	0		0
	C(134)		2			0	2
	C(135)		0		0		0
	C(145)		0	0			0
	C(234)	2				1	3
	C(235)	0		1			1
	C(245)	0		1			1
	C(345)	0	1				1
Fourth	C(1234)					1	1
	C(1235)				1		1
	C(1245)			1			1
	C(1345)		1				1
	C(2345)	1					1
	Sum %	19	20	18	19	19	95

Table 10.12.—Generalized Commonality Analyses of Ninth-Grade Student Home Background, Motivation, and Achievement Measures

Order		1 Home Background	2 Motivation	3 Achievement	Sum %
Residual	(X1)	30	44	7	81
First	U(1)		2	2	4
	U(2)	3		1	4
	U(3)	3	1		4
Second	C(12)			2	2
	C(13)		4		4
	C(23)	2			2
	Sum %	38	51	12	101

set, divided by the total number of variables in the matrix.

The results of such an analysis are displayed in table 10.12. Since there were three variables in the Home Background set, its variance was 3 divided by 8, the total number of variables in the analysis. This value, rounded to two places of decimals, is given in the "Sum" row. Similarly, the four motivational variables accounted for half of the total matrix variance (the 51 in the table was due to rounding), while Achievement, a single variable, accounted for only 12 percent. It should be immediately clear from table 10.12 that most of the variance for each set of variables is residual to the others. Thus roughly 79 percent (i.e., 30 divided by 38) of the variance in Home Background is residual, while the corresponding values for Motivation and Achievement are 85 and 58 percent respectively. Overall, 81 percent of the matrix variance is residual, with a remainder of 12 percent in the first order and 8 percent in the second. Since there are differing numbers of variables in each set, we cannot proceed as before and pick out the variable with the best explanatory performance. However, if the total matrix variance is used as a base, it becomes obvious that the degree of relationship among these sets is not as great as our analyses in previous chapters might have led us to believe.

In summary, the commonality model can be generalized

to show how several sets of variables, both singly and in combination, contribute to total matrix variance. By applying this type of generalized model to a set of five achievement measures, we found that some 35 percent of the total matrix variance was residual, but that 42 percent of the common variance was shared among three or more of the other variables. When we combined Achievement with each of the four motivational measures in turn, we found that some 60 percent of the total matrix variance was residual, while most of the common variance was either unique to a single variable (13 percent) or shared among three of them (11 percent). When we combined the four motivational measures into a single set, called Motivation, and entered it into the analysis with sets called Achievement and Home Background, we found that some 81 percent of the total matrix variance was residual. Of the remainder, 12 percent was unique to one of the sets, while 10 percent was shared by two of the sets together. We concluded that the commonality model could indeed be generalized to a partitioning of *total* matrix variance, and that such a procedure could help to reveal structural interrelationships among variables—a result not readily achieved by factor analysis.

10.4. DOES A WITHIN-SCHOOL STUDENT EQUATION YIELD A BETTER MEASURE OF SCHOOL EFFECTS?

Among the myriad researchers who have worked with the data from the Equality of Educational Opportunity Survey not a few have suggested alternative methods by which these data could be aggregated, analyzed, or both. The remaining sections of this chapter will therefore be devoted to examining the comparative merits of several such methods, including some recent extensions of our own commonality model.

D. E. Wiley (1973) has suggested that a more appropriate way of analyzing so-called school effects would be to compute a within-school regression equation on individual students and then, using this equation, adjust individual student achievement scores for their within-school relationships. Residuals to this equation would then be averaged by school and treated as dependent in an among-schools analysis. Such an approach assumes that the within-school relationships are unaffected by school differences. Since, as we have seen, there was such a pronounced streaming of students into schools on the basis of their socioeconomic status and ethnicity in 1965, when these data were collected, the assumption is probably unwarranted. Moreover, a great many other sets of variables were correlated with these two. Nevertheless, Wiley's approach seems worth a try, and we have therefore examined it here in some detail. The data used were for the sixth grade, since the sample of schools (a total of 2,372) was most adequate at that level, and the variance in Achievement among schools (some 32 percent of the total variance) was greatest.

In most of our analyses we have used a mixed data-analysis model. By this we mean that the individual student is the unit of analysis, and the attributes of the school he attends are appended to him as if they were his own.[8] When student variables are analyzed by means of such a model, the resulting equation is called "Total," since all the differences among students on these variables have been entered into the analysis. When student and school variables are analyzed together in such a model, the resulting equation is called a mixed one because, although school differences, like student differences, enter to the maximum extent, they are not as great because there are more students than schools.

In the analyses that follow, we began by comparing the results obtained from the "Total" student equation with those from the Within-school equation. The latter was obtained from our data analysis model merely by partialing out of the dependent variables its among-school counterpart, and then regressing this residual on the individual student scores. For example, if we were analyzing Achievement and Socio-Economic Status, a simple regression of the former on the latter would yield a "Total" student equation. By partialing school mean Achievement (i.e., the mean Achievement of the students in each school) out of individual student Achievement, and then regressing these residuals on individual student Socio-Economic Status, we would obtain a within-school equation. Such equations were computed with the following sets of variables:

1. Socio-Economic Status.
2. Home Background, consisting of: *(a)* Socio-Economic Status; *(b)* Family Structure and Stability.
3. Home Background and Racial-Ethnic Group Membership.
4. Family Background, which in this case consists of: *(a)* Home Background and Racial-Ethnic Group Membership; *(b)* the four motivational measures that we called Family Process.

The resulting equations were then applied to the total student differences to see how much of the variance in Achievement each accounted for.[9] The difference between them, we reasoned, would be a measure of the extent to which the variance that was accounted for by one would be unaccounted for by the other. We therefore formed the following measure of difference:

$$\Delta = RSQ\ (HB)_{\text{Total}} - RSQ(HB)_{\text{Within}}, \qquad (1)$$

In equation 1, the rightmost terms differ only in their weights; the variables are the same in each case. The variance accounted for by the "Total" equation for Home Background (i.e., $RSQ(HB)_{\text{Total}}$) is given first because it is the highest value. This is so because the weights used are taken from a least-squares fit to total students. The variance accounted for by the "Within" equation is subtracted from it. The difference between these two terms, Δ, is a measure of the extent to which variance unexplained by the "Within" weights is explained by "Total"

[8] For a computational rationale, see section A.1 of appendix A.

[9] This was done by obtaining an estimated score with the different equations, and then regressing Achievement against it. The R-square resulting from this regression was a measure of the variance that it accounted for.

weights. When Δ is zero, it indicates that the same results would have been obtained with either equation. When Δ is large, it indicates that the "Within" equation would leave more variance unexplained than would the "Total" equation. The importance of this for our inquiry is that such unexplained variance might then be picked up by school variables, thereby affording grounds to estimate a greater school effect.

The "Percent" column of table 10.13 contains these Δ's. It will be seen that the "Total" and "Within" equations, yield the same results for both Socio-Economic Status and Home Background. However, when ethnicity (RETH) is included as an aspect of Home Background, the "Total" equation picks up .1 percent more than the "Within" equation, and 2 percent more when it is included as an aspect of Family Background. Hence, when a more comprehensive set of student background variables is used, the "Within" Equation accounts for 1 to 2 percent *less* of the variance than does the "Total" equation.

Table 10.13.—Percentage of Student Variation in Achievement Associated With the Total Equation That Is Independent of the Within-School Equation: Sixth Grade

Variable Set	Percent
1. Socio-Economic Status	0
2. Home Background	0
3. Home Background Including Ethnicity	1
4. Family Background	2

NOTE.—There are 123,305 students and their 2,372 schools included in these analyses.

Is it the school variables that are picking up this extra 1 to 2 percent? To find out, we computed regressions in which the estimated score from the "Total" or "Within" analysis was entered as a variable along with a set of 12 variables pertaining to residence and school, called SCHOOL(12).[10] The unique variances for the two kinds of analyses were computed as follows:

$$U(SCH) = RSQ(HB_{Total}SCH) - RSQ(HB)_{Total} \quad (2)$$

$$U(SCH) = RSQ(HB_{Within}SCH) - RSQ(HB)_{Within} \quad (3)$$

The difference, *d*, between equations 2 and 3 is a measure of the extent to which the "Within" equation allows more variance to be explained by SCHOOL(12)—SCH in the equations—than does the "Total" equation. These values are given in the "*T*," "*W*," *and* "*d*" columns of table 10.14. Here, the *d* values indicate that SCHOOL(12) does indeed pick up the variance that: *(a)* was left unexplained by the "Within" equation; *(b)* would have been picked up by the "Total" equation. In consequence, a very slightly greater school effect might be inferred from these results.

We were not able to follow Wiley's suggestion and aggregate the residuals to the school level for an among-schools analysis. However, we did scale up the unique variance for the school variables from the student level to the among-school level. Our method was to divide them by

[10] These were: two variables pertaining to regional and rural-urban location; five student body variables; and the five teaching staff variables.

Table 10.14.—Percentage of Student Variation in Achievement Uniquely Associated With School Variables for the Total and Within-School Equations: Sixth Grade

Variable Set	Unique Percent T	W	d
1. Home Background and Twelve Residential/School Variables	14	14	0
2. Home Background, including Ethnicity and Twelve Residential/School Variables.	6	7	1
3. Family Background and Twelve Residential/School Variables	6	8	2

NOTE.—There are 123,305 students and their 2,372 schools included in these analyses.

the percentage of variation in Achievement that lies among schools, viz, 32. Having done this, we found that use of the "Within" equation allowed the School variables to account for some 3 to 6 percent more of the among-school variance than the "Total" equation.[11] We concluded that this procedure did yield more variance that could be accounted for by differences among schools. It should be added immediately that, with these data, the procedure is a questionable one. This is because of the pronounced assignment of students to schools on the basis of their socio-economic status and ethnicity—a practice that renders unlikely Wiley's assumption that, at the individual level, the relationship of these factors with achievement is not affected by differences among schools.[12]

10.5. IS THE COMMONALITY MODEL MISLEADING?

We have already mentioned our reliance on the analytic technique known as the commonality model. This model was developed in 1965–66 by Alexander M. Mood, to deal with problems arising out of the initial analysis of the Equality of Educational Opportunity Survey.[13] Briefly, the problem was that student achievement could be estimated moderately well from a number of school attributes before any student background attributes had been taken into account. However, after the relationship of achievement with these background attributes had been allowed for, this previous relationship with school attributes tended to vanish. These results seemed to imply that there was a degree of overlap, or confounding, in the way

[11] Using school differences as their own variance base.

[12] Another approach, not tried here, would be to make the following comparison:

1. Take residuals to the "Within" equation for each student, and average these by school.
2. For these averaged residuals, compute the variation among schools.
3. For the same variables as in step 1, take residuals to the "Among" school equation.
4. For these residuals, compute the variation among schools.
5. Compare the magnitude of the variation obtained by step 2 with that obtained by step 4.

It seems likely that, for this kind of analysis as well, the "Within" equation would yield more variation that could be associated with differences among schools. However, the same assumptions would still be required for the "Within" adjustment.

[13] For the type of problem to which we refer, see the Coleman Report (e.g., Coleman et al., 1966, table 3.23.1, p. 303). A version of the commonality model was developed in England at about the same time, but in a very different context, by R. G. Newton and D. J. Spurrell (1967).

that student background and school attributes related to achievement. The commonality model was developed in order to obtain a quantitative expression for the extent of this overlap.

Another aspect of the survey that should be recalled here is that it collected a broad range of data about individual students, their teachers, and their schools, from students of different grade levels at a single point in time. Thus the relationships observed among students at any one grade level were associational in nature. This meant that their interrelationships could be thought of as arising in part from previous interrelationships, as well as from their interplay over time. The possibility therefore existed of a degree of intercorrelation among the different classes of variables that would be difficult to classify in terms of a causal or quasi-causal model. The problem was that, within each class of variables, gross indicators rather than well-measured variables were all that was available. Often even these did not adequately sample their domain of representation. For example, the indices related to student attitudes and motivation were often merely crude composites of those items that happened to be available. One could certainly think of many other kinds of attitudinal items related to school effects that might have been collected had time and money allowed. Some of the other drawbacks have already been alluded to: indices were more comprehensively measured at the higher than at the lower grade levels; responses were likely to be more reliable for older than for younger students; differences across grade levels tended to reflect dropout rates that differed by region and ethnicity. Findings based on such data are necessarily tentative.

But let us return to the reasons for our adoption of the commonality model. Ordinarily, in a study of this type, one might classify the variables into those that can be considered dependent, or "outcome variables," such as achievement, and those that can be considered independent, or "input variables," such as student background and school resources. A regression analysis of outcome on input variables would yield regression coefficients from which tentative causal inferences might be made—provided, of course, that the assumed direction of the causal relationship corresponded to reality. Here, when we actually performed such analyses, the regression coefficients associated with our crude indicators behaved in a more or less erratic manner, depending on their partners in the equation. For example, the coefficients for the ethnic composition of the student body and of the teaching staff would each be positive—except when they appeared in the analyses together, whereupon the latter would take on a large negative value. We realized, of course, that such erratic behavior on the part of regression coefficients was chiefly due to the degree of relationship that existed among the variables (this is often called the problem of collinearity). What we needed was an explanatory model that would enable us to (*a*) deal with classes of variables rather than single ones; (*b*) accommodate our analysis to the shifting directional values that single variables might take on because of their companions in an equation; (*c*) avoid some of the metric assumptions required of our indices in order to interpret their regression coefficients. We therefore adopted a version of the so-called unique variance explained model. What we wanted was to represent the degree of correlation that existed among different variables, and to single out the portion of it that might be meaningful. We found that the unique variance explained model could be extended so as to express the portion of variance explainable in terms of either one of the several sets of variables being analyzed. This extension was called the commonality model because it expressed the portion of variance common to two or more of the sets.

The commonality model, then, was not something imposed on our data, but a natural result of the confrontation between the unique variance explained model and the peculiarities of our data. For example, in our first monograph, referred to here as the School Study, we observed that the correlation of Achievement with student body and school factors was substantial for each, but that when both were combined in a regression analysis their multiple correlation was not much greater than the one observed for either alone. In terms of our unique variance explained model, this meant that each of the sets would have small unique values, but that there was a great deal of overlap in the variance that either one could explain alone. More formally, for two sets of variables, S and B, their unique values, U, would be defined as follows:

$$U(S) = RSQ\ (S,B) - RSQ\ (B) \quad (1)$$
$$U(B) = RSQ\ (S,B) - RSQ\ (S) \quad (2)$$

where $RSQ\ (\ )$ denotes the squared multiple correlation, or R-square, of each set in the parentheses. Clearly, if the separate R-squares for S and B are both large, and the value when both are entered together is not much larger, then the U values will be small. To express the overlap between S and B, then, the following equation was developed:

$$C(S,B) = RSQ\ (S,B) - U\ (S) - U\ (B) \quad (3)$$

The R-square for each set of variables could then be expressed as a function of its unique and common portions, as follows:

$$RSQ\ (S) = C\ (S,B) + U\ (S) \quad (4)$$
$$RSQ\ (B) = C\ (S,B) + U\ (B) \quad (5)$$

and the R-squares for both sets as:

$$RSQ\ (S,B) = C\ (S,B) + U\ (S) + U\ (B) \quad (6)$$

There are $2^k - 1$ coefficients that result from a commonality analysis. In the next section, then, we have applied to our data the models proposed by W. A. Creager and R. F. Boruch (1969), and by P. Horst (1973). Each of these models transforms the number of independent or regressor variables into orthogonal or unrelated variables, and then expresses the variation in the dependent variable as a function of the latter. The Creager and Boruch approach, which might be termed a reduced-rank model, attempts also to reduce the number of observed variables to a lesser number of composites. In contrast, the Horst approach works with the full number of observed variables, and might therefore be termed a full-rank model.

The reduced-rank model can be described, at the risk of oversimplification, as one in which the number of factors or components used is smaller than the number of observed variables.[16] It is applied somewhat as follows:

1. A dependent variable is regressed against an independent, or regressor, set of variables, and a composite variable is formed.
2. The *n*th-order regressor correlation matrix is then subjected to a principal components analysis.
3. Some number of the components fewer than *n* is orthogonally rotated to a meaningful position by means of any desired rotational scheme (including a least-squares rotation to a predetermined structure).
4. Component scores are computed, and the variance in the composite dependent variable is expressed as a function of the orthogonal components.[17]
5. A new multiple correlation and a regression weight for each of the *n* observed variables can then be computed from these components.

The above approach was tried with: (*a*) 31 school-level variables (listed in table 11.6, below); (*b*) 20 student-level and school-level variables combined. The school-level analyses proved unfruitful for two main reasons:

1. The variables analyzed did not fall into meaningful groupings.
2. A substantial portion of predictable variance in the dependent variable was lost.

When student-level and school-level variables were analyzed together, the results were even worse. In addition to both aforementioned reasons, level-of-analysis components emerged (i.e., one component that was primarily student-level and one that was primarily school-level). As a consequence, the reduced-rank model was not given further consideration, even though for singular matrices it remained an attractive approach.[18]

The full-rank model differs from the reduced-rank model in that it extracts as many principal components as there are observed variables. If these components are then rotated so that each one is maximally related with an observed variable, the same computations can be performed as in stages 4 and 5 of the reduced-rank model described above. However, these computations yield very little that cannot be obtained from a straightforward regression analysis. This is because: (*a*) the total variance of each variable is retained in the model; (*b*) the dependent variable tends to be fitted to the variance in each component that is unique to it. Accordingly, we did not pursue this form of the full-rank model further.

There was one form of the full-rank model, however, that we felt might yield results that would be well suited to such data. It will be recalled that the data we are working with are associational in nature. Because of this, we did not designate any one variable or set of variables as dependent. Rather, we entered them all in the component analysis together, extracted the full number of components (i.e., the same as the number of variables), and orthogonally rotated them so that each would be maximally related to only one of the observed variables. The results of this analysis are given below in table 10.15.

Table 10.15.—Relation of Each Observed Variable With Its Orthogonalized Counterpart

Rank Order	Variable	Correlation Coefficient
1	Rural-Urban Location	.97
2.5	Regional Location and Teaching Staff's Training and Salary Level	.96
4	Family Structure and Stability	.95
5.5	Expectations for Excellence and Teaching Staff's Preference for Student Ability Level	.94
7	Socio-Economic Status	.92
8	Educational Plans and Desires	.91
9.5	Attitude Toward Life and Study Habits	.90
11	Teaching Staff's Teaching Conditions	.89
12	Achievement	.88
13	Ethnic Group Membership	.86
14	Teaching Staff's Verbal Skill Mix	.84
15	Teaching Staff's Ethnic Composition	.80
16	Student Body's Expectations for Excellence	.78
17	Student Body's Educational Plans	.73
18	Student's Body Study Habits	.71
19.5	Student Body's Achievement Level and Student Body's Attitude Toward Life	.69

NOTE.—These analyses were conducted on the 123,305 sixth-grade students and their 2,372 schools.

Our first comparison of interest here is the extent to which the correlation of each orthogonal component can be related to its observed counterpart. The higher this correlation, the less likely it is that the observed variable can correlate with any of the other components. Similarly, the lower this correlation, the more likely it is that the observed variable can be correlated with components other than its own. It will be seen that the coefficients are great-

[16] We shall not distinguish here between a factor analytic and component analysis approach, although each can be thought of as proceeding from different assumptions (Beaton, 1974).

[17] See Beaton (1974) for the computational details.

[18] I.e., for cases where the empirical rank of the matrix was less than its order.

est for such variables as: Rural-Urban Location; Regional Location; Teaching Staff's Training and Salary Level; and the individual student's Family Structure and Stability. Next come most of the individual student motivational measures, closely followed by Achievement. In the lowest group are two of the teaching staff variables and—lowest of all—every one of the student body variables. It should be remembered that, since all the variance of each variable is retained in the analysis, even a 0.9 correlation of an observed variable with its orthogonalized counterpart leaves 0.19 of its variance (viz, $1-(.9)^2$) to be accounted for by other components.

Table 10.16 shows the coefficients for the primary orthogonal components of interest: the individual student achievement and motivational measures.[19] For Expectations for Excellence (EXPTN), all the coefficients are low relative to the correlation of the observed variable with its orthogonalized counterpart, which is 0.94. However, if we use a cutoff value of 0.07 (which is roughly 1 percent of the variance, when squared and rounded), we can note that, of the individual student variables, only Ethnic Group Membership and Achievement fail to qualify as related to the orthogonalized EXPTN. At the school level, however, only the student body version of EXPTN qualifies. Applying the same cutoff point to the coefficients for ATTUD, we find that, of the individual student variables, only Racial-Ethnic Group Membership fails to qualify, while at the school level only the student body version of ATTUD qualifies. The same pattern is to be found in the coefficients for EDPLN and HBTS, except that, for the latter at the school level, the student body version of ATTUD also qualifies and those of EXPTN and EDPLN almost do. For ACHV the picture changes somewhat: at the individual student level, only EXPTN *fails* to qualify, while at the school level 7 of the 12 variables qualify and another three almost do.[20] Hence, when these orthogonalized definitions are used, achievement has many more correlates than do the other motivational components.

Whether such results appear meaningful or not surely depends more on the investigator's own theoretical and methodological preferences than on any weight of scientific opinion; the latter, indeed, is sorely lacking in this area. Our own preference, with these particular data, is for the commonality and regression models. However, orthogonal decomposition could be useful as an auxiliary technique for throwing light on how such results might have come about.

Nevertheless, when we applied this technique to the same school and student-level variables we had used in our commonality and regression models, a meaningful framework did not emerge. In fact, the orthogonal decomposition technique actually discarded information that had been retained in the commonality and regression models. Nor did a full decomposition yield any information that could not be obtained from a regular regression analysis. A variant of this technique, whereby all dependent and regressor variables were orthogonally decomposed together and maximally related to their observed counterparts, did seem well suited to our data. However, the investigator would still have to make up his own mind on whether to retain these orthogonalized definitions, since there is nothing in the technique itself to guide him.

10.7. SUMMARY

In this chapter we reexamined a number of our earlier findings by applying new analytic techniques to the same

[19] Note that these 5 components are orthogonal to one another as well as to the 15 other components not included in the table.

[20] The two that come nowhere near qualifying are Rural-Urban Location and Teaching Staff's Training and Salary Levels.

Table 10.16.—Coefficients for the Orthogonal Motivation and Achievement Components

Variable	Expectations for Excellence	Attitude Toward Life	Educational Plans and Desires	Study Habits	Achievement
Socio-Economic Status (SES)	07	10	13	11	18
Family Structure and Stability (FSS)	10	13	07	13	08
Racial Ethnic Group Membership (RETH)	03	04	03	04	17
Expectations for Excellence (EXPTN)	94	18	16	16	05
Attitude Toward Life (ATTUD)	18	90	19	25	12
Educational Plans and Desires (EDPLN)	16	19	91	19	18
Study Habits (HBTS)	16	25	19	90	11
Achievement (ACHV)	05	12	18	11	88
Rural-Urban Location	−01	0	02	0	−01
Regional Location	−01	01	01	01	06
Student Body's Expectations for Excellence	09	05	04	06	06
Student Body's Attitude Toward Life	04	09	05	07	08
Student Body's Educational Plans and Desires	04	05	09	06	09
Student Body's Study Habits	04	06	05	10	08
Student Body's Achievement	01	03	02	04	20
Teaching Staff's Training and Salary Levels	−01	01	02	01	02
Teaching Staff's Preference for Student Ability Level	01	01	02	01	06
Teaching Staff's Teaching Conditions	01	02	02	02	10
Teaching Staff's Ethnic Composition	02	02	01	02	11
Teaching Staff's Verbal Skill Mix	01	02	02	02	10

—Analyses conducted on 123,305 sixth grade students and their 2,372 schools. All numbers are rounded to two places of decimals, with leading decimal points omitted.

body of data. Our chief purpose was to estimate the usefulness and validity of the techniques previously used.

We first examined the maximum extent to which individual student differences could be explained by school differences. We found that, as increasingly more variables were brought into the analysis, school differences played less and less of a role vis-à-vis individual differences. This result was explainable in part by the fact that the variables at the school level were more closely interrelated.

We tried a number of techniques designed to break up the confounding of student and school variables. One technique involved stratifying on student-level variables and then attempting to explore differential school effects within these strata. This approach was not considered productive.

We also generalized the commonality model to the case in which each variable in turn was treated as dependent. By applying this technique to a set of five achievement measures and their correlates, we were able to detect various orders of overlap between subsets that, we felt, were highly suggestive of structural relationships.

We next used the within-school equation to adjust for the relationship of achievement with student background factors. This equation did allow slightly more of the variability in achievement to be explained by school factors. But because of the pronounced relationship between various individual and student body background factors, we considered it a questionable procedure.

Turning to the various objections that had been raised to our commonality model, we contended that it was a natural result of applying the unique variance-explained model to sets of variables as heavily confounded as the ones in the Equality of Educational Opportunity Survey. Given the peculiarities of our data, the commonality model, it seemed to us, had yielded more meaningful results than could have been obtained by standard regression analysis.

Finally, we tried out two variants of a technique that had been proposed as an alternative to commonality analysis, namely, orthogonal decomposition. Using the first variant, we attempted to reduce the student and school variables to a smaller number of orthogonal components from which meaningful explanations might be made more parsimoniously than from commonality or regression models. A meaningful framework did not emerge. In addition, this approach tended to discard information used in fitting commonality and regression models. With the second variant, we transformed the observed variables into mutually orthogonal components, and then examined the extent to which the observed variables could be related to each of their orthogonalized components. Here, although meaningful correlations could be observed, the acceptability of the results appeared to depend on the investigator's willingness to live with the orthogonalized definitions. We decided that this second variant might be a useful adjunct to commonality and regression models, but should not supplant them.

PART 5: SUMMARY AND RECOMMENDATIONS

Chapter 11

SYNTHESIZING THE SEPARATE ANALYSES

In this chapter, we shall draw on several of our earlier chapters to construct two very primitive analytic models of the roles played by family background and school factors in individual student achievement and motivation. We use the term "primitive" because, as we shall soon see, we cannot distinguish among the various categories of data to the degree we would prefer. This severely limits our ability to construct hypotheses about a number of causal relationships. Nevertheless, the models do at least permit speculation on the subject of so-called school effects.

It should be borne in mind here that the data we are using is *concomitant*, that is, it was all collected at one and the same point in time. Since the same students were not measured at two different points in time, it is difficult and in some cases impossible to sort out what might appear to be the effects of different classes of variables on one another. This is especially the case with the set of variables we have called either Motivation or Family Process.[1] Thus we can think of Family Process and Achievement as influencing one another, as when parents or other family members employ incentives to enhance a child's performance in one time period because his or her performance wavered somewhat in the preceding time period. Alternatively, we can think of a child who is excelling in school as encouraging the family to support this enhanced performance. For instance, the child may talk with the parents about schoolwork, ask them to keep the television turned down or off, request books of interest, or wonder openly about planning for college. No doubt this would be an unusual child; the point is that with concomitant data we cannot easily distinguish between the child's and the parent's contributions. Accordingly, in our first and simpler model we shall regard both Achievement and Family Process as reflecting the joint effects of family background and school influences, while in our second and more complex one we shall attempt to distinguish among these different types of influence. For each model, our basic approach will be to form indices at the macroanalytic level and then use them to explore various questions.

11.1. A RUDIMENTARY MODEL OF STUDENT ACHIEVEMENT/MOTIVATION

Our first model is called one of Achievement/Motivation because it is based on the assumption that we cannot distinguish between Achievement and the four variables reflecting the motivational aspects of family life.[2] To form our primary dependent variable, then, we combined these five variables according to their weights on their first principal component. These weights, along with the percentage of variance accounted for by each principal component at the different grade levels, are given in table 11.1. As can be seen from the "Percentage of variance" row in the upper left-hand portion of the table, these weights capture about half the variability in these measures. At the lower grade levels, somewhat greater weight accrues to the four motivational measures than to Achievement. Since it is just as hard to distinguish among the same classes of variables at the school level, these, too, were weighted according to their first principal component (see the upper right-hand portion of table 11.1). The percentage of variance accounted for by them ranges from 81 at the sixth grade to 48 at the twelfth; the greatest shift occurs for Student Body's Expectations for Excellence.

Let us next focus on student background variables at the individual level. We have come to regard Socio-Economic Status as the main variable for locating a student's family with regard to the structural aspects of society. However, as we saw in chapters 6 and 7, a student's ethnic background is another important indicator, not only of his family's socioeconomic position, but of the attributes of the students with whom he attends school. Again, in chapter 8 we found that, at the individual level, separate ethnic slopes were not required to explain Achievement/Motivation, but that separate ethnic intercepts occasionally were. We therefore feel justified in including ethnicity as an aspect of the individual student's social background.[3] Since chapters 6 and 7 showed that the role of Family Structure in Achievement was highly confounded with that of Socio-Economic Status, we shall include Family Structure as another aspect of the student's background. Last, it will be remembered from chapter 9 that separate boy-girl slopes were not needed to explain individual student Achievement/Motivation, but that, on occasion, separate intercepts might be used for some of the motivational variables, even though the differences between boys and girls in this area were never great. We shall therefore add boy-

[1] Family Process and Achievement were combined as Motivation/Achievement only when treated as a single set of dependent variables. Family Process consisted of Expectations for Excellence, Attitude Toward Life, Educational Plans and Desires, and Study Habits, which together represented the motivational aspects of family life.

[2] At the school level, we called this variable Student Body Achievement/Motivation, and at the individual level simply Achievement/Motivation.

[3] Using an index that gave whites the highest value, Oriental-Americans the next highest, and all the remaining groups lower values.

Table 11.1.—Percentage of Variance and Principal Component Weights for the Achievement/Motivation Model

Variable	Student Achievement/ Motivation		
1. Expectations for Excellence	71	78	71
2. Attitude Toward Life	83	76	68
3. Educational Plans and Desires	79	80	78
4. Study Habits	82	76	64
5. Achievement	63	71	71
Percentage of Variance	58	58	50
Grade Level	6	9	12

Variable	Student Body's Achievement/ Motivation		
1. Student Body's Expectations for Excellence	89	87	22
2 Student Body's Attitude Toward Life	95	91	84
3 Student Body's Educational Plans	93	82	66
4. Student Body's Study Habits	95	91	81
5. Student Body's Achievement	78	78	74
Percentage of Variance	81	74	48
Grade Level	6	9	12

Variable	Student Social Background		
1. Socio-Economic Status	75	75	76
2. Family Structure and Stability	74	76	74
3. Ethnic Group Membership	70	69	67
4. Sex	37	59	40
Percentage of Variance	44	49	43
Grade Level	6	9	12

Variable	Student Body's Social Background		
1. Student Body's Socio-Economic Status	90	88	79
2. Student Body's Family Structure	90	93	98
3. Student Body's Ethnic Composition	90	92	91
Percentage of Variance	81	82	74
Grade Level	6	9	12

NOTE.—Leading decimal points were omitted throughout the table, and all numbers rounded to two places of decimals. At the twelfth grade males were scored highest.

girl differences to our array of student background variables. At the individual level, then, the set known as Social Background consists of the following variables: Socio-Economic Status; Family Structure and Stability; Racial-Ethnic Group Membership; and Sex.[4] The weights for these variables, given in the lower left-hand portion of table 11.1, show that somewhat less weight is allotted to Sex than to the other variables. The corresponding set at the school level, which we called Student Body's Social Background, consisted of the student body equivalents of all these variables except Sex. The weights, given in the lower right-hand portion of table 11.1, show that, at all grades, these variables account for a similarly high percentage of the variance among schools.

Analyses in chapter 8 showed that separate slopes were not required for the different regional and metropolitan student groupings, but that separate regional intercepts might on occasion be warranted. In order to capture these regional and metropolitan differences we shall include in our model the two quantitative variables known as Regional Location and Rural-Urban Location (for which see chapter 2). However, since school organization most often differs along regional and rural-urban lines, we shall include them in our comprehensive set of school variables (table 11.2). But how should we weight these 31 variables? Extended analyses, not included here, showed that many of them played highly specific roles, so that weighting them by their first principal components would not have captured the variance of interest to us. Accordingly, we used weights obtained by regressing Student Body Achievement/Motivation on them.[5] The correlations and regression weights resulting from these analyses are given in table 11.2. Comparison of the regression and zero-order correlation coefficients for the different grade levels shows that many of the variables with a high-to-moderate correlation have much smaller regression coefficients. For example, the following all show a much reduced value for their regression coefficients as compared to their zero-order correlation coefficients: Regional Location; Free Milk and Lunch Programs; Availability of Texts; Pupil-Teacher Ratio; Principal's Estimate of School's Reputation; and many of the teaching staff variables. In fact, the only variables that have really large regression coefficients are the teaching staff variables of Teaching Conditions, Ethnic Composition, and Verbal Skill Mix. Much of the shrinkage from the zero-order correlation to the regression coefficient reflects the degree of intercorrelation among these variables. It is also of interest to note that, depending upon grade level, some 58 to 64 percent of the differences in Achievement/Motivation among schools is explained by those variables (see the "Squared multiple correlation" row).

In our rudimentary model, then, we shall have five main sets of variables: (*a*) Social Background; (*b*) Student Body's Social Background; (*c*) Achievement/Motivation; (*d*) Student Body Achievement/Motivation; (*e*) School (31), i.e., the comprehensive set of residential and school variables. Given the restrictions of our data, can we hypothesize any relationships among these sets? Perhaps the data will allow us to test a hypothesis of the kind in which Social Background is an antecedent and Achievement/Motivation a consequent, with the school variables as intervening factors. These relationships can be stated more formally as follows. Let us form a matrix in which the intersection of a row and a column represents a possible causal linkage, indicated by a check mark. A zero will indicate the absence of such linkage, and a dash the intersection of a row with its own column. Such a matrix might be represented as follows:

[4] Sex was scored as a quantitative variable, with girls usually ranked high.

[5] We used this set as the dependent variable because we wanted to see how the school variables explained differences among schools in their Achievement/Motivation.

Table 11.2.—Correlates and Weights for the Regression of Student Body Achievement and Motivation on School and Residence, by Grade Level

Variable	Sixth Grade		Ninth Grade		Twelfth Grade	
	r	β	r	β	r	β
1. Rural-Urban Location	−01	03	−06	06	02	03
2. Regional Location	26	06	23	09	31	11
3. Plant and Physical Facilities	11	03	17	03	07	0
4. Instructural Facilities	−07	−02	−05	−09	24	08
5. Age of Building	−01	04	−04	02	03	03
6. Tracking	−05	02	−03	02	01	−01
7. Testing	−01	06	−16	01	−03	02
8. Transfers	−01	01	−08	−03	−09	0
9. Remedial Programs	−18	−08	−20	−15	−09	−08
10. Free Milk and Lunch Programs	−22	−08	−27	−08	−06	0
11. Accreditation	17	01	02	−03	12	−01
12. Age of Texts	03	03	02	05	−11	−05
13. Availability of Texts	17	04	21	04	11	01
14. Pupil-Teacher Ratio	−16	−05	−19	−10	−09	−05
15. Principal's Experience	−05	02	−01	10	0	03
16. Principal's Training	08	01	−01	−16	07	−02
17. Principal's College Attended	−01	−01	−01	−03	−01	−03
18. Principal's Sex	04	01	−08	−04	04	01
19. Principal's Estimate of Schools Reputation	28	07	32	02	35	05
20. Specialized Staff and Services	11	02	09	16	18	−03
21. Teaching Staff's Experience	−06	−04	−13	−10	−03	06
22. Teaching Staff's Training	13	−02	07	06	20	−05
23. Teaching Staff's Socio-Economic Background	29	−04	18	−05	25	−05
24. Teaching Staff's Localism	08	−01	20	10	10	08
25. Teaching Staff's College Attended	23	−03	16	−06	30	05
26. Teaching Staff's Teaching Conditions	55	28	55	34	59	36
27. Teaching Staff's Teaching Related Activities	−16	08	−13	04	−29	−05
28. Teaching Staff's Preference for Student Ability Level	38	05	27	09	45	21
29. Teaching Staff's Sex Composition	01	01	−05	09	−06	02
30. Teaching Staff's Ethnic Composition	63	37	58	43	62	42
31. Teaching Staff's Verbal Skill Mix	58	20	30	03	50	−04
Squared Multiple Correlation of Variable 1 to 31	58		61		64	

NOTE.—The numbers of schools included in these analyses at grades 6, 9, and 12, respectively, are: 2,370, 923, and 780. Leading decimal points have been deleted.

From \ To	1	2	3	4	5
1. Social Background	—	√	0	0	√
2. Student Body's Social Background	0	—	√	√	0
3. School (31)	0	0	—	√	0
4. Student Body's Achievement/Motivation	0	0	√	—	√
5. Achievement/Motivation	0	0	0	0	—

It will be seen from the checkmarks in the first row of this matrix that we have hypothesized a direct causal linkage of Social Background with: (*a*) Student Body's Social Background; (*b*) Achievement/Motivation. On the other hand, as is indicated by the zeros, we have not postulated such a linkage between Social Background and either the set of 31 school and residential variables or Student Body's Achievement/Motivation. This is because we conceive of the relationships at the school level as relatively self-contained. Thus we think of Student Body's Social Background as having a direct effect on both School (31) and Student Body's Achievement/Motivation, but not on Social Background or Achievement/Motivation. Similarly, we regard School (31) as having a direct effect only on Student Body's Achievement/Motivation, and the latter as affecting both School (31), particularly the school's policies and resources, and Achievement/Motivation (i.e., the performance and outlook of individuals). Last, we do not regard Achievement/Motivation as affecting any of these other classes of variables, but rather as being affected by them. Let us see then, just how well this model holds up by examining the intercorrelations of our macroanalytic indices and then performing some analyses on them.

Table 11.3 displays these intercorrelations. A number of interesting relationships are in evidence. Let us begin at the level of the individual student. It will be seen that for Achievement/Motivation (row 5 and column 5), the higher correlation is with Social Background, also at the individual level, and the next highest with Student Body's Achievement/Motivation. Somewhat lower are the correlations of Achievement/Motivation with Student Body's Social Background (39) and the set of 31 school and residential variables (34). The values decrease for the higher grade levels.

Let us now examine the results of analyses directed toward our set of school-level hypotheses, as outlined in the matrix of causal linkages depicted above. These linkages suggest that almost all the variability among schools in the achievement and motivational levels of their students can be accounted for in terms of the student body background variables. Actually, the intercorrelations at the school level reflected the interplay of these classes of

variables on one another over time. Our theory, however, relegates most of this to Student Body's Social Background.

Table 11.4 shows the results of commonality and regression analyses in which Student Body's Achievement/Motivation is dependent and the regressors are Student Body's Social Background (SBSB) and the set of school and residential variables (SCH(31)).[6] It will be seen that 72 and 78 percent of this variability can be explained by these two sets, but that most of it, as the common portions indicate, is confounded between them. Significant, too, for our theory about the interplay of the sets with each other over time is the way in which the common portions increase over the grade levels, while the unique value for SBSB decreases slightly, and the value for SCH (31) stays near zero. We are inclined, then, to attribute most, if not all, of this variability among schools to: (*a*) the manner in which students were initially assigned to them (that is, on the basis of social background); (*b*) the interplay of social background and school factors over time. The regression weights shown in the upper right-hand portion of table 11.4 indicate that most of the explanatory weight was given to Student Body's Social Background. The one exception was the twelfth grade, where the set of School variables took on a larger value.

What does all this add to our understanding of Achieve-

[6] The values given in this table will not be the same as those in earlier chapters and their appendices. The reason is that here we are dealing with single composites, whereas there we were often dealing with multivariate analyses of a set of dependent variables.

Table 11.3.—Intercorrelations of the Macroanalytic Indices for Achievement and Motivation [a]

Variable	Sixth Grade 1	2	3	4	5
1. Individual Student Social Background	100	58	50	51	65
2. Student Body's Social Background	58	100	88	88	39
3. School (31)[b]	50	88	100	76	34
4. Student Body's Achievement/Motivation	51	88	76	100	45
5. Individual Student Achievement/Motivation	65	39	34	45	100
	Ninth Grade				
	1	2	3	4	5
1. Individual Student Social Background	100	48	40	43	62
2. Student Body's Social Background	48	100	87	88	37
3. School (31)[b]	40	87	100	78	33
4. Student Body's Achievement/Motivation	43	88	78	100	42
5. Individual Student Achievement/Motivation	62	37	33	42	100
	Twelfth Grade				
	1	2	3	4	5
1. Individual Student Social Background	100	51	44	43	54
2. Student Body's Social Background	51	100	88	84	29
3. School (31)[b]	44	88	100	80	28
4. Student Body's Achievement/Motivation	43	84	80	100	36
5. Individual Student Achievement/Motivation	54	29	28	36	100

[a] Initial decimal points have been deleted from all numbers less than 100; for 100, read 1.00.
[b] I.e., the set of 31 school and residential variables.

Table 11.4.—Commonality and Regression Analyses of Achievement and Motivation With School and Background Variables, by Grade Level

Grade Level	RSQ	Unitized Unique SBSB	Commonality Common	Analyses Unique SCH(31)	Regression Weights β SBSB	β SCH(31)
Twelfth	72	11	87	2	60	27
Ninth	78	22	78	0	84	05
Sixth	78	25	75	0	93	−06
Dependent Variable	Student Body Achievement/Motivation					
Grade Level	RSQ	Unitized Unique SB	Commonality Common	Analyses Unique School	Regression Weights β SB	β SBAM
Twelfth	31	60	34	6	48	15
Ninth	41	58	35	7	54	19
Sixth	44	54	42	4	57	16
Dependent Variable	Individual Student Achievement/Motivation					

NOTE.—Leading decimal points have been omitted throughout the table and all numbers rounded to two places of decimals.

ment/Motivation at the individual level? In the lower half of table 11.4 we have included some analyses in which Achievement/Motivation is regressed against: (*a*) Social Background (viz, the student's own); (*b*) Student Body's Achievement/Motivation. The last named represents all the possible differences among schools and therefore all the differential school-level effects that could occur.[7] Commonality analysis of these variables show that most of the individual students' variability in Achievement/Motivation can be uniquely associated with their Social Background. The portion that can be uniquely associated with Student Body's Achievement/Motivation is very small, while the common portion is moderate to substantial. It is also noteworthy that the unique value for Social Background increases slightly over the grade levels, as does that of Student Body's Achievement/Motivation. Their common portion on the other hand, decreases.

How, then, shall we regard this common portion? Might some part of it be assigned to SB or to SBAM, or should it remain as we see it now? We are inclined to relegate most, if not all, of it to SB. Our reason is that, as we observed in chapter 8, most of the individual student variability in Achievement/Motivation lies within schools. Our conclusion is reinforced by the fact that the regression weights (shown in the lower right-hand portion of table 11.4) tend to give somewhat more weight to the among-school differences than we would have on the basis of the commonality analyses. Thus we believe that most of the variability among schools in the achievement and motivational levels of their students can be explained by: (*a*) factors relating to the social background of the student body; (*b*) the interaction, over time, of these factors with differences among schools in their policies, resources and staff. However, before we carry this line of reasoning any further, let us see if a somewhat more complex model will alter our interpretation.

11.2. A RUDIMENTARY MODEL OF STUDENT ACHIEVEMENT

In this section we shall attempt to differentiate between achievement and the motivational variables. In other words, achievement will be regarded as the end product of social background, motivational, and school factors. This model will entail seven sets of variables, as follows:

1. Social Background (i.e., individual student background, as defined and developed in the previous section).
2. Student Body's Social Background (also as defined in the previous section).
3. Family Process/Motivation (at the individual level).
4. Student Body's Motivation (the among-school counterpart of set 3).
5. School (31), that is, the same set of 31 school and residential variables that was used earlier.
6. Achievement (the individual student achievement composite).
7. Student Body's Achievement (the school-level counterpart of set 6).

The new sets known as Family Process/Motivation and Student Body's Motivation were formed with the principal component weights in table 11.5. At the individual level, the percentage of variance accounted for by these weights

Table 11.5.—Percentage of Variation and Principal Component Weights for the Achievement Model

Variable	Individual Level: Family Process/Motivation Grade 6	Grade 9	Grade 12
1. Expectations for Excellence	75	81	74
2. Attitude Toward Life	85	76	68
3. Educational Plans and Desires	77	79	77
4. Study Habits	84	80	72
Percentage of Variance	65	63	53

Variable	Among-School Level: Student Body Motivation Grade 6	Grade 9	Grade 12
1. Student Body's Expectations for Excellence	92	92	50
2. Student Body's Attitude Toward Life	96	90	74
3. Student Body's Educational Plens	92	81	67
4. Student Body's Habits	96	93	88
Percentage of Variance	88	79	50

NOTE.—Leading decimal points have been omitted and all numbers rounded to two places.

ranges from 53 to 65 (the weights for each variable tend to vary somewhat by grade level). At the among-school level, the corresponding percentages range from 50 to 88—larger than for the individual level, except at the twelfth grade.

A school-residential set, called School (31), was formed with the regression weights from table 11.6, which shows the results of regressing Student's Body Achievement on the set of 31 school and residential variables. Comparison of the zero-order correlations and regression weights shows that, as in Table 11.2, there is a shrinkage brought about by the degree of intercorrelation of the regressors. Here, too, most of the weight is carried by the Teaching Staff's Teaching Conditions, Ethnic Composition, and Verbal Skill Mix. However, Regional Location takes on a slightly greater weight than it did in table 11.2. In addition, about 20 percent more of the among-school variability is explained by these variables, as can be seen by comparing the "Squared multiple correlation" rows of the two tables.[8]

The intercorrelations of these macroanalytic indices are given in table 11.7. For individual Achievement (row 7 and column 7), we can note that some of its largest cor-

[7] In our data analysis model (for which see appendix A), the among-school counterpart of our dependent variable captures all the school-level variability in our dependent variable. Consequently, when it is first partialed out of our dependent variable, all other school-level variables are correlated zero with the dependent variable.

[8] The correlations of School (31), if we use the weights from tables 11.2 and 11.6 are 0.98, 0.96, and 0.96 for grades 6, 9, and 12, respectively.

Table 11.6.—Correlates and Weights for the Regression of Student Body's Achievement on School and Residence, by Grade Level

Variable	Grade Level: Sixth r	Sixth β	Ninth r	Ninth β	Twelfth r	Twelfth β
1. Rural-Urban Location	−02	02	−03	05	03	05
2. Regional Location	35	13	37	20	43	22
3. Plant and Physical Facilities	10	0	19	04	07	−01
4. Instructural Facilities	−09	−03	−02	−11	32	13
5. Age of Building	−04	02	−16	−04	02	−02
6. Tracking	−08	−01	02	−01	04	−03
7. Testing	−04	04	−16	05	−02	03
8. Transfers	−01	−01	−03	−02	−02	08
9. Remedial Programs	−17	−06	−16	−11	−11	−10
10. Free Milk and Lunch Programs	−21	−03	−24	−09	−11	−01
11. Accreditation	22	02	09	06	15	0
12. Age of Texts	−01	01	−02	01	−09	0
13. Availability of Texts	19	03	21	01	14	0
14. Pupil-Teacher Ratio	−18	−04	−32	−14	−13	−05
15. Principal's Experience	−11	−01	−10	03	−03	03
16. Principal's Training	11	02	08	−13	09	−05
17. Principal's College Attended	02	−01	06	−02	05	0
18. Principal's Sex	04	01	−07	−03	02	−01
19. Principal's Estimate of School's Reputation	30	06	36	04	36	06
20. Specialized Staff and Services	14	03	20	22	25	0
21. Teaching Staff's Experience	−12	−05	−19	−05	−03	02
22. Teaching Staff's Training	15	−02	10	−01	24	−10
23. Teaching Staff's Socio-Economic Background	35	−04	24	−03	36	02
24. Teaching Staff's Localism	16	04	20	09	14	−05
25. Teaching Staff's College Attended	30	−01	22	−07	34	−02
26. Teaching Staff's Teaching Conditions	65	39	55	29	58	31
27. Teaching Staff's Teaching Related Activities	−23	05	−20	02	−31	03
28. Teaching Staff's Preference for Student Ability Level	4	04	28	04	44	11
29. Teaching Staff's Sex Composition		0	−16	05	−12	−01
30. Teaching Staff's Ethnic Composition	75	44	74	56	75	50
31. Teaching Staff's Verbal Skill Mix	67	15	37	03	65	10
Squared multiple correlation of variables 1 to 31		79		80		81

NOTE.—The numbers of schools included in these analyses at grades 6, 9, and 12, respectively, are: 2,370, 923, and 780. Leading decimal points have been omitted throughout.

relates are for Social Background and Family Process/Motivation (both at the individual level) and Student Body's Achievement; the first- and last-named decline with the higher grades, while Family Process/Motivation increases somewhat. The correlates for the remaining variables are somewhat smaller, although still substantial. Given these kinds of interrelationship, what might we hypothesize about their possible causal linkages? As before, let us form a matrix of possible linkages:

From	To 1	2	3	4	5	6	7
1. Social Background	—	√	√	0	0	0	√
2. Family Process/Motivation	0	—	0	0	0	0	√
3. Student Body's Social Background	0	0	—	√	√	√	0
4. School (31)	0	0	0	—	√	√	0
5. Student Body's Motivation	0	0	0	√	—	√	0
6. Student Body's Achievement	0	0	0	√	√	—	√
7. Achievement	0	0	0	0	0	0	—

The checkmarks in row 1 of this matrix show that we regard the individual student's Social Background as affecting both his Family Process/Motivation and his Student Body's Social Background. Similarly, as we have indicated by the zeros, we do *not* think of the student's Social Background as affecting the variables known as School (31), Student Body's Motivation, and Student Body's Achievement, but it does affect his own Achievement. We do not think of Family Process/Motivation as affecting anything other than his own Achievement. Student Body's Social Background is thought of as affecting School (31), particularly the school's policies, as well as Student Body's Motivation and Student Body's Achievement, but not individual Achievement. The 31 school and residential variables, we believe, affect only Student Body's Motivation and Student Body's Achievement, but, again, not individual Achievement. It is not clear whether we should regard the Student Body's Motivation as being an antecedent or a consequent of these other variables. But since we are interested primarily in individual Achievement, we shall regard Student Body's Motivation as having an effect only through the other school-level variables, viz, School (31) and Student Body's Achievement. Similarly, we shall regard Student Body's Achievement as affecting other school-level variables such as School (31) and Student Body's Motivation, but as operating directly only on Achievement at the individual level. Although in one sense this is a peculiarly narrow view of both achievement and motivation, concomitant data of this sort do not

lend themselves to any plausible before-and-after treatment. We have therefore attempted to capitalize, to the maximum extent possible, on the explanatory properties of our data analysis model.

Let us first analyze a number of interrelationships at the school level to see if our notions about Student Body's Social Background tend to hold up. We will then be in a position to pursue the implications of among-schools differences for individual achievement. The upper portion of table 11.8 shows the results of commonality analyses of Student Body's Social Background (SBSB), Student Body's Motivation (SMTVTN), and the set of 31 school and residential variables (SCH(31)), with Student Body's Achievement as dependent. If we regard SBSB as the primary variable by which students are assigned to schools, then we can note from the "Sum" row under the "SBSB" column that almost all the differences among schools in their achievement levels can be accounted for by this variable. As for SMTVTN, it is inseparable from the other variables, and cannot account for any variability not already accounted for by SBSB. For School (31), a slight unique value does emerge. This indicates that some slight differential school effect might exist. If we were relying on the interpretation of regression coefficients, this line of reasoning would be strongly reinforced. As can be seen from the lower left-hand portion of table 11.8, more weight is assigned to the composite of 31 school and residential variables by the latter than by the commonality model. However, it will be recalled from table 11.6 that the variables contributing to this composite are not ones that readily lend themselves to a specifically educational interpretation, as opposed to a more general, sociological one.

Since Student Body's Achievement captures all the among-school variability in Achievement, let us carry it over into an analysis of school differences and their apparent influence on individual student differences. The middle portion of table 11.8 shows the results of commonality analyses with individual Achievement as the dependent variable, and individual Social Background (SB), Family Process/Motivation (PRCS), and Student Body's Achievement (SBA) as the three regressor variables. If we allow among-school differences in Achievement to account for only their unique percentage, which is roughly one-fourth of the variance accounted for, then we can see that most of the variability in student Achievement that can be accounted for, as well as that which remains unaccounted for, lies within schools. And much of this within-school variability is accounted for by Family Process/Motivation, either alone or in combination with the individual Social Background. Incidentally, if we had relied on the interpretation of regression coefficients, we would have ended up giving about the same relative emphasis to these regressors as we did to our commonality analysis.

Our results for Achievement, then, are rather similar to our earlier ones for Achievement/Motivation. They can be summarized as follows. Differences among schools in the achievement of their student bodies can be explained almost completely in terms of the student body's social background, and the interplay over time of these background variables with the schools' policies and resources. Many of these latter can be viewed simply as the way the

Table 11.7.—Intercorrelations of the Macroanalytic Indices for the Achievement Model

Variable	Sixth Grade 1	2	3	4	5	6	7
1. Individual Student Social Background	100	59	58	50	45	52	55
2. Individual Student Family Process/Motivation	59	100	30	23	39	26	45
3. Student Body's Social Background	58	30	100	88	77	91	52
4. School/Residential Variables	50	23	88	100	60	89	50
5. Student Body's Motivation	45	39	77	60	100	68	38
6. Student Body's Achievement	52	26	91	89	68	100	57
7. Individual Student Achievement	55	45	52	50	38	57	100
	Ninth Grade 1	2	3	4	5	6	7
1. Individual Student Social Background	100	59	48	41	39	43	49
2. Individual Student Family Process/Motivation	59	100	29	22	37	26	56
3. Student Body's Social Background	48	29	100	88	78	92	48
4. School/Residential Variables	41	22	88	100	61	90	48
5. Student Body's Motivation	39	37	78	61	100	71	37
6. Student Body's Achievement	43	26	92	90	71	100	52
7. Individual Student Achievement	49	56	48	48	37	52	100
	Twelfth Grade 1	2	3	4	5	6	7
1. Individual Student Social Background	100	49	51	46	33	47	48
2. Individual Student Family Process/Motivation	49	100	18	15	30	17	53
3. Student Body's Social Background	51	18	100	90	63	92	47
4. School/Residential Variables	46	15	90	100	53	90	46
5. Student Body's Motivation	33	30	63	53	100	59	30
6. Student Body's Achievement	47	17	92	90	59	100	51
7. Individual Student Achievement	48	53	47	46	30	51	100

school has adapted to its students' social background. Most of the variability among students in their achievement or their achievement plus their motivation remains unexplained by differences among the schools they attended. This suggests that, if we are ever going to understand differential student performance, we shall have to study it within schools.

11.3. DIFFERENTIAL STUDENT PERFORMANCE WITHIN SCHOOLS

The instructional process, as we have known it historically and still know it today, has always tended to judge a student with reference to his peers. Thus, if one is performing better than one's peers in some regard, he is said to be "doing well" and is often rewarded accordingly. On the other hand, if one is behind one's peers in some regard, he is said to be "doing poorly" and perhaps in need of special assistance. By some fixed criterion, of course, all might be doing very well or very poorly. But no such criterion exists.

We would suggest, on the basis of this series of reports, that the criterion of good or bad performance is set initially by two factors: (*a*) the mean achievement level of the school; (*b*) the nature of the instructional process itself. The two factors reinforce each other because, when the group is used as the basis of comparison among students, its initial variability tends to be preserved. Thus groups (or schools) that have high mean achievement levels at one point in time will tend also to have them at a second, later point in time. The same holds, we would argue, for groups with low mean achievement levels.

For individuals, this stability is not as pronounced over time, but there is still a universal tendency to hover around the group mean. As John Carroll's model of school learning suggests, one way to break this trend would be to have groups that score low initially spend proportionately greater amounts of time in developing or exercising the skill in question, thereby raising their relative standing (Block, 1971). However, standardization of the curriculum so that all spend an equal amount of time on the development of this skill would only tend to preserve the various groups' initial standing and, to a lesser extent, that of the individuals within these groups. We believe that a model similar to this can be used to explain the enormous stability that is observed in the relationship of student background with achievement and motivation at both the individual and school levels throughout the years of schooling.

If this line of reasoning has any merit, it follows that: (*a*) the natural focus for the study of differential student performance is within schools; (*b*) much of this within-school variability is school produced or at least school related. In this section, then, we shall attempt to learn more about the nature of this within-school variability. First, we shall partial out the among-school variability and examine the within-school correlations, in a series of analyses we shall label "Within (W)." Then, for comparative

Table 11.8.—Commonality and Regression Analyses of Achievement With School and Background Variables, by Grade Level

Commonality Coefficients	Unitized Commonality Analyses of Student Body Achievement								
	SBSB	SMTVTN	SCH(31)	SBSB	SMTVTN	SCH(31)	SBSB	SMTVTN	SCH(31)
U(Xi)	5	0	4	4	0	4	5	0	3
C(X1X2)	4	4	–	5	5	–	2	2	–
C(X1X3)	38	–	38	35	–	35	52	–	52
C(X2X3)	–	0	0	–	0	0	–	0	0
C(X1X2X3)	49	49	49	52	52	52	38	38	38
Sum %	96	53	91	96	57	91	97	40	93
RSQ(T)		86			88			87	
Grade Level:		Sixth			Ninth			Twelfth	

Commonality Coefficients	Unitized Commonality Analyses of Individual Student Achievement								
	SB	PRCS	SBA	SB	PRCS	SBA	SB	PRCS	SBA
U(Xi)	5	7	26	1	23	25	1	28	27
C(X1X2)	15	15	–	18	18	–	15	15	–
C(X1X3)	23	–	23	8	–	8	13	–	13
C(X2X3)	–	−02	−02	–	1	1	–	−04	−04
C(X1X2X3)	25	25	25	25	25	25	21	21	21
Sum %	68	45	72	52	47	59	50	60	57
RSQ(T)		44			47			47	
Grade Level:		Sixth			Ninth			Twelfth	

Dependent Variable	Regression Weights (β) Student Body Achievement			Individual Student Achievement			
Student Body Social Background	55	52	55	Individual Student Social Background	22	9	9
Student Body Motivation	2	5	4	Individual Student Family Process/ Motivation	22	40	42
School (31)	40	40	38	Student Body Achievement	40	38	40
Grade Level:	6	9	12	Grade Level:	6	9	12

NOTE.—Leading decimal points have been omitted, and all numbers rounded to two places.

purposes, we shall carry along the results of analyses based upon individual students without regard to differences among their schools. These latter analyses, labeled "Total (T)," still include the among-school variability, and therefore act as a control. The correlates of Achievement for these two kinds of analysis are given in table 11.9. The reader will note that we have included partial results for the first and third grades, too, since we hope to gain some insight into the magnitude of these relationships and their possible interplay over time.[9] The correlations of individual Social Background with Achievement tend to increase from the first to the third and sixth grades, but then decline somewhat at the ninth and twelfth grades. Not dissimilarly, the values for Family Process/Motivation tend to increase from the third to ninth grades for both the "Total" and the "Within" analyses, while at the twelfth grade the value for the "Total" analysis declines slightly and that for "Within" stays about the same. For these four grade levels, the correlations between individual Social Background and Family Process/Motivation, for the "Total" and "Within" analyses respectively, are: third, 0.41 and 0.37; sixth, 0.59 and 0.55; ninth, 0.59 and 0.55; and twelfth, 0.49 and 0.49. Thus the intercorrelations, too, tend to decline in moving from the sixth to the twelfth grade.

[9] We introduced these results from the lower grades in hopes that they might help us depict a developmental trend despite the insufficiencies of the data. The weights for Social Background at the third and first grades were, respectively: Socio-Economic Status, 0.68, 0.67; Family Structure, 0.68, 0.61; Ethnic Group Membership, 0.68, 0.68; Sex, 0.50, 0.43 (boys were scored higher than girls at the first grade). The weights for Family Process/Motivation at the third grade were: Expectations, 0.65; Attitude Toward Life, 0.62; Educational Plans and Desires, 0.65; Study Habits, 0.63. The numbers of students (N) and schools (n) for these grade levels were: third, $N = 130{,}212$, $n = 2{,}453$; first, $N = 74{,}201$, $n = 1{,}302$ (see Mayeske, et al., 1972a for further details).

Table 11.10 shows the results of commonality and regression analyses of individual Achievement with individual Social Background and Motivation. The commonality analyses are presented in a somewhat different format than heretofore. Here, we can see that the residual, or unexplained, variance is greater for the "Within" than for the "Total" analyses, though less so at the higher grade levels. The unique value for Social Background is also smaller for the "Within" than for the "Total" analyses. Both, however, tend to decrease at the higher grades. Alternatively, the unique value for Family Process/Motivation tends to be greater for "Within" than for "Total," and also tends to increase progressively at the higher grade levels. The common portion tends to increase slightly at the ninth grade and then decrease, but these latter grade-level differences are not large. The most salient feature of the common portions is for them to be smaller for "Within" than for "Total."

The regression coefficients in the lower half of table 11.10 display these trends in a slightly different way. For "Within," the coefficients progressively decrease at the higher grade levels for Social Background and progressively increase for Family Process/Motivation. For "Total," the trend is not as clear: for Social Background, there is a decrease at the ninth grade and then a slight increase at the twelfth, while for Family Process/Motivation there is an increase at the ninth grade and then a slight decrease.

What, then, do these trends mean? To us they suggest—and "suggest" is the key term here—that Family Process/Motivation plays an increasingly greater role in achievement at the higher grade levels, while the role of Social Background, though it increases during the early grades, either decreases or stays roughly the same for the remain-

Table 11.9.—Correlates of Achievement for Total and Within-School Analyses, by Grade Level [a]

Variable	Total	Within	Total	Within	Total	Within	Total	Within	Total	Within
1. Individual Student Social Background	41	18	52	33	55	38	49	35	48	32
2. Individual Student Family Process/ Motivation	—[b]	—[b]	33	27	45	39	56	51	53	52
	Grade 1		Grade 3		Grade 6		Grade 9		Grade 12	

[a] Leading decimal points have been deleted, and all numbers rounded to two decimal places.
[b] Measures not available at this grade level.

Table 11.10.—Commonality and Regression Analyses of Achievement With Student Social Background and Motivation for Total and Within-School Analyses, by Grade Level

Coefficients	Total	Within	Total	Within	Total	Within	Total	Within
Commonality Analyses								
Residual	71	87	67	82	65	73	66	73
Unique (Social Background)	18	6	13	4	4	1	6	1
Unique (Process/Motivation)	2	2	2	5	11	15	11	18
Common	9	5	18	10	20	11	17	9
Grade Level:	Third		Sixth		Ninth		Twelfth	
Regression Coefficients								
Social Background	47	26	44	22	25	10	29	9
Family Process/Motivation	14	17	19	26	41	46	38	48
Grade Level:	Third		Sixth		Ninth		Twelfth	

NOTE.—All numbers have been rounded to two decimal places and leading decimal points omitted.

ing years of schooling. This trend is more pronounced for the "Within" than for the "Total" analyses because students are assigned to schools on the basis of Social Background, and therefore tend to resemble each other in these respects. At the same time, since a student's performance is rated against that of his peers, it seems natural that performance-related factors such as Family Process/Motivation would come to play a larger role in Achievement over time. Indeed, it is not hard to imagine a number of ways in which Achievement and these factors might influence each other.

Such conclusions, as far as this study is concerned, must remain highly tentative, since it is just possible that the trends on which we have based them are simply byproducts of the data and study design. For instance, as we have repeatedly pointed out, the student indices are both more comprehensive and more reliable at the upper grade levels, and the dropout rates, which remove many of the poorer, lower-achieving students from the sample, are always much higher. Moreover, the variability among schools is reduced at these grades by the so-called feeder effect, which refers to the way in which, the older students become, the more likely they are to be "fed" into schools with students of dissimilar background.

In view of all these possible sources of error and misinterpretation, it behooves us to formulate and consider a number of alternative hypotheses, as follows:

1. No trend exists: what we have observed are merely deviations from the same underlying relationships, distorted in different ways at the different grade levels for reasons such as the ones just mentioned.
2. A developmental trend does exist and is of the following form:
   (*a*) The relationship of Family Process/Motivation (and other factors of that kind) with Achievement increases progressively from the lower to the upper grade levels, while that of Social Background increases initially and then stays about the same (this, of course, is the hypothesis we already adopted).
   (*b*) The same as 2(*a*), except that Social Background increases at first, and then decreases slowly but steadily.
   (*c*) The relationship of both classes of variables with Achievement increases from the lower to the upper grade levels.

Hypothesis 2(*c*) implies that Social Background and Family Process/Motivation would also become more highly correlated with one another. Since this tends *not* to happen, we are inclined to favor hypotheses 2(*a*), 2(*b*), and 1, in that order.

Another way to test the validity of our findings is to speculate about the relationship of Family Process/Motivation with Achievement and Social Background at the first grade. If we regard the grade-level differences as representing, at least in part, a genuine trend of the kind hypothesized, then we would expect a *smaller* explanatory role for Family Process/Motivation at the first grade than the one we have observed for it and its components at the third and sixth grades. At the same time, we would not expect these relationships at the first grade to be zero, since the effects of differential family involvement in students' cognitive development should be visible when they first enter school. Let us assume, for present purposes, that this correlation at the first grade was half of what we observed it to be at the third grade. We can obtain this value by squaring the within-school value for the third grade, halving it, and then extracting its square root. This procedure yields a value of about 0.2. If we regard the correlation of Social Background with Achievement as increasing in the early years of schooling, then we might well accept the observed within-school value for this grade of 0.18. If, however, we regard the correlation of Social Background with Achievement as staying about the same throughout the years of schooling, then we might fix on a value of about 0.36. But what about the relationship of Social Background and Family Process/Motivation? Do they become increasingly correlated, at least initially, or do they stay the same? Let us assume that their correlation begins by increasing. If we take the within-school correlation observed at the third grade, halve it, and extract the square root, we obtain a value of 0.27. Let us summarize these hypothesized first-grade relationships, and then see what kinds of result they would yield in a commonality analysis. Row 1, as can be seen from column 1, reflects the hypothesis that correlation of Social Background and Achievement will stay about the same over the years, and row 2 that it will increase over the lower grades.

Social Background and Achievement	Family Process/Motivation and Achievement	Social Background and Family Process/Motivation	
.36	.2	.27	(1)
.18	.2	.27	(2)

By substituting these values in the appropriate formula we observe the following results of a commonality analysis:

Residual	Unique Social Background	Unique Process/ Motivation	Common	
86	10	1	3	(3)
94	2	2	2	(4)

In row 3, which gives the results for row 1, the residual variance is about what we observed at the third grade and Social Background has the largest explanatory role. In row 4, which gives the results for row 2, the residual variance is much greater than at the higher grade levels, and the explanatory roles of the two variables are about equal. Neither solution is totally satisfying, but these figures do provide some insight into how family background factors and differential student performance might affect each other over time. Most of the within-school variability, however, remains unexplained—a major challenge to future researchers.

11.4. SUMMARY

In this chapter we attempted to synthesize our earlier results by forming various macroanalytic indices and then performing regression and commonality analyses on them. Two models were formed. The first combined Achievement and Family Process/Motivation into a single composite, so that they could be regarded as the joint product of student background and school factors. The second model treated Achievement as the primary dependent, or outcome, variable, so that Family Process/Motivation could be regarded as intervening between the student background and the school factors. Both models suggested that the portion of the variability among students in Achievement or Achievement/Motivation that was associated with their schools could be explained by: (*a*) their Social Background; (*b*) the interaction of the social background factors with the schools' staff, policies, and resources over time.[10]

Most of the student variability in Achievement and Achievement/Motivation lay within schools. We suggested that most of this within-school variability was school related if not school produced, as follows:

1. Students tended to be aggregated into schools on the basis of their social background (primarily, socioeconomic status and ethnicity).
2. Since achievement tends to be correlated with these background factors when students first enter school, this means that schools will have different achievement levels.
3. The instructional process has always tended to base its evaluations of a student's progress on that of his or her fellow students. If the student's score on a particular learning task falls above the group average, it is called "good," and "poor" if it falls below, even though by some fixed standard all the students might be doing well or poorly.
4. The same instructional process tends to preserve the relative achievement levels of schools and instructional groups within schools, especially when there is a standardized curriculum for all groups.
5. The proper focus for understanding differential student performance is from within the school. In short, we should study the extent to which students differ from their peers.

When we examined this within-school variability, we observed that the correlation of Achievement with Social Background increased slightly in the early years of schooling, but tended to stay about the same thereafter. On the other hand, the correlation of Achievement with the motivational factors tended to increase in an almost progressive manner over the years.

These results led us to suggest that a student entering school for the first time is somewhat more likely to perform at or near peer-group level because social background factors weigh more heavily at that age, and because students of similar social background are usually assigned to the same schools. Over the years, however, an increasing role will be played by the parents' perception of the student's performance in the group and their values concerning education. We also observed that these suggestions were highly tentative, and that the variability of student achievement within schools was still largely unexplained—a challenge to future researchers.

[10] The set known as Social Background consisted of the students' Socio-Economic Status, Family Structure and Stability, Racial-Ethnic Group Membership, and Sex, all at the individual level, and of the first three of these at the student body level.

Chapter 12

MAJOR FINDINGS

The main purpose of this study was to investigate, in greater detail and with more powerful analytic techniques, a number of hypotheses suggested by our earlier reports in this series. We also wanted to explore a number of new topics. In this chapter, we shall give an overview of our results, as they relate to a number of special topics. Although these results are called "findings," they will sometimes be stated in the form of hypotheses to emphasize their provisional nature. Later in the chapter, we shall attempt to relate the implications of these findings to selected issues raised by other investigators.

Before we proceed with the findings, however, it is necessary to emphasize, as we did in the previous chapter, that great caution must be observed in making inferences about what happens to students as they move from one grade to another. The chief difficulty is that, although we have data from different grade levels, they were all collected during the same time period. This difficulty is compounded by the higher dropout rates, more comprehensive indices, and greater reliability of responses at the upper grade levels. Finally, it has been shown that students in some ethnic and regional categories are more likely to drop out of school than others (U.S. Bureau of the Census, 1973).

12.1. ACHIEVEMENT ABOVE AND BELOW THE POINT OF DISCONTINUITY

In the Achievement Study, we noted that roughly one-half of the differences among individual students in their scores on Achievement could be explained in terms of the linear, or straight-line, relationship of Achievement with Family Background, Area of Residence, and a set of variables representing the type of school attended (Mayeske et al., 1973a, p. 99).[1] In chapter 5 of the present study, we inquired whether or not this relationship stayed the same for the entire range of these social background factors. Might there be breaking points above and below which this relationship between Achievement and the other factors would taper off or even stop altogether?

To shed light on this question, we examined departures from the aforementioned linear relationship at grades 6, 9, and 12, to see if they were systematic. We found that they were indeed, but appreciably so at the lower end of the continuum only. The pattern of the departures suggested to us that below a certain point there might be a different kind of relationship between these variables, and that a different kind of equation might therefore be appropriate. Accordingly, we sorted out the students who were above and below this point of discontinuity, and fitted a new equation for each group.

Figure 12.1 shows what happens, above and below the point of discontinuity, to the equation for students at the sixth grade—the ones for whom the discontinuity was most pronounced. It will be seen that for the "A" group—that is, the one above the point of discontinuity—the relationship between these variables can be expressed by a straight line passing through the ordinate near the origin, with a slope of about 1. In contrast, for the "B" group—that is, the one below the point—the relationship is virtually null. At the higher grade levels, the slope for the "B" group becomes increasingly positive, but never as pronounced as for the "A" group. The slope for the "A" group, however, remains much the same. It is clear from these results that the social background factors have a much less pronounced relationship with Achievement in their low range than in the middle and high ranges. The "B" groups are never large; in fact, they are only about 1 percent of the total students at each grade level. Since they are more heavily populated by minority-group than by white students, it seems likely they experienced background conditions that blocked the development of their potential for achievement. In any case, these results should be further explored by other investigators using different data bases. Hence, we offer the following hypothesis:

Finding 1.—There is a point of discontinuity in the relationship of achievement and social background such that, in the low range of the variables representing the latter, the relationship is much less pronounced than in the middle and high ranges.[2]

12.2. ETHNICITY, ACHIEVEMENT, AND MOTIVATION

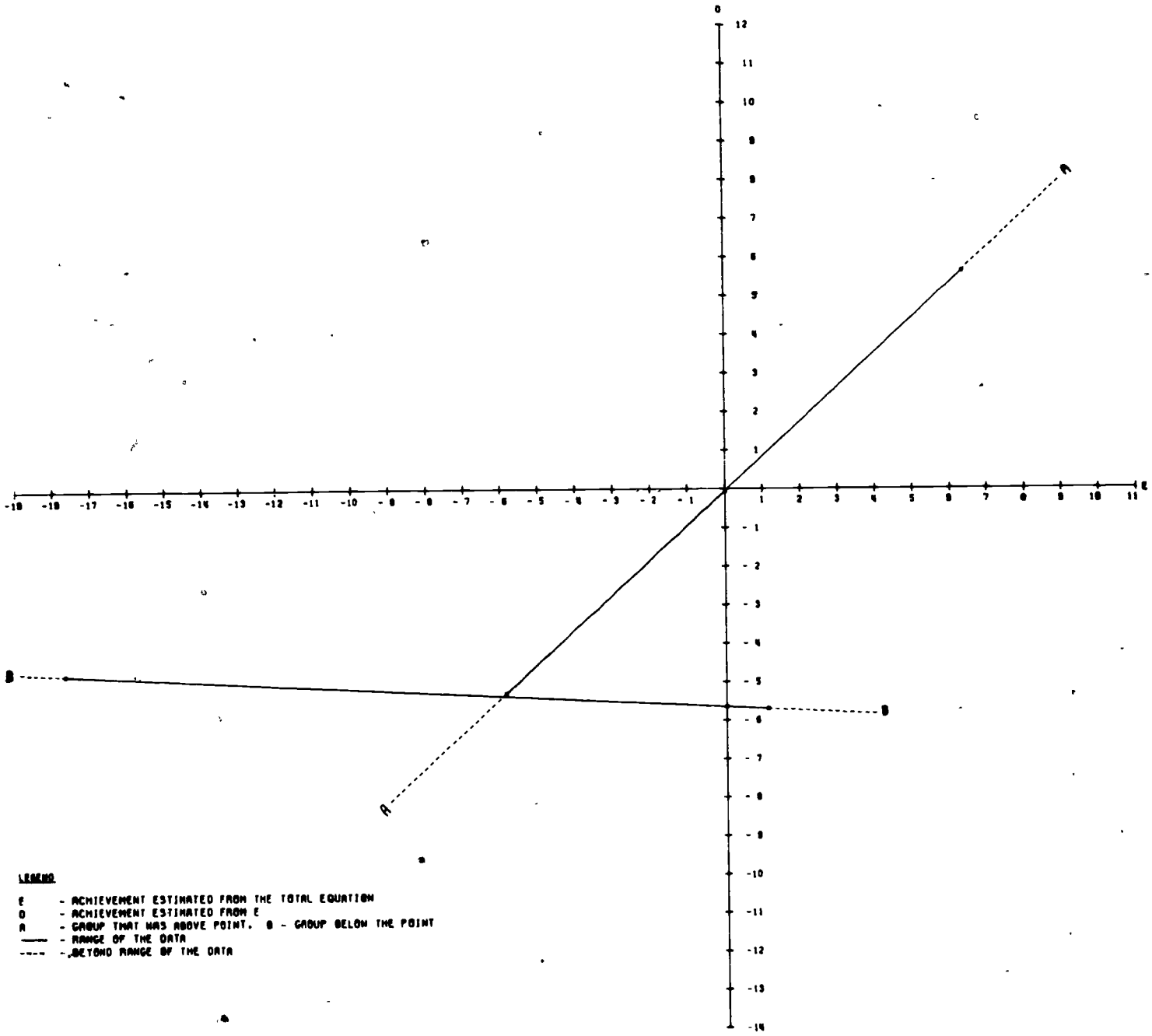
In what ways and to what extent can the ethnic groups included in this study be considered different from one another? In this section, a series of analyses related to this general question will be summarized and related to our earlier work. Later, the results of these analyses will be subsumed under other topics, such as the influence of regional factors.

In the Achievement Study, we tried to find out what proportion of student differences in achievement could be accounted for by ethnicity as distinct from social background conditions. Our analyses showed that, when ethnicity was coded as a quantitative index, it explained some 20 to 24 percent of student differences in achievement before any background conditions had been allowed for. However, after a wide variety of background factors had

[1] See chapter 2 of the present study for a description of these variables.

[2] In our study, this shift occurred at roughly one and two-thirds to two full sigma units below the average achievement of all students.

FIGURE 12.1.--RELATIONSHIP OF ACHIEVEMENT WITH FAMILY BACKGROUND, RESIDENCE, AND SCHOOL, FOR GROUPS ABOVE AND BELOW THE POINT OF DISCONTINUITY. SIXTH GRADE



been allowed for, these percentages dropped to about 1 to 2 percent (Mayeske et al., 1973a, p. 126). In short, as more and more background factors are allowed for, the mean achievement scores of each ethnic group approach more closely to a common value. To illustrate this effect, here are the group scores before and after this adjustment was made:

Ethnic Group	Mean ACHV Before	Mean ACHV After
Indian	44.0	48.6
Mexican	42.0	47.4
Puerto Rican	38.3	47.1
Negro	42.3	49.3
Oriental	49.3	51.1
White	53.0	50.5

Source: Adopted from Mayeske et al., 1973a, p. 8.

These results led us to inquire whether points on the distribution of group achievement scores other than the mean would also approach a common value as more background conditions were allowed for. We therefore compared the extent to which the scores for each ethnic group exceeded the whites' at the following percentile points: 10th; 25th; 50th; 75th; and 90th.

If a group, we reasoned, had as large a percentage of its members exceeding a point on the distribution as did the whites, then we could say that the two groups were similar at that point. Alternatively, if the percentage of whites was greater than that of some other group at that point, then the difference would give us a measure

of their difference in achievement. Such percentages are given in table 12.1, for the unadjusted ("Before") and adjusted ("After") conditions. Since the whites' distribution serves as the standard, exactly 90 percent of their scores exceed its 10th percentile point for both "Before" and "After," exactly 75 percent exceed its 25th percentile point, and so on. Turning to the other ethnic groups, we find that, for instance, only 46 percent of Puerto Ricans' scores exceed the whites' 10th percentile point "Before," as compared with 80 percent of the Oriental-Americans'. The group called "Other" consists of students to whom the major ethnic categories did not apply or who did not indicate any ethnic group membership. At the 10th percentile, their "Before" percentage is similar to those of the first four ethnic groups, but their "After" percentage only 3 points short of the whites'—a result in which they are matched by Negroes and Oriental-Americans. Similar results, with a few major exceptions, are found at the remaining percentiles. At the 50th and 90th percentile points, the values of Oriental-Americans and the "Other" group come to equal or exceed the whites' for the "After" condition. Similar (though not as spectaucular) gains are registered by Negroes at the 25th, 50th, and 75th percentile points in relation to Puerto Ricans and Mexican-Americans. Overall, however, the trend is for the groups to closely approach but not attain a common distribution, not just a common mean. Consequently, we are inclined to broaden our earlier assertions as follows:

Finding 2.—As increasingly more factors related to the differing social backgrounds of the ethnic groups are taken into account, they tend to approach a common distribution.

We should not construe these results to mean that all student variability in achievement is eliminated with the differences in social background among ethnic groups. Actually, when the student differences in achievement that are associated with these background factors are eliminated, they take with them only some one-fifth to one-fourth of the differences associated with ethnicity and another one-fourth of those not associated with ethnicity. Hence, roughly one-half of the student differences in achievement remain unaffected by adjustment for these social background factors.

In the preceding analyses, we gave the same weight to each single background factor for each of the separate ethnic groups. For example, in estimating Achievement, we gave the same relative emphasis to Socio-Economic Status for whites as for Puerto Ricans. Clearly, this procedure is not necessarily the best one. To continue with our example, it is quite possible that Socio-Economic Status, in its relationship with Achievement, should be weighted one way for whites and another way for Puerto Ricans. If such a procedure were followed, would it yield different results? We explored this question by systematically applying each group's regression weights to each of the others in turn. Thus to Puerto Ricans we applied each of the other ethnic groups' equations to them and then compared these estimates with those obtained from their own equation. The resulting differences allowed us to scale the groups in terms of their degree of similarity to the referent group, viz, Puerto Ricans.[3]

We performed such computations for the 6 family background variables, both alone and in combination with the 12 area of residence and school variables. We found that the estimates made with the other groups' equations were remarkably similar to—indeed, usually only 2 to 4 percent less accurate than—the ones made with each group's own equation, although the dissimilarities were greater for the residential and school variables than for Family Background. The ethnic groups that were most and least similar to each of the others in these respects are shown in table 12.2. It will be seen that Oriental-Americans are the one ethnic group whose equation yielded estimates that differed most from each group's

[3] For further details of this procedure, see chapter 3.

Table 12.2.—Ethnic Group Similarity Analyses for Family Background, Area of Residence, and School

Ethnic Group to Which Weights Applied	Ethnic Groups from Which Weights Applied: Family Background, Most Similar	Family Background, Least Similar	Family Background, Area and School, Most Similar	Family Background, Area and School, Least Similar
Indian American (I)	W	O	W	O
Mexican-American (M)..	P	N	I	O
Puerto Rican (P)	M	N	M	O
Negro	I	P	W	O
Oriental-American (O) ..	M	N	N or W	I
White (W)	I	O	N	O
Total.[a]	W or I	O	W	O

[a] I.e., all students combined.

Table 12.1.—Percentage of Each Ethnic Group Exceeding White's Selected Percentile Points, Before and After Adjustment for Social Background Conditions

Ethnic Group	Before	After	Before	After	Before	After	Before	After	Before	After
Indian American	66	84	43	65	26	39	8	18	3	7
Mexican-American	59	81	36	60	19	31	5	15	1	6
Puerto Rican	46	80	24	58	12	33	3	17	1	8
Negro	52	87	26	67	13	40	3	19	1	7
Oriental-American	80	87	64	72	48	51	21	30	9	15
Other	57	87	40	70	27	50	10	31	4	20
White	90	90	75	75	50	50	25	25	10	10
	Tenth Percentile		Twenty-fifth Percentile		Fiftieth Percentile		Seventy-fifth Percentile		Ninetieth Percentile	

NOTE.—These are the average percentages, taken from the tables in chapter 4.

own, and that this tendency was most pronounced for the combined set of Family Background, Area of Residence, and School. For the groups whose weights yielded results most similar to the others', the results were not as consistent. Thus Indian Americans, Mexican-Americans, and whites are almost on a par with one another for Family Background, whereas for Family Background combined with Area of Residence and School, the whites' equation more frequently yielded the percentages most similar to each group's own.

These analyses also afforded us an opportunity to examine two kinds of relationship: (*a*) the extent to which differences among ethnic groups can be used to explain differences among individual students within each ethnic group; and (*b*) the extent to which individual student differences within each ethnic group can be used to explain differences among ethnic groups.

The first topic was investigated by comparing the extent to which the weights (called "among-group weights") obtained by regressing the six ethnic group achievement means on the group means for Family Background, Area of Residence, and School, yielded estimates, when applied to the students in each ethnic group, that were similar to those obtained with the group's own equation. For example, the estimates of Achievement obtained by applying the among-group weights to Puerto Ricans were compared to the estimates obtained with the equation for Puerto Ricans. These analyses showed that the among-group weights yielded estimates that were remarkably unlike those obtained either with each group's own equation or with any of the host of other equations that we tried.

The second topic was investigated by applying each ethnic group's weights to the group means, and comparing these estimates of achievement to those obtained with the among-group weights. These estimates turned out to be rather poor for the family background variables, but were very close when the latter were combined with the residential and school variables. We attributed this latter result to the fact that there were more variables being weighted than there were groups on which observations were based. This redundancy offset much of the uniqueness attributable to a set of weights.

When we were about midway through the study, we came upon an analytic technique that enabled us to supplement these results. With it, we could estimate, in a different way, the extent to which the weights from the single equation for all students could be used for each of the separate ethnic groups. We found that the same set of weights could indeed be used, but that on occasion one would also want to include, as a quantitative variable, the mean differences among the groups (see appendixes C and D, below). Since the ethnic group means appeared to be the crucial indicators of ethnic differences, we also conducted extensive analyses of them. These analyses showed that a group that ranked high or low on Achievement or on any one of the background variables tended to rank that way on all the other factors. To illustrate this trend, we have included some of these analyses here. Table 12.3 contains the ranked ethnic group means for each grade level, as well as the rank of their grade average (a low rank indicates a high mean). This rank consistency is more pronounced for the family background variables (i.e., the first six in the table) than for the others. The trend across all grade levels and variables is for a rank order more or less as follows: whites; Oriental-Americans; Indian Americans; Mexican-Americans; Negroes; and Puerto Ricans. In order to express this quantitatively, we intercorrelated the ranks and subjected the intercorrelations to a principal components analysis. The percentage of variance accounted for by the first principal component is an indication of the consistency of these rankings across the variables: if it is high, then one rank ordering can serve to describe them all; if low,

Table 12.3.—Ethnic Group Rankings on Family Background and School, by Grade Level

Variables	Indian Americans				Mexican-Americans				Puerto Rican				Negroes				Oriental-Americans				Whites			
1. Socio-Economic Status	5	5	3	5	4	3	5	4	6	6	6	6	3	4	4	3	2	2	2	2	1	1	1	1
2. Family Structure and Stability	5	5	4	5	4	3	3	3	6	6	6	6	3	4	5	4	2	2	2	2	1	1	1	1
3. Expectations for Excellence	4	5	4	4	5	4	6	5	6	6	5	6	2	3	1	2	3	2	2	3	1	1	3	1
4. Attitude Toward Life	4	4	3	3	5	3	4	4.5	6	6	6	6	2	5	5	4.5	3	2	2	2	1	1	1	1
5. Educational Plans and Desires	4	4	3	4	5	5	5	5	6	6	6	6	3	3	2	3	2	1	4	2	1	2	1	1
6. Study Habits	4	5	4	4	5	4	5	5	6	6	6	6	3	3	2	3	2	2	3	2	1	1	1	1
7. Achievement	3	3	3	3	5	4	4	4	6	6	5	6	4	5	6	5	2	2	2	2	1	1	1	1
8. Student Body's Expectations for Excellence	4	5	4	5	3	2	2	2	5	6	5	6	6	3	1	3	2	4	6	4	1	1	3	1
9. Student Body's Attitude Toward Life	2	4	3	3	4	3	2	3	5	6	5	4	6	5	6	5	3	2	4	3	1	1	1	1
10. Student Body's Educational Plans and Desires	3	4	5	4	4	3	3	3	5	6	6	6	6	5	4	5	2	2	1	2	1	1	2	1
11. Student Body's Study Habits	3	4	3	4	4	2	2	2	5	6	6	6	6	5	5	5	2	3	4	3	1	1	1	1
12. Student Body's Achievement	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	2	2	2	2	1	1	1	1
13. Teaching Staff's View of Teaching Conditions	4	4	4	4	3	3	3	3	5	6	6	6	6	5	5	5	2	2	2	2	1	1	1	1
14. Teaching Staff's Training and Salary Level	6	6	4	6	3	3	3	2	5	4	2	3.5	2	5	6	5	1	1	1	1	4	2	5	3.5
15. Teaching Staff's Preference for Student Ability Level	5	5	5	5	3	4	3	3	4	3	4	4	6	6	6	6	2	1	2	2	1	2	1	1
16. Teaching Staff's Ethnic Composition	2	2	2	2	4	4	3	4	5	5	5	5	6	6	6	6	3	3	4	3	1	1	1	1
17. Teaching Staff's Verbal Skill Mix	3	3	4	3	4	4	5	4.5	5	5	3	4.5	6	6	6	6	2	1	1	2	1	2	2	1
Grade Level:	6	9	12	*A*	6	9	12	*A*	6	9	12	*A*	6	9	12	*A*	6	9	12	*A*	6	9	12	*A*

—A low number indicates a high ranking; *A* represents the ranked averages of the three grade levels.

then different subsets of variables might require different rank orders.

The resulting percentages are given in tables 12-4. Analyses were computed for the family background and achievement variables (i.e., variables 1 through 7 in table 12.3) both alone and when combined with the 10

Table 12.4.—Percentage of Variation Among Ethnic Group Ranks on Family Background, Achievement, and School Accounted for by Successive Principal Components

Sets of Variables	Principal Components	Grade 6	Grade 9	Grade 12	Average
Family Background and Achievement	1st	93	89	71	88
	2nd	4	4	23	7
	3rd	—	—	4	5
Family Background, Achievement, and School (10)	1st	68	77	58	72
	2nd	22	10	21	13
	3rd	8	8	14	9
	4th	2	4	5	5

school variables. It will be seen that rank consistency is greatest for Family Background and Achievement at the sixth and ninth grades. At the twelfth grade, this generalized consistency is still pronounced, but the possibility emerges of using a second ranking. This possibility is indicated by the figure of 23 percent for the second component. When Family Background and Achievement are combined with School (10), the percentage accounted for by the first principal component is reduced somewhat, but is still relatively large.

With these latter analyses, the possibility of using a second ranking emerges at each grade level. Which of these variables plays the greatest role in defining the first principal component? The coefficients for each variable on the first principal component are given in table 12.5. It will be seen that one of the highest coefficients is for Achievement. When these coefficients are squared, we find that almost all the ethnic group differences in Achievement (some 88 to 92 percent) are accounted for by this component. The coefficients are also high for most of the other variables, although there are some differences by grade level. It appears likely that, if an additional set of rankings were used, it would probably involve the variables that reflect these differences.[4]

These results can be expressed hypothetically as follows:

Finding 3.—In order to explain student differences in achievement within major ethnic groups, it is not necessary to vary the weights given to each group's social background factors, with the following partial exceptions.

(*a*) A variable denoting ethnicity also needs to be included, until school factors are brought into the analysis. When they are, it is no longer needed as much.

(*b*) The arguments used to explain among-group differences in student achievement cannot be used to explain the differences within groups.

(*c*) An ethnic group that ranks high or low on achievement tends to occupy a similar rank on the social background factors. It is therefore of no consequence, when explaining the differences among groups, which of these factors one emphasizes. Moreover, ethnic group differences in achievement tend not to be separable from their differences in social background.[5]

[4] The variables in question are Student Body's Expectations for Excellence (at grade 12) and Teaching Staff's Training and Salary Levels (at grades 6 and 12).

[5] As measured by the Family Background, Residential, and School variables described in chapter 2.

Table 12.5.—Coefficients of the First Principal Component of the Ethnic Group Rank Intercorrelations, by Grade Level

Variable	Grade Level			
	Sixth	Ninth	Twelfth	Average
1. Socio-Economic Status	85	96	89	87
2. Family Structure and Stability	85	96	97	93
3. Expectations for Excellence	72	88	16	71
4. Attitude Toward Life	72	78	98	95
5. Educational Plans and Desires	72	88	54	86
6. Study Habits	72	88	62	86
7. Achievement	94	94	96	97
8. Student Body's Expectations for Excellence	89	70	−18	69
9. Student Body's Attitude Toward Life	84	99	79	86
10. Student Body's Educational Plans and Desires	93	99	78	98
11. Student Body's Study Habits	93	90	82	89
12. Student Body's Achievement	93	88	96	90
13. Teaching Staff's View of Teaching Conditions	89	99	97	98
14. Teaching Staff's Training and Salary Levels	20	75	0	36
15. Teaching Staff's Preference for Student Ability Level	78	64	82	81
16. Teaching Staff's Ethnic Composition	84	74	80	80
17. Teaching Staff's Verbal Skill Mix	93	83	63	85
Percentage of Variance Accounted for	68	77	58	72

NOTE.—Leading decimal points have been omitted. The "Average" column is based on the average ranks of the grade levels.

12.3. ACHIEVEMENT AND MOTIVATION IN BOYS AND GIRLS

It is often argued that boys and girls mature at different rates and therefore react differently to certain aspects of their socilization. It occurred to us that, if such differences existed, they might be manifested in the relationships among our variables. We therefore investigated the magnitude of boy-girl differences in some detail. We also inquired whether boy-girl differences or ethnic group differences played the greater explanatory role in achievement and motivation.

We first examined the extent to which different sets of weights were needed in explaining the achievement and motivation of boys as compared with girls. Should we give the same emphasis to the background variables for both groups? We asked this question for Achievement, and for each of the four motivational variables taken singly and in combination. We also asked it for each of the six ethnic groups taken singly and in combination, and at grades 6, 9, and 12. The detailed analyses are presented in appendix D. In general, we found that the same set of weights could indeed be used for boys and girls. However, we also found that boys and girls differed significantly in their mean scores on some of these variables. For the most part, these variables were Study Habits, at all three grade levels, and Educational Plans and Desires, at the twelfth grade. For the remaining variables—Achievement, Expectations for Excellence, Attitude Toward Life at all grades, and Educational Plans and Desires at the lower ones—sex appeared to make no difference at all.

The aforementioned differences on Study Habits and Educational Plans were never large—only 3 percent or less, in fact, of the total differences among students on these variables. However, these differences did tend to exist even after the total range of background factors available to us had been allowed for. Hence, whatever the reasons why girls score slightly higher than boys on Study Habits at all grades and boys score higher than girls on Educational Plans and Desires at the twelfth grade, they tend not to be supplied by the comprehensive set of variables available to us. In Achievement, the absence of boy-girl differences may possibly be due in part to the way in which our achievement composite was developed. A student's score on this composite is a weighted sum of his or her scores on the verbal and mathematical tests. It could be that (especially at the higher grade levels, where differential course enrollment occurs) the girls scored higher on the verbal tests and the boys higher on the mathematical ones. Such differences would have been obscured when the separate test scores were combined to form a single index. Nevertheless, we would have expected more substantial differences between boys and girls on some of the motivational indices than the ones we observed.

We also examined the relative explanatory roles of sex and ethnicity in Achievement and each of the motivational variables. We found that differences in ethnicity outweighed differences in sex. However, both kinds of differences were small compared with the within-group differences between students classified by sex and ethnicity. The percentage of difference that lay within such groups ranged from 100 percent for Expectations for Excellence to 78 percent for Achievement. These percentages therefore represent a large source of student variability with which sex and ethnicity would appear to have nothing to do. In addition, appreciable interactions between sex and ethnicity was not observed for the achievement and motivational variables or, in other words, there was no one ethnic group in which boy-girl differences were more pronounced than in another.

The following hypotheses incorporate these results:

Finding 4.—Sex is not a major source of differences among students in achievement and motivation.

(*a*) The explanatory role of ethnicity far exceeds that of sex, but it remains small compared to the proportion of student variability left unexplained either by it or by sex.

12.4. REGIONAL AND LOCAL FACTORS IN ACHIEVEMENT AND MOTIVATION

We examined the role of regional factors in two ways: (*a*) by region alone; (*b*) by region and metropolitan (and nonmetropolitan) area.

12.4.1. Region

In our earlier studies, we had used only four regional groups: nonmetropolitan North; metropolitan North; nonmetropolitan South; and metropolitan South. In the present study, besides the distinction between metropolitan and nonmetropolitan we used seven: Northeast, Mid-Atlantic; Great Lakes; Plains; Far West; Southwest; and Southeast.[6] We conducted analyses for all the students in each region, whenever possible by ethnic group.[7]

In our earlier work, we theorized that in regions where the institution of caste (i.e., caste-like discrimination on the basis of skin color) was less highly developed, personal attributes fostered in the family would be more likely to play a role in achievement, and a disrupted family situation would therefore be more critical for the student. Our earlier results did not support such a notion. We wondered if it might be supported when we used the more refined regional stratification devised for the present study. It was not. What we did find was that much of the moderate-to-small-relationship of Family Structure and Stability with Achievement could not be disentangled from its relationship with Socio-Economic Status. In other words, both disrupted family situations and lower achievement levels are found more often among the lower socioeconomic groups. The portion of it that could be

[6] The States included in each of these groupings are listed in chapter 2.

[7] I.e., whenever census data indicated that a sufficient concentration of that group's members might be expected in that region, and there were also sufficient members of it in our sample to support such analyses.

disentangled was small for both Negroes and whites in all regions, but larger for the remaining ethnic groups, especially Oriental-Americans. On the other hand, the explanatory role of Socio-Economic Status in Achievement was large for nearly all groups, although more so for Negroes and whites than for the others. However, we were unable to discern any clear regional trend in the distribution of these values. We therefore offer the following hypothesis:

Finding 5.—For most students, the relationship of family structure with achievement tends to be moderate to small. Most of this relationship can be accounted for by variation in socioeconomic status: the lower it is, the less likely the family is to remain intact.
(*a*) This is true irrespective of region.

In our earlier work, we classified some of our variables into a set denoting the family's position in the social structure, and others into a set denoting the nature of the family's involvement with the child in his schooling.[8] We observed, in comparing the two sets, that the latter tended to account for more of a student's achievement in the North than in the South. Accordingly, we suggested that "the color-caste aspects of the social structure, as represented by Racial-Ethnic Group Membership, had a greater impact on Achievement in the South, and would consequently be more difficult to overcome there through educationally related child-rearing activities" (Mayeske et al., 1973a, p. 147).

In the present study, using more differentiated regional groups and a greater number of grade levels, we found that this generalization had to be modified somewhat. When we regarded the Southeastern and, to a lesser extent, the Southwestern regions as representing the South, we found the generalization moderately well supported at the ninth and twelfth grades. At the sixth grade, however, there were certain anomalies that, we felt, were due primarily to the less comprehensive nature of the motivational indices at this level.

We also compared the roles of these two sets of variables in the achievement of the separate ethnic groups. The hypothesis we were testing was the same one as before, namely, that motivational factors play a greater role than social class factors in achievement, but that there is substantial overlap among them—an overlap that might be regarded as the behavioral correlates of social class membership as it relates to Achievement. This hypothesis was supported for almost all the ethnic groups. For the separate ethnic groups, no systematic regional trend in these relationships was either hypothesized or observed.[9]

As a result of these analysis we are inclined to the view that our hypothesis needs to be checked through the use of other, more detailed kinds of data, like that from the census. Nevertheless, the following hypothesis can be tentatively offered:

Finding 6.—Attitudinal and motivational factors tend to play a greater explanatory role in achievement than do social class factors, but there is also substantial overlap among them.
(*a*) This overlap may represent the effect of the interplay of social class and motivational factors on one another over time.

The Achievement Study showed that the independent role of family background factors exceeded that of school factors to a considerable degree, but that the independent role of school factors was greater in the South than in the North.[10] In this study, with its larger number of regional groups, we found exactly the same trend. As before, the independent role of school factors was greater in the South, though rather more so in the Southeast than in the Southwest.

The Achievement Study also showed that, although the role of family background factors exceeded that of school factors, individual differences in achievement were more likely to be associated with school factors among minority group members than among whites. This was true both before and after allowance had been made for family background factors, and the trend was more marked in the South than in the North. In the present study, we tended to find these same results.[11] In consequence, we hypothesize:

Finding 7.—For virtually all students, the role of family background factors in achievement exceeds that of school factors.
(*a*) The achievement of minority students shows a greater sensitivity to school factors than does that of whites.
(b) The achievement of students in the South tends to show a greater sensitivity to school factors than does that of students in other regions.
(c) The overlap of family background and school factors, as they relate to achievement, reflects: (*i*) the allocation of students to schools on the basis of their social background (especially their ethnicity and socioeconomic status); (*ii*) the effects of such allocation.

Another earlier finding that we reinvestigated was the way in which the association of ethnic group membership with achievement varied by region, being higher in the South than in the North. It will be remembered that virtually all these group differences could be explained by

[8] The former set consisted of Socio-Economic Status, Family Structure, and Racial-Ethnic Group Membership, and the latter in Expectations for Excellence, Attitude Toward Life, Educational Plans and desires, and Study Habits, the set known collectively as Family Process.

[9] Our hypothesis pertained to all students combined, not to the separate ethnic groups.

[10] For the composition of the sets known as Family Background and School, see chapter 2. When the ethnic groups were combined, Racial-Ethnic Group Membership was included as an aspect of Family Background.

[11] The only exception was the Oriental-American group in the Far West, for whom school factors played a small role and family background a large one.

differences in social background conditions, and that by far the greater explanatory role was played by factors independent of ethnicity. Similar results were reported in the present study. In almost all the regions, minority group students were, on the average, about one full standard deviation below the whites in achievement. Once more, however, this difference was either greatly reduced or completely eradicated after the family background and school factors had been taken into account. The major exception to this trend was the Oriental-American group in the Far West, which was very close to the white group initially, and came to surpass it after group differences in family background and schools in that region had been allowed for. We therefore feel reasonably confident in asserting:

Finding 8.—Within each region, most if not all student variation in achievement that is associated with ethnic group membership can be explained by differences in family background and type of school attended.

(*a*) The portion of student variation in achievement that is independent of ethnicity—a portion usually much larger than that associated with it—can also be explained by differences in family and school background.

The students' views of their life situations can be influenced not only by the set of variables we have called Family Process, but by their achievement level.[12] We therefore conducted a new series of analyses in which Achievement and the four motivational variables that made up Family Process were regarded as the joint result of differences among students in their social class and type of school attended. We found that the explanatory role of school factors tended to be much greater than in our preceding analyses. For the separate minority groups, the independent role of the school factors came to exceed that of the social class or, in our terminology, home background factors. This tendency, however, was less pronounced for Oriental-Americans than for the other groups. For whites, the opposite was true, viz, social class played a greater role than school. These results prevailed in most regions. Consequently, we hypothesize that:

Finding 9.—When achievement and motivation are treated as the joint product of social class and school, the latter take on more nearly equal explanatory roles.

(*a*) For the separate minority groups, the type of school attended assumes a larger explanatory role than social class: for whites, the reverse is true.

(*b*) Finding 9(*a*) tends to prevail in most regions.

Finally, we studied the extent to which total student variation could be accounted for by regional variation. In other words, what percentage of the total differences among students in, say, their achievement, could be accounted for by virtue of their residing in one region rather than in another? This relationship was assessed by means of the following ratio:

$$\frac{\text{Percentage of total student variation associated with regional membership on attribute } x}{} = \frac{\text{Variation among regions on attribute } X}{\text{Variation among students on attribute } X}$$

When this percentage is high, it indicates a pronounced relationship of regional membership with the attribute; when it is low, the relationship is either less pronounced or absent. Grade-level averages for these analyses are given in table 12.6; for details, see appendixes B and C.

The first column in this table, headed "Total," contains the percentages for all students combined. It can be seen that the largest percentages occur for Socio-Economic Status, Achievement, and Racial-Ethnic Group Membership, but that even the largest of these is hardly more than 5 percent of the total. The percentages for Family Structure and Stability and for the four motivational variables tend to be even smaller. For the separate ethnic groups, the percentages tend to be equal to or smaller than those in the "Total" column. The main exceptions are the values for Indian and Oriental-Americans, which are relatively high for Family Structure and Stability. Expectations for Excellence, and Study Habits. Oriental-Americans also have large values for Achievement and for Educational Plans and Desires. Even here, however, the largest values scarcely exceed 5 percent.

We must conclude, then, that the largest percentage of variation associated with regional membership, whether the ethnic groups are combined or taken separately, occurs for achievement, but that it is only about 5 percent of the total variation among students. The reasons for these regional differences in Achievement are not at all clear.

[12] For the composition of Family Process, see chapter 2.

Table 12.6.—Percentage of Total Variation in Individual Student Variables Associated With Regional Membership

Variable	Total	White	Negro	Mexican-American	Indian American	Oriental-American
Socio-Economic Status	3.3	2.3	3.3	.3	1.3	.7
Family Structure and Stability	1.0	.3	0	1.3	2.7	6.3
Expectations for Excellence	.3	.3	0	0	1.3	1.3
Attitude Toward Life	1.0	.3	1.0	0	.3	.7
Educational Plans and Desires	1.0	.7	.6	0	.7	3.0
Study Habits	.3	0	.6	.7	2.3	2.3
Achievement	5.3	2.0	5.3	0	.7	5.3
Racial Ethnic Group Membership	4.7					

When we examined the factors at our disposal, we found a great deal of overlap among them. In fact, we found that virtually all the differences could be accounted for by any one of the following factors, singly or in combination: Socio-Economic Status; the 4 motivational factors; and the 10 school factors.[13] In addition, the association of regional achievement with regional ethnic composition practically vanished after their differences on any one of the above classes of factors had been taken into account. We are therefore inclined to offer the following hypothesis:

Finding 10.—The region of the United States in which a student resides has little effect on his or her level of achievement or motivation.

(*a*) This is so for students of every ethnic group represented in our study.

(*b*) Regional membership is more highly associated with Achievement than with any other variable, but accounts for only about 5 percent of the total student variation in it.

(*c*) Such regional differences in achievement as do exist can be explained in terms of the regional averages for socioeconomic well-being, motivation, and type of school attended, either singly or in any combination.

(*i*) Regional differences in achievement associated with a group's ethnic composition can be explained by these same factors, either singly or in any combination.

12.4.2. Region and Metropolitan Area

We have just dealt with the results of analyses based upon seven regions. In this section, we shall subdivide each of these regions into a metropolitan and a nonmetropolitan area, to give a total of 14 groups. In order to handle this large number, we found it necessary to employ a new and more powerful analytic technique that, since it caused us to revise our findings, will now be discussed in some detail.

The results of a least-squares regression analysis can be put in the form of an equation that indicates how much weight should be given to each of a number of variables in order to estimate values of the dependent variable, Y. For example, in the equation:

$$Y^1 = B_0 + B_1X_1 + B_2X_2$$

Y^1 is the estimated value of our dependent variable, obtained by multiplying the values of X_1 (the first regressor variable) by the weight B_1, those of X_2 by B_2 and adding both to the constant B_0. In the present context, X_1 might be a value on the index we called Socio-Economic Status, X_2 a value on the index for type of school attended, and Y^1 an estimated achievement score.[14] For the 14 groups considered here, this new analytic technique allowed us to ask two related questions. For a given set of regressor variables and a given dependent variable, they were:

1. Are different slopes needed for the different geographic groups?

If the answer to question 1 was yes, then a different equation was used for each group and the analysis proceeded no further. If, on the other hand, the answer was no, then the next question was:

2. Are different intercepts needed for the different geographic groups?

If the answer to question 2 was yes, then the same B_1's and B_2's were used for each group, but a different B_0. If, on the other hand, the answer was no, then the same B_0 was used.

To arrive at answers to questions 1 and 2, a variance-accounted-for framework was used. This means that the extent of the differences among groups could be put in a percentage framework. In this way, it was possible to judge how worthwhile it might be to use separate slopes and intercepts for each group. In our earlier studies, we had made tests of statistical significance to help us in this type of decision: if an acceptable level of significance was reached, the groups were judged to be different and were kept separate. However, with large samples trivial differences can appear statistically significant. As a result, the analytic approach used here is preferable.

We conducted these analyses sequentially, gradually increasing the number of regressor variables so that first the student background and then the school-related variables were brought in. Computations were made for each ethnic group separately and for all students combined. The geographic classifications employed were region, metropolitan area, and selected regions (when ethnicity was included as a criterion of classification). Whether the dependent variable was Achievement alone or Achievement combined with the four motivational variables, we found that the same slopes could be used for the different geographic and ethnic groups (for details, see appendix C). When the ethnic groups were kept separate, we found that separate regional and metropolitan-nonmetropolitan intercepts might be desired on occasion, depending upon the particular ethnic group, but only until we brought the school-related variables into the analysis. When we did, separate intercepts were no longer needed. However, when we included ethnicity in the same framework as a criterion of classification, we found that a separate intercept was needed for each ethnic group, but not for the regional or metropolitan classifications. As before, the introduction of school-related variables eliminated this need. These latter results suggested to us that the school-related variables tended to pick up differences among ethnic groups and regions. We therefore examined the differences among schools in some detail.

The most significant result of these analyses was that the same slopes can be used for the different geographic groups. How can this be? After all, the regional differences uncovered by our previous analyses were far from negli-

[13] The four motivational factors (often called Family Process) were: Expectations for Excellence; Attitude Toward Life, Educational Plans and Desires; and Study Habits. The set of 10 school factors consisted of 5 student body and 5 teaching staff factors (see chapter 2).

[14] The weights B_1 and B_2 are often called "partial slopes," while the constant B_0 is called the "intercept."

gible. The answer is that the basis of those previous analyses was the variation within each regional group, while that for the present analyses was the variation among all students. In the latter case, regional slope differences simply did not appear worthwhile. But, we might go on to ask, what should an investigator do when the groups are meaningful in their own right, and he wants to analyze them separately? Assuming that the groups are of sufficient size to warrant keeping them separate, we think he should opt for the use of the framework outlined here. He could then use a test of statistical significance to pinpoint percentages that are both statistically reliable and worthwhile in some predictive or explanatory sense. We suspect that use of such an approach would greatly reduce the number of groups considered to be "different" from one another.

What, then, of our earlier analyses by region? Are we to discard them entirely? It seems safer to accept them with the proviso that they are based upon categorizations of people that, at least with regard to the variables involved, may be more important for the way in which people react to them than for anything they are in themselves. Unfortunately, it seems likely that these categorizations will retain their social meaning for some time to come, and that investigators will therefore go on using them. For the explanation of achievement, however, they are likely to prove unnecessary, as the following hypotheses suggest.

Finding 11.—For achievement, both alone and combined with motivation, separate regression weights are not required for the different geographic groups studied herein. This is equally true for all students combined and for each ethnic group treated separately.

(*a*) Separate intercepts are warranted for different geographic groups only until school-related variables are brought into the analysis, after which there is much less need for them.[15]

(*b*) Separate intercepts are warranted for the different ethnic groups only until school-related variables are brought into the analysis, after which there is much less need for them.

(c) School-related variables tend to capture both ethnic group differences and geographic differences.

12.5. STUDENT DIFFERENCES AMONG AND WITHIN SCHOOLS

We undertook a number of analyses designed to explore the nature of student differences at the school and individual levels. Special variables were created to quantify regional and rural-urban differences. We were then able to determine their association with school differences in achievement, both alone and when combined with the four motivational variables. We found that this association was never large; in fact, it was only about 12 percent of the school differences in achievement for regional location, and only about 13 percent for both regional and rural-urban location. Comparable values for achievement and motivation combined were 3 percent for regional location and 5 percent for both regional and rural-urban location. The comparatively insignificant nature of these geographic differences helps explain why they were so easily absorbed by the school-related variables when the latter were brought into the analysis.

Next, we examined the extent to which variation among students' achievement, both alone and when combined with motivation, was distributed (*a*) among ethnic groups and (*b*) among schools. We found that nearly all the portion of this variation that could be associated with ethnicity lay among schools. However, most of the variation among students was not explained either by ethnicity or by school differences. Sex, too, was found to play only a minor explanatory role.

Accordingly, we were led to inquire how far differences among schools could be used to explain differences among individuals. We did so by taking the full set of individual-student variables, making them the dependent set, and regressing them against their school-level counterparts. We found that as increasingly more variables were brought into the analysis, the explanatory role of school differences became progressively weaker. This result is not too surprising when one considers that these variables are more highly correlated at the school level than at the individual level. As a consequence, individual student variability on these measures tends to overwhelm school variability. The importance of differences among students within schools—a topic to which we shall return in our final chapter—could scarcely be better demonstrated. Meanwhile, the following hypotheses seem appropriate.

Finding 12.—The association of geographic differences with school differences in achievement and motivation is small, and all the former differences can be explained by the latter.

Finding 13.—No inferences can be made about the independent effect of ethnicity on achievement and motivation, for virtually all ethnic group differences on these variables can be explained by the type of school attended.

Finding 14.—For virtually all student variables studied herein, whether separately or in combination, there is greater student variation within than among schools.

(*a*) The main exception is ethnicity, for which the reverse is often true.

12.6. METHODOLOGICAL DEVELOPMENTS

The present study was also responsible for a number of methodological developments, most of which arose from our use of the commonality model in our earlier studies. The commonality model was originally developed in order

[15] By "school-related variables" are meant primarily those referring to the social background of the student body and teaching staff.

to explore the overlap of student background and school factors in their relationship to student motivation and achievement. It has been severely criticized for producing, under some circumstances, results that seem irrational (for instance, overlaps with negative values). Although we succeeded in showing that such results can actually be helpful if regarded in the proper light, we decided to test two of the proposed alternatives to the commonality model, in the hope that they would reveal some new aspect of our data.

Both of these proposed alternatives were designed to yield a more parsimonious kind of analysis by transforming the number of regressor variables into orthogonal, or unrelated, variables. They differed in their approach to the range of observed variables: the first alternative tried to reduce them to a smaller number of composite variables, while the second was prepared to accept the full range. We therefore called the first one the "reduced-rank model" and the second one the "full-rank model." We found that the reduced-rank model tended to throw out the very information that was used most heavily in a regression analysis. Moreover, the variables reduced in this way were not always interpretable. The full-rank model did not yield much more information than could be obtained from a regular regression analysis. Nevertheless, we concluded that it might provide an investigator with some insights into how the results of a regression analysis came about. The utility of these techniques could not be fully displayed with our data, primarily because the matrices we were working with were not singular.[16] There was, however, one application of the full-rank model that we found to be useful with associational data, that is, data from which, because they were collected at one point in time, no direct inferences can be made about causal relationships. This application was to include regressor and dependent variables in the analysis together, transform them to orthogonal components (where each orthogonal component was maximally related to its observed counterpart), and then examine the different coefficients of the components. Even in this case, however, the investigator had to be willing to accept these orthogonalized definitions of his variables.

We also tried supplying our own alternatives to the commonality model. In one, we first stratified on student-level variables, and then searched for differential school effects within each stratum. This approach was not productive, because the stratification procedure did not sufficiently eliminate the redundancy among the stratifying variables. In another, following D. E. Wiley (1973), we used the within-school equation to adjust achievement for student background relationships, and then related this residual achievement score to the school-level variables. We found that this procedure did indeed give the school-level variables a slightly larger explanatory role in achievement. However, we did not consider this a desirable procedure because of the pronounced disparities among schools on some of these same variables, particularly ethnicity and socioeconomic status.

[16] I.e., although some high correlations did exist, full linear dependencies were not present.

We also commented on an extension of the commonality model developed by A. E. Beaton, Jr. (1973b). This model allows an investigator to obtain a percentage expression of the extent to which groups classified in a number of different ways differ in the nature of their regression equations. We felt that this was an unusually powerful tool, and one that would discourage the prevailing tendency to view groups as different merely on the basis of their statistical significance.

12.7. SUMMARY

In this chapter we listed our 14 major findings. We did so with the caution that no direct inferences could be made about what happened to students as they passed from one grade to another; since all the data had been collected during the same period of time. In addition, dropout rates were not only higher at the upper grades, but affected some regional and ethnic groups more than others. Finally, the indices used were both less comprehensive and less reliable at the lower grades. Our findings were therefore presented as hypotheses, to be tested by future research from which these disadvantages would be absent.

Our first set of findings dealt with the point of discontinuity that we discerned in the relationship between the students' achievement and their environment. Below this point, it appeared, the relationship became very much weaker and threatened to vanish abruptly. This suggested to us that some social conditions were too unfavorable to exert even a slight positive influence on achievement.

We next examined the relationship of ethnicity, achievement, and motivation. Here our major finding was that, as allowance was made for more and more differences in the various ethnic groups' social background, their achievement scores tended to approach a common distribution. We also found that, with only partial exceptions, it was not necessary to vary the relative importance attached to the different sets of background conditions for each ethnic group.

Turning to the special topic of sex, which we had previously neglected, we found no major differences between the achievement of boys and girls; indeed, sex as a variable had even less explanatory power than ethnicity. Much the same appeared to be true of geographic factors, whether in terms of region alone or of region and metropolitan area, despite our use of seven regional groups instead of the earlier four. However, we succeeded in confirming our earlier finding that the achievement level of students in the South tended to be more affected by school-related factors than did that of students elsewhere. But the general trend in all regions and areas was for the role of school factors to be exceeded by that of family background. There were, of course, some regional variations in achievement, but insofar as they were at all related to ethnicity, they could be accounted for in terms of regional variations in the ethnic groups' social conditions.

Our final set of findings centered on the fact that all the student characteristics in our sample, *with the major exception of ethnicity*, varied far more within schools than they did among schools. Since the independent role of geo-

graphic differences was minimal, virtually all the differences among ethnic groups in achievement and motivation could be explained by the type of school they attended.

We concluded by reviewing a number of methodological developments that had arisen out of the present study. Most of these were connected with attempts to improve on or find replacements for the commonality model, which provided the basis for our separation of school and family influences on student achievement. We tested several of these alternative models, and found them largely unproductive. The most promising approach, it seemed to us, lay in further refinement of the commonality model.

Chapter 13

ISSUES AND IMPLICATIONS

Facts alone carry no recommendations for policy; there is no science that can tell us what we should do. Nevertheless, viable policy rests on agreement about basic facts. It is important, then, to realize which facts this report has established, and which it has merely put on the agenda for future research and analysis.

13.1. WHAT ARE THE FACTS?

The broad factual issues with which we have been dealing can most easily be expressed in a series of questions, as follows.

1. *How do a person's general cognitive skills develop under a wide range of environmental conditions?*

On a priori grounds, we would expect the relationship between these two variables to take the statistical form of an ogive, or flat, S-shaped curve. In substantive terms, this would mean that there is a range of environmental conditions that is optimum for the development of general cognitive skills, or, in other words, that within this range the relationship of environment with development is linear. Above or below this optimum range, the relationship is very much less pronounced, and may even cease to exist.

We are able to uncover evidence that tended to support this assumption of an S-shaped curve at the lower and middle range of environmental conditions and cognitive skills. But no such evidence presented itself at the upper range. Perhaps our achievement composite did not measure skills adequately; perhaps we did not sample a wide enough range of environmental conditions. Or perhaps the assumption itself is invalid. At this stage, however, we find that it still has great appeal.

A. R. Jensen (1969) hypothesized that intelligence, as supposedly measured by IQ tests, has a linear relationship with environmental conditions at the low range, but that beyond a certain threshold this relationship tapers off. Our data did not include IQ tests, but it seems likely that the students' performance on our achievement composite would be highly correlated with their performance on such tests. To the extent that the former can be used as a proxy for the latter, these results suggest that Jensen's theory is either inadequate or incomplete, depending on the location of his threshold point. If he were to place it between our middle and high ranges, then we would argue that his theory is incomplete, for there is a breaking point in the low range. If, on the other hand, he were to place it between our middle and low ranges, we would argue that his theory is inadequate. Indeed, it is refuted by our evidence, which shows a low-to-null relationship where he postulates a linear one (viz, below his threshold), and a pronounced linear relationship where he postulates little or none (viz, above his threshold). Of course, it would be possible to argue that, even if a strong empirical relationship were to be demonstrated between our achievement scores and IQ, one cannot serve as proxy for the other.

2. *How should we interpret the fact that the cognitive skills of different ethnic groups have been developed to different levels?*

We have seen that as far as this study is concerned, much the same emphasis can be given to one group's background factors (both family and school) as another's. In other words, the same regression equation can be used for all groups, and all that is needed to understand the differences among them—that is, the differences in their students' cognitive skills—is their means on the factors in question. Hence, the corresponding individual differences within each group can be thought of as arising to about the same degree from the same kinds of social background factor. However, although the same is true of the differences among groups, the background factors are so highly interrelated at this level that it is difficult if not impossible to distinguish the influence of each one separately.

A large part of this problem is due to the nature of our data, which, as we have repeatedly emphasized, were collected during one period of time. Had we had a larger number of ethnic groups represented in our study, the relationships observed here might not have been as marked. Other studies, however, offer more opportunity for speculation about the origin of these differences. This is not the place for a systematic review of the literature on the nature and numbers of social groups that perform differentially on tests of IQ, attitude, and achievement. Even if we could determine the extent of this literature, there would be too much of it.

A few studies, however, have been selected for comment, both because they more than suffice to prove the quite limited point we are trying to make about achievement and environment, and because they seem particularly suggestive in other respects.[1]

The first of these studies is by J. R. Mercer, who found, in a survey of the epidemiology of mental retardation in Riverside, California, that the performance of blacks and

[1] We use the term "suggestive" either because we did not have an opportunity to examine the detailed study results, or because it contained some methodological fault (sampling bias, nonrandom assignment, small sample, etc.) that prevented it from being definitive.

Chicanos on IQ tests differed from that of whites to about the same extent (i.e., about one sigma lower) as we have observed in this study. However, when allowance was made for the relative affluence and different cultural practices of these groups, the blacks' and Chicanos' scores became more nearly equal to the whites'.

A study that more nearly approximated experimental conditions was that of R. Heber and associates (1972). They found that a group of infant children of mentally retarded mothers that was taken from the home during the major portion of the day and exposed to a program of intellectual stimulation, scored about 1.5 sigma units above a comparable group not so treated. M. Smilansky (1972), in recounting studies of children reared in kibbutzim, has reported that, on an IQ test, children of European Jews perform about one full sigma above those of Oriental (i.e., North African and Middle Eastern) Jews when each are raised by their own parents. However, when children of European and Oriental parentage are raised in a kibbutz, where all mothers are exposed to the same kind of prenatal care and all children are not only reared in the same way but are left with their own parents for only about two hours during a normal working day, their performances on IQ tests is more nearly similar. Moreover, it tends to be about one sigma above the average performance of all children on the test. But even though a kibbutz upbringing eliminates the intergroup differences, there are still individual differences, some of which can be associated with differences in their parents' educational levels.

If we broaden our concept of ethnicity to include religious background, equally suggestive results can be found for selected groups in the United States. Thus J. G. Bachman (1970) reports that students who identify themselves as Jewish or Episcopalian tend, on an IQ test, to score roughly seven-tenths of a sigma above those who identify themselves as Roman Catholic or Methodist, and one full sigma above those who identify themselves as Baptists. J. A. Hostetler and G. E. Huntington (1971) found the performance of Amish children on achievement tests requiring the use of language were somewhat below the averages for non-Amish children, whereas their performance on such tests that had less to do with language and more with the rest of the curriculum were on a par with or even somewhat above them. We could go on; however, these few studies are enough to suggest that the differential performance of ethnic groups on tests of this kind arises from differences in their sociocultural experience as a group. At the same time, vast individual differences can be observed within each group.

An entirely different view of this phenomenon is to assume that it results from inherent characteristics of the various ethnic groups. Proponents of this latter view usually cite studies alleged to show that the test performances of persons with a known degree of biological relationship to one another (e.g., monozygotic and dizygotic twins, cousins, parents and their children) tend to be highly associated. It is inferred from this that there is a strong genetic component in achievement. However, these studies have been conducted for the most part on relatively homogeneous cultural and biological groups. They also suffer from a number of other shortcomings (Kamin, 1973). But even if they did not, they would still tell us little, if anything, about the nature of mean differences among cultural groups. It is depressing to have to repeat this, but the fact is that, in order to understand such differences, it is more fruitful to examine the ways in which ethnic groups actually differ from one another as groups than it is to make any other kind of comparison.

Thus A. R. Jensen (1969) has argued that the lower performance of Negroes than whites on IQ tests is due to some inherent factor that is constraining Negro performance. However, as we have already shown at some length, Negroes are far from being the only nonwhite group that scores low on such tests.[2] Indeed, Puerto Ricans score lower than Negroes, while Indian and Mexican-Americans are about on a par with Negroes. Moreover, the slight differences that do exist among these latter minority groups cannot be interpreted at all without first taking into account their differential dropout rates. For example, Indian and Mexican-Americans are said to (and probably do) have much higher dropout rates than Negroes even before the sixth grade. Had the children who dropped out been retained in school, the relative status of these groups might have turned out quite differently.

Another form of the genetic theory has been put forward by W. Shockley (1971), who also stresses the lower performance of Negroes than whites on IQ tests. He has suggested that for each 1 percent of Caucasian genes that Negroes have, there will be a corresponding increase of 1 point in their test scores. Since there has been a greater genetic mixture of Negroes with whites in the North than in the South, he argues, it follows that Northern Negroes will have higher test scores than Southern ones.[3]

The present authors know nothing of genetic mixtures in different regions of the country. We have observed, however, that the percentage of student variation on our achievement composite that can be associated with regional membership is never large; in fact, the largest values are on the order of 5 percent for Negroes and Oriental-Americans and 2 percent for whites. It follows that, even if such regional differences were brought about by genetic factors, they would still be relatively unimportant. However, no genetic explanation is necessary. As we noted earlier, these differences among regions could just as well be explained by differences in their affluence, in their motivation for achievement, or in the social organization of their schools, whether singly or in any combination. A resort to inherent differences among ethnic groups as an explanatory theme does not further our understanding in the slightest.[4] We may also recall that most of the differential performance of the ethnic groups on our achievement composite could be accounted for by differences in the types of school they attended. If such performance can serve as a proxy for performance on an IQ test, then it is clearly essential to

[2] Assuming once again that our measure of achievement may serve as a proxy for IQ.

[3] His specific hypothesis actually pertains to Negroes in Georgia as compared with those in California.

[4] Students of migration might also note that such differences among regions are not as great as some theories of migration might lead one to believe.

include type of school attended as a variable in any explanation of differential IQ scores by ethnic group.

In summary, we suggest that differences among ethnic groups on tests of general cognitive skill development can best be understood in terms of differences in their experience as groups, and not in terms of factors that give rise to individual differences within each group.

3. *In what sense do schools affect their students' achievement levels, and to what extent?*

We have come to believe that, at least with this body of data, it is possible to distinguish two different kinds of "school effect": (*a*) the effect that can be attributed to attending one type of school rather than another, different type; (*b*) the effect of a student's immediate classmates on his or her own performance. We shall suggest that these are by no means independent phenomena, even though they can be separated algebraically.

As of 1965, the process of public schooling, it seems to us, ran somewhat as follows:

1. Neighborhoods were organized along socioeconomic and racial-ethnic lines.
2. School attendance areas were defined in terms of neighborhoods, with the result that students of the same socioeconomic and racial-ethnic background attended school with one another.
3. Since performance on standardized achievement tests tended to be correlated with a student's socioeconomic and racial-ethnic background upon entry into school, schools differed in the achievement levels of their entering students.
4. A student's progress in school tended to be gauged against the progress of his or her fellow students: to be ahead of them was equated with doing well, and to be behind with doing poorly and needing assistance.
5. Since there was no fixed standard by which all students might have been said to be doing well or poorly, and since the curriculum was a standardized one that compelled all students to spend a fixed amount of time on different subjects, the relative standing of different schools or instructional groups within schools tended to be preserved throughout the years of schooling, and with it (though to a lesser extent) the relative standing of individuals within those groups.

Given a process of this kind, it is not surprising that, when we examined differences among schools to see what kind of an effect, if any, they might have been having on their students' achievement and motivational levels, we found that almost all such differences could be explained by differences in the students' socioeconomic and racial-ethnic composition. The slight portion that remained unexplained by such factors could be explained by the social composition of the teaching staff, by the way in which the school had adapted to the recurring nature and needs of its student body, or by some combination of both.

When we turned to differential student performance within schools, we found a somewhat different set of relationships. Thus the relationship of achievement with individual social background was much diminished, while that of individual motivation was increased. Over the years of schooling, it seemed likely that such motivational factors might become increasingly related to achievement, while the role of social background factors stayed much the same as it had been in the early years. Then, too, most of the differences *among* students within schools remained unexplained. We felt that this was a promising field for future research, especially if such differences were regarded as being related to and perhaps produced by the school.

13.2. WHAT IS TO BE DONE?

In our earlier studies we noted that, as of 1965, American schools tended to reflect and perpetuate inequities that existed in the society at large. In order to remove these inequities, we felt that a concerted effort would be required in numerous areas of society, including employment, education, and housing.

It is not our purpose here to assess progress in these areas, except to note that much has been done since that time to correct ethnic imbalances in the schools, especially Southern schools. Undoubtedly, much more could be done in the North. What we wish to emphasize, however, are three much broader problem areas suggested by the results of our analytic work. These areas are problematic today, and are likely to remain so in the near future. For the sake of succinctness, these areas will be labeled here as follows: (*a*) purposeful attainment; (*b*) relevance; (*c*) disciplined diversity.

13.2.1. Purposeful Attainment

Education, both historically and as we know it today all over the world, can be characterized as peer referenced. By this we mean that an individual's rate of progress and degree of success are judged against those of the average student, particularly in his or her instructional group. If the individual student performs better than average, this is called "doing well"; the student may even be labeled as "bright." A worse-than-average performance, on the other hand, is called "doing poorly," and a student who has one is likely to be labeled "dull," "lacking in effort," or even "in need of special assistance." In short, to be doing well one has to be doing better than someone else.

A moment's reflection will show that this way of judging good and bad performance need have nothing to do with what is taught or how much is learned. By some fixed standard, all the students might be doing well or poorly. But no fixed standards exist. Obviously, they should be developed. How can this be done? The first prerequisite, it seems to us, is to have a definite idea of what education is supposed to achieve; the second, is to plan how to achieve it. Such an approach would necessarily involve setting minimum levels of student competence for different developmental stages. Assessing this competence would be a matter of finding out what skills or knowledge the children had acquired from the educational experiences that they

would probably not have attained otherwise. In contrast, the standardized achievement tests now in use are based on what roughly only half the children know, and are of questionable relevance to what is being taught.

The type of system we are advocating would call for much greater individualization of instruction. This might take one of several forms. Some students, by virtue of their more rapid mastery, might go on to more advanced or more detailed learning tasks, or at least to tasks that are in some way different. The latter might include helping other students, whether younger ones or peers, but the emphasis would be not on what one's peers were achieving but on personal achievement relative to fixed standards.

It may be objected that such an approach would involve a lowering of current standards (as if this were possible). However, it has been demonstrated that even high standards are capable of attainment if one bothers to make them explicit and keep them fixed (Block, 1973, chapter 4). Such a system might seem utopian to some and undesirable to others. Its attainment would undoubtedly be difficult; as of this writing, even basic adult literacy levels are in dispute. However, there seems little point in offering education to all via an instructional process that guarantees the failure of at least half the students.

13.2.2. Relevance

A second problem area is the relationship between the activities that are carried out in the name of education and the later life circumstances that students are likely to encounter. It is, in short, the problem of relevance in education. Relevance can be thought of as having two aspects: (*a*) the scope of the learning tasks; (*b*) the structure of learning relationships within schools. Let us deal with each in turn.

It seems axiomatic that schools should teach children more than just how to get a job. Certainly, many do; but much more could be done. For example, as we suggested in the Achievement Study, the quality of parent-child relationships might be enhanced if high school students were taught something of how they may affect *their* children's physical, emotional, and intellectual well-being. Similar arguments could be made for familiarizing students comparatively early with the possible pleasure and pitfalls of marriage. More generally, the schools could tell their students far more about the major national and international problems that will profoundly affect both their and their children's lives.

The structures of learning relationships within school affects not only the students' achievement levels but also their attitudes and opinions. School authorities should develop a greater sensitivity to these forces, and attempt to harness them in a positive manner. For example, in order to foster a sense of cooperativeness among students, tasks in which they have to work together in a positive manner might be preferable to ones that pit individual students against each other.

Finally, many of the learning tasks with which students are confronted consist largely in the passive assimilation, storage, retrieval and (sometimes) transformation of information. Such tasks involve a very limited range of human abilities. The range of tasks, then, should be restructured so as to employ a greater range of capabilities. For instance, J. S. Coleman (1972) has suggested that, in the adolescent years, the setting in which learning tasks occur should be broadened to include the adult world of work. This would enable adolescents to learn something about that world instead of being separated from it. At the same time, they would be able to acquire marketable skills through "learning by doing."[5] Many activities within schools might also provide opportunities for such "learning by doing": the tutoring of younger by older students, the employment of students in management and custodial functions, and the sponsorship of individual and team projects are just a few of the possibilities. Some of these latter might also help to foster cooperative relationships among students, as suggested earlier.

13.2.3. Disciplined Diversity

As we noted earlier, the process of education is carried out in a surprisingly uniform manner, in this country as well as others. How, then, are we to plan for change? It would seem highly desirable to diversify our educational practices so that we can learn of other and perhaps better ways to attain common goals and objectives. However, if we are to learn from such diversification, it will have to be carried out in a disciplined manner. In the past, experiments were often conducted so haphazardly that it was difficult, if not impossible, to decide what had been learned from them. The motto of the future should be: No experimentation without randomization. Not that introducing experimental controls such as randomization is likely to revolutionize the educational process, however, if educators are ever to know what they are doing and students what is being done to them, then experimental controls will be needed. At the very least, they will save educators from repeating the fads of the past.

But how, we may ask, might experimental controls be applied in practice? Whenever local school authorities plan to adopt new procedures, a unique opportunity exists for them to give these procedures a trial run by creating a group subject to the old procedures as well as a group subject to the new ones, and to assign both students and teachers randomly to each group. Whenever an agency gives funds for new practices to be developed or tried out, it could easily require, as a condition of funding, that the potential recipient designate one or more groups from whom the new practice will be withheld, so that it can act as a control group in gauging this practice's effectiveness. Preferably, both control and experimental groups would be selected at random from the total number of eligible groups. Such practices are in fact currently being incorporated in a number of federally funded programs (see Crain et al., 1973).

It matters little what is said for or against specific proposals of this kind as long as school authorities are prepared to accept the main point, namely, that education is a

[5] I.e., learning through action, and then evaluating their performance on the basis of what has occurred.

science, although a fledgling one, and that its results should be assessed by scientific means in a spirit of scientific inquiry. Equality of educational opportunity, then, is more than a high-sounding slogan: it is a concept that can be defined scientifically. Now that we have located the sources of inequality, and found that they are manmade, how can we refuse to pursue the goal of equality with renewed zeal?

APPENDIXES

APPENDIX A

THE DATA-ANALYSIS MODEL[1]

The following logical steps were incorporated into our computer program:

Item Analyses. Each questionnaire item was analyzed against one or more variables of interest. In this way we were able to use not only the percentage of respondents choosing each item but also their average on the variables of interest as a guide in assigning scale values. We did the same with the nonrespondents. For the student questionnaire, item responses were analyzed against an achievement composite.[2] For the teacher questionnaire, item responses were analyzed against the number of items that were answered correctly on the teacher's vocabulary test.[3] Responses to the school principal questionnaire were analyzed against the principal's response to questions concerned with his annual salary, number of students enrolled in his school, the rural, suburban, or urban location of the school, and the proportion of children in the school from working-class families.[4]

Coding and Intercorrelation of Variables. An approximately 10-percent sample of students was drawn from the student master tapes at each grade level. The variables were then coded and intercorrelated.[5] For the teachers and principals a breakdown into elementary and secondary was made, and correlations computed for each breakdown. The full number of teachers and principals included in the survey was used in these analyses.

Reduction of Variables Into Indices. The intercorrelation matrices for the above steps were subjected to a series of factor analyses in order to obtain meaningful groupings of the variables, called indices.[6]

Computation of Index Scores. The weights obtained from the factor analyses were used to compute index scores first, by standardizing each variable to a mean of zero and a standard deviation of one; then, by multiplying each variable by its respective weight; and finally, by summing these values. In this step index scores were computed for all of the students included in the survey. Index means, standard deviations, and intercorrelations were also computed.

Computation of School Averages. The mean score for each school was computed for both students and teachers on the indices and variables that were carried along separately.

Merging of School Data. The school means for students and teachers were merged with the school data for principals on a single tape (one tape for each of the five grade levels).

Computation of Correlations and Regressions. We performed a large number of statistical analyses in order to interrelate the variables. The primary statistical tools used were regression analysis and partition of multiple correlation.

Ideally, we would have liked to study these responses for the same students as they progressed through their years of schooling. However, as explained in chapter 1, we decided to use cross-sectional data; viz, we collected them from students at different grade levels at one point in time. Consequently, whenever we made inferences about trends over time we did so with great caution.

A.1. THE DATA-ANALYSIS MODEL AND ITS PROPERTIES

The data for this study were obtained by appending to each student the attributes of his school appropriate for his grade level, as they were developed in the School Study. This procedure generates a data matrix that can be compared with the following hypothetical one:

		1	2	3	4	5
		SES	ACHV	SES	ACHV	PTR
STUDENTS	1	SES_{1A}	$ACHV_{1A}$	SES_A	$ACHV_A$	PTR_A
	2	SES_{2B}	$ACHV_{2B}$	SES_B	$ACHV_B$	PTR_B
	3	SES_{3C}	$ACHV_{3C}$	SES_C	$ACHV_C$	PTR_C
	4	•	•	•	•	•
	•	•	•	•	•	•
	•	•	•	•	•	•
	•	•	•	•	•	•
	•	•	•	•	•	•
	N	•	•	•	•	•

In this matrix the individual student, as represented by the numbered rows from 1 to N, is the basic unit of observation. The five columns of the matrix represent different kinds of variables. The first two columns con-

[1] This appendix has already been published in the Achievement Study (Mayeske et al., 1973a) and in the Attitude Study (Mayeske et al., 1973b). It is reproduced here, mutatis mutandis, because each report in this series is designed to stand by itself.

[2] Mayeske et al., 1968b.

[3] Mayeske et al., 1967.

[4] Mayeske et al., 1968a.

[5] The codes used for these analyses, as well as the means, standard deviations, and intercorrelations for the students, teachers, and principals, are given in the appendixes of the School Study (Mayeske et al., 1969). The student items were coded by means of criterion scaling.

[6] Principal components analyses were used, with varimax rotations of components having a root of one or more.

tain observations on each student's Socio-Economic Status (SES) and Achievement (ACHV), respectively. The third and fourth columns contain the average Socio-Economic Status ($\overline{SES}$) and average Achievement ($\overline{ACHV}$) of students in the same school and grade level as the individual student. The last column contains a more traditional school variable, the Pupil-Teacher Ratio (PTR) for students of the same school and grade level. The alphabetical subscripts (A, B, C, etc.) are used to designate the schools.

When these variables are intercorrelated the values for each individual student enter into the computational formula. They result in the following hypothetical correlation matrix:

	STUDENT CORRELATIONS					
	1	2	3	4	5	
	SES	ACHV	$\overline{SES}$	$\overline{ACHV}$	PTR	
1. SES	1.00	r_{12}	r_{13}	r_{14}	r_{15}	STUDENT-SCHOOL CORRELATIONS
2. ACHV	r_{12}	1.00	r_{23}	r_{24}	r_{25}	
3. $\overline{SES}$	r_{13}	r_{23}	1.00	r_{34}	r_{35}	SCHOOL CORRELATIONS
4. $\overline{ACHV}$	r_{14}	r_{24}	r_{34}	1.00	r_{45}	
5. PTR	r_{24}	r_{25}	r_{35}	r_{45}	1.00	

Since this matrix is symmetric, the values below the main diagonal (upper left to lower right) will be the same as those above the diagonal. The dotted line is used to separate the submatrix of student correlations from school correlations. Using this matrix, and assuming that we are interested in the regression of ACHV on SES, we can conduct the following analyses:

TOTAL: The effectiveness of the regression of individual ACHV on SES is measured by r^2_{12}. For more than one variable it would be measured by the squared multiple correlation obtained by regressing individual ACHV on several other individual student variables. School variables can be brought into this analysis as well. For example, PTR can be brought into the nalysis with SES and ACHV to give the multiple regression of ACHV on PTR and SES.

AMONG: The effectiveness of the regression of school $\overline{ACHV}$ on school $\overline{SES}$ is measured by r^2_{24}. For more than one variable it would be measured by the squared multiple correlation obtained by regressing school $\overline{ACHV}$ on several other school variables. For reasons given below, individual student variables are not brought into this kind of analysis.

WITHIN: A within-school regression is conducted by partialing $\overline{ACHV}$ out of ACHV by means of partial correlation techniques, and then regressing ACHV on SES (i.e. through observation of the squared partial correlation that remains). This operation renders the residuals of ACHV uncorrelated with or independent of $\overline{ACHV}$, and consequently uncorrelated with any other school variables that are correlated with $\overline{ACHV}$.[7]

$\overline{ACHV}$ is the one school variable that is most similar to or highly correlated with ACHV. The squared correlation of $\overline{ACHV}$ with ACHV represents the maximum amount of variance in ACHV that can be explained by analyzing differences among schools. Consequently, when $\overline{ACHV}$ is partialed out of ACHV all the remaining school variables are uncorrelated with ACHV. In general, when an individual student variable is correlated with its school mean counterpart, that correlation is the maximum value that can be obtained by correlating it with any other variable or combination of variables. When the school mean counterpart is partialed out of an individual student variable, all of the differences in that variable associated with differences among schools are removed. This is also one of the reasons why an individual student variable is not entered into an "AMONG" analysis: the maximum differences among schools on that variable are just as well represented by the variable's school mean counterpart.

A.1.1 COMMONALITY ANALYSIS

Extensive use was made in this study of a technique called commonality analysis. This technique partitions the variance in a dependent variable that is predictable from two or more sets of regressor variables into the proportion that can be uniquely associated with each set, and the proportion that is in common with two or more of the sets. The following discussion will focus on the development of the model for two and three sets of variables and then go on to a discussion of the meaning of these results. A mathematical development of the model is given in the Technical Supplement to the Achievement Study.

Let us assume that we have two sets of variables, B and S. In the context of the ensuing chapters, *B* might represent different measures of the student's family background, *S* might represent different measures of the school he attends, and *A* might represent his achievement. Suppose now that we run a regression and obtain a squared multiple correlation for *A* against each set of variables, alone and in combination. For two sets of variables we will have three squared multiple correlations: $R^2(B)$; $R^2(S)$; and $R^2B, S)$, where the letter or letters in parentheses represent the set or sets entered into the regression. Then the proportion of the squared multiple correlation that can be uniquely associated with the *B* and *S* sets, designated $U(B)$ and $U(S)$, is given by:

$$U(B)=R^2(B,S)—R^2(S) \quad (1)$$

$$U(B)=R^2(B,S)—R^2(S) \quad (2)$$

These unique values are sometimes referred to as first-order commonality coefficients. The proportion of predictable variance that is common to the two sets of variables, called the second-order commonality coefficient, is given by:

[7] An algebraic proof of this assertion is given in the Technical Supplement to the Achievement Study.

$$C(B,S)=R^2(B,S)-U(B)-U(S) \quad (3)$$

This partitioning results in the following additive properties:

$$R^2(B)=C(B,S)+U(B)$$
$$R^2(S)=C(B,S)+U(S)$$

That is, the squared multiple correlations for B and S can be expressed as a function of their different orders of commonality coefficients, viz, the common portion plus the unique portion. In the context of our study this kind of analysis would indicate the extent to which the predictable variance is shared in common by the two sets, and the extent to which it can be associated with one or the other of the two sets.

The results of these analyses are organized somewhat as follows:

Order of Commonality Coefficients	B 1	S 2
First U(X1)	*a*	*b*
Second C(X1X2)	*c*	*c*
R-square(X1)	*d*	*e*
R-SQ(X1,X2)	*f*	*f*

In this table, the first-order commonality coefficient, or portion uniquely attributable to each set, is given in the "*U(Xi)*" row. Here, *Xi* stands for the set contained in each column, represented by *B* and *S* respectively. The second-order commonality coefficient is the same for each column, as is the *R-SQ(X1,X2)*. The squared multiple correlation for each set, *B* or *S*, is given in the row "*R-Square(Xi)*." Also, the following empirical values in this table would be additive: $a+c=d$, $b+c=e$, *and* $a+b+c=f$. When we perform a unitizing operation on these results, the different order-of-commonality coefficients sum to 100. This operation is performed by dividing each of the empirical values in this table by the value for *f*. Usually only the unitized values for *U(Xi)* and *C(XIX2)* are presented.

For the three-set case let us designate the third set as *O*, for "other." From entering all the different combinations of sets in the regression we obtain the following squared multiple correlations: $R^2(B)$; $R^2(S)$; $R^2(O)$; $R^2(B,S)$; $R^2(B,O)$; $R^2(SO)$; and $R^2(B,S,O)$. Then the first-order commonality coefficients are given by:

$$U(B)=R^2(B,S,O)-R^2(S,O)$$
$$U(S)=R^2(B,S,O)-R^2(B,O)$$
$$U(O)=R^2(B,S,O)-R^2(B,S)$$

The second-order commonality coefficients are given by:

$$C(B,S)=R^2(B,S,O)-R^2(O)-U(B)-U(S)$$
$$C(B,O)=R^2(B,S,O)-R^2(S)-U(B)-U(O)$$
$$C(SO)=R^2(B,S,O)-R^2(B)-U(S)-U(O)$$

Finally, the third-order commonality coefficient, of which there is only one, is given by:

$$C(B,S,O)=R^2(B,S,O)-C(B,S)-C(B,O)-C(S,O)-U(B)-U(S)-U(O)$$

The squared multiple correlation for any single set can then be expressed as a function of its different order-of-commonality coefficients. For example, the squared multiple correlation for the "other" set, $R^2(O)$, can be expressed as:

$$R^2(O)=C(B,S,O)+C(B,O)+C(S,O)+U(O)$$

Results of three-set commonality analyses are organized somewhat as follows:

Order of Commonality Coefficients		B 1	S 2	O 3
First	U(X1)	*a*	*b*	*c*
Second	C(X1X2)	*d*	*d*	
	C(X1X3)	*e*		*e*
	C(X2X3)		*f*	*f*
Third	C(X1X2X3)	*g*	*g*	*g*
	R-square	*h*	*i*	*j*
	R-SQ (X1X2X3)	k	k	k

With three sets there are now three second-order commonality coefficients. The additive properties are $a+d+e+g=h$; $b+d+f+g=i$; $c+e+f+g=j$; and $a+b+c+d+e+f+g=k$. When these coefficients are divided by *R-SQ (X1X2X3)*, which in the above table has the empirical value of *k*, they are called "unitized" coefficients. Usually only these unitized coefficients are given in the following chapters.

APPENDIX B

FAMILY AND SCHOOL INFLUENCES ON ACHIEVEMENT, BY REGION AND ETHNICITY

In this section we explore, for selected ethnic groups, many of the same kinds of questions posed in chapter 6. In conducting these analyses we have to contend with two problems. First, for many regions the sample sizes for some of the ethnic groups are exceedingly small. Second, errors in ethnic group self-identification occur, and these errors can be magnified when the groups are sorted out by a degree of regional stratification as fine as this one. In order to cope with these problems, we shall present regional analyses only for those ethnic groups for which there is an adequate representation in our sample, and of which census data also indicate that there should be a sufficient concentration within each region of interest. For example, we shall examine whites and Negroes for all seven regions, whereas we shall study Indians and Mexican-Americans for only two regions each.

In order to cope with the small number of schools in some of our regional samples, we shall, on occasion, use a lesser number of school variables to represent school differences. This will, at times, have the effect of understating the magnitude of the association of school differences with student variables. But we willingly make this sacrifice in order to gain a clearer understanding of regional differences. The number of questions addressed will be fewer here than in chapter 6 because ethnicity is not employed as a variable (i.e., within and across regions each ethnic group is kept separate from the others).

We begin the analyses with the whites because they are the most populous group, and hence determine who is and is not a minority.

B.1. REGIONAL VARIATIONS FOR WHITE AMERICANS

The numbers of white students and their schools are given in table B.1. The small numbers of schools represented in the sample at the higher grade levels, particularly in the Northeast and Plains regions, suggest that we need to take special precautions in the school analyses to conserve on degrees of freedom. For individual students, however, adequate sample sizes are available in each region. Our first question then is:

1. What is the magnitude of the role played in Achievement (ACHV) by Family Structure and Stability (FSS) before and after allowance has been made for Socio-Economic Status (SES)?

The results of commonality analyses with these two variables are given in the first few columns of table B.2. We can note from the column labeled "RSQ (SES, FSS)" that the values are uniformly higher at the ninth grade than at either of the other grade levels, and that they appear, on the average, to be slightly greater in the Northeast, Mid-Atlantic, and Southeast than elsewhere. We conjecture that from the sixth to the ninth grades, these differ-

Table B.1.—Number of Students and Schools in Selected Regions, by Grade Level: Whites

Region	Grade Level	No. of Students	No. of Schools	Region	Grade Level	No. of Students	No. of Schools
Northeast	12	3,873	20	Far West	12	9,973	83
	9	4,409	25		9	11,489	105
	6	4,327	96		6	10,058	288
	3	4,401	109		3	10,474	305
	1	2,561	54		1	6,466	161
Mid-Atlantic	12	16,433	80	Southwest	12	3,580	66
	9	21,406	128		9	4,764	80
	6	17,075	328		6	4,913	154
	3	17,025	364		3	5,063	154
	1	8,524	165		1	3,035	76
Great Lakes	12	10,884	65	Southeast	12	13,255	177
	9	12,680	83		9	17,359	226
	6	11,054	289		6	15,906	579
	3	11,894	304		3	16,231	510
	1	6,777	142		1	9,795	233
Plains	12	4,040	42	Total	12	62,038	533
	9	4,646	48		9	76,753	695
	6	3,959	135		6	67,291	1,869
	3	4,299	136		3	69,385	1,882
	1	2,660	83		1	39,816	914

Table B.2.—Commonality Analyses of Family Background and School Factors in Achievement, by Region and Grade Level: Whites

Region	Grade Level	RSQ (SES,FSS)	Unique SES	Common	Unique FSS	RSQ (HB,PRCS)	Unique HB	Common	Unique PRCS	RSQ (FB,SCH)	Unique FB	Common	Unique SCH
Northeast	12	19	88	12	0	42	4	41	55	44	78	19	3
	9	24	78	21	1	42	7	51	42	43	81	16	3
	6	17	84	14	2	29	22	37	41	34	61	25	14
Mid-Atlantic	12	17	92	8	0	42	4	36	60	45	77	17	6
	9	24	82	16	2	42	9	49	42	44	70	25	5
	6	18	81	15	4	30	21	41	38	35	61	24	15
Great Lakes	12	15	87	10	3	41	3	33	64	43	88	6	6
	9	18	77	19	4	35	8	44	48	37	87	7	6
	6	13	77	14	9	29	12	34	54	34	70	16	14
Plains	12	18	85	10	5	46	6	32	62	48	87	8	5
	9	19	83	15	2	39	6	43	51	40	79	17	4
	6	14	78	15	7	28	13	39	48	31	71	19	10
Far West	12	14	81	16	3	37	4	33	63	38	91	6	3
	9	17	74	22	4	34	8	42	50	36	86	10	4
	6	13	76	17	7	26	15	36	49	30	75	13	12
Southwest	12	10	93	5	2	31	4	29	67	34	83	10	7
	9	18	87	13	0	34	9	46	45	36	83	11	6
	6	15	88	10	2	26	17	40	43	27	82	11	7
Southeast	12	18	94	6	0	38	7	41	52	43	71	18	11
	9	23	86	13	1	38	10	51	39	41	73	20	7
	6	21	81	13	6	32	22	44	34	38	55	30	15
Total	12	17	90	9	1	39	6	36	58	43	78	13	9
	9	21	82	16	2	37	10	47	43	40	75	18	7
	6	17	81	14	5	29	18	41	41	34	63	22	15

ences reflect a difference in the composition of the indices, and that from the ninth to the twelfth grades they reflect different dropout rates. Hence, the percentage of difference among white students in their ACHV accounted for by these two variables varies from a low of one-tenth to a high of one-fourth. However, when we examine the percentage role that can be attributed to FSS, we can note that it is always small before SES has been taken into account, and, as indicated by the unique portion for FSS, it gets even smaller when SES is first allowed for. The unique percentage role for SES, on the other hand, is extremely large—on occasion, as much as 40 to 90 times greater than that of FSS. Therefore, we are inclined to conclude that the role of FSS in whites' ACHV is exceedingly small, and that most of it is confounded with that of SES. This conclusion holds for virtually all regions and grade levels studied here.

Our second question is:

2. When HB and PRCS are analyzed together, what is the magnitude of their respective roles in ACHV?

We may recall from chapter 6 that the HB factors are SES and FSS taken together, while PRCS is comprised of the four attitudinal and motivational variables. The results of these analyses are given in the center columns of table B.2. Inspection of the "RSQ(HB, PRCS)" column shows that the values tend to increase at the higher grade levels and, on the average, to be smaller in the Far West and Southwest than elsewhere. We suspect that this increasing value over the grade levels reflects not only changes in the composition of the indices and differential dropout rates, but a tendency for the PRCS factors to pick up additional variance in ACHV at the twelfth grade (see for example, the Great Lakes and Plains regions). Hence, these percentages range from a low of a little more than 0.25 to a high of a little more than 0.4. When we look at the columns containing the relative percentage roles for these two sets of variables, we can note that the unique percentage role for the PRCS factors exceeds that of HB in each region and at every grade level, although the extent of this departure is usually smaller at the sixth than at the higher grade levels. In some regions, most notably the Great Lakes, Plains, and Far West, the magnitude of the unique percentage for PRCS also exceeds that of the common portion. Hence, the motivational variables (as indexed by PRCS) account for more variance in ACHV relative to the HB set in some regions than in others (note that the Southwest almost falls in this category too). We are inclined to regard the common portions as reflecting achievement-related correlates of social class membership. We therefore feel that most of these portions might be classified as part of the HB rather than as part of the PRCS set. However, even if we were to make this kind of classification, the unique percentage role for PRCS would still be large; in fact, it would often exceed those of HB and the common portion combined. This is particularly so at the twelfth grade.

Our third question is:

3. When FB and SCH are analyzed together, what is the magnitude of their respective roles in ACHV?

We may recall that FB is comprised of the two home background and four family process measures taken together, a set of six factors in all. Before we proceed further with this question, however, it may be instructive to examine the degree to which students who are similar with regard to FB and ACHV attend school with one another

for the magnitude of these associations will have a definite influence on the kinds of inference we make. These percentages are given in table B.3. Perusal of this table shows a tendency for the values to decline at the higher grade levels. We interpret this as reflecting the "feeder school effect," whereby students of dissimilar backgrounds tend to be channeled into the same schools at the higher grade levels.

For SES, the regional percentages tend to depend in part on grade level, since they are largest in the Northeast and Mid-Atlantic at the lower grades and smallest in the Southwest. At the higher grade levels, the regional values tend to be closer together: they remain smallest in the Southwest and tend to become largest in the Southeast, Northeast, Mid-Atlantic, and Plains. On the average (i.e., the mean of the five grade levels), these regional values range from high to low as follows: Northeast (26.8); Mid-Atlantic (25.2); Southeast (24.8); Plains (21.6); Great Lakes (18.4); Far West (15.6); and Southwest (9.0).

For FSS, the regional values tend to be low and fairly close together, except in the Northeast. Just why these values should be so high in this region for this particular variable (especially at the third grade) is not clear. If they were merely due to the small sample of schools, then we would expect similar aberrations for the other variables. Since we do not observe such aberrations, we are inclined to believe that the values reflect, in part, peculiarities of the respondents (for instance, teachers at the third grade unable to answer some of these items). For the remaining regions, the lower grade values tend to be slightly higher in the Far West, Mid-Atlantic, and Southeast. On the average the regional values run from highest to lowest as follows: Northeast (19.2); Plains (5.2); Southeast (5.0); Far West (4.8); Mid-Atlantic (4.0); Great Lakes (3.2); and Southwest (3.0).

For ACHV, the lower grade values are somewhat smaller in the Far West and Southwest than elsewhere. On the average, the values run from high to low as follows: Southeast (16.2); Mid-Atlantic (14.2); Northeast (13.6); Plains (11.0); Great Lakes (8.6); Far West (7.6); and Southwest (7.2).

For the remaining variables, adequate representation was not available for grades one and three. Consequently, percentages are available only for the higher grade levels. For EXPTN, the regional values are very low and close together. On the average (i.e., mean of the three grade-level values), the Southeast is highest (4.3); followed in descending order by: the Northeast and Mid-Atlantic (3.0); Far West (2.7); and all the remaining regions (2.3 each). For ATTUD, the regional averages range from high to low as follows: Southeast (7.7); Southwest (7.3); Mid-Atlantic (4.7); Far West (4.0); and all the remaining regions (3.7 each). The percentages for EDPLN tend to be slightly higher than for the other attitudinal and motivational variables. These values, on the average, range from high to low in the following manner: Mid-Atlantic (10.3); Northeast (9.0); Southeast (8.3); Plains (6.0); Great Lakes (5.3); Southwest (4.7); and Far West (3.7). The final variable, HBTS, is, on the average, highest in the Plains (5.7) and Southeast (5.3), followed by the Southwest (4.3), Northeast and Mid-Atlantic (3.7 each), Far West (3.0), and Great Lakes (2.7).

Across all variables, then, the average percentages (obtained by averaging the grade-level averages across all seven variables) are largest in the Northeast (11.3, produced in part by the high values for FSS), followed closely by the Southeast (10.2) and the Mid-Atlantic (9.3). Intermediate in value are the Far West (8.3) and the Plains (7.9), while the lowest overall percentages occur in the Great Lakes (6.3) and Southwest (5.4). We might anti-

Table B.3.—Percentage of Variance in Individual Student Variables Associated With the Schools Students Attend, by Region and Grade Level: Whites

Region	Socio-Economic Status (SES)					Family Structure and Stability (FSS)					Achievement (ACHV)				
Northeast	38	39	18	17	22	14	52	24	4	2	17	20	13	8	10
Mid-Atlantic	32	32	17	21	24	8	5	4	2	1	15	19	14	13	10
Great Lakes	23	23	12	15	19	4	5	4	2	1	12	11	10	5	5
Plains	28	21	17	23	19	6	6	5	4	5	16	16	9	8	6
Far West	19	22	11	12	14	9	5	5	3	2	10	12	8	5	3
Southwest	7	12	7	8	11	3	3	3	3	3	9	10	5	6	6
Southeast	28	27	21	22	26	5	8	7	3	2	18	22	17	11	13
Total	26	27	16	19	22	7	10	6	3	2	17	17	13	10	10
Grade Level:	1	3	6	9	12	1	3	6	9	12	1	3	6	9	12

Region	Expectations for Excellence (EXPTN)			Attitude Toward Life (ATTUD)			Educational Plans and Desires (EDPLN)			Study Habits (HBTS)		
Northeast	2	4	3	3	6	2	5	10	12	4	3	4
Mid-Atlantic	4	3	2	6	5	3	6	12	13	6	3	2
Great Lakes	3	2	2	4	6	1	5	4	7	5	2	1
Plains	4	2	1	5	3	3	6	8	4	7	5	5
Far West	3	3	2	3	4	5	3	4	4	4	3	2
Southwest	3	2	2	3	9	10	4	5	5	4	5	4
Southeast	6	3	4	8	9	6	9	8	8	10	3	3
Total	4	3	3	5	7	5	6	8	9	6	3	3
Grade Level.	6	9	12	6	9	12	6	9	12	6	9	12

pate, then, that in the ensuing analyses there will be somewhat more confounding of family background and school factors in Achievement for some of these regions than for others.

Let us turn next to these analyses. In chapter 6 the set called SCH contained 10 variables, 5 pertaining to the student body and 5 to the teaching staff. Because of the small number of schools represented in our samples for some regions, in these analyses we shall use only one variable to represent possible school influences. This variable will be the student body counterpart of the dependent variable (i.e., the mean achievement of all students in a school at that grade level). In order to get an idea of how much explanatory power we are sacrificing by using a single school variable in lieu of 10 school variables, we can compare, over all schools, the percentage of variance in ACHV explained when the other 9 school variables are first included with Student Body's Achievement, and the 6 family background variables are left out of the analyses. For example, if we let:

$\triangle = RSQ[FB,SCH(10)] - RSQ[FB,SCH(1)]$

then these percentage values for grades 12, 9, and 6 are, respectively, 1, 0, and 1. Hence, for whites, over all schools, very little loss in explanatory power takes place when these nine school variables are deleted. Of course, the loss might be much greater for separate regional groups. Let us see, then, how these regional analyses compare if we use the six family background variables and the single school variable of Student Body's Achievement (here designated SCH). These analyses are given in the last columns of table B.2.

Inspection of the column labeled "RSQ(FB, SCH)" in table B.2 shows that from roughly one-third to, on occasion, almost one-half of the differences among students in ACHV can be explained by these combined sets of variable, and that the values are lower in the Far West and Southwest than elsewhere. In each region, these percentages tend to increase uniformly as one ascends the grade levels. The increases are probably due to the reasons already cited in connection with this same table. When the percentages in this column are compared with those in the "RSQ(HB, PRCS)" column, we can note that an increase of from 1 to 5 percent takes place when SCH is brought into the analysis. When we examine the relative percentage roles for FB and SCH, we can see that the role of FB is very large and that of SCH very small. As in the previous set of analyses, we incline to regard the common portions as reflecting family background influences that, although they are confounded with school influences, more likely belong to FB than to SCH. Hence, for whites in all regions, the unique percentage role attributable to school factors is small in both an absolute and a relative sense; in fact, it is completely overshadowed by the percentage role for family background factors. Although some regional differences in these relative roles do exist, they do not appear to lend themselves to any simple interpretation.

Our fourth question is:

4. What is the magnitude of the roles played by HB and SCH in ACHV and the four motivational factors combined?

Since there were so few schools in the regional samples at the ninth and twelfth grades, we performed these analyses only for the sixth grade.[1] We used the same two home background and ten school variables as described in chapter 6, and the same multivariate commonality technique. The results of these analyses are given in table B.4. Inspection of this table shows that the MR-square is largest in the Southeast, intermediate in the Plains and Mid-Atlantic, and smallest in the remaining regions. The unique percentages for HB and SCH tend to be more nearly equal than those observed heretofore. The major exception is in the Southwest, where the role of HB factors is about twice that of SCH factors. In the footnote of table B.4, we can note that this trend tends to hold for the other grade levels, but to a greater degree for the twelfth than for the ninth grade. To us, it appeared significant that, when a more comprehensive set of student variables—i.e., one that included motivational considerations—was used as the dependent set, school factors came to assume a role more nearly equal to that of home background factors.

Our next series of questions deals with the nature of mean differences among regions. We introduce them by asking:

5. How much of the total variance among white students on each of the family background and achievement variables can be associated with their membership in the various regional groups?[2]

The results of these computations are given in table B.5. Examination of these percentages shows that they tend to be small for each grade level, but that they increase slightly at the higher grades. On the average, SES and ACHV tend to have the largest percentage values, on the order of 2 percent. Next largest are the values for FSS, which are on the order of 2 percent; the remaining values taper off

[1] The 10 school variables were used because this set, known as SCH, included the student body counterparts of the 5 dependent variables. It was necessary to include these five in order to give at least minimal representation to school differences on these factors.

[2] The way in which these percentages were computed is described in chapter 6. Here, only the grades for which complete data were available were used.

Table B.4.—Multivariate Commonality Analyses of Home Background and School Factors in Achievement and Motivation for Sixth-Grade Whites

Region	MRSQ (HB, SCH)	Unique HB	Common	Unique SCH
Northeast	40	42	18	40
Mid-Atlantic	49	44	19	37
Great Lakes	41	39	12	49
Plains	48	42	13	45
Far West	38	48	10	42
Southwest	39	60	8	32
Southeast	60	37	21	42
Total	48	41	16	43
[a]The "Total" values for the other grade levels are:				
Grade 12	52	42	16	42
Grade 9	57	50	15	35

Table B.5.—Percentage of Total Variance in Individual Student Variables Associated with Regional Differences, by Grade Level: Whites

Variable	Grade Level			
	Twelfth	Ninth	Sixth	Average
Socio-Economic Status	3	2	2	2.3
Family Structure and Stability	1	1	1	1.0
Expectations for Excellence	1	0	0	.3
Attitude Toward Life	1	0	0	.3
Educational Plans and Desires	1	1	0	.7
Study Habits	0	0	0	0
Achievement[a]	2	2	2	2.0

[a] Corresponding values for the third and first grades with 69,385 and 39,816 white students, were 1 and 3, respectively

to zero or near zero. On the basis of these percentages we must conclude that, for whites, regional membership does not play a large role in explaining differences among individual students. We shall continue our analyses through to completion in order to learn what we can about these regional differences. However, we must bear in mind that they are never large.

Our next question is:

6. For Achievement and each of the family background variables, which regions score high and which low?

In order to answer this question, we ranked the regional means for each variable so that a low rank indicated a high mean. There was sufficient consistency across the three grade levels to average these ranks for each variable and then rerank the averages.[3] These composite ranks are given in table B.6, which shows that, for some of the variables, there is a tendency for the same regions to rank high or low, whereas between others there seems to be an inverse relationship. For example, the Northeast and Mid-Atlantic tend to rank high on SES, ATTUD, and ACHV, whereas the Southeast and Southwest tend to rank low on these same variables. For EXPTN, just the reverse is true (i.e., the Southeast and Southwest rank highest while the Northeast and the Mid-Atlantic are lowest). These consistencies suggest that there may be such a marked degree of interdependence among three or four of these variables that one or two factors could be used to describe it. Accordingly, our next question is:

7. What degree of interdependence exists among the regional ranks?

As in chapter 6, the degree of interdependence is assessed by intercorrelating the variables and subjecting these intercorrelations to a principal components analysis. If the intercorrelations are large, we shall require only one or two components to account for their covariance, but several if they are low. The results of these analyses are given in table B.7, which shows that: (*a*) three principal components can be used to describe the interrelationship of these ranks; (*b*) the three account for almost all this interdependence. Some grade-level differences do occur, with the first and second principal components accounting for somewhat more of the variance at the sixth than at the higher grades. However, enough consistency was observed across grade levels for us to accept the components computed on the average of the ranks (actually, their ranked sums) as being representative.

Our next question is:

8. Can the principal components be transformed to produce a meaningful description of the subgroups of variables?

The varimax transformation of these components is given in table B.8. An examination of the variables with high and low coefficients on these factors suggests that the first one might be called "general well-being," since all the variables contribute to it in a positive manner (although not all to the same degree). Most salient on this factor are SES, EXPTN, ATTUD, EDPLN, and ACHV. The second factor, as indicated by HBTS and ATTUD, ap-

[3] When the ranks for each variable were correlated across grade levels, they ranged from a low of 61 for HBTS and EDPLN, to a high of 100 for SES. The majority (actually 70 percent) were in the 80 to 100 range.

Table B.6.—Rank Order of Each Region on Individual Student Variables, Averaged by Grade Level: Whites

Variable	Regions						
	NE	MA	GL	PL	FW	SW	SE
Socio-Economic Status	2	1	5	4	3	6	7
Family Structure and Stability	5.5	2	1	3	7	5.5	4
Expectations for Excellence	7	6	5	3	4	2	1
Attitude Toward Life	3	1.5	4	1.5	5	7	6
Educational Plans and Desires	4.5	2	6	3	1	4.5	7
Study Habits	4	1.5	5	1.5	6	7	3
Achievement	2	3	4	1	5	6	7

NOTE.—NE = Northeast, MA = Mid-Atlantic, GL = Great Lakes, PL = Plains; FW = Far West; SW = Southwest, SE = Southeast. A low rank indicates a high mean.

Table B.7.—Principal Components Analysis of Regional Differences in Individual Student Variables: Whites

Grade level	Percentage of Variance Accounted for by:		
	1	1 & 2	1, 2, 3
Twelfth	55	77	91
Ninth	48	71	87
Sixth	72	89	95
Average	56	81	91

Table B.8.—Varimax Rotated Principal Components of the Regional Intercorrelations

Variable	Factors		
	1	2	3
Socio-Economic Status	93	07	36
Family Structure and Stability	12	86	−49
Expectations for Exellence	99	−02	−17
Attitude Toward Life	69	69	23
Educational Plans and Desires	51	14	85
Study Habits	18	95	24
Achievement	82	53	21

pears to reflect a certain view of life that may arise from intact family situations (FSS), and that, to a degree, may spill over into ACHV. We will give this factor the provisional name of "immediate and/or intimate parental involvement in schooling." The third factor, with its high values for EDPLN and SES, appears to merit the name of "belief in education and intent to affect one's future lot in life through it." The high negative value for FSS on this index suggests to us that this intent might be greatest where access to higher education is great but family structure ranks low. This leads us to our next question:

9. What is the relative status of each region on the factors obtained in table B.8?

These ranks, computed in the same manner as those in chapter 6, are given in table B.9. For our first factor, "general well-being," the Plains, Mid-Atlantic and Far West rank highest, while the Southeast and Southwest rank lowest. For our second factor, "immediate and/or intimate parental involvement in schooling," the Plains, Mid-Atlantic and Great Lakes rank highest, while the Far West and Southwest rank lowest. For our third factor, "belief in education and intent to affect one's future lot in life through it," the Mid-Atlantic and Far West rank highest, while the Great Lakes and Southeast rank lowest. More generally, we can note that a region that ranks high or low on one of the factors tends to rank in a similar manner on the others. Hence, considering the techniques used, these differences are not as unrelated as we would prefer them to be.[4]

Our final question in this series actually pertains to a sequence of analyses concerned with the explanatory role of different sets of variables at the individual and at the regional level. It is:

10. What happens to the roles of FB and SCH in ACHV when the analysis shifts from the individual to the regional level?

It will be recalled from chapter 6 that there was one type of regional analysis, called "Among," which was performed on the regional means, and two types of individual analysis: the "Within" type, which consisted in subtracting the mean for each individual's region from his scores and then performing regressions on these adjusted scores; and the "Total" type, which was performed on the scores for individual students without regard to region. Such analyses for the explanatory roles of SES and FSS are given in the first three rows of table B.10. Inspection of the "RSQ" columns shows that less than 0.25 of the differences among students in their ACHV is explained by these two variables at the individual level, whereas upwards of 0.8 of the differences among regions are explained by these same variables. Comparison of the relative percentage roles for these two variables shows that SES can carry most of the explanatory role for all levels. In a similar manner, the explanatory role of FSS is always small. Hence, for whites, the magnitude of the explanatory roles played by SES and FSS at the individual and regional levels are similar but by no means identical, with SES assuming the major role.

The middle rows of table B.10 contain the results of similar analyses for HB and PRCS. Inspection of the "RSQ" columns shows that the percentage of variance in

Table B.9.—Rank of Weighted Averages for Each Region by Rotated Component: Whites

Region	Factors 1	2	3
Northeast	4	4	3
Mid-Atlantic	2	2	1
Great Lakes	5	3	6
Plains	1	1	4
Far West	3	6	2
Southwest	6	7	5
Southeast	7	5	7

[4] Although we must recognize from table B.5 that the regional differences were small initially, and that the use of ranks of factor means tends to obscure these differences even more.

Table B.10.—Commonality Analyses of Family Background and School Factors in Achievement for "Total," "Among," and "Within" Analyses, by Grade Level: Whites

Type	Twelfth Grade RSQ (SES,FSS)	Unique SES	Common	Unique FSS	Ninth Grade RSQ (SES,FSS)	Unique SES	Common	Unique FSS	Sixth Grade RSQ (SES,FSS)	Unique SES	Common	Unique FSS
Total	17	90	9	-1	21	82	16	2	17	81	14	5
Among	88	89	-6	17	84	72	20	8	88	79	17	4
Within	16	89	10	1	21	81	17	2	16	81	14	5
	RSQ (HB,PRCS)	Unique HB	Common	Unique PRCS	RSQ (HB,PRCS)	Unique HB	Common	Unique PRCS	RSQ (HB,PRCS)	Unique HB	Common	Unique PRCS
Total	39	6	36	58	37	10	47	43	29	18	41	41
Among	100	8	80	12	100	10	74	16	100	11	77	12
Within	39	4	36	60	37	8	48	44	29	18	39	43
	RSQ (FB,SCH)	Unique FB	Common	Unique SCH	RSQ (FB,SCH)	Unique FB	Common	Unique SCH	RSQ (FB,SCH)	Unique FB	Coommn	Unique SCH
Total	44	77	12	11	40	75	18	7	35	63	20	17
Among	100	0	100	0	100	5	95	0	100	0	100	0
Within	43	82	10	8	39	78	16	6	34	67	17	16

ACHV explained by each of these sets of variables is very much the same for the two individual-level analyses (i.e., "Total" and "Within"), being in the neighborhood of one-third, whereas at the regional level the two sets explain all the variance. Further, at the individual level the percentage role of PRCS far outweighs that of HB, whereas at the regional level most of the explained variance is confounded, so that regional differences in ACHV could just as easily be explained by the one set as by the other. We conclude, then, that the relative explanatory roles of home background and family process factors differ considerably from the individual to the regional level.

The last rows of table B.10 give similar kinds of analysis for the set of six family background factors (i.e., HB and PRCS combined) and the set of ten school factors, as described in chapter 6. Examination of the "RSQ" columns shows that from roughly one-third to slightly less than one-half of the variance in ACHV is explained by these factors at the individual level, but all of it at the regional level. Further, at the individual level nearly all the explanatory power lies with family background, whereas at the regional level the percentage roles are almost completely confounded, so that these differences in ACHV could as readily be explained by the one set of factors as by the other. In summary, the analyses in this section have shown that, for white American students:

1. The role of Family Structure and Stability in Achievement is small in every region, and most of the relationship that does exist is confounded with that of Socio-Economic Status.
2. In every region, the percentage of variance in Achievement explained by Family Process exceeded the percentage explained by Home Background, and this percentage remained substantial even when the common portion was assigned to Home Background.
3. When Home Background and Family Process were combined into a single set known as Family Background, and their percentage role in Achievement compared with that of the 10 school factors known as School, it was noted that, in every region, the role of Family Background vastly exceeded that of School by a factor that ranged from 4 to 1 to, on occasion, 30 to 1.
4. When Achievement and Family Process were together regarded as a set that could be influenced by both Home Background and School, it was observed that, for most regions, the percentage role of School came to equal or exceed that of Home Background, and that this trend became more pronounced at the higher grade levels.[5]
5. The association of Achievement and Family Background with regional membership was never large, being on the order of 2 percent for Achievement and Socio-Economic Status, and less for the other variables.
6. Three factors were found to account for nearly all the regional mean differences on Achievement and Family Background. These factors were interpreted as reflecting (a) "General well-being" (to which all seven variables contributed positively); (b) "immediate and/or intimate parental involvement in schooling"; (c) "belief in education and intent to affect one's future lot in life through it."
7. Comparative analyses of the role of regional differences (called "Among" analyses) and of individual differences (called "total" and "Within" analyses) in Achievement showed that, for Socio-Economic Status and Family Structure, the explanatory roles were similar. They also showed that most of the explanatory weight was being carried by Socio-Economic Status, whereas for the other pairs of variables (i.e., Home Background compared with Family Process and Family Background compared with School), the explanatory roles were very different at the different levels. We concluded that results for one level could not be considered indicative of what would obtain for the other level. We also pointed out that, at the regional level, the explanatory roles of these different sets were completely confounded, and that the differences could therefore be explained as readily by the one set as by the other, whereas this was not so at the individual level.

B.2. REGIONAL VARIATIONS FOR NEGRO AMERICANS

We turn next to Negro Americans because they are both the most populous and the most dispersed minority group and, in consequence, are adequately represented in all the regional groups, as can be seen from table B.11. Examination of this table shows that the numbers of schools for some of the regional groups, most notably the Northeast and Plains, are so small that we must exercise great caution in interpreting analyses based upon them.[6] We will use the same series of questions as before.

1. What is the magnitude of the role played in Achievement (ACHV) by Family Structure and Stability (FSS) before and after allowance has been made for Socio-Economic Status (SES)?

The results of analyses designed to answer this question are given in the first set of columns in table B.12. Inspection of the "RSQ(SES, FSS)" column shows that these percentages do not fluctuate in a consistent manner across grade levels or regions. For example, in the Northeast they increase at the higher grade levels, in the Southwest they rise at the ninth grade to fall again at the twelfth, and in the Plains they drop at the ninth grade to rise again at the twelfth. Similarly, at the twelfth grade the Northeast has

[5] Only the sixth grade had enough schools to support regional analyses, while only "Total" grade-level analyses were conducted for the higher grade levels.

[6] Many minority group students attend the same schools. We can therefore expect some overlap in the number of schools represented for each separate group. In addition, some minority group students attend schools with whites. For these groups as well, then, there will be some overlap in the schools represented. Analyses were not conducted at the first and third grades because accurate minority group identification was more difficult to obtain for them.

Table B.11.—Number of Students and Schools in Selected Regions, by Grade Level: Negroes

Region	Grade Level	Students	Schools	Region	Grade Level	Students	Schools
Northeast	12	191	10	Far West	12	1,526	41
	9	436	11		9	2,461	59
	6	247	31		6	2,120	123
Mid-Atlantic	12	4,614	72	Southwest	12	2,432	83
	9	8,650	117		9	3,107	100
	6	6,805	251		6	2,603	151
Great Lakes	12	1,809	44	Southeast	12	13,443	274
	9	3,003	67		9	18,496	305
	6	3,342	165		6	17,303	604
Plains	12	787	18	Total	12	24,802	542
	9	1,112	24		9	37,265	683
	6	1,151	47		6	33,571	1,372

Table B.12.—Commonality Analyses of Family Background and School Factors in Achievement, by Region and Grade Level: Negroes

Region	Grade Level	RSQ (SES,FSS)	Unique SES	Common	Unique FSS	RSQ (HB,PRCS)	Unique HB	Common	Unique PRCS	RSQ (FB,SCH)	Unique FB	Common	Unique SCH
Northeast	12	32	67	32	1	45	15	55	30	54	59	25	16
	9	12	61	28	11	28	11	30	59	34	78	7	15
	6	7	26	54	20	18	18	22	60	20	78	16	6
Mid-Atlantic	12	15	71	22	7	35	7	36	57	40	70	17	13
	9	16	79	18	3	30	14	38	48	34	68	21	11
	6	14	82	13	5	25	26	32	42	32	56	24	24
Great Lakes	12	10	96	3	1	28	5	29	66	30	91	3	6
	9	11	55	30	15	24	12	34	54	30	77	4	19
	6	8	69	16	15	19	18	24	58	23	76	8	16
Plains	12	17	85	12	3	37	8	39	53	44	75	10	15
	9	9	91	9	0	26	10	26	64	30	82	3	15
	6	13	82	10	8	25	21	31	48	26	86	9	5
Far West	12	8	80	18	2	26	6	27	67	29	93	−3	10
	9	13	57	31	12	26	14	38	48	28	89	4	7
	6	11	55	24	21	24	13	32	55	26	82	9	9
Southwest	12	9	92	6	2	28	8	23	69	31	88	3	9
	9	16	83	14	3	28	23	34	43	34	72	10	18
	6	10	78	14	8	21	22	26	52	27	68	9	23
Southeast	12	14	96	4	0	26	23	32	45	41	47	17	36
	9	16	89	10	1	29	19	35	46	37	50	26	24
	6	13	78	12	10	24	23	30	47	36	40	13	37
Total	12	15	92	7	1	28	22	33	45	43	50	15	35
	9	16	83	15	2	28	20	35	45	36	56	21	23
	6	13	77	14	9	24	25	30	45	34	51	19	30

the highest percentage and the Far West has the smallest, while for the sixth grade the Northeast is one of the lowest —and so on. What does seem apparent, with a few exceptions, is that the percentages tend to hover in the range of 8 to 15 percent. When we examine the unique percentages for SES and FSS, we can note that the latter percentage is always small and the former almost always large, if not very large; and even the common portion exceeds the percentage value for FSS. We must therefore conclude for Negroes, as for whites, that the relationship of FSS with ACHV is never large. Moreover, the relationship that does exist is highly confounded with SES, and there is no readily discernible trend across the regional groups.

2. When HB and PRCS are analyzed together, what is the magnitude of their respective roles in ACHV?

Results for these analyses are given in the center columns of table B.12. Inspection of the "RSQ(HB,PRCS)" column shows that for all regions except the Southeast there is an increasing value at the higher grades. As for whites, so too for Negroes we are inclined to feel that these grade-level differences reflect: (*a*) the changing composition of the indices in moving from grade 6 to grade 9; (*b*) the loss of the dropouts in moving from grade 9 to grade 12; (*c*) tendency for the factors represented by PRCS to pick up more variance. These values appear to

hover around the range of 20 to 30 percent, and to exceed this range at the twelfth grade. Inspection of the unique percentages for HB and PRCS shows that, in every region and for every grade level, the percentage for PRCS is much greater than that for HB, exceeding it by a factor that ranges from 2 to 1 to as much as 10 to 1. Even if we were to regard the common portion as belonging to HB, the percentage for PRCS would still tend, more often than not, to exceed them both. Hence PRCS tends to explain a substantial portion of the differences in ACHV among Negro students, and this is so independently of their HB. The portion explained tends to be in the range of 40 to 60 percent for each region at almost every grade level. However, there do not appear to be systematic differences in these relationships across the regions.

3. When FB and SCH are analyzed together, what is the magnitude of their respective roles in ACHV?

Before we proceed further with this question, it may be instructive to note, for each region, the extent to which Negro students attend school with others who are similar to themselves in FB and ACHV, for the magnitude of these relationships will have an effect on the kinds of inference we make about possible school influences. The percentages expressing the magnitude of these relationships are given in table B.13. Inspection of this table shows that the grade-level trends are not as consistent as those observed for whites in the previous section or those observed for all students in chapter 6. These differences may reflect the results of a smaller sample size, as well as, perhaps, some very real grade-level differences in the manner in which Negro students were "streamed" into schools in these different regions.

For Socio-Economic Status, on the average (i.e., the average of the three grade levels in each region), the highest values occur in the Northeast (18.7) and Southeast (15.0). The high value for the Northeast arises mainly from its high value at the sixth grade. It is difficult to say whether this value is due to the aberrations of a small sample or to a real relationship.[7] The Plains values are third highest (13.0), the Southwest and Mid-Atlantic tie for fourth highest (11.3), while the lowest values are for the Great Lakes and Far West (2.7). The values for FSS tend to be small and closer across regions. The major exception is in the Northeast, where the value for the ninth grade is unusually low and those for the sixth and twelfth grades are unusually high. On the average, the Northeast is by far the highest (2.4), with the Plains (4.7) and Southwest (2.7) running second and third respectively. Tied for fourth are the Mid-Atlantic and Far West (2.3), while the Great Lakes region is lowest of all (0.7).

For Achievement, the highest average values occur in the Southeast (21.0) and the next highest in the Mid-Atlantic (12.3) and Northeast (11.3). Then comes the Southwest (7.3) and Plains (7.0), with the Great Lakes (5.3) and Far West (3.3) lowest of all. For Expectations for Excellence, the regional values tend again to be low and close together in magnitude. The largest average values occur in the Southeast (5.7) and Southwest (5.3). Second highest are the Great Lakes (4.3) and Plains (4.0), while the Mid-Atlantic and Far West are tied for next to lowest (3.0). The Northeast has the lowest value of all the regions.

Attitude Toward Life has its largest values in the Southeast (16.3) and Southwest (11.0). The Mid-Atlantic is third highest (8.0), the Great Lakes and Far West tie for fourth (5.7), and the Northeast and Plains tie for lowest (3.7). The highest values for Educational Plans and Desires also occur in the Southeast (7.7) and Southwest (7.0), the next highest in the Mid-Atlantic (6.3), Plains (5.3), and Far West (3.0), and the lowest in the Northeast and Great Lakes (2.7). For Study Habits, the highest values occur in the Southeast (8.0), and the Great Lakes and Southwest (6.3) tie for second. The third-highest values occur in the Mid-Atlantic (5.7), Northeast (4.7), and Far West (4.0), with the Plains having the lowest ones (3.3).

In summary, over all regions the highest values, obtained by averaging each region's grade-level average for each of the seven variables, were to be found in the Southeast (10.8), and the second highest in the Northeast (9.6). These were followed by the Southwest (7.3) and Mid-Atlantic (7.0). The lowest values occurred in the Plains (5.9), Great Lakes (4.0), and Far West (3.4). How do these relationships affect our answer to question 3?

In order to conserve degrees of freedom for schools, we shall follow the same procedure as in section B.1 and use

[7] However, the erratic grade level variations for FSS and ACHV in this region suggest that they may be due to the small (and perhaps unusual) sample of schools.

Table B.13.—Percentage of Variation in Individual Student Measures Associated With the Schools Students Attend, by Region and Grade Level: Negroes

Region	Socio-Economic Status			Family Structure and Stability			Achievement			Expectations for Excellence			Attitude Toward Life			Educational Plans and Desires			Study Habits		
Northeast	38	8	10	39	1	32	4	8	22	5	1	1	1	4	6	3	2	3	5	5	4
Mid-Atlantic	10	13	11	2	3	2	14	11	12	3	4	2	5	11	8	4	6	9	6	5	6
Great Lakes	4	3	1	2	0	0	6	7	3	5	2	6	3	6	8	5	1	2	5	1	13
Plains	14	9	16	5	1	8	4	6	11	3	2	7	2	5	4	4	2	10	6	2	2
Far West	5	3	0	5	2	0	5	3	2	4	3	2	6	8	3	6	3	1	7	4	1
Southwest	8	10	16	3	2	3	9	9	4	5	5	6	5	11	17	7	4	10	8	5	7
Southeast	13	16	16	3	2	1	23	18	22	6	6	5	8	18	23	9	8	6	10	9	5
Total	12	13	15	3	2	2	16	16	19	5	5	6	6	14	17	6	6	6	8	7	5
Grade Level:	6	9	12	6	9	12	6	9	12	6	9	12	6	9	12	6	9	12	6	9	12

only one school variable, namely, Student Body's Achievement, in lieu of the set of 10 school variables. The loss of explanatory power experienced by this reduction, over all schools, is indicated by the following difference:

$$\Delta = RSQ[FB,SCH(10)] - RSQ[FB,SCH(1)]$$

For grades 12, 9, and 6 respectively, these values are 0, 2, and 2. Hence, although the loss of explanatory power is considerable in some individual regions, it is usually small.

The results of commonality analyses with these sets of variables are given in the last column of table B.12. Inspection of the "RSQ(FB,SCH)" column shows that, in each region save the Southwest, the values increase at the higher grade levels, very likely for the reasons already cited in our earlier analyses. Moreover, it is clear that in some regions the school variables, as represented by Student Body's Achievement, are picking up additional variance at the higher grade levels. In fact, perusal of the relative percentages for FB and SCH shows that there are some readily discernible regional differences. In each region the percentage for FB exceeds that for SCH. However, the extent of this departure is much less in the Southeast than elsewhere. On the average, the role of FB factors exceeds that of SCH by a factor of less than 2 to 1, whereas in the other regions this factor is always greater (usually, between 3 to 1 and 10 to 1). Even if we were to relegate the common portion to the FB set, we would still be inclined to regard the SCH percentage for the Southeast as being substantial; on the average, in fact, it is one-third of the explained variance. For the other regions, the SCH percentage is smaller; it is smallest of all in the Far West. However, these remaining regional differences do not lend themselves readily to interpretation of any kind. In summary, then, the role of SCH factors in ACHV is greatest in the Southeast and smallest in the Far West, whereas the reverse tends to be true for FB.

4. What is the magnitude of the roles played by HB and SCH in ACHV and the four motivational factors combined?

The results of these multivariate commonality analyses are given for the sixth grade (the only one with a sufficient number of schools available) in table B.14. Examination of this table shows that there are considerable fluctuations in the "MRSQ(HB,SCH)" values for the different regions. The largest values, occurring in the Northeast, Southeast, and Southwest, are roughly 20 percent greater than the smallest values, which occur in the Plains and Great Lakes. When we examine the relative percentage roles for HB and SCH, we can note that, in all regions except the Far West, the role of SCH is larger. Often, as in the case of the Northeast and Southeast, this departure is a substantial one. In addition, we can see from the footnote to table B.14 that the MR-squares and the unique percentages for SCH increase at the higher grades, while the unique percentage for HB decreases. Clearly, then, SCH accounts for a substantial portion of the variance in the set that consists of ACHV and PRCS combined. In some regions, the role of SCH substantially exceeds that of HB, even if all the common portion is assigned to the HB factors.

5. How much of the total variance among Negro students on each of the family background and achievement variables can be associated with their membership in the various regional groups?

We can see from table B.15 that these percentages (computation of which is described in chapter 6) are never large, although they do tend to increase over the grade levels. The largest association with regional differences is for ACHV, followed by SES. The four motivational variables known as PRCS show a much smaller association with regional membership, while FSS shows no relationship at all. It is difficult to speculate on whether or not these increasing values at the higher grade levels reflect a genuine regional effect. As we shall see later, virtually all these regional differences can be explained by either of a number of the same sets of variables at each grade level. However, it is obvious that these percentages are never large enough to make regional membership a major explanatory variable for understanding differences among individual Negro students on these variables.

6. For Achievement and each of the family background variables, which regions score high and which low?

As before, the regional means for each variable were ranked at each grade level. Although there was not a great deal of consistency in the ranks for some variables, they were nevertheless summed across grade levels. These sums were then ranked to obtain a composite grade-level

Table B.14.—Multivariate Commonality Analyses of Home Background and School Factors in Achievement and Motivation, for Sixth-Grade Negroes

Region	MRSQ (HB, SCH)	Unique HB	Common	Unique SCH
Northeast	66	30	0	70
Mid-Atlantic	48	36	15	49
Great Lakes	44	43	14	53
Plains	40	42	10	48
Far West	50	60	11	29
Southwest	60	34	8	58
Southeast	64	28	14	58
Total[a]	57	35	13	52
[a]The "Total" values for the other grade levels are				
Grade 12	80	24	8	68
Grade 9	67	33	11	56

Table B.15.—Percentage of Total Variation in Individual Student Variables Associated With Regional Differences, by Grade Level: Negroes

Variable	Grade Level Twelfth	Ninth	Sixth	Average
Socio-Economic Status	5	3	2	3.3
Family Structure and Stability	0	0	0	0
Expectations for Excellence	2	1	0	0
Attitude Toward Life	1	1	0	1
Educational Plans and Desires	1	1	0	.6
Study Habits	1	1	0	.6
Achievement	8	5	3	5.3

measure.[8] The ranks in question are given in table B.16, which shows what appear to be two or even three distinct groupings. The first grouping is suggested by the similar rankings for SES and ACHV, and the almost reverse ranking of EXPTN. A second, less clear-cut grouping is suggested by FSS, ATTUD, and HBTS. For the first grouping, the Northeast and Plains tend to rank highest on two of the variables, while the Southeast and Southwest rank among the lowest. For the second grouping, the regional ranks are not as consistent across variables.

7. What degree of interdependence exists among the regional ranks?

The mode of analysis used here is the same as that described earlier: the ranks are intercorrelated, and these intercorrelations are subjected to principal components analysis. The variance accounted for by successive numbers of these components is given in table B.17, which shows that, for most of the grade levels, a greater number of components is required to account for the rank intercorrelations than was required for whites. At the twelfth and ninth grades, as well as for the average ranks (or, more correctly, for the ranked sums of the grade-level ranks) four components were required, as compared with only three at the sixth grade.[9]

8. Can the principal components be transformed to produce a meaningful description of the subgroups of variables?

[8] The correlations of the ranks across grade levels ranged from a low of 21 for Socio-Economic Status between the sixth and Twelfth grades to a high of 96 for Study Habits and for Achievement between the sixth and twelfth grades. The majority (actually 61 percent) of the correlations across grades were in the 30-to-70 range. This averaging procedure was followed because, as will be shown later, the results were no less interpretable than those for the separate grade levels.

[9] We should recall that the computational rationale we are following extracts components with a root of one or greater, plus the next largest one of those that remain.

Table B.16.—Rank Order of Each Region on Individual Student Variables, Averaged by Grade Level: Negroes

Variable	Regions						
	NE	MA	GL	PL	FW	SW	SE
Socio-Economic Status	2.5	4	5	2.5	1	6	7
Family Structure and Stability	5	5	3	5	2	1	7
Expectations for Excellence	3.5	5.5	5.5	2	4	1	3
Attitude Toward Life	3.5	2	5	1	7	3.5	6
Educational Plans & Desires	3	7	5	1.5	4	1.5	6
Study Habits	5	2	6	1	7	3	4
Achievement	1	4	3	2	5	6	7

NOTE.—NE = Northeast, MA = Mid-Atlantic, GL = Great Lakes, PL = Plains, FW = Far West, SW = Southwest, SE = Southeast. A low rank indicates a high mean.

Table B.17.—Principal Components Analysis of Regional Differences in Individual Student Variables: Negroes

Grade Level	1	1-2	1-3	1-4
Twelfth	49	75	92	98
Ninth	42	73	92	98
Sixth	58	76	89	—
Average	46	76	92	98

Results of varimax rotations of the first four components are given in table B.18. These components do not lend themselves as readily to interpretation as did those for "Total" students in chapter 6 or for whites in section B.1.[10] One of our hypothesized groupings—the one that involved FSS, ATTUD, and HBTS—did seem to form a group with EDPLN (see factor 2). But the tendency was not a strong one. There was no sign of our other hypothesized groupings.[11] Actually, both ACHV and EXPTN are involved to a degree in all the factors, whereas SES is involved most heavily in the third. One set of interpretations that could be given to these factors might run as follows:

1. The first factor, with ACHV having the highest weight and EXPTN the lowest, appears to be an achievement-specific factor.
2. The second would look more like our earlier factor, "general well-being," if only SES were positive and had a higher value. Since this is not the case, and since all the motivational variables, plus ACHV and FSS, do have moderate-to-substantial weights on it, we shall call it "affective well-being."
3. The third factor, with its high weights for SES and EDPLN and its moderate weight for ACHV, seems to reflect a combination of economic well-being and intent to influence one's future through education.
4. The last factor appears to be characterized by what we might call an "intact family situation and its correlates."

It seems, then, that we can after all pose our next question:

9. What is the relative status of each region on the factors obtained in table B.18?

Table B.19 shows the ranks of each region's weighted average rank on each factor. On each of these factors the Southeast ranks consistently low, while the Plains region tends to rank high. Some of the other regions show

[10] Actually, the rotated components for the separate grade levels were not any more readily interpretable than the ones presented here. Three instead of four components were also rotated, with no greater success. Consequently, the four that were originally obtained are presented here.

[11] Described under question 8 of section B.1.

Table B.18.—Varimax Rotated Principal Components of the Regional Intercorrelations: Negroes

Variable	Factors			
	1	2	3	4
Socio-Economic Status (SES)	13	−10	89	−11
Family Structure and Stability (FSS)	−02	72	−08	69
Expectations for Excellence (EXPTN)	−28	22	13	15
Attitude Toward Life (ATTUD)	−06	98	22	10
Educational Plans and Desires (EDPLN)	−02	49	72	29
Study Habits (HBTS)	05	95	−11	−12
Achievement (ACHV)	50	30	32	29

Table B.19.—Rank of Weighted Average for Each Region, by Rotated Components: Negroes

Region	1	2	3	4
Northeast	1	4	2	4
Mid-Atlantic	4	3	6	5
Great Lakes	2	5	5	2
Plains	3	1	1	1
Far West	5	7	3	7
Southwest	7	2	4	3
Southeast	6	6	7	6

a much greater degree of fluctuation: for example, the Far West ranges from 3 to 7, while the Southwest ranges from 2 to 7.

10. What happens to the roles of FB and SCH in ACHV when the analysis shifts from the individual to the regional level?

These analyses, for the different sets of variables, are given in table B.20. Examination of the percentage values for SES and FSS shows that the R-squares tend to range from 12 to 16 percent at the individual level, and are slightly smaller for the "Within" than for the "Total" analyses. For the regional or "Among" analyses, these values jump up into the 80's and 90's. Examination of the respective percentage roles of SES and FSS shows that the largest explanatory role, in each case, accrues to SES. The percentage role for FSS is much smaller, while the common portion is moderate—even though it becomes negative at the twelfth grade. Clearly, then, at both the individual and regional levels of analysis, the explanatory role of SES exceeds that of FSS to a substantial degree, though more so at the individual than at the regional level. In addition, almost all the differences among regions in their achievement levels can be explained by differences among them in their socioeconomic status.

The next set of analyses, given in the middle rows of table B.20, pertains to the explanatory roles of HB and PRCS for these same levels. We can note that the R-squares for the two individual-level analyses ("Total" and "Within") range from 23 to 28 percent, and are slightly higher for the former than the latter. At the "Among" level, all the regional differences in ACHV can be explained by these two sets of variables. Perusal of the relative percentage values shows them to be fairly similar at the individual level, but virtually completely confounded at the regional level, though slightly less so at the sixth grade. Consequently, at the individual level most of the explanatory power lies with PRCS and the portion it shares with HB, while at the regional level ACHV differences can be explained about as well in terms of the one set as of the other.

The last of these analyses, given in the bottom rows of table B.20, focuses on the explanatory roles of the 6 family background and 10 school factors, as described in chapter 6. Inspection of the R-squares shows that, at the individual level, they vary from a low of a little better than 0.33 to a high of a little better than 0.40, with the values being somewhat smaller for the "Within" than for the "Total" analyses. For the "Among" analyses, on the other hand, they are once again 1.00. Examination of the relative percentage roles shows that they are roughly comparable for the "Total" and "Within" analyses (with the FB percentage being slightly greater for "Within"), whereas at the "Among" level the explanatory roles of the two sets are completely confounded. As a consequence, regional differences in Achievement can be explained as readily by the one set as by the other.

By way of summarizing, this section has shown that, for Negro American students:

1. In every region, the relationship of Family Structure and Stability with Achievement is never large, and that which does exist is highly confounded with a student's Socio-Economic Status. Further, there does not appear to be any trend in this relationship across regions.
2. In every region, the percentage of differences in Achievement explained by Family Process exceed-

Table B.20.—Commonality Analyses of Family Background and School Factors in Achievement for "Total," "Among," and "Within" Analyses, by Grade Level: Negroes

	Twelfth Grade				Ninth Grade				Sixth Grade			
Type	RSQ (SES,FSS)	Unique SES	Common	Unique FSS	RSQ (SES,FSS)	Unique SES	Common	Unique FSS	RSQ (SES,FSS)	Unique SES	Common	Unique FSS
Total	15	92	7	1	16	83	15	2	13	77	14	9
Among	94	54	36	10	92	98	−19	21	85	71	28	1
Within	13	91	8	1	14	80	17	3	12	76	14	10
Type	RSQ (HB,PRCS)	Unique HB	Common	Unique PRCS	RSQ (HB,PRCS)	Unique HB	Common	Unique PRCS	RSQ (HB,PRCS)	Unique HB	Common	Unique PRCS
Total	28	22	33	45	28	20	35	45	24	25	30	45
Among	100	2	92	6	100	0	92	8	100	14	71	15
Within	27	14	33	53	27	16	36	48	23	22	30	48
Type	RSQ (FB,SCH)	Unique FB	Common	Unique SCH	RSQ (FB,SCH)	Unique FB	Common	Unique SCH	RSQ (FB,SCH)	Unique FB	Common	Unique SCH
Total	43	50	15	35	38	53	20	27	36	48	17	35
Among	100	0	100	0	100	0	100	0	100	0	100	0
Within	39	60	10	30	35	62	12	22	34	52	16	32

ed that explained by Home Background. This percentage was substantial, even when its common portion was relegated to Home Background. However, systematic regional trends were not observed.

3. When Home Background and Family Process were combined into a single set of variables called Family Background and their percentage role in Achievement compared with that of School, it was noted that the percentage role of Family Background exceeded that of School factors in all regions and at all grade levels by a factor that ranged from as much as 10 to 1 to as little as 2 to 1. The extent of this departure was always smallest in the Southeast and tended to be greatest in the Far West.
4. When Achievement and Family Process were taken together as a set that could be influenced by both Home Background and School, it was observed that for most regions at the sixth grade (the only grade for which regional analyses were conducted) the percentage role for School exceeded that of Home Background, often to a substantial degree. This tendency increased at the higher grade levels (for which regional analyses were not conducted). It was also observed that this percentage would be substantial even if the common portion were relegated to Home Background.
5. The association of Achievement and Family Background with regional group membership was never large; in fact, it was on the order of 3 percent for Socio-Economic Status, 5 percent for Achievement, and 1 percent or less for the remaining variables.
6. Four factors were found to account for virtually all the differences among the regional means. These were interpreted as reflecting "achievement-specific differences," "affective well-being," "economic well-being and intent to influence one's future through education," and "intact family situations."
7. Comparative analyses of regional differences (the "Among" analyses) versus individual differences (the "Total" and "Within" analyses) in Achievement showed that, for Socio-Economic Status and Family Structure and Stability, the results for the different levels were somewhat similar, in that most of the explanatory weight was carried by Socio-Economic Status. In fact, virtually all the regional differences in Achievement could be explained by regional differences in Socio-Economic Status. The other paired comparisons (Home Background versus Family Process and Family Background versus School) revealed a very different distribution of explanatory power at the individual and regional levels. Consequently, results from one level could not be considered indicative of results for the other level. Indeed, at the regional level the explanatory roles of these latter sets of variables were completely confounded. Hence the regional differences in Achievement could be explained as well by the one set as by the other.

B.3. REGIONAL VARIATIONS FOR MEXICAN-AMERICANS

In this section, and in those that follow, we deal only with selected regions in which: (a) census data indicates a sufficient concentration of the ethnic group being studied; (b) we have sufficient representation of that group in the sample. For Mexican-American students, the Southwest and Far West fulfill these conditions, even though not as many schools are represented at the higher grades as we would like. These figures are given in table B.21. We shall ask the same series of questions as before.

1. What is the magnitude of the role played in Achievement (ACHV) by Family Structure and Stability (FSS) before and after allowance has been made for Socio-Economic Status (SES)?

The first few columns of table B.22 show that the percentage of variance in ACHV explained by SES and FSS

Table B.21.—Numbers of Students and Schools in Selected Regions, by Grade Level: Mexican-Americans

Region	Grade Level	Students	Schools
Southwest	12	445	48
	9	909	77
	6	1,304	137
Far West	12	895	51
	9	1,552	78
	6	1,386	182
Total[a]	12	1,340	99
	9	2,461	155
	6	2,690	319

[a] Represents the Southwest and Far West regions combined.

Table B.22.—Commonality Analyses of Family Background and School Factors in Achievement, by Region and Grade Level: Mexican-Americans

Region	Grade Level	RSQ (SES,FSS)	Unique SES	Common	Unique FSS	RSQ (HB,PRCS)	Unique HB	Common	Unique PRCS	RSQ (FB,SCH)	Unique FB	Common	Unique SCH
Southwest	12	3	57	11	32	20	2	14	84	35	46	12	42
	9	20	69	21	10	36	10	45	45	40	64	27	9
	6	17	40	14	46	30	11	47	42	34	63	25	12
Far West	12	7	66	21	13	29	4	20	76	30	94	3	3
	9	15	40	34	26	29	12	41	47	33	67	21	12
	6	17	34	23	43	26	19	46	35	35	56	19	25
Total	12	6	62	17	21	23	4	20	76	27	77	6	17
	9	17	53	28	19	32	11	44	45	36	64	25	11
	6	17	38	18	44	27	16	47	37	34	59	22	19

ranges downward from 20 percent, dropping considerably at the twelfth grade. Across grade levels, however, the values are not systematically greater for the one region than for the other. Inspection of the relative percentages for these sets shows the percentage of SES increasing at the higher grade levels and that of FSS tending to decrease. At the sixth grade in both regions, the unique role of FSS is greater than that of SES. Also, in both regions, the percentage role of FSS tends to be somewhat greater than we found it to be for Negroes and whites. Between the two regions, the most systematic difference is for the common portions (i.e., the confounding of SES and FSS) to be greater in the Far West than in the Southwest.

2. When HB and PRCS are analyzed together, what is the magnitude of their respective roles in ACHV?

The central columns of table B.22 show that, except at the twelfth grade, the percentage of variance in ACHV explain by HB and PRCS tends to be greater in the Southwest than in the Far West. The reversal at the twelfth grade may reflect a proportionately greater loss of low-achieving dropouts from the Southwest. For both regions the percentage role for HB decreases while that for PRCS increases, the latter to a substantial extent, at the higher grade levels. The regional differences between the roles do not appear to be large enough to be worth stressing.

3. When FB and SCH are analyzed together, what is the magnitude of their respective roles in ACHV?

Before proceeding further with this question, let us analyze the extent to which Mexican-American students in these regions attend schools with other students like themselves. Table B.23 shows that, for every variable at almost every grade level, there is a greater "streaming" effect in the Southwest than in the Far West. The average of the three grade-level values shows that this effect is most pronounced for Attitude Toward Life (14.7 for the Southwest versus 5.7 for the Far West), Achievement (15.3 versus 9.7), and Socio-Economic Status (15.3 versus 11.3). The differences between the two regions for the other variables are much less pronounced, their values being: 6.7 versus 4.0 for Family Structure and Stability; 5.3 versus 2.3 for Expectations for Excellence; 5.3 versus 4.0 for Educational Plans and Desires; and 7.0 versus 5.3 for Study Habits. Over all grade levels and across all variables, these percentages tended to be greater in the Southwest (9.9) than in the far West (6.0). At the same time, there was a slight tendency for the percentages to decline more rapidly at the higher grade levels in the Far West than in the Southwest.[12] Let us see, then, how the "streaming effect" might influence the explanatory role played by the school variables.

As before, we shall use only 1 school variable, Student Body's Achievement, in lieu of the full set of 10. The loss in explained variance caused by this substitution can again be indexed by forming the difference between the R-squares for the full set, viz, FB plus SCH(10), and the reduced set, viz, FB plus SCH(1). These differences, for the sixth, ninth, and twelfth grades, are, respectively, 1, 2, and 2.[13] Although these losses are small, they might have been greater in each region had we used the full set of 10 school variables. This, however, would have led us to capitalize too much on the peculiarities of a small sample.

Inspection of table B.22 shows that the percentage of variance explained by FB and the single school factor tends to decrease at the higher grade levels in the Far West. In the Southwest, however, it increases at the ninth grade and then decreases again at the twelfth grade. Similarly, these values tend to be slightly higher in the Southwest. In the Far West, the unique percentage role for the school variable (SCH) declines at the higher grade levels, while that of FB increases. In the Southwest, however, the unique percentage for SCH is greatest at the twelfth grade, while that of FB is lower than for the other grade levels. All the same, it is difficult to say to what extent these values represent systematic regional differences rather than aberrations due to the small sample of schools at the higher grades.

4. What is the magnitude of the roles played by HB and SCH in ACHV and the four motivational factors combined?

Table B.24 shows the results of these analyses, by region, for the sixth grade. Inspection of this table shows that the variance in the dependent variables accounted for by these two sets—i.e., the MR-squares—is somewhat greater in the Far West than in the Southwest. Further, the percentage role of HB is somewhat greater in the Far West, that of the common portion is somewhat greater in the Southwest, and the percentage roles of the 10 school factors are more nearly equal in both regions. The relative percentage roles for HB and SCH are nearly equal in the Southwest, whereas HB exceeds that of SCH in the Far

[12] Obtained by averaging the grade-level averages for each of the seven variables in each region.

[13] Computed on the total of Mexican-American schools and students in these two regions.

Table B.23.—Percentage of Variation in Individual Student Measures Associated With the Schools Students Attend, by Region and Grade Level: Mexican-Americans

Region	Socio-Economic Status			Family Structure and Stability			Achievement			Expectations for Excellence			Attitude Toward Life			Educational Plans and Desires			Study Habits		
Southwest	15	20	11	10	6	11	13	14	19	6	4	6	10	16	18	8	7	1	9	6	6
Far West	15	13	6	5	3	4	16	11	2	3	3	1	5	7	5	4	6	2	7	4	5
Total	15	16	9	8	6	7	14	13	6	4	3	3	7	12	11	8	6	5	8	6	5
Grade Level:	6	9	12	6	9	12	6	9	12	6	9	12	6	9	12	6	9	12	6	9	12

Table B.24.—Multivariate Commonality Analyses of Home Background and School Factors in Achievement and Motivation, by Region and Grade Level, for Sixth-Grade Mexican-Americans

Region	MRSQ (HB, SCH)	Unique HB	Common	Unique SCH
Southwest	55	37	23	40
Far West	67	49	14	37
Total[a]	58	47	17	36
[a]The "total" values for the other grade levels are.				
Grade 12	57	25	6	69
Grade 9	65	39	14	47

West. The footnote to table B.24 shows that the MR-squares increase at the ninth grade to decrease again at the twelfth. However, the percentage role of HB progressively declines and that of SCH progressively increases at the higher grade levels. We conclude, then, that school factors come to play an increasingly greater role at the higher grade levels.

5. How much of the total variance among Mexican-American students on each of the family background and achievement variables is associated with their membership in these two regional groups?

Table B.25 shows that the percentages are small to null for the most part. The lack of any stronger relationship may be due in part to the fact that we are dealing with only two regions, and that these regions are geographically contiguous. The only relationships that do emerge are slight ones for Family Structure and Stability, Study Habits, and Socio-Economic Status. When the regional means for these three variables were examined for each of the three grade levels, it was found that: (a) Family Structure and Study Habits each had consistently higher means in the Southwest than in the Far West; (b) Socio-Economic Status tended to have a higher mean in the Far West than in the Southwest (viz, for two of three grade levels).

In summary, then, we have seen that, for Mexican-American students in the Southwest and Far West:

1. In each region, the percentage role played by Socio-Economic Status in Achievement tended to exceed that of Family Structure, but the extent of this departure tended to be smaller than that observed for earlier groups. The main exception was the sixth grade, at which the percentage role of Family Structure actually exceeded that of Socio-Economic Status.
2. For each region, the percentage role of Family Process exceeded that of Home Background by a factor that ranged from a low of 3 to 1 to a high of more than 20 to 1. This was increasingly so at the higher grade levels.
3. For almost all grade levels in each region, the role of Family Background exceeded that of a set of school factors. This tended to become increasingly so at the higher grade levels; the one exception was the twelfth grade in the Southwest.
4. When Achievement and the four motivational variables (i.e., Family Process) were treated as dependent, the percentage roles of Home Background and the school factors were on a nearly equal footing in the Southwest. In the Far West, however, the role of the former tended to exceed that of the latter by a factor of about 1.3 to 1. The latter result was untypical, since the percentage role of school factors came increasingly to exceed that of Home Background by a factor of almost 3 to 1 at the higher grade levels (which were not differentiated by region).
5. The association of Achievement and Family Background with regional membership was negligible to null; in fact, only Family Structure and Stability, Study Habits, and Socio-Economic Status had values above zero.
6. For Family Structure and Stability as well as Study Habits, the regional means were higher in the Southwest; for Socio-Economic Status, they were higher in the Far West.

B.4. REGIONAL VARIATIONS FOR INDIAN AMERICANS

In this section we turn to an examination of these same kinds of relationship for Indian American students. The same regions used to classify Mexican-Americans (viz, Southwest and Far West) will also be used here. Such analyses are supported by both Census data and our sample, even though, as can be seen from table B.26, the representation of schools in the Southwest and at the higher grades in the Far West is somewhat meager. Our series of questions remains the same.

Table B.25.—Percentage of Total Variation in Individual Student Variables Associated With Regional Differences, by Grade Level: Mexican-Americans

Variable	Grade Level: Twelfth	Ninth	Sixth	Average
Socio-Economic Status	1	0	0	.3
Family Structure and Stability	1	3	0	1.3
Expectations for Excellence	0	0	0	0
Attitude Toward Life	0	0	0	0
Educational Plans and Desires	0	0	0	0
Study Habits	0	2	0	.7
Achievement	0	0	0	0

Table B.26.—Numbers of Students and Schools in Selected Regions, by Grade Level: Indians

Region	Grade Level	Students	Schools
Southwest	12	476	30
	9	713	39
	6	1,022	95
Far West	12	428	47
	9	745	69
	6	860	148
Total	12	904	77
	9	1,458	108
	6	1,882	243

1. What is the magnitude of the role played in Achievement (ACHV) by Family Structure and Stability (FSS) before and after allowance has been made for Socio-Economic Status (SES)?

Inspection of the first column in table B.27 shows that the percentage of variance in Achievement explained by SES and FSS is uniformly larger in the Southwest than the Far West and tends, for both regions, to be larger at the higher grade levels. When we examine the relative percentage roles for these two variables, we can note that the role of SES gets progressively larger at the higher grade levels, while that of FSS gets progressively smaller. Only at the sixth grade is the role of FSS substantial, and only in the Far West does it exceed that of SES. The most salient regional difference, then, appears to be in the extent to which FSS and SES explain differences in Achievement in the different regions.

2. When HB and PRCS are analyzed together, what is the magnitude of their respective roles in ACHV?

It will be seen from the central columns of table B.27 that, once again, the percentage of variance in Achievement explained by these two sets of variables is uniformly greater in the Southwest than in the Far West. When we examine the relative percentage roles for these two sets, we can note that the unique percentage for PRCS tends to exceed that for HB to a much greater extent in the Far West than in the Southwest. In fact, in the Southwest at the twelfth grade, the percentage role for HB is almost eight times greater than that for PRCS. In addition, the common portions tend to be somewhat greater in the Southwest. Hence, although more of the difference in Achievement among Indian American students are explained by these two sets of variables in the Southeast than in the Far West, PRCS plays a greater explanatory role relative to HB in the Far West than in the Southwest.

3. When FB and SCH are analyzed together, what is the magnitude of their respective roles in ACHV?

Before examining these analyses, we should first examine the extent to which Indian American students in these different regions go to school with others like themselves. Percentages expressing these relationships are given in table B.28. From this table we can note that, for SES, ACHV, and FSS, this "streaming" effect is more pronounced in the Southwest than in the Far West. However, for EXPTN, ATTUD, EDPLN, and HBTS, those percentages tend to be slightly greater in the Far West than in the Southwest. For example, the averages for the Southwest and the Far West are, respectively: 6.0 versus 6.3 for Expectations for Excellence; 11.0 versus 15.3 for Attitude Toward Life; 3.7 versus 8.0 for Educational Plans and Desires; and 7.0 versus 8.0 for Study Habits. For all variables, the grade-level averages are slightly greater in the Southwest than in the Far West. This is so despite the Southwest's higher values for Home Background and Achievement and the Far West's higher values for Family Process.

We return now to the respective roles of FB and SCH in ACHV. Here, as in previous sections, we shall use only 1 school factor, namely, Student Body's Achievement, in lieu of the full set of 10 school features. The resulting losses in percent of variance explained, computed for all students and schools for these regions, are: 4 (grade 12); zero (grade 9); and 2 (grade 6). Accordingly, the regional differences may be understated.

Turning now to the right-hand columns of table B.27, we find that the percentage of variance in Achievement explained by Family Background and School is once again greater in the Southwest than in the Far West. Inspection

Table B.27.—Commonality Analyses of Family Background and School Factors in Achievement, by Region and Grade Level: Indiana

Region	Grade Level	RSQ (SES,FSS)	Unique SES	Common	Unique FSS	RSQ (HB,PRCS)	Unique HB	Common	Unique PRCS	RSQ (FB,SCH)	Unique FB	Common	Unique SCH
Southwest	12	44	97	2	1	48	63	29	8	53	42	47	11
	9	27	65	29	6	38	26	45	29	41	63	31	6
	6	27	51	17	32	37	26	46	28	46	58	23	19
Far West	12	19	90	10	0	37	21	31	48	46	66	15	19
	9	11	70	23	7	21	9	42	49	25	62	20	18
	6	13	28	18	54	26	21	28	51	34	53	22	25
Total	12	30	95	5	0	37	48	33	19	45	51	32	17
	9	16	68	25	7	26	17	45	38	30	63	24	13
	6	17	40	17	43	30	23	34	43	38	55	22	23

Table B.28.—Percentage of Variation in Individual Student Measures Associated With the Schools Students Attend, by Region and Grade Level: Indiana

Region	Socio-Economic Status			Family Structure and Stability			Achievement			Expectations for Excellence			Attitude Toward Life			Educational Plans and Desires			Study Habits		
Southwest	19	21	36	11	8	10	19	15	31	6	2	10	16	11	6	3	7	1	15	5	1
Far West	19	14	15	7	2	4	16	10	16	10	7	2	18	20	8	10	7	7	11	9	4
Total	19	17	27	9	4	8	18	11	22	9	7	5	17	19	7	7	7	4	12	8	4
Grade Level:	6	9	12	6	9	12	6	9	12	6	9	12	6	9	12	6	9	12	6	9	12

of their relative percentages shows that of School to be slightly greater in the Far West than in the Southwest, while the common portions tend to be greater in the Southwest than in the Far West. In addition, in the Far West the percentage role for Family Background tends to increase at the higher grade levels, while in the Southwest it increases at the ninth grade and then decreases again. The most salient regional differences, then, appear to be: (*a*) a greater percentage of the differences in Achievement is explained by these two sets of factors in the Southwest than in the Far West; (*b*) the school factors play a slightly greater role, relative to that of Family Background, in the Far West than in the Southwest.

4. What is the magnitude of the roles played by HB and SCH in ACHV and the four motivational factors combined?

Regional analyses for the sixth grade are given in table B.29. Inspection of the MR-squares shows them to be very similar for the two regions. Moving to the percentage roles, we find that, in each region, the role of SCH outweighs that of HB, with the extent of this departure being greater in the Far West than in the Southwest (by a factor of about 3 to 1 in the former, compared to one of 2 to 1 in the latter). The MR-squares for the "Total" values stay about the same at the ninth as at the sixth grade (see the footnote), but then increase substantially at the twelfth grade. The relative percentage roles stay about the same for HB at the higher grade levels, whereas for SCH they tend to decrease. At the sixth grade, then, SCH exceeds HB by a factor of almost 3 to 1, by one of 1.6 to 1 at the ninth grade, and by one of 1.3 to 1 at the twelfth grade. The most salient regional difference to appear in these analyses is for the role of SCH to exceed that of HB to a greater extent in the Far West than in the Southwest (of course, we have such figures for the sixth grade only). With respect to grade-level differences, the most salient trend is for the role of SCH to decrease at the higher grade levels, while that of HB stays about the same.

5. How much of the total variance among Indian American students on each of the family background and achievement variables can be associated with their membership in one of the regional groups?

These percentages, given in table B.30, are usually fairly small; the largest, for FSS at the twelfth grade, is on the order of 6 percent. For SES, FSS, and EXPTN, the percentages tend to increase slightly at the higher grades; for the other sets, they tend to decrease slightly. Over all three grade levels, the mean percentages are highest for FSS and HBTS, intermediate for SES and EXPTN, and lowest for ACHV, EDPLN, and ATTUD. For the most part however, these percentages are never large. When the regional means were examined for these seven variables, it was found that the Far West tended to rank highest in SES and ACHV, whereas the Southwest ranked highest, on the average, for the remaining variables.

In summary, we have seen for Indian American students that:

1. The percentage of variation among students in their Achievement that could be explained by Home Background, Family Background, and School, both alone and in combination, was always greater in the Southwest than in the Far West.
2. Socio-Economic Status almost always played a greater explanatory role than did Family Structure, and this tended to become increasingly so at the higher grade levels.
3. The set of motivational factors known as Family Process played a greater explanatory role than did Home Background factors. This tended to be so for both regions, although the extent of this departure was greater in the Far West than in the Southwest.
4. School factors were found to play a slightly greater role in Achievement, relative to Family Background, in the Far West than in the Southwest.
5. When Achievement and PRCS were taken together as a dependent set, it was found that the role of School exceeded that of Home Background, but that the extent of this departure was greater in the Far West than in the Southwest (these analyses could be performed only for the sixth grade).
6. At the higher grade levels, for these same kinds of analysis, the role of School decreased while that of Home Background stayed about the same.
7. The percentage of variation in Family Background and Achievement associated with regional membership was usually small, ranging downward from 6 percent or less.
8. Examination of the regional means for these same variables showed them to be higher for the Far West on Socio-Economic status and Achievement

Table B.29.—Multivariate Commonality Analyses of Home Background and School Factors in Achievement and Motivation, by Region and Grade Level: Sixth-Grade Indians

Region	MRSQ (HB, SCH)	Unique HB	Common	Unique SCH
Southwest	82	27	21	52
Far West	81	21	12	67
Total[a]	78	24	15	61
[a]The "Total" values for the other grade levels are.				
Grade 12	98	33	22	45
Grade 9	76	33	13	54

Table B.30.—Percentage of Total Variation in Individual Student Variables Associated With Regional Differences, by Grade Level: Indians

Variable	Grade Level Twelfth	Ninth	Sixth	Average
Socio-Economic Status (SES)	2	2	0	1.3
Family Structure & Stability (FSS)	6	2	0	2.7
Expectations for Excellence (EXPTN)	3	1	0	1.3
Attitude Toward Life (ATTUD)	0	1	0	.3
Educational Plans & Desires (EDPLN)	0	1	1	.7
Study Habits (HBTS)	3	4	0	2.3
Achievement (ACHV)	0	1	1	.7

and higher for the Southwest on the remaining variables.

B.5. REGIONAL VARIATIONS FOR ORIENTAL-AMERICANS

Members of our next ethnic group, Oriental-Americans, tend to be most heavily concentrated in the Mid-Atlantic and Far West, with the overwhelming majority in the latter region. Table B.31 shows that the numbers in our sample, no less than the census data, reflect this distribution. Both features of the sample should be borne in mind in the discussions that follow.

1. What is the magnitude of the role played in Achievement (ACHV) by Family Structure and Stability (FSS) before and after allowance has been made for Socio-Economic Status (SES)?

The left-hand set of columns in table B.32 shows that the percentage of variance in ACHV accounted for by SES and FSS tends to be greater in the Mid-Atlantic than in the Far West. Examination of the percentage roles for these two variables shows some distinct regional differences. Thus in the Mid-Atlantic the percentage role of FSS increases at the higher grade levels while that of SES, together with their common portion, decreases. In the Far West, on the other hand, the percentage role of SES increases at the higher grade levels while those of FSS and the common portion decrease. In the Mid-Atlantic, for two of three grade levels, the role of FSS exceeds that of SES, whereas in the Far West this does not occur for any grade level. For the most part, then, family structure plays a greater explanatory role in the Mid-Atlantic than in the Far West, and the magnitude of this role is at times substantial.

2. When HB and PRCS are analyzed together, what is the magnitude of their respective roles in ACHV?

Examination of the central columns of table B.32 shows that the percentage of variation in achievement explained by HB and PRCS tends to be greater in the Mid-Atlantic than in the Far West. Examination of the percentage values for the two sets shows that, in each region, the role of PRCS exceeds that of HB, and that the extent of this departure is much greater in the Far West than in the Mid-Atlantic. In addition, in the Far West the role of PRCS increases at the higher grade levels while that of HB decreases. The most salient result for this set of analyses, then, is that the role of PRCS exceeds that of HB, and that it does so to a greater extent in the Far West than in the Mid-Atlantic.

3. When FB and SCH are analyzed together, what is the magnitude of their respective roles in ACHV?

Before proceeding with these analyses, we should examine the extent to which Oriental-American students in these two regions attend school with other students who are similar to them in Family Background and Achievement. We can see from table B.33 that such "streaming" of students into schools is, on the average (viz, the average of the three grade levels), greater in the Mid-Atlantic than in the Far West for Socio-Economic Status (8.7 versus 7.3), Family Structure (5.7 versus 1.7), Achievement (13.0 versus 1.0), Attitude Toward Life (9.0 versus 3.3), and Study Habits (8.0 versus 3.3). For Educational Plans and Desires the regional averages are equal (1.0 each), whereas for Expectations for Excellence the average is slightly greater in the Far West than in the Mid-Atlantic (1.7 versus 2.3). For the average across all variables, however, the value for the Mid-Atlantic (6.7) exceeds that for the Far West (2.8).

Returning to question 3, we shall use the same convention as before and allow a single school variable, Student Body's Achievement, to represent a set of 10 school variables. The loss of variance in Achievement occasioned by this reduction was 4 percent for each of the three grade levels. It was computed by forming the difference between the R-squares for a set of 16 family background and school

Table B.31.—Numbers of Students and Schools in Selected Regions, by Grade Level: Oriental-Americans

Region	Grade Level	Students	Schools
Mid-Atlantic	12	135	24
	9	320	44
	6	141	55
Far West	12	1,168	30
	9	1,169	47
	6	504	77
Total	12	1,303	54
	9	1,489	91
	6	645	132

Table B.32.—Commonality Analyses of Family Background and School Factors in Achievement, by Region and Grade Level: Oriental-Americans

Region	Grade Level	RSQ (SES,FSS)	Unique SES	Common	Unique FSS	RSQ (HB,PRCS)	Unique HB	Common	Unique PRCS	RSQ (FB,SCH)	Unique FB	Common	Unique SCH
Mid-Atlantic	12	33	2	7	91	53	26	36	38	54	96	2	2
	9	14	25	29	46	34	5	38	57	34	90	7	3
	6	26	33	38	29	33	20	58	22	51	34	32	34
Far West	12	12	74	16	10	34	4	31	65	35	97	0	3
	9	16	52	25	23	37	8	35	57	37	100	0	0
	6	18	38	35	27	31	15	34	41	32	94	2	4
Total	12	17	28	26	46	40	7	35	58	40	99	0	1
	9	17	46	28	26	37	8	38	54	36	100	0	0
	6	20	34	36	30	32	15	48	37	35	83	8	9

Table B.33.—Percentage of Variation in Individual Student Measures Associated With the Schools Students Attend, by Region and Grade Level: Oriental-Americans

Region	Socio-Economic Status			Family Structure and Stability			Achievement			Expectations for Excellence			Attitude Toward Life			Educational Plans and Desires			Study Habits		
Mid-Atlantic	19	7	0	14	3	0	33	4	2	4	0	1	10	3	14	0	1	2	10	1	13
Far West	5	8	9	4	1	0	2	0	1	3	1	3	5	5	0	2	0	1	5	4	1
Total	7	8	5	6	1	0	6	0	0	4	1	2	6	4	1	1	1	1	7	3	3
Grade Level	6	9	12	6	9	12	6	9	12	6	9	12	6	9	12	6	9	12	6	9	12

variables and a set of 7 family background and school variables. The results of the analyses for the seven-variable set are given in the right-hand columns of table B.32. Here, as in the previous analyses, the percentage of ACHV variance explained tends to be greater in the Mid-Atlantic than in the Far West. For each region and grade level, except the sixth grade in the Mid-Atlantic, the percentage role of SCH is negligible while that of FB looms large, exceeding that of SCH by a factor of as much as 16 or even 100 to 1. At the sixth grade in the Mid-Atlantic, however, the roles of FB and SCH are on an even footing. It is difficult to say to what extent this can be attributed to the effect of SCH factors as opposed to a "streaming" effect.[14] We are inclined to regard it as a "streaming" effect, since it is not sustained over the grade levels. The most salient finding for these analyses, then, is for the role of school factors to be negligible in both regions (although somewhat greater in the Mid-Atlantic than in the Far West), and that of family background factors to be very large (although somewhat larger in the Far West than in the Mid-Atlantic).

4. What is the magnitude of the roles played by HB and SCH in ACHV and the four motivational factors combined?

The regional analyses for the sixth grade are given in table B.34. It will be seen that in the Mid-Atlantic the MR-square is much greater than in the Far West. However, we are reluctant to make much of this difference due to the Mid-Atlantic's small number of students and schools. For both regions, the percentage role of SCH exceeds that of HB, with the extent of this departure being greatest in the Mid-Atlantic. At the higher grade levels, the MR-squares increase and then decrease. In contrast, role of SCH tends to stay about the same or decrease slightly, while that of HB slightly increases. For each region at the sixth grade, then, and for most of the grade levels, the role of SCH slightly exceeds that of HB.

5. How much of the total variance among Oriental-American students on each of the family background and achievement variables can be associated with their membership in one of the regional groups?

It will be seen from table B.35 that these percentages are never large; in fact, they range downward from 13 percent for Family Structure and Stability at grade 12. When the percentages are averaged across the three grade levels, the highest values are for FSS and ACHV, followed by EDPLN, HBTS, and EXPTN. The lowest averages occur for SES and ATTUD. When the regional means were examined for each region and grade level, it was found that for each variable they were uniformly greater or higher in the Far West than in the Mid-Atlantic.

In summary, in this section we have seen that for Oriental-American students:

1. The percentage of variance in Achievement explained by a set of home background, family process, and school factors, in different combinations, tended to be greater in the Mid-Atlantic than in the Far West.
2. Family Structure played a greater explanatory role in the Mid-Atlantic than in the Far West; at times, its role was 2 to 15 times greater than that of Socio-Economic Status.
3. For both regions, the percentage role of Family Process tended to exceed that of Home Background, with the extent of this departure being greater in the Far West than in the Mid-Atlantic.

[14] Note the high percentage for this group's Achievement in table B.33.

Table B.34.—Multivariate Commonality Analyses of Home Background and School Factors in Achievement and Motivation, by Region and Grade Level: Sixth-Grade Oriental-Americans

Region	MRSQ (HB, SCH)	Unique HB	Common	Unique SCH
Mid Atlantic	137	20	14	66
Far West	75	48	2	50
Total[a]	77	45	4	51
[a]The "Total" values for the other grade levels are:				
Grade 12	60	48	7	45
Grade 9	100	49	0	51

Table B.35.—Percentage of Total Variation in Individual Student Variables Associated With Regional Differences, by Grade Level: Oriental-Americans

Variable	Grade Level Twelfth	Ninth	Sixth	Average
Socio-Economic Status (SES)	0	2	0	.7
Family Structure and Stability (FSS)	13	2	1	5.3
Expectations for Excellence (EXPTN)	1	0	3	1.3
Attitude Toward Life (ATTUD)	2	0	0	.7
Educational Plans and Desires (EDPLN)	6	1	2	3.0
Study Habits (HBTS)	5	0	2	2.3
Achievement (ACHV)	9	3	4	5.3

4. The explanatory role of school factors in Achievement tended to be negligible in both regions, although somewhat larger in the Mid-Atlantic than in the Far West. On the other hand, the explanatory role of Family Background was very large, although somewhat larger in the Far West than in the Mid-Atlantic.
5. When Achievement and PRCS were taken together as the dependent set, it was noted that, for each of the regional groups at the sixth grade, the explantory role of the set of 10 school factors slightly exceeded that of Home Background.
6. The association of Family Background and Achievement with regional membership was seldom large, and was greatest for Family Structure and Achievement.
7. The average values for each of the family background and achievement measures were higher in the Far West than in the Mid-Atlantic.

B.6. REGIONAL VARIATIONS FOR PUERTO RICANS

The last group to which we shall apply our series of questions consists of students who, though all residing in the continental United States, identified themselves as Puerto Rican. Only the Mid-Atlantic region will be dealt with, because it contained nearly all the Puerto Rican students in our sample—a distribution confirmed by the census—and therefore could not be compared with any other region in this respect. The sample figures are given in table B.36. We can see from this table that schools are scarce indeed at the ninth and twelfth grades, and are not even as plentiful as we would like them to be at the sixth grade. Nevertheless, we shall proceed with our questions in order to obtain results that will be at least partly comparable with those for the other ethnic groups.

1. What is the magnitude of the role played in Achievement (ACHV) by Family Structure and Stability (FSS) before and after allowance has been made for Socio-Economic Status (SES)?

Table B.37 shows that the percentage role of FSS in ACHV is quite substantial at the sixth grade. However, it becomes much smaller at the ninth and twelfth grades, while the role of SES becomes quite substantial. We are therefore inclined to regard SES as playing the greater role.

Table B.36.—Numbers of Students and Schools in Selected Regions, by Grade Level: Puerto Ricans

Region	Grade Level	Students	Schools
Mid-Atlantic	12	888	44
	9	2,470	68
	6	1,393	131

Table B.37.—Commonality Analyses of Family Background and School Factors in Achievement, by Region and Grade Level: Puerto Ricans

Region	Grade Level	RSQ (SES, FSS)	Unique SES	Common	Unique FSS
Mid-Atlantic	12	11	76	23	1
	9	10	60	28	12
	6	16	18	22	60
		RSQ (HB,PRCS)	Unique HB	Common	Unique PRCS
Mid-Atlantic	12	27	12	28	60
	9	28	5	32	63
	6	22	20	53	27
		RSQ (FB,SCH)	Unique FB	Common	Unique SCH
Mid-Atlantic	12	34	58	23	19
	9	30	86	6	8
	6	33	57	9	34

2. When HB and PRCS are analyzed together, what is the magnitude of their respective roles in ACHV?

These analyses, given in the central rows of table B.37 show that the unique percentage for PRCS exceeds that for HB. The extent of this departure is much greater at the two upper grade levels, but their common portion is greater at the lowest one.

3. When FB and SCH are analyzed together, what is the magnitude of their respective roles in ACHV?

Before dealing with this question, let us examine the degree to which Puerto Rican students attend school with others who are similar to them in FB and ACHV. Table B.38 shows that this "streaming" effect is greater for ACHV (the average of the three grade levels being 10.7), ATTUD (7.0), and HBTS (5.3). Intermediate are the values for EDPLN (3.0) and SES (2.7), while the lowest values are for EXPTN (1.7) and FSS (0.7). Returning to table B.37, we find that the relative percentage roles for the six family background factors and single school factor fluctuate somewhat erratically over the grade levels, with the percentages for FB being much larger and those for SCH much smaller at the ninth than at the other grade levels. However, the percentage role for SCH here is much greater than for many of the groups previously analyzed.

Table B.38.—Percentage of Variation in Individual Student Measures Associated With the Schools Students Attend, by Region and Grade Level: Puerto Ricans

Region	SES			FSS			ACHV			EXPTN			ATTUD			EDPLN			HBTS		
Mid-Atlantic	3	3	2	2	0	0	14	14	14	3	1	1	3	4	14	1	1	4	6	1	9
Grade Level	6	9	12	6	9	12	6	9	12	6	9	12	6	9	12	6	9	12	6	9	12

NOTE. SES = Socio-Economic Status, FSS = Family Structure and Stability, ACHV = Achievement, EXPTN = Expectations for Excellence, ATTUD = Attitude Toward Life, EDPLN = Educational Plans and Desires, HBTS = Study Habits.

4. What is the magnitude of the roles played by HB and SCH in ACHV and the four motivational factors combined?

This is the last question we propose to ask for this group. It will be seen from table B.39 that the MR-squares tend to dip at the ninth grade and then rise again substantially at the twelfth grade. This rise is due, in part, to the aforementioned small sample of schools. For the lower grade levels, the percentage role of HB exceeds that of SCH by a factor of about 1.3 to 1. We would be inclined to assert, then, that this is so for all grade levels.

Table B.39.—Multivariate Commonality Analyses of Home Background and School Factors in Achievement and Motivation, by Region and Grade Level: Puerto Ricans

Region		MRSQ (HB, SCH)	Unique HB	Common	Unique SCH
Mid-Atlantic	12	176	22	5	73
	9	45	54	7	39
	6	75	52	7	41

In summary, these analyses have shown that:

1. For most of the grade levels, the explanatory role of Socio-Economic Status in Achievement tended to outweigh that of Family Structure and Stability by a factor of as much as 76 to 1.
2. The explanatory role of Family Process in Achievement outweighed that of Home Background by as much as 13 to 1. However, the extent of the departure was much greater at the higher than at the lower grade levels.
3. The percentage role for Family Background always exceeded that of School. However, the extent of this departure was much less than noted for some of the other groups.
4. When Achievement and the four motivational variables (i.e., Family Process) were treated as dependent, the role of Home Background tended to exceed that of School by a factor of about 1.3 to 1.

APPENDIX C

ANALYSES BY REGION AND AREA

In this appendix we explore ethnic group differences by region and metropolitan area. The ethnic and regional groups will be the same as in chapters 6 and 7 and in appendix B. The metropolitan-nonmetropolitan distinction used here refers to the location of the student's school: if located in a Standard Metropolitan Statistical Area (SMSA) it was designated "metropolitan," and if not so located as "nonmetropolitan."[1] In the analyses that follow, we shall make extensive use of a framework for ascertaining systematically the extent to which a number of groups differ from each other. This framework allows one to judge whether or not it is worthwhile (in a rather specific sense) to take these group differences into account. Since this is a seldom-used framework, we shall first devote some space to a discussion of it.

Suppose we have a very large sample, and decide to break it up in different ways to determine whether or not certain subgroups are different enough to keep separate. The usual procedure for this is to use a statistical test. However, with large samples and sizable subgroups, even trivial differences can yield this kind of statistical significance. Consequently, we have relied throughout on a variance-accounted-for framework.

We can also stratify the groups in a number of different ways—by region, for example, and by their metropolitan-nonmetropolitan location within each region. Thus for 7 regions we would have 14 groups (i.e., 7 regions, subdivided into 2 metropolitan-nonmetropolitan). Accordingly, the question we ask is: How powerful an explanatory role do these stratifications play with regard to our set of dependent variables? That is, do they add enough to the explanation of our dependent variable to make us want to keep the groups separate? Or do they make us want to disregard these group differences, and thereby sacrifice some explanatory power in return for the convenience of working with a smaller number of groups?

It would be a relatively simple matter to conduct such analyses for the group means alone. However, since we are interested in the relationship of one set of variables with another in each group, we shall utilize a sequence of questions pertaining to differences among the group slopes and intercepts, as follows:

1. How much of the variation in the set of dependent variables can be associated with each of the slope factors? There will be a slope factor for each stratification, one for each of their possible interactions as well as one for the grand slope. If we note that one or more of the stratifications accounts for a substantial portion of the variance in the set of dependent variables, then we shall go no farther, since we shall want to use each group's own slope and intercept. However, if we decide that the grand slope serves us adequately (or, in other words, that separate slopes aren't needed) then we would go on to ask the second question about the intercepts.
2. How much of the variance in the set of dependent variables can be associated with each of the intercept factors? There will be an intercept factor for each stratification, as well as for each of their possible interactions.[2] If we note that a substantial portion of the variance is associated with one or more of the intercept factors, then we may want to use the same slope but a different intercept for each of these groups. If this is not the case, however, then we shall use a common slope and a common intercept for each group. This would be tantamount to saying that we do not need to maintain these group distinctions.

The technique, then, consists in examining the variance in the set of dependent variables that is associated with each of these slope and intercept factors independently of all the others. In contrast, our earlier framework of unique and common variances required us to examine only the variance uniquely associated with each factor. It is also possible to examine the higher-order commonalities for these factors, although we have not done so here (Beaton, 1973b).

In order to clarify these steps, let us proceed with a specific example taken from one of our analyses. Here, we are concerned with the relationship of our achievement composite, ACHV, with our index of socio-economic status, SES, for the 14 groups already mentioned. The

[1] An SMSA is a geographic and statistical unit officially designated as such by the U.S. Office of Management and Budget, and used in the data collection procedures of U.S. government agencies, including the Bureau of the Census. The nucleus of an SMSA is a city or adjacent pair of cities of at least 50,000 inhabitants, plus as much of the surrounding area as is economically integrated with it.

[2] There will be no slope factor for the grand intercept, since it is merely a constant for the grand slope.

slope and intercept factors, along with the total variance in ACHV for which they account (i.e., the "Total R-square") can be shown as follows:

Source of Variation:		Unique %
INTERCEPTS	MET/NONMET (M)	1
	Region (R)	5
	MR interaction	1
SLOPES	Z (Grand Slope)	42
	MZ Interaction	0
	RZ Interaction	0
	MRZ Interaction	0
Total R-square		31

The Total R-square of 31 percent means that a little less than one-third of the variance in ACHV can be associated with these stratifying factors when we are using SES as the covariate (i.e., focusing on its relationship with ACHV). The unique percentages in the body of the table have been divided by this Total R-square, so that they represent the percentage of common or explained variance that can be uniquely associated with each factor. Moving upwards in this table, we observe that the interaction factors for the slopes are all zero whereas the percentage associated with the grand slope is quite large (42 percent). These results indicate that a common slope will suffice for these different groups. Examination of the intercept percentages indicates that the interaction term is negligible, as is that for metropolitan-nonmetropolitan. The percentage for regional differences, however, is large enough to suggest that we might want to use a different intercept for each region. In closing, we may note that the unique percentages sum to 19, which means that 49 percent of the common variance is accounted for by these factors and these alone, while 51 percent is confounded among them.

In the sections that follow we shall conduct analyses of this kind for: (*a*) each ethnic group separately, across appropriate regions of the country ("appropriate" in the sense that both the census data and our sample support such an analysis); (*b*) a number of ethnic groups simultaneously, across selected regions of the country; (*c*) a number of ethnic groups simultaneously, within a single region. The analyses will proceed in a sequential manner, that is, at each step more variables will be used. There are two distinct types of analysis, one with a single dependent variable and the other with a set of five. The latter consists of: (*a*) Achievement; (*b*) Achievement plus the four motivational variables, called "Achievement and Motivation."[3] Because of limitations on the number of regressor variables that can be handled, we shall have to drop some variables at one stage in order to include others later. Unless indicated otherwise, the regressions will be performed as follows.

Sets of regressor variables when the dependent variables are:

Achievement	*Achievement and Motivation*
1. Socio-Economic Status	1. Socio-Economic Status
2. Home Background, i.e.: (*a*) Socio-Economic Status (*b*) Family Structure and Stability	2. Home Background, i.e.: (*a*) Socio-Economic Status (*b*) Family Structure and Stability
3. Family Background, i.e.: (*a*) Socio-Economic Status (*b*) Expectations for Excellence (*c*) Attitude Toward Life (*d*) Educational Plans and Desires (*e*) Study Habits	3. Home Background and School, i.e.: (*a*) Socio-Economic Status (*b*) Student Body's Attitude Toward Life (*c*) Student Body's Educatoinal Plans (*d*) Student Body's Study Habits
4. Family Background and School, i.e.: (*a*) Socio-Economic Status (*b*) Attitude Toward Life (*c*) Educational Plans and Desires (*d*) Study Habits (*e*) Student Body's Achievement Level	

As can be seen from this table, when Achievement is dependent the motivational variables are treated as an aspect of Family Background, but when Achievement and Motivation are dependent they are treated, like Achievement, as the joint product of home background and school factors. These two types of analysis are necessary because, as we pointed out in chapters 6 and 7 and in appendix B, the motivational factors cannot be regarded as belonging solely to the one or the other classification.

C.1. INTERREGIONAL ANALYSES FOR SELECTED ETHNIC GROUPS[4]

C.1.1. Total Students

Table C.2 contains the strata analyses for all students combined. In the top half of the table Achievement is the dependent variable, and in the bottom half both Achievement and Motivation are dependent. For our first set of analyses, which use Socio-Economic Status as the covariate, we can see from the upper left-hand portion of the table that the percentage of common variance associated with the slope interaction factors *MZ*, *RZ*, and *MRZ* are negligible, while that associated with the grand slope is substantial. Hence, for these 14 groups, a common slope will suffice. For the intercept factors *M*, *R*, and *MR*, only the regional factor, *R*, has a substantial portion of the

[3] The four motivational variables are: Expectations for Excellence; Attitude Toward Life; Educational Plans and Desires; and Study Habits.

[4] The numbers of students and schools for these different strata are given in table C.1.

Table C.1.—Number of Students (N) and Schools (n) by Region, Metropolitan Area, Ethnic Group, and Grade Level

Region	Locale		Total			White			Negro		
			6	9	12	6	9	12	6	9	12
Northeast	MET	N	4,283	4,513	3,612	3,796	3,880	3,292	245	432	191
		n	82	21	15	81	21	15	30	9	8
	NONMET	N	562	551	597	531	529	581	2	4	0
		n	15	4	5	15	4	5	1	2	0
Mid-Atlantic	MET	N	22,727	30,470	20,009	13,987	18,752	14,363	6,111	8,063	4,261
		n	281	109	65	254	98	63	197	92	56
	NONMET	N	4,155	3,378	2,498	3,088	2,654	2,069	694	587	353
		n	78	26	22	71	20	17	42	15	15
Great Lakes	MET	N	13,712	14,364	11,242	9,171	10,620	9,086	3,112	2,653	1,626
		n	244	59	42	219	47	40	123	49	31
	NONMET	N	2,264	2,538	2,059	1,883	2,060	1,798	230	350	183
		n	73	29	27	65	28	25	24	18	12
Plains	MET	N	3,487	3,839	3,174	2,319	2,700	2,415	958	960	663
		n	56	16	10	50	10	8	28	12	7
	NONMET	N	2,247	2,572	1,985	1,640	1,946	1,625	193	152	124
		n	98	37	36	82	33	33	18	12	8
Far West	MET	N	9,467	11,671	9,545	5,762	6,848	6,289	1,989	2,342	1,433
		n	152	44	26	143	41	26	77	36	20
	NONMET	N	5,678	5,976	4,596	4,296	4,641	3,684	131	119	93
		n	156	64	59	143	61	56	26	23	13
Southwest	MET	N	3,836	4,014	2,965	1,913	1,929	1,475	1,151	1,617	1,242
		n	59	35	31	41	24	17	44	28	22
	NONMET	N	6,399	5,628	4,046	3,000	2,835	2,105	1,452	1,490	1,190
		n	168	90	85	106	56	48	101	55	57
Southeast	MET	N	12,134	12,293	8,645	4,163	4,956	3,859	6,405	6,624	4,475
		n	194	68	54	119	43	25	132	59	44
	NONMET	N	27,146	26,301	19,123	11,743	12,403	9,396	10,898	11,872	8,968
		n	716	321	303	418	183	147	463	238	228
Grade Level			6	9	12	6	9	12	6	9	12

Region	Locale		Mexican-American			Indian American			Oriental-American			Puerto Rican		
			6	9	12	6	9	12	6	9	12	6	9	12
Northeast	MET	N												
		n												
	NONMET	N												
		n												
Mid-Atlantic	MET	N							116	318	129	1,280	2,445	864
		n							47	50	22	110	43	36
	NONMET	N												
		n												
Great Lakes	MET	N												
		n												
	NONMET	N												
		n												
Plains	MET	N												
		n												
	NONMET	N												
		n												
Far West	MET	N	1,042	1,173	671	225	175	102	286	941	936			
		n	115	32	24	68	35	17	53	33	21			
	NONMET	N	344	379	224	635	570	326	218	228	232			
		n	67	9	27	80	42	30	24	19	9			
Southwest	MET	N	400	294	136	226	113	77						
		n	40	14	18	24	14	7						
	NONMET	N	904	615	309	796	600	399						
		n	97	16	30	71	31	21						
Southeast	MET	N												
		n												
	NONMET	N												
		n												
Grade Level:			6	9	12	6	9	12	6	9	12	6	9	12

Table C.2.—Percentage of Variation in Achievement and Motivation Associated With Family Background and School, When Stratified by Region and Metropolitan Area: Total Students

Source of Variation		Dependent Set: Achievement											
		Socio-Economic Status			Home Background			Family Background			Family Background and School		
Intercepts	M	0	1	0	0	0	0	0	0	0	0	0	0
	R	7	5	8	6	4	7	5	3	5	0	0	0
	MR	1	1	1	1	1	1	1	1	0	0	0	0
Slopes	Z	42	42	39	43	42	40	48	47	46	34	35	39
	MZ	0	0	0	0	0	0	0	0	0	0	0	0
	RZ	0	0	1	0	0	1	1	1	2	0	1	1
	MRZ	0	0	0	0	0	1	0	0	1	0	0	0
Total R-square		25	31	27	27	32	27	35	43	44	47	50	50
Grade Level:		6	9	12	6	9	12	6	9	12	6	9	12

Source of Variation		Dependent Set: Achievement/Motivation								
		Socio-Economic Status			Home Background			Home Background and School		
Intercepts	M	0	1	1	0	0	1	0	0	0
	R	3	6	8	3	5	8	0	0	0
	MR	1	1	1	1	1	1	0	0	0
Slopes	Z	15	20	19	20	23	21	19	18	22
	MZ	0	0	0	0	0	0	0	0	0
	RZ	0	1	2	1	1	2	0	1	1
	MRZ	0	0	1	0	0	1	0	0	1
Total MR-square		86	88	88	88	89	89	90	92	92
Grade Level:		6	9	12	6	9	12	6	9	12

common variance associated with it. These statements about the slopes and intercepts tend to hold for each of the three grade levels. It is clear, then, that we should use the same slope for each region and metropolitan or nonmetropolitan group. It is also clear, however, that we should use a different intercept for each region. But different intercepts are not needed at the metropolitan-nonmetropolitan level.

The same tends to be true for the "Home Background" and "Family Background" analyses. For the "Family Background" and "School" analyses, only the grand slope is needed. This can be seen from the substantial percentage of common variance associated with the grand slope factor, *Z*, and the negligible-to-null relationships for the other factors. If these latter analyses do in fact represent the most comprehensive range of regressor variables available to us, then it seems likely that the more comprehensive the set, the less need there will be to allow for differences of this kind in studying the correlates of Achievement. Indeed, other variables would appear more educationally meaningful in this context.

When both Achievement and Motivation are treated as dependent, similar results obtain.[5] In other words, when Socio-Economic Status or Home Background are used as regressor variables, we find that we can use the common slope for each of the seven groups, but would use a different intercept. Different metropolitan-nonmetropolitan intercepts would not be required, as is indicated by the negligible-to-null *M* and *MR* percentages. Once school variables are brought into the analysis, however, we find that only a common slope and a common intercept are required. We are therefore inclined to assert that, for multivariate dependent variables as for single ones, the more comprehensive the set of regressor variables, the more likely it is that the sample will not need to be stratified along these lines.

But do we perhaps need different slopes and intercepts for these same 14 groups when account is explicitly taken of ethnicity? That is, when Achievement is regressed on Racial-Ethnic Group Membership (RETH), which is our variable denoting ethnicity, is anything to be gained from additional stratification? Since we are limited in the number of regressor variables we can use, we shall depart from our sets of variables as follows:

1. For both the univariate and the multivariate cases, RETH will be entered into the analysis first alone, and then in combination with SES.
2. For the multivariate case, RETH and SES will be entered into the analysis with the three student body variables of Attitude Toward Life, Educational Plans and Desires, and Achievement, in the "Home Background and School" analyses.
3. For the univariate case, RETH and SES will be entered into the analysis with the three individual

[5] To convert these multivariate R-squares to an upper limit of 1, the reader needs only to divide them by the number of dependent variables, which in this case is 5 (see Beaton, 1973a).

student variables of Attitude Toward Life, Educational Plans and Desires, and Study Habits, in the "Family Background" analyses.

4. For the univariate case, RETH and SES will be entered into the analysis with the individual student variables of Attitude Toward Life and Educational Plans and Desires, plus the student body variable of Achievement, in the "Family Background and School" analyses.

The results of these analyses are given in table C.3. The values in the top half of the table show that when RETH is entered into the analyses alone, a common slope will suffice. We say this because the slope interaction factors are negligible, whereas the *Z* percentage is appreciable. However, the size of the *R* percentage indicates that a separate intercept might be used for each regional group. These same results tend to hold both when SES and when the family background factors are brought into the analysis. The major change here is that the percentage for the slope factor, *Z*, gets larger, while that for the regional intercept factor, *R*, gets smaller. However, when the school factors are also brought in, only a common slope and a common intercept are needed, as can be seen from the zero value for the regional intercept percentage, *R*. These same results tend to hold for the multivariate analyses as well. Consequently, we are inclined to conclude that even when RETH is explicitly entered into the analysis, a separate slope for each of the 14 groups is never needed, but a separate intercept for each of the 7 regions is. Moreover, when Family Background (or Home Background, for the multivariate case) is entered into the analysis with School, only a common slope and a common intercept are needed for all 14 groups.

C.1.2. Whites

Table C.4 shows the results of analyses for the whites in these same 14 groups—analyses made with the same sets of variables as in table C.2. When Achievement alone is the dependent variable, a common slope, as we can see from the upper half of table C.4, will always suffice. For two of the three grade levels, the analyses would suggest the use of a separate regional intercept in the first three types of analysis, viz, those involving Socio-Economic Status, Home Background, and Family Background. But when the school variables are also brought into the analysis, a common slope and a common intercept will suffice. These same kinds of results tend also to hold when Achievement and Motivation are taken together as the dependent set. Here, there tend to be some slight slope interactions for *RZ* and *MRZ*. However, their magnitude is so small, relative to that for the slope factor, *Z*, that we do not consider it worthwhile to keep the groups separate. Consequently, these results for whites tend to parallel

Table C.3.—Percentage of Variation in Achievement and Motivation Associated With Family Background and School, When Stratified by Region and Metropolitan Area: Ethnicity for Total Students

Source of Variation		Dependent Set: Achievement											
		Ethnicity			Ethnicity and Socio-Economic Status			Family Background			Family Background and School		
Intercepts	M	0	0	1	0	0	0	0	0	0	0	0	0
	R	5	4	6	2	2	2	2	1	2	0	0	0
	MR	1	1	1	1	0	0	0	0	0	0	0	0
Slopes	Z	21	15	9	30	29	25	37	37	35	31	32	35
	MZ	0	0	0	0	0	0	0	0	0	0	0	0
	RZ	1	0	1	1	0	0	1	1	1	0	0	1
	MRZ	0	0	0	0	0	0	0	0	0	0	0	0
Total R-square		25	24	23	35	38	34	44	49	49	48	51	52
Grade Level:		6	9	12	6	9	12	6	9	12	6	9	12

Source of Variation		Dependent Set: Achievement/Motivation								
		Ethnicity			Ethnicity and Socio-Economic Status			Home Background and School		
Intercepts	M	0	0	1	0	0	0	0	0	0
	R	2	4	5	1	3	4	0	0	1
	MR	1	1	1	0	1	1	0	0	0
Slopes	Z	6	5	3	16	21	20	18	18	22
	MZ	0	0	0	0	0	0	0	0	0
	RZ	0	1	1	1	1	2	1	1	2
	MRZ	0	1	1	0	1	1	0	1	1
Total MR-square		85	86	87	88	90	90	90	92	92
Grade Level:		6	9	12	6	9	12	6	9	12

Table C.1.—Percentage of Variation in Achievement and Motivation Associated With Family Background and School, When Stratified by Region and Metropolitan Area: Whites

Source of Variation		Dependent Set: Achievement											
		Socio-Economic Status			Home Background			Family Background			Family Background and School		
Intercepts	M	0	0	0	0	0	0	0	0	0	0	0	0
	R	3	0	5	3	0	4	2	0	3	0	0	1
	MR	1	0	2	1	0	2	0	0	0	0	0	0
Slopes	Z	55	54	54	55	54	54	61	58	59	56	55	58
	MZ	0	0	0	0	0	0	0	0	0	0	0	0
	RZ	0	0	0	0	0	1	0	0	1	0	0	1
	MRZ	0	0	1	0	0	1	0	0	1	0	0	1
Total R-square		17	22	18	18	22	18	30	39	41	35	40	41
Grade Level:		6	9	12	6	9	12	6	9	12	6	9	12

Source of Variation		Dependent Set: Achievement/Motivation								
		Socio-Economic Status			Home Background			Home Background and School		
Intercepts	M	0	0	1	0	0	1	0	0	0
	R	1	4	5	1	4	5	0	0	0
	MR	0	1	1	0	1	1	0	0	0
Slopes	Z	16	23	21	19	25	23	22	22	22
	MZ	0	0	0	0	0	0	0	0	0
	RZ	0	1	1	1	1	2	0	1	2
	MRZ	0	0	1	0	0	2	0	1	2
Total MR-square		85	87	87	86	88	87	87	89	89
Grade Level:		6	9	12	6	9	12	6	9	12

those obtained for all students combined. For the latter, it will be recalled, a common slope would always suffice but a separate intercept was suggested for each of the seven regions until the school variables were brought into the analysis.

C.1.3. Negroes

In our sample, as can be seen from table C.1, there were virtually no Negroes in the nonmetropolitan Northeast. Consequently, in order to conduct the same kinds of analyses for Negroes as for whites and all students combined, it was necessary to combine the Northeast with the Mid-Atlantic. This resulted in 12 groups—6 regions, subdivided into metropolitan and nonmetropolitan.[6] The results of these analyses, given in table C.5, show that when Achievement is the dependent variable, a common slope will suffice for each type of analysis. This is true even though the *RZ* and *MRZ* percentages for the "Family Background" and "Family Background and School" analyses are not negligible. The situation is somewhat different with regard to the intercepts, chiefly because whether one or several are required depends upon the number and type of regressor variables being used. For the first three types of analysis (viz, "Socio-Economic Status," "Home Background," and "Family Background"), one would want to use a separate intercept for each regional group. This is indicated by the *R* and *MR* percentages. However, once the school variables are also brought into the analysis, the use of separate intercepts becomes unnecessary; it is enough to use a common slope and a common intercept.

For the Multivariate case these same conclusions tend to hold, except for the "Home Background" and "School" analyses. For these latter, the *RZ* and *MRZ* percentages tend to be somewhat larger relative to the *Z* percentages. However, we are inclined to favor a common slope and common intercept for this latter type of analysis as well, since we would actually sacrifice some explanatory power if we used separate slopes.

For all these analyses, then, we shall conclude that a common slope will suffice, but that a separate intercept will be needed for each region until the school variables are brought into the analysis. When they are, a single intercept will suffice.

C.1.4. Mexican-Americans

Analyses of the same type were also conducted for Mexican-American students in the Southwest and Far West. Each of these regions was subdivided into metropolitan and nonmetropolitan, to give a total of four groups. The result of these analyses are shown in table C.6. The per-

[6] A check on the effects of this reduction was made at the ninth grade, since at this grade level there were a few Negro students in the nonmetropolitan Northeast. A comparison of the results of these two analyses, using 12 groups in the one case and 14 in the other, showed that the Total R-squares remained about the same, but that the variance accounted for by the grand slope factor, *Z*, was much reduced.

centages in the top half of the table indicate that at grades 6 and 9 the slope interaction factors *MZ*, *RZ*, and *MRZ* are negligible, whereas the common slope factor, *Z*, is substantial. At the grade 12, however, the slope interaction factors are large enough to bring into question whether or not it is worth keeping the four groups separate. One way to settle this question is to compare the *Z* percentage with the sum of the *MZ*, *RZ*, and *MRZ* percentages, for each type of analysis. In this case, such comparison produces the following figures (with the *Z* percentage first): for the "Socio-Economic Status" analysis, 50 and 22 percent; for the "Home Background" analysis, 41 and 26 percent; for the "Family Background" analysis, 60 and 16 percent; and for the "Family Background and School" analysis, 62 and 14 percent. In view of the relatively large ratio of the *Z* percentage to the sum of the interaction percentages, as well as the negligible percentages for these same interaction factors at the lower grade levels, we are inclined to conclude in favor of using a common slope. At the same time, we would note that some slope interactions do occur at the twelfth grade.

The intercept interactions also vary somewhat by grade level and type of analysis. Although it is hard to strike an average here, the values suggest that we might want to use a separate intercept for each metropolitan or nonmetropolitan group within each region. This being the case, we would probably opt for using a separate regional intercept as well. Examination of the results for the multivariate analyses (the lower half of table C.6) shows that they, too, follow a somewhat similar trend. Thus, except at grade 12, the slope factor, *Z*, tends to have a much larger percentage than the sum of the slope interaction factors *MZ*, *RZ*, and *MRZ*. At the grade 12, these percentages are, respectively: for the "Socio-Economic Status" analysis, 8 and 7 percent; for the "Home Background" analysis, 15 and 16 percent; and for the "Home Background and School" analysis, 26 and 21 percent. As with the previous analyses, so too here we are inclined to opt for the common slope, *Z*, since the separate slopes would not bring any increase in explanatory power (in most cases, not as much as the common slope). The percentages for the intercept factors suggest that one might use a separate value for each of these four groups, especially at the twelfth grade. However, when the school variables are brought into the analysis, the need for separate intercepts once more becomes less compelling. Hence, if we were to have to strike an average between the univariate and multivariate analyses, we would be inclined to opt for separate intercepts because this would help to make the conclusions consonant with one another.

C.1.5. Indian Americans

In this section we perform analyses of the same kind for Indian Americans, using the same regional classifications —viz. Southwest and Far West, subdivided into metropolitan and nonmetropolitan—as for Mexican-Americans. The results, given in table C.7, show that the slope interaction factors, *MZ*, *RZ*, and *MRZ*, account for much less of the variance than does the common slope, *Z*, even though at the twelfth grade there are some interaction percentages that cannot be overlooked. Since the intercept percentages

Table C.5.—Percentage of Variation in Achievement and Motivation Associated With Family Background and School, When Stratified by Region and Metropolitan Area: Negroes

Source of Variation		Dependent Set: Achievement											
		Socio-Economic Status			Home Background			Family Background			Family Background and School		
Intercepts	M	1	0	0	1	0	0	0	0	0	0	0	0
	R	7	8	9	6	7	9	5	5	5	1	0	1
	MR	2	2	2	2	2	2	1	1	1	0	1	1
Slopes	Z	21	21	12	22	21	13	26	24	18	25	23	17
	MZ	0	0	0	0	0	1	0	0	0	0	0	0
	RZ	0	0	1	1	1	1	1	1	2	2	1	2
	MRZ	0	0	1	0	1	1	1	1	1	1	1	1
Total R-square		15	19	20	16	20	21	27	33	35	35	38	43
Grade Level:		6	9	12	6	9	12	6	9	12	6	9	12

Source of Variation		Dependent Set: Achievement/Motivation								
		Socio-Economic Status			Home Background			Home Background and School		
Intercepts	M	0	0	0	0	0	0	0	0	0
	R	2	4	5	2	4	5	1	0	1
	MR	1	1	2	1	1	1	0	1	1
Slopes	Z	5	8	6	8	9	7	10	9	7
	MZ	0	0	0	0	0	0	0	0	0
	RZ	0	0	1	1	1	1	2	2	3
	MRZ	0	0	1	2	1	1	2	2	2
Total MR-square		84	86	87	86	88	88	88	90	92
Grade Level.		6	9	12	6	9	12	6	9	12

show some low-to-moderate values, especially for *MR* at the twelfth grade, we are inclined to prefer separate intercept values for each region and metropolitan area.

For the multivariate analyses, the slope interaction percentages *MZ*, *RZ*, and *MRZ* are much more pronounced (especially at the twelfth grade) than for the univariate analyses. At the twelfth grade, the *Z* percentage and the sum of the interaction percentages are, respectively: for the "Socio-Economic Status" analysis, 32 and 8 percent; for the "Home Background" analysis, 37 and 22 percent; and for the "School" analysis, 36 and 31 percent. Since the common slope, *Z*, yields more variance than the sum of the interaction factors, and since it is easier to deal with one slope than with four separate ones, we are inclined to opt for the common slope. Similarly, the intercept percentages are large enough, especially at the twelfth grade, to suggest that we would want to use a separate intercept for each of the four groups. For the multivariate case too, then, we shall use a common slope but different intercepts for each of the four groups.

C.1.6. Oriental-Americans

Oriental-Americans tend to be most heavily concentrated in the metropolitan Mid-Atlantic and the Far West.[7] We therefore used a classification somewhat different from the earlier one. This one had only three groups: metropolitan Mid-Atlantic; metropolitan Far West; and nonmetropolitan Far West. Since it was of course impossible to use three groups in a two-way classification, we devised a one-way classification that we regarded as representing differences in geographic locale. This did not allow us to pinpoint among which groups the greatest differences were to be found. However, as we may recall from appendix B, there were pronounced differences between the Mid-Atlantic and Far West groups. Moreover, we had already found that the differences between ninth-grade Oriental-Americans in the Far West were much less pronounced than the differences between them and their Mid-Atlantic counterparts (Mayeske et al., 1973b). Examination of the data for these analyses tends also to suggest that differences in the nature of the regions are the chief source of the differences between these geographic groups. Unfortunately, the present analyses do not allow us to go farther than this.

A word of explanation about the results of the analyses for Oriental-Americans, given in table C.8, is necessary. Since these analyses utilize only one direction of classification, there is only one factor for locale, designated L. Accordingly, *LZ* represents the interaction of locale with the common slope, while *L* represents variation in the intercept values. We can see from the top half of table C.8 that the common slope, *Z*, accounts for much more of the variance than does the slope interaction factor, *LZ*. This is true even though the percentage value for *Z* is much lower at the twelfth grade than at the other grade levels. Consequently, the common slope will suffice for all these analyses in which Achievement is the single dependent variable.

[7] There were virtually no Oriental-Americans in the nonmetropolitan Mid-Atlantic.

Table C.6.—Percentage of Variation in Achievement and Motivation Associated With Family Background and School, When Stratified by Region and Metropolitan Area: Mexican-Americans

		Dependent Set: Achievement											
		Socio-Economic Status			Home Background			Family Background			Family Background and School		
Source of Variation													
Intercepts	M	4	3	10	3	3	6	2	1	2	1	1	2
	R	1	1	0	2	0	1	1	0	2	0	0	1
	MR	1	5	2	1	3	1	0	2	0	0	0	2
Slopes	Z	79	75	50	83	72	41	80	72	60	78	75	62
	MZ	0	0	11	0	1	10	0	1	4	0	2	4
	RZ	0	0	7	0	1	6	2	1	8	1	0	7
	MRZ	0	2	4	0	3	10	1	3	4	1	1	3
Total R-square		11	16	6	18	20	7	28	33	28	34	36	33
Grade Level:		6	9	12	6	9	12	6	9	12	6	9	12

		Dependent Set: Achievement/Motivation								
		Socio-Economic Status			Home Background			Home Background and School		
Source of Variation										
Intercepts	M	1	1	3	2	1	2	0	0	1
	R	1	1	3	1	0	3	0	0	2
	MR	1	1	2	1	1	2	1	1	1
Slopes	Z	15	24	8	36	30	15	33	39	26
	MZ	1	1	2	2	1	5	2	2	6
	RZ	0	1	1	3	1	6	1	1	8
	MRZ	0	2	3	1	2	5	3	3	7
Total MR-square		83	86	84	88	88	86	87	90	91
Grade Level:		6	9	12	6	9	12	6	9	12

Table C.7.—Percentage of Variation in Achievement and Motivation Associated With Family Background and School, When Stratified by Region and Metropolitan Area: Indians

Source of Variation		Dependent Set: Achievement											
		Socio-Economic Status			Home Background			Family Background			Family Background and School		
Intercepts	M	4	5	0	1	4	0	1	1	0	0	1	0
	R	0	6	0	0	5	0	0	3	1	0	2	0
	MR	4	4	28	2	4	21	1	3	13	1	1	8
Slopes	Z	86	79	51	88	73	50	84	75	38	78	76	41
	MZ	1	0	0	1	1	0	1	1	4	0	0	4
	RZ	1	3	0	2	3	0	1	5	4	0	3	2
	MRZ	1	1	6	0	2	8	1	1	6	1	1	5
Total R-square		13	19	44	20	20	45	28	30	55	38	32	55
Grade Level:		6	9	12	6	9	12	6	9	12	6	9	12

Source of Variation		Dependent Set: Achievement/Motivation								
		Socio-Economic Status			Home Background			Home Background and School		
Intercepts	M	2	3	5	1	2	4	1	1	1
	R	0	2	4	0	2	3	0	0	1
	MR	1	1	14	1	2	12	1	0	6
Slopes	Z	20	26	32	35	35	37	49	36	36
	MZ	0	1	2	2	3	8	4	3	10
	RZ	2	1	2	2	2	7	6	3	10
	MRZ	1	1	4	3	2	7	4	2	11
Total MR-square		85	86	92	88	88	94	91	91	96
Grade Level:		6	9	12	6	9	12	6	9	12

Table C.8.—Percentage of Variation in Achievement and Motivation Associated With Family Background and School, When Stratified by Region and Metropolitan Area: Oriental-Americans

Source of Variation		Dependent Set: Achievement											
		Socio-Economic Status			Home Background			Family Background			Family Background and School		
Intercepts	L	13	9	37	7	5	13	2	3	3	3	3	3
Slopes	Z	68	60	38	73	69	30	74	71	44	76	70	43
	LZ	2	2	6	1	4	13	4	3	2	6	3	3
Total R-square		17	14	15	22	18	20	33	37	39	36	37	38
Grade Level:		6	9	12	6	9	12	6	9	12	6	9	12

Source of Variation		Dependent Set: Achievement/Motivation								
		Socio-Economic Status			Home Background			Home Background and School		
Intercepts	L	13	5	10	12	4	4	3	3	3
Slopes	Z	21	20	13	34	32	16	35	30	15
	LZ	2	3	5	6	8	12	13	14	16
Total MR-square		87	85	86	90	88	89	90	89	89
Grade Level:		6	9	12	6	9	12	6	9	12

When we examine the intercept percentages, *L*, we find them large enough to suggest that we would want to use a separate value for each group. However, the need to do this becomes less pronounced as more family background and school variables are brought into the analysis.

These same conclusions tend to hold, although to a lesser degree, for the results of the multivariate analyses. For the "Home Background" and "School" analyses in particular, we can note that the slope interaction factor, *LZ*, takes on fairly substantial values. At the twelfth grade it even exceeds the common slope, *Z*, by 1 percent. We are still inclined, however, to opt for the common slope because it generally yields much more variance than separate slopes, and is in addition much easier to work with. The intercept percentages indicate that we would want to use a seperate value for each group, even though this becomes

less necessary when the school factors are brought into the analysis.

C.2. INTERREGIONAL ANALYSES FOR MIXED ETHNIC GROUPS

In some of the regions there are enough students and schools to support analyses for more than two ways of classification. For example, in the previous section we conducted analyses for students classified by region and metropolitan and nonmetropolitan area. But their ethnicity was either fixed or incorporated as a quantitative variable. In this section we shall bring in a third stratifying factor, namely, the student's ethnicity. For example, we shall examine those same kinds of relationship for whites and Negroes, by 6 regions and 2 metropolitan locales—a total of 24 groups. We shall do the same for whites, Negroes, Indians, and Mexican-Americans in the metropolitan and nonmetropolitan Southwest and Far West—a total of 16 groups. Similarly, though not in a three-way classification, we shall examine these kinds of relationship for whites, Negroes, and Oriental-Americans in the metropolitan Mid-Atlantic and Far West—a total of six groups.[8]

C.2.1. Ethnic Differences in the Southwest and Far West

In this section we examine the results of similar analyses for: (*a*) white, Negro, Indian, and Mexican-American students, who are (*b*) located in the Southwest and Far Western regions, and (*c*) attend school in either a metropolitan or a nonmetropolitan area in one of these regions. Since these analyses involve a total of 16 groups, we have to use even fewer regressor variables than heretofore, as follows.

Sets of regressor variables when the dependent variables are:

Achievement	*Achievement and Motivation*
1. Socio-Economic Status	1. Socio-Economic Status
2. Home Background, i.e.: (*a*) Socio-Economic Status (*b*) Family Structure and Stability	2. Home Background, i.e.: (*a*) Socio-Economic Status (*b*) Family Structure and Stability
3. Family Background, i.e.: (*a*) Socio-Economic Status (*b*) Attitude Toward Life (*c*) Educational Plans (*d*) Study Habits	3. Home Background and School, i.e.: (*a*) Socio-Economic Status (*b*) Student Body's Achievement (*c*) Student Body's Attitude Toward Life (*d*) Student Body's Educational Plans
4. Family Background and School, i.e.: (*a*) Socio-Economic Status (*b*) Attitude Toward Life (*c*) Educational Plans (*d*) Student Body's Achievement	

The results of these analyses using these sets of variables and strata factors are given in table C.9, where E denotes ethnicity, M metropolitan or nonmetropolitan location, and R regional location. Inspection of the top half of the table, when Achievement alone is the dependent variable, shows that, for each type of analysis, the percentages for the slope interaction factors are negligible to null, while those for the common slope, Z, are substantial. For these 16 groups, then, a common slope will suffice. Examination of the percentages for the intercept interactions shows that they, too, are negligible to null. Those for metropolitan location are also null, whereas those for ethnicity are large enough to suggest that we would want to use a separate intercept for each ethnic group.

The results for the multivariate analyses, given in the bottom half of the table are highly similar. The slope interaction percentages tend to be more frequent, but are never large. Those for the slopes, however, are definitely large. The intercept interaction percentages are even smaller, while those for M are null. The ethnic group percentages, E, are large enough to suggest that we would want to use a separate intercept for each group.

In summary, for both the univariate and multivariate analyses, we have observed that the same slope can be used for each of these 16 groups. A different intercept is suggested for each of the four ethnic groups, but not for their region or area.

We next compare the results of similar analyses for whites and Negroes in each of six regions (the Northeast and Mid-Atlantic will be collapsed into one), and by metropolitan or nonmetropolitan area. With 24 groups, we shall have to use an even smaller number of regressor variables than before, as follows.

Achievement	*Achievement and Motivation*
1. Socio-Economic Status	1. Socio-Economic Status
2. Home Background, i.e.: (*a*) Socio-Economic Status (*b*) Family Structure and Stability	2. Home Background, i.e.: (*a*) Socio-Economic Status (*b*) Family Structure and Stability
3. Family Background, i.e.: (*a*) Socio-Economic Status (*b*) Attitude Toward Life	3. Home Background and School, i.e.: (*a*) Socio-Economic Status (*b*) Student Body's Achievement
4. Family Background and School, i.e.: (*a*) Socio-Economic Status (*b*) Student Body's Achievement	

[8] In the final section of this chapter, we shall examine intra-regional analyses for some of these same groups.

The results of these analyses are given in table C.10. Here, *E* denotes stratification by ethnic group, *M* by metropolitan and nonmetropolitan, and *R* by regional location. Examination of the slope interaction percentages for both the univariate and multivariate analyses shows them to be all zero, whereas those for the common slopes, *Z*, are quite substantial. The intercept interaction percentages are all zero, too (the multivariate analyses involving the home background and school factors resulted in some small percentages, but they were too small to show up here). There is a value of 1 percent for the regional intercept, except when the school factors are brought into the analysis. The intercept percentage for *M* is consistently zero. In contrast, that for ethnic group membership is consistently larger, though it diminishes considerably when the school factors are brought into the analysis. Overall then, we are prone to conclude that: (a) a common slope will suffice for each of these 24 groups; (b) a separate intercept is suggested for each ethnic group; (c) the regional differences are not substantial enough to warrant a separate intercept value.

In the last set of analyses in this section, we shall compare whites, Negroes, and Oriental-Americans in the metropolitan Mid-Atlantic with their counterparts in the metropolitan Far West; nonmetropolitan groups will not be used at all. Since these analyses involve only six groups, we can apply a larger number of regressor variables to them than to the previous analyses in this section. The composition of these sets was described in the introduction to this appendix. The results of these analyses are given for the three ethnic groups, *E*, and their metropolitan location, *M*, in table C.11. Examination of the slope interaction percentages for both the univariate and multivariate cases shows that there is a consistent but slight

Table C.9.—Percentage of Variation in Achievement and Motivation Associated With Family Background and School, When Stratified by Region and Metropolitan Area: Negroes, Whites, Indians, and Mexican-Americans

Source of Variation		Dependent Set: Achievement											
		Socio-Economic Status			Home Background			Family Background			Family Background and School		
Intercepts	E	20	9	9	16	8	8	11	5	5	4	2	2
	M	0	0	0	0	0	0	0	0	0	0	0	0
	EM	0	0	0	0	0	0	0	0	0	0	0	0
	R	0	0	0	0	0	0	0	0	0	0	0	0
	ER	0	0	0	0	0	0	0	0	0	0	0	0
	MR	0	0	1	0	0	1	0	0	0	0	0	0
	EMR	0	0	1	0	0	1	0	0	0	0	0	0
Slopes	Z	9	10	5	11	10	5	14	12	5	16	13	7
	EZ	0	0	1	1	0	1	1	0	1	0	0	1
	MZ	0	0	0	0	0	0	0	0	0	0	0	0
	EMZ	0	0	0	0	0	0	0	0	0	0	0	0
	RZ	0	0	0	0	0	0	0	0	0	0	0	0
	ERZ	0	0	0	0	0	0	0	0	0	0	0	0
	MRZ	0	0	0	0	0	0	0	0	0	0	0	0
	EMRZ	0	0	0	0	0	1	0	0	0	0	0	0
Total R-Square		30	33	28	32	34	29	41	45	44	43	46	45
Grade Level		6	9	12	6	9	12	6	9	12	6	9	12

Source of Variation		Dependent Set: Achievement/Motivation								
		Socio-Economic Status			Home Background			Home Background and School		
Intercepts	E	8	5	5	7	5	5	2	1	1
	M	0	0	0	0	0	0	0	0	0
	EM	0	0	0	0	0	0	0	0	0
	R	0	0	0	0	0	0	0	0	0
	ER	0	0	1	0	0	1	0	0	0
	MR	0	0	0	0	0	0	0	0	0
	EMR	0	0	1	0	0	1	0	0	0
Slopes	Z	5	7	3	10	9	4	11	8	4
	EZ	0	0	1	2	1	1	1	1	1
	MZ	0	0	0	0	0	0	0	0	0
	EMZ	0	0	0	0	0	1	1	0	1
	RZ	0	0	0	0	0	0	0	0	0
	ERZ	0	0	0	0	0	1	1	1	1
	MRZ	0	0	0	0	0	0	0	0	0
	EMRZ	0	0	0	0	0	1	1	1	1
Total MR-square		87	89	89	89	90	90	89	91	91
Grade Level:		6	9	12	6	9	12	6	9	12

value for ethnicity (EZ). This value is never large enough, however, to warrant the use of separate slopes for the different ethnic groups, as can be seen when the magnitude of these slopes is compared with that of the common slope. It is noteworthy that the slope percentages are not as large as those seen in earlier analyses, while the ethnic group intercept percentages are somewhat larger. The intercept percentages for metropolitan location are zero while those for the interaction of ethnic group and metropolitan location range from negligible to zero.

In summary, then, we can say that a common slope can be used for each of these groups. A different intercept is required for each ethnic group, but not for whether they are located in the metropolitan Mid-Atlantic or metropolitan Far West. On the basis of the analyses in the previous appendix, we would not have expected this result. We had already judged that the Mid-Atlantic Oriental-Americans tended to be very different from their Far Western counterparts, and this expectation received some support from our analyses of Oriental-Americans in the prior section of this appendix. Apparently the Mid-Atlantic Orientals are so few relative to their counterparts in the Far West that they do not upset the trend in variance accounted for.

C.3. INTRAREGIONAL ANALYSIS FOR MIXED ETHNIC GROUPS

In this section we shall make comparisons of ethnic groups within selected regions in order to bring the groups into a common framework that the earlier groupings did not permit. For example, in the Far West we shall compare Negro, white, Indian, Oriental-, and Mexican-American students as to how they differ from one another in

Table C.10.—Percentage of Variation in Achievement and Motivation Associated With Family Background and School, When Stratified by Region and Metropolitan Area: Negroes and Whites

Source of Variation		Dependent Set: Achievement											
		Socio-Economic Status			Home Background			Family Background			Family Background and School		
Intercepts	E	10	5	4	8	5	4	8	4	3	2	1	1
	M	0	0	0	0	0	0	0	0	0	0	0	0
	EM	0	0	0	0	0	0	0	0	0	0	0	0
	R	1	1	1	1	1	1	1	1	1	0	0	0
	ER	0	0	0	0	0	0	0	0	0	0	0	0
	MR	0	0	0	0	0	0	0	0	0	0	0	0
	EMR	0	0	0	0	0	0	0	0	0	0	0	0
Slopes	Z	7	7	4	7	7	4	9	10	6	8	8	5
	EZ	0	0	0	0	0	0	0	0	0	0	0	0
	MZ	0	0	0	0	0	0	0	0	0	0	0	0
	EMZ	0	0	0	0	0	0	0	0	0	0	0	0
	RZ	0	0	0	0	0	0	0	0	0	0	0	0
	ERZ	0	0	0	0	0	0	0	0	0	0	0	0
	MRZ	0	0	0	0	0	0	0	0	0	0	0	0
	EMRZ	0	0	0	0	0	0	0	0	0	0	0	0
Total R square		33	37	34	37	37	34	37	44	41	37	39	37
Grade Level		6	9	12	6	9	12	6	9	12	6	9	12

Source of Variation		Dependent Set: Achievement/Motivation								
		Socio-Economic Status			Home Background			Home Background and School		
Intercepts	E	4	4	3	4	4	3	1	1	1
	M	0	0	0	0	0	0	0	0	0
	EM	0	0	0	0	0	0	0	0	0
	R	1	1	1	1	1	1	0	0	0
	ER	0	0	0	0	0	0	0	0	1
	MR	0	0	0	0	0	0	0	0	1
	EMR	0	0	0	0	0	0	0	0	1
Slopes	Z	4	6	3	6	7	4	5	6	4
	EZ	0	0	0	0	0	0	0	0	0
	MZ	0	0	0	0	0	0	0	0	0
	EMZ	0	0	0	0	0	0	0	0	0
	RZ	0	0	0	0	0	0	0	0	1
	ERZ	0	0	0	0	0	0	0	0	0
	MRZ	0	0	0	0	0	0	0	0	1
	EMRZ	0	0	0	1	0	0	0	0	0
Total MR-square		88	90	91	89	91	91	89	91	91
Grade Level:		6	9	12	6	9	12	6	9	12

Table C.11.—Percentage of Achievement and Motivation Associated With Family Background and School, When Stratified by Region and Metropolitan Area: Negroes, Whites, and Oriental-Americans

Source of Variation		Dependent Set: Achievement											
		Socio-Economic Status			Home Background			Family Background			Family Background and School		
Intercepts	E	26	18	21	22	14	17	19	11	11	3	3	4
	M	0	0	0	0	0	0	0	0	0	0	0	0
	EM	0	0	1	0	0	0	0	0	0	0	0	0
Slopes	Z	3	3	3	4	4	3	6	5	4	6	5	4
	EZ	1	1	1	1	1	1	1	2	1	1	1	1
	MZ	0	0	0	0	0	0	0	0	0	0	0	0
	EMZ	0	0	0	0	0	0	0	0	0	0	0	0
Total R-square		31	36	30	32	36	30	40	49	48	43	50	48
Grade Level		6	9	12	6	9	12	6	9	12	6	9	12

Source of Variation		Dependent Set: Achievement/Motivation								
		Socio-Economic Status			Home Background			Home Background and School		
Intercepts	E	11	13	15	10	12	13	2	1	2
	M	0	0	0	0	0	0	0	0	0
	EM	0	0	0	0	0	0	0	0	0
Slopes	Z	2	3	2	3	4	2	3	4	3
	EZ	1	1	1	2	2	1	1	1	1
	MZ	0	0	0	0	0	0	0	0	0
	EMZ	0	0	0	0	0	0	0	0	0
Total R-square		87	90	89	89	90	89	89	91	91
Grade Level		6	9	12	6	9	12	6	9	12

both metropolitan and nonmetropolitan areas. In our earlier analyses, including other regional groups precluded our using all five of these ethnic groups. This first set of analyses, then, includes 10 groups (5 ethnic groups, subdivided into metropolitan and nonmetropolitan). With this number of groups, we can use the same sets of regressor variables as were outlined in the beginning of this appendix.

The results of these analyses for these five ethnic groups (labeled "E") and two metropolitan locations (labeled "M") are given in table C.12. Inspection of the slope interaction percentages shows that they range from negligible to zero for the univariate analyses. For the multivariate analyses, however, their values tend to increase somewhat, especially when the school factors are brought in. Even for these analyses, however, the sum of the slope interaction percentages is almost always less than the percentage for the common slope. The exception is for the "Home Background and School" analysis at the twelfth grade, where the common slope is exceeded by one percentage point. Since the major trend is for these slope interaction percentages to be negligible, we conclude that a common slope will suffice for all 10 groups.

The percentages for the metropolitan-nonmetropolitan intercept (labeled "M") and their interaction with ethnicity (labeled "ME") also range from negligible to zero. In contrast, the percentages for ethnicity ("E") are usually quite large; the main exceptions are for the twelfth grade, when the school factors are brought into the analysis. As a consequence, we conclude that a common slope can be used for each of the 10 groups, but that a separate intercept would be preferable for each of the 5 ethnic groups.

Finally, we shall attempt to bring in a heretofore ignored group, namely, the Puerto Ricans. We shall do so by comparing the four available ethnic groups in the metropolitan Mid-Atlantic: Negroes, whites, Oriental-Americans, and Puerto Ricans. Since there are only four groups, we will use the same sets of regressor variables that we outlined in the introduction to this appendix. Since this is a one-way classification, namely, by ethnicity, there will be only one slope interaction percentage and only one intercept percentage.

The results of these analyses are given in table C.13. For the univariate case, shown in the top half of the table, the slope interaction percentages range from negligible to zero for each type of analysis. For the multivariate case, these percentages are somewhat larger, but not large enough to suggest that a separate slope should be used for each group. The other percentages indicate that most of the variance is accounted for by the differences among the ethnic group intercepts. Consequently, for all types of analysis, whether the dependent variables are univariate or multivariate, use of a common slope will suffice, but use of a separate ethnic group intercept is warranted. However, even this intercept becomes less necessary as more school variables are brought into the analysis.

C.4. SUMMARY

Two basic research strategies were followed: (*a*) ethnic groups were kept separate and examined for the ways in

Table C.12.—Percentage of Variation in Achievement and Motivation Associated With Family Background and School, When Stratified by Metropolitan Area Within Region: Negroes, Whites, Indians, Oriental-Americans, and Mexican-Americans

Source of Variation		Dependent Set: Achievement											
		Socio-Economic Status			Home Background			Family Background			Family Background and School		
Intercepts	E	16	8	4	12	6	4	8	4	2	3	3	1
	M	0	1	1	0	1	1	0	1	0	0	0	0
	EM	0	0	1	0	0	0	0	0	0	0	0	0
Slopes	Z	7	7	5	9	8	5	11	11	6	12	11	6
	EZ	0	0	0	1	1	0	1	1	1	1	1	1
	MZ	0	0	0	0	0	0	0	0	0	0	0	0
	EMZ	0	0	0	0	0	1	0	0	1	0	0	1
Total MR-square		30	33	28	32	34	28	41	46	46	44	47	45
Grade Level		6	9	12	6	9	12	6	9	12	6	9	12

Source of Variation		Dependent Set: Achievement/Motivation								
		Socio-Economic Status			Home Background			Home Background and School		
Intercepts	E	6	5	3	5	4	3	1	1	0
	M	0	1	1	0	0	1	0	0	0
	EM	1	0	1	1	0	1	0	0	0
Slopes	Z	4	5	3	8	8	3	9	7	3
	EZ	1	0	1	2	1	1	2	1	2
	MZ	0	0	0	0	0	0	0	1	0
	EMZ	0	0	0	1	1	1	2	1	2
Total MR-square		87	89	89	89	90	89	89	91	90
Grade Level:		6	9	12	6	9	12	6	9	12

Table C.13.—Percentage of Variation in Achievement and Motivation Associated With Family Background and School, When Stratified by Metropolitan Area Within Region: Negroes, Whites, Oriental-Americans, and Puerto Ricans

Source of Variation		Dependent Set: Achievement											
		Socio-Economic Status			Home Background			Family Background			Family Background and School		
Intercepts	E	21	15	19	18	13	16	16	11	11	3	3	4
Slopes	Z	3	2	1	3	2	2	4	3	3	5	3	3
	EZ	0	1	0	0	1	0	1	1	0	1	1	0
Total R-square		33	38	30	34	38	31	41	51	50	45	53	51
Grade Level:		6	9	12	6	9	12	6	9	12	6	9	12

Source of Variation		Dependent Set: Achievement/Motivation								
		Socio-Economic Status			Home Background			Home Background and School		
Intercepts	E	9	12	15	9	11	13	2	1	2
Slopes	Z	2	2	1	4	3	3	4	4	4
	EZ	1	2	1	1	3	2	1	2	3
Total MR-square		88	90	89	89	90	89	90	92	91
Grade Level:		6	9	12	6	9	12	6	9	12

which they differed by region and metropolitan or nonmetropolitan area; (*b*) selected regions and ethnic groups were examined together. In both cases, for both the univariate and multivariate analyses, there were no appreciable slope differences. For these same groups, however, the use of separate intercepts appeared warranted for some types of analysis. For instance, when the ethnic groups were kept separate, use of a different intercept was appropriate for their regional differences. For Indian and Mexican-Americans, this also applied to their differences by metropolitan and nonmetropolitan area. However, the need for such intercepts was much diminished once school factors were brought into the analysis with family background factors. For selected regional analyses, when ethnicity was included as another stratifying variable, a separate intercept was needed for each ethnic group, but

not for each region or area. But even for these latter results, the need for separate ethnic group intercepts was much diminished, if not eliminated, when school variables were brought into the analyses along with family background factors. These results have already been discussed at length in chapter 8. Here, it seems sufficient to note that, in studying the roles of geographic location and ethnicity in achievement and motivation, in all cases a common slope will suffice, but on occasion separate intercepts seem warranted. Such differences can easily be incorporated into the analyses as quantitative variables, as was done in this appendix with our variable denoting ethnicity.

APPENDIX D

FAMILY BACKGROUND AND SCHOOL INFLUENCES ON THE ACHIEVEMENT AND MOTIVATION OF BOYS AND GIRLS, FOR SELECTED ETHNIC GROUPS

In this appendix, we shall examine the extent to which students of different ethnic groups differ from one another when separated into groups of boys and groups of girls. It is often said that the sexes differ widely in their rate of maturation and sensitivity to socialization practices. We might therefore expect them to differ somewhat in terms of the variables and relationships among variables included in this study. We might also wonder whether boy-girl differences or ethnic differences play the greater explanatory role in achievement and motivation. In the sections that follow, we shall address these and similar questions. We shall use the covariance analysis model, as described in appendix C and chapter 8, for analyzing the magnitude of group differences in their slopes and intercepts.

The numbers of students and schools included are given in table D.1, which shows the percentages of each by ethnic group and (male) sex. Close inspection of this table suggests a number of cautions that should be observed in making inferences about sex differences, either within or across grade levels. The first caution pertains to the increasing percentage of white and Oriental-American students at the higher grade levels, and the decreasing percentages of students from the other groups. This trend strikingly reflects the greater incidence of dropouts among Indians, Mexican-Americans, Puerto Ricans, and Negroes. Evidently, a small proportion of the females in these groups either identified themselves as "Other" on the ethnic identification question, or failed to respond to that question at all. In addition, a higher proportion of those who failed to identify themselves by sex have been females. A third caution pertains to the absolute numbers of students in each ethnic group included in these analyses. In the preceding appendix, we excluded regional groups that, according to the census data, did not include sufficient members of the minority group under discussion. In this appendix, however, we shall include these groups in the analyses because it is worth absorbing some errors in ethnic group identification in order to: (*a*) allow a greater range of ethnic diversity in the sample; (*b*) reduce the complexity of the data processing. In any case, such errors are not as much of a problem at the higher grade levels as at the sixth grade.[1]

D.1. VARIATIONS BY SEX AND ETHNICITY FOR ALL STUDENTS COMBINED

In this section we pose one question repeatedly. It is: For Achievement and Motivation, how do sex and ethnicity compare as explanatory factors with respect to their slopes and intercepts?

It will be recalled from appendix C that there will be one slope factor for each type of stratification, as well as a term for each of their possible interactions and for the grand slope. For example, if we use "S" to designate difference in sex and "E" to designate ethnic differences, then there will be a percentage associated with the grand slope, Z, one for the interaction of S with Z (SZ), one for the interaction of E with Z (EZ), and one for the interaction of both S and E with Z (SEZ). In similar vein, for the intercepts there will be a percentage for S, one for E, and one for their interaction (SE). We say

[1] In fact, the ninth grade may represent an optimal level for study, since these errors of identification are probably not as frequent there as at the sixth grade, and the proportion of dropouts is not as great as at the twelfth grade.

Table D.1.—Percentage of Students and Schools, by Ethnic Group and Grade Level

Ethnic Group	Students from Group (%)			Males in Group (%)			Schools for Group (%)		
	6	9	12	6	9	12	6	9	12
Indian	3	2	2	55	54	55	31	38	27
Mexican-American	7	5	3	58	58	54	53	67	49
Puerto Rican	3	3	2	58	51	50	29	35	23
Negro	28	29	26	47	48	46	55	73	67
Oriental-American	1	1	2	56	52	54	12	17	12
White	57	60	66	51	51	50	77	73	66
Total	118,106	128,108	94,096	51	51	49	2,370	923	780
Grade Level:	6	9	12	6	9	12	6	9	12

NOTE.—Because of rounding, the percentages for students do not always add to 100. The percentages for schools do not add to 100, since many students from different groups attend the same schools.

"repeatedly" because we shall be asking this question for different sets of regressor and dependent variables, as follows.

Regressor Set	*Dependent Set*
1. Socio-Economic Status	1. Achievement and Motivation
2. Home Background, i.e.: (*a*) Sociol-Economic Status (*b*) Family Structure and Stability	2. Achievement and Motivation
3. Home Background and School, i.e.: (*a*) Two home background variables (*b*) Five student body variables [2]	3. Achievement and Motivation
4. Family Background, i.e.: (*a*) Two home background variables (*b*) Four family process variables	4. Achievement
5. Family Background and School, i.e.: (*a*) Socio-Economic Status (*b*) Four family process variables [3] (*c*) Student Body's Achievement	5. Achievement

In our first set of analyses in this section, we shall examine the explanatory roles of sex and ethnicity in Achievement and Motivation, both alone and in combination with one another. The role of each motivational variable will be examined separately. For example, table D.2 gives these analyses for Expectations for Excellence (EXPTN), Attitude Toward Life (ATTUD), Educational Plans and Desires (EDPLN), and Study Habits (HBTS). It also gives the results of an analysis in which these four motivational variables are taken together as the dependent set (see column "M"), and in which the same operations are performed for Achievement (see column "A"). Finally, Achievement and the four motivational variables are taken together as a set (see column "A/M"). In this way, the roles played by sex and ethnicity can be ascertained as they cumulate across dependent variables.

The upper one-third of table D.2 shows these results, by grade level, when Socio-Economic Status is the regressor variable.[4] Examining first the slope interaction percentages, we can note that there are slight values for the interaction of ethnicity with the grand slope, *EZ*, especially at the sixth and twelfth grades, but that the other values are zero. Compared with the percentages for the grand slope, *Z*, these interaction values are never large enough to warrant separate slopes. Hence, when Socio-Economic Status is the regressor variable, separate slopes are not needed for these 12 groups. When we examine the intercept values, we find that at each grade level the percentages for sex alone ("S") and for the interaction of sex and ethnicity (SE) range from negligible to zero. However, for the ethnic intercepts we find small-to-appreciable values, depending upon the set of variables. At all grade levels the largest of these values occurs for Achievement (A), both alone and in combination with the four Motivational variables (A/M). The percentage for the set of four motivational variables (M) increases over the grade levels. This increase appears to be due primarily to the increasingly large values taken on by Attitude Toward Life (ATTUD) at grades 9 and 12, and to Expectations for Excellence (EXPTN) at grade 12.

When Home Background (i.e., Family Structure and Stability combined with Socio-Economic Status) is used as the regressor set, there are, as can be seen from the middle third of table D.2, a number of differences in the percentage values. For the slope interaction, some slight increases occur in the ethnic percentages, *EZ*, while the *SEZ* and *SZ* percentages continue to range from negligible to null. However, these increased values are still not large enough compared to the grand slope *Z* to warrant our using separate slopes. The *Z* percentages are, in fact, uniformly larger when Home Background is the regressor set than when it is Socio-Economic Status. The intercept percentages remain negligible to null both for Sex (S), and for the interaction of sex with ethnicity, while in almost every case the percentages for ethnicity (E) are smaller. We conclude, then, that when Home Background is the regressor, a common slope will suffice in every case. We also conclude that separate intercepts might be adopted for the six ethnic groups, even though they would not be needed for some of the separate motivational variables. Sex, however, is not needed as a stratifying variable.

When the School is combined with Home Background to form the final set of regressors, we find that the slope interaction percentages change very little. The percentage for the grand slope, *Z*, is either increased very slightly or stays about the same, while the intercept percentages tend to shrink or stay about the same. Accordingly, when the school variables are brought into the analysis, the need for separate percentages by ethnic group is much reduced, and may even disappear.

[2] These are the five variables pertaining to the student body's achievement and motivational levels, described in chapter 2.

[3] These are the four motivational variables, taken as a set.

[4] As in the previous appendix, these percentages have been "unitized" by dividing them by the R-square for the variable or variables under analysis. The MR-squares have been converted to an upper limit of one by dividing by the number of variables in the set. As a result of this operation, the percentages are comparable for the univariate and multivariate cases despite the different numbers of dependent variables.

Table D.2.—Percentage of Variation in Achievement and Motivation Associated With Home Background and School, When Stratified by Sex and Ethnic Group

Source of Variation	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
	Socio-Economic Status							Socio-Economic Status							Socio-Economic Status						
Intercepts S	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0
E	3	4	6	2	1	28	14	2	12	2	1	4	20	14	11	26	3	2	6	22	16
SE	0	0	1	0	0	0	0	0	1	1	0	0	0	1	0	1	1	0	0	0	0
Slopes Z	23	19	14	18	5	6	5	16	8	9	13	4	4	4	7	2	5	6	2	3	2
SZ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EZ	7	3	1	3	1	0	1	1	1	1	1	1	1	1	3	0	2	1	1	0	1
SEZ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total R-square	7	13	16	16	16	36	18	12	14	27	15	21	37	18	8	11	26	9	17	33	18
Grade Level	Sixth							Ninth							Twelfth						

Source of Variation	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
	Home Background							Home Background							Home Background						
Intercepts S	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
E	0	0	2	0	1	23	13	2	8	3	0	4	17	14	12	20	3	1	6	20	16
SE	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	0
Slopes Z	32	29	20	27	10	8	10	19	10	11	18	6	5	6	8	4	5	11	3	3	3
SZ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EZ	6	6	3	5	2	1	3	1	1	2	1	2	1	2	3	1	3	4	2	0	2
SEZ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Total R-square	13	21	19	24	17	38	18	15	15	28	20	21	37	18	9	11	26	12	17	33	18
Grade Level	Sixth							Ninth							Twelfth						

Source of Variation	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
	Home Background and School							Home Background and School							Home Background and School						
Intercepts S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	1	1	2	1	1	4	2	1	0	2	1	1	4	2	2	0	1	0	1	4	2
SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Slopes Z	31	30	21	27	14	11	14	18	12	10	17	9	5	9	8	4	4	10	4	3	4
SZ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EZ	3	4	2	4	2	1	3	2	1	2	2	1	1	2	3	2	2	4	2	1	2
SEZ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1
Total R-square	16	24	22	27	18	43	18	18	23	30	23	22	41	19	13	20	28	16	18	37	19
Grade Level:	Sixth							Ninth							Twelfth						

NOTE.—The dependent set of variables is as follows: EXPTN = Expectations for Excellence; ATTUD = Attitude Toward Life; EDPLN = Educational Plans and Desires; HBTS = Study Habits; M = Motivation (which includes the aforementioned variables); A = Achievement; A/M = Achievement and Motivation. Among the sources of variation: S = Sex; E = Ethnicity.

Table D.3.—Percentage of Variation in Achievement Associated With Family Background and School, When Stratified by Sex and Ethnic Group

Source of Variation	Dependent Set: Achievement			Dependent Set: Achievement		
	Family Background			Family Background and School		
Intercepts S	0	0	0	0	0	0
E	18	12	11	4	3	3
SE	0	0	0	0	0	0
Slopes Z	10	7	3	12	7	4
SZ	0	0	0	0	0	0
EZ	2	1	2	1	1	1
SEZ	0	0	0	0	0	0
Total R-square	47	49	50	51	53	54
Grade Level	6	9	12	6	9	12

The next set of analyses, given in table D.3, corresponds to item 4 on the list of regressor and dependent variables. That is, the regressor set consists of Home Background (Socio-Economic Status plus Family Structure and Stability), together with the four family process variables—a combination known as Family Background—and the dependent set of Achievement. Both for this type of analysis and for the one corresponding to item 5 on our list (i.e., when Family Background was combined with School), the slope interaction percentages range from negligible to zero, while the percentage for the grand slope is somewhat larger. For the intercepts, the percentages are zero for Sex (S) and its interaction with ethnicity (SE). For ethnicity alone however, the percentages (labeled "E") are substantial when Family Background is the regressor set,

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but become much smaller when School is brought into the analysis.

Over all analyses, then, separate slopes are never warranted for these 12 groups classified by sex and ethnicity, nor are separate intercepts warranted for the groups classified by sex. Separate intercepts *are* warranted, however, for the six ethnic groups until the school variables are brought into the analysis. This greatly reduces the need for them, and even makes many of the motivational variables unnecessary. Throughout these analyses, we have observed that, of the variance explained by our regressors (variance represented by the Total R-squares), only a fraction (usually, less than half) could be uniquely associated with the stratifying factors. Accordingly, a substantial portion was left confounded among them. Although we could perform a commonality analysis, with the stratifying factors as variables, in order to see where this confounding is greatest, the values so generated would be too numerous to assimilate or even communicate. Nevertheless, the possibility does exist that, since whites are more numerous than the other ethnic groups, trends that apply to them may be swamping those of the other groups, especially in a variance-accounted-for framework.[5] With this in mind, we shall proceed to analyze sex differences within each of the separate ethnic groups.

D.2. VARIATIONS BY SEX FOR INDIAN AMERICANS

In this section and those that follow, the composition of the regressor sets will be as follows unless noted otherwise:

Regressor Set	*Dependent Set*
1. Socio-Economic Status	1. Achievement and Motivation
2. Home Background, i.e.: (*a*) Socio-Economic Status (*b*) Family Structure and Stability	2. Achievement and Motivation
3. Home Background and School, i.e.: (a) Two home background variables (*b*) Ten school variables [6]	3. Achievement and Motivation
4. Family Background, i.e.: (*a*) Two home background variables (*b*) Four family process variables [7]	1. Achievement
5. Family Background and School, i.e.: (*a*) Six family background variables (*b*) Ten school variables	5. Achievement

The results of analyses with these sets of variables for Indian Americans are given in table D.1. As before, we have unitized the percentages in order to make them comparable across sets of variables. Since there are only two sexes, the analyses will have a single slope interaction percentage, *SZ*, one for the grand slope, *Z*, and only one for the intercepts, *S*. In the top third of the table, which show the "Socio-Economic Status" analyses, the slope interaction percentages are almost always negligible compared with the grand slope. The major exception is for Attitude Toward Life at the twelfth grade. This value—28 percent, compared to 31 percent for the grand slope—is almost large enough to suggest separate slopes for each sex. At the sixth and ninth grades, the intercept percentages are seldom large, although they do seem large for some variables at the twelfth grade. In general, we would be inclined to say that when Socio-Economic Status is the regressor variable, a common slope can be used for Indian American boys and girls, but that separate intercepts would be warranted for most of the variables.

When Family Structure is combined with Socio-Economic Status to form Home Background (see the middle third of the table), the slope interaction percentages get smaller on the sixth and ninth grades, but tend to get larger at the twelfth grade. In the case of Attitude Toward Life, these percentages are large enough to suggest that separate slopes would be appropriate. The intercept percentages tend to get smaller for the sixth and ninth grades, while at the twelfth grade they either get smaller (the "ATTUD," "HBTS," and "A" values) or slightly larger (the "EDPLN," "M," and "A/M" values). At the twelfth grade especially, then, separate intercepts would seem warranted.

When the school variables are brought into the analysis with Home Background (see the bottom third of the table), the slope interaction percentages increase, save for Attitude Toward Life (ATTUD) at the twelfth grade, but never get large enough to warrant separate intercepts. The intercept percentages, on the other hand, get so small that they are no longer needed except in the case of Educational Plans and Desires (EDPLN) at the twelfth grade, and perhaps Motivation (M) and Achievement and Motivation (A/M) at the same grade.

Finally, table D.5 shows the results of analyses in which the motivational variables are included as an aspect of Family Background, and Achievement is the sole dependent variable. Here, the slope interaction percentages are so small that there is no question of separate slopes. Similarly, the intercept percentages, which are small before the school variables form part of the analysis, become zero when they do.

We are inclined to conclude, then, that in the analysis for Indian American boys and girls separate slopes are not needed, except perhaps for Attitude Toward Life at

[5] Moreover, our weights reflect the preponderance of whites.

[6] These are the five student body variables and five teaching staff variables, as described in chapter 2.

[7] These are the four motivational variables that, when included as an aspect of Family Background, are called Family Process.

Table D.4.—Percentage of Variation in Achievement and Motivation Associated With Home Background and School, When Stratified by Sex: Indians

Source of Variation	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
	Socio-Economic Status							Socio-Economic Status							Socio-Economic Status						
Intercepts S	0	2	7	8	2	12	3	1	7	0	6	2	3	2	0	40	16	24	11	5	10
Slopes Z	96	93	84	84	17	86	22	98	94	98	83	24	96	27	90	34	74	55	20	91	29
SZ	0	1	1	0	0	0	0	0	5	0	1	1	7	2	1	28	3	2	1	0	2
Total R-square	7	8	9	13	20	14	17	11	6	17	9	20	14	17	7	3	21	6	20	21	17
Grade Level	Sixth							Ninth							Twelfth						
	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
Source of Variation	Home Background							Home Background							Home Background						
Intercepts S	0	0	3	3	2	7	3	1	5	0	2	2	2	2	0	31	18	8	12	4	12
Slopes Z	92	92	86	85	32	87	37	98	95	98	89	35	95	37	88	19	66	59	27	89	37
SZ	0	0	0	0	0	1	0	0	4	0	1	1	6	2	1	42	8	4	5	1	6
Total R-square	16	20	14	23	21	20	18	16	8	21	18	21	16	17	10	6	22	12	21	22	18
Grade Level	Sixth							Ninth							Twelfth						
	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
Source of Variation	Home Background and School							Home Background and School							Home Background and School						
Intercepts S	0	0	1	1	0	1	1	0	1	0	1	1	0	1	0	0	8	0	5	1	5
Slopes Z	92	92	89	86	55	92	78	91	91	95	84	58	94	75	81	50	54	52	63	85	91
SZ	3	2	2	3	2	1	3	3	6	2	4	4	5	6	11	40	14	16	22	6	25
Total R-square	22	28	21	30	22	37	18	21	22	25	23	22	28	18	20	26	33	23	23	38	19
Grade Level	Sixth							Ninth							Twelfth						

NOTE.—The dependent set of variables is as follows: EXPTN = Expectation for Excellence, ATTUD = Attitude Toward Life, EDPLN = Educational Plans and Desires, HBTS = Study Habits, M = Motivation (which includes the aforementioned variables), A = Achievement, A/M = Achievement and Motivation.

Table D.5.—Percentage of Variation in Achievement Associated With Family Background and School, When Stratified by Sex: Indians

Source of Variation	Dependent Set: Achievement			Dependent Set: Achievement		
	Family Background			Family Background and School		
Intercepts S	2	1	2	0	0	0
Slopes Z	88	93	78	91	93	78
SZ	2	4	5	2	4	6
Total R-square	34	28	33	48	39	50
Grade Level	6	9	12	6	9	12

the twelfth grade. On the other hand, separate intercepts might be appropriate until the school variables are brought into the analysis. But when they are, such intercepts would seem warranted only at the twelfth grade, and at this grade only for Educational Plans and Desires, the four motivational variables, and Achievement and Motivation combined.

D.3. VARIATIONS BY SEX FOR MEXICAN-AMERICANS

The results of analyses for Mexican-American boys and girls are given in table D.6. When Socio-Economic Status is the regressor variables, the slope interaction percentages are negligible for all grade levels. However, the intercept percentages for some of the variables are large enough to warrant separate intercepts, especially at the twelfth grade. For example, separate intercepts might be used for Study Habits (HBTS) at all grade levels, and for Attitude Toward Life (ATTUD) at grades 9 and 12. For the "Home Background" analyses, the slope interaction percentages increase somewhat at the twelfth grade only, but not enough to warrant separate slopes. At the same time, the intercept percentages either get smaller or remain roughly the same. When the school variables are brought into the analysis, the slope interaction percentages increase slightly at the lower grades, and rather more at the twelfth grade, but are still not large enough to warrant separate slopes. Most of the intercept percentages range from negligible to zero: the exceptions are Educational Plans and Desires (EDPLN) and the motivational variables (M), at the twelfth grade.

Turning now to table D.7, in which the motivational variables are considered an aspect of Family Background, we find that the slope interaction percentages and the intercept percentages alike range from negligible to zero, both before and after the school variables are brought into the analysis. For these latter analyses, then, a common slope and a common intercept will suffice.

Table D.6.—Percentage of Variation in Achievement and Motivation Associated With Home Background and School, When Stratified by Sex: Mexican-Americans

Source of Variation	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
	Socio-Economic Status							Socio-Economic Status							Socio-Economic Status						
Intercepts . . . S . .	0	0	1	4	1	1	1	0	6	0	8	2	1	2	4	3	13	17	5	2	5
Slopes . . . . Z	92	90	87	85	20	93	24	99	89	98	90	25	97	28	90	92	78	57	16	93	17
SZ	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	3	2	1	1	1
Total R-square	9	10	14	15	20	16	17	9	8	18	9	20	15	17	5	3	15	5	20	8	17
Grade Level	Sixth							Ninth							Twelfth						
	Home Background							Home Background							Home Background						
Intercepts . . . S	0	0	0	1	1	0	1	0	4	0	3	2	1	2	4	2	14	7	5	1	5
Slopes . . Z . . .	89	90	89	90	45	93	50	96	89	95	92	35	94	39	86	96	76	79	24	94	26
SZ .	1	0	1	0	1	0	1	1	0	1	0	0	1	0	2	5	4	1	2	1	2
Total R-square	25	33	26	35	22	26	18	13	10	21	18	21	20	17	6	7	16	11	20	9	17
Grade Level.	Sixth							Ninth							Twelfth						
	Home Background and School							Home Background and School							Home Background and School						
Intercepts . . .S	0	0	0	0	0	0	1	0	1	0	1	1	0	1	0	0	6	2	3	1	2
Slopes . . . . Z	89	90	88	90	58	94	80	94	92	92	93	64	93	82	78	92	71	68	58	85	73
SZ	1	1	1	0	2	1	2	4	1	3	1	2	1	2	13	6	9	11	9	7	12
Total R-square	28	36	29	39	22	40	19	17	24	25	24	22	34	18	15	23	21	21	22	25	19
Grade Level	Sixth							Ninth							Twelfth						

NOTE.—The dependent set of variables is as follows: EXPTN = Expectation for Excellence, ATTUD = Attitude Toward Life, EDPLN = Educational Plans and Desires, HBTS = Study Habits, M = Motivation (which includes the aforementioned variables), A = Achievement, A/M = Achievement and Motivation.

Table D.7.—Percentage of Variation in Achievement Associated With Family Background and School, When Stratified by Sex: Mexican-Americans

Source of Variation	Dependent Set: Achievement Family Background			Dependent Set: Achievement Family Background and School		
Intercepts . . S	0	0	0	0	0	0
Slopes . . . . . Z	91	92	82	92	92	80
SZ . .	1	1	2	1	1	5
Total R-square . . .	34	33	27	47	45	41
Grade Level: . .	6	9	12	6	9	12

Taking these analyses as a whole, we are inclined to conclude that, for Mexican-American boys and girls, a common slope will suffice but separate intercepts may be warranted for some of the motivational variables. This is true for most grade levels until the school variables are brought into the analysis, whereupon separate intercepts become unnecessary except at the twelfth grade. Even here, they are really needed only for Educational Plans and Desires, Study Habits, and the four motivational variables.

D.4. VARIATIONS BY SEX FOR PUERTO RICANS

The unitized results of the analyses for Puerto Rican boys and girls are given in table D.8. From the top one-third of the table, which shows the analyses for Socio-Economic Status, it is clear that the slope interaction percentages, *SZ*, range from negligible to zero, while those of the grand slope, *Z*, are considerable. The values for the intercept percentages suggest that separate intercepts might be warranted for most variables at all grade levels, with the major exception of Expectations for Excellence for all grades and Achievement at grade 9.

For the "Home Background" analyses, shown in the middle portion of the table, the slope interaction percentages remain small and the grand slope percentage large. The intercept percentages however, are greatly reduced, except at the twelfth grade where the percentage for Achievement increases slightly while the others decrease somewhat or stay the same. Clearly, the need for separate intercepts at grades 6 and 9 becomes questionable, but at grade 12 they are still warranted for most variables.

When school is brought into the analysis with Home Background (see the bottom third of the table), the slope interaction percentages usually increase slightly, but re-

Table D.8.—Percentage of Variation in Achievement and Motivation Associated With Home Background and School, When Stratified by Sex: Puerto Ricans

Source of Variation		EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
		Socio-Economic Status							Socio-Economic Status							Socio-Economic Status						
Intercepts	S	0	1	5	2	1	7	2	0	3	1	3	1	0	1	0	11	13	2	7	9	7
Slopes	Z	84	86	79	79	17	88	20	99	95	99	93	27	92	27	97	69	80	82	22	82	21
	SZ	1	1	0	1	0	0	0	0	0	0	0	0	3	1	1	2	4	1	1	9	1
Total R-square		9	11	10	14	20	13	17	12	8	19	12	20	9	17	11	3	19	7	20	5	17
Grade Level		Sixth							Ninth							Twelfth						
		EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
Source of Variation		Home Background							Home Background							Home Background						
Intercepts	S	0	0	1	0	1	3	1	0	2	0	1	1	0	1	0	4	13	1	6	13	7
Slopes	Z	90	91	86	87	44	92	48	98	94	99	95	41	92	40	98	82	81	93	41	71	41
	SZ	0	0	0	0	0	1	1	0	0	0	0	0	2	1	1	2	4	1	2	20	3
Total R square		26	35	23	33	21	24	18	17	9	23	23	21	12	17	17	6	21	22	21	6	18
Grade Level		Sixth							Ninth							Twelfth						
		EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
Source of Variation		Home Background and School							Home Background and School							Home Background and School						
Intercepts	S	0	0	0	0	1	1	1	0	1	0	0	1	0	1	0	0	5	0	4	0	3
Slopes	Z	91	90	86	88	57	84	83	94	94	96	89	59	90	72	87	66	75	80	64	76	80
	SZ	1	1	2	1	2	1	3	2	2	2	6	4	3	5	7	4	10	5	7	9	10
Total R-square		30	39	28	39	22	41	19	20	17	25	27	22	24	18	22	25	28	29	23	27	19
Grade Level		Sixth							Ninth							Twelfth						

NOTE: The dependent set of variables is as follows: EXPTN = Expectation for Excellence, ATTUD = Attitude Toward Life, EDPLN = Educational Plans and Desires, HBTS = Study Habits, M = Motivation (which includes the aforementioned variables), A = Achievement, A/M = Achievement and Motivation.

main small relative to the percentage for the grand slope. The intercept percentages become so small that separate intercepts seem unnecessary, save for the following variables at grade 12: Educational Plans and Desires, the four motivational measures, and the latter when combined with Achievement (A/M).

Turning now to table D.9, we can note from the ratio of Z to SZ that, when the four motivational measures are considered as an aspect of Family Background, separate slopes are not needed for the family background variables, either alone or when combined with the School variables. Similarly, the need for separate intercepts is questionable for the family background variables alone, and clearly ruled out when School variables are brought into the analysis.

Our general conclusion, then, is that separate slopes are not needed for Puerto Rican boys and girls, but that separate intercepts are—at least for some of the variables, and especialy at the twelfth grade. However, this need is eliminated once the school variables are brought into the analysis, with the following exceptions at the twelfth grade: Educational Plans and Desires, and the four motivational measures, both as a set and combined with Achievement.

Table D.9.—Percentage of Variation in Achievement Associated With Family Background and School, When Stratified by Sex: Puerto Ricans

Source of Variation	Dependent Set: Achievement	Family Background		Achievement Family Background and School		
Intercepts..S	1	0	2	1	0	0
Slopes .....Z	90	95	86	92	93	80
SZ ...	2	2	5	2	3	5
Total R-square ...	32	26	21	48	37	37
Grade Level: ...	6	9	12	6	9	12

D.5. VARIATIONS BY SEX FOR NEGRO AMERICANS

The analyses for Negro Americans, given in table D.10, show that the slope interaction percentages, SZ, are small relative to the percentage for the grand slope, Z. Accordingly, separate slopes are not needed for any of the following regressor sets: Socio-Economic Status; Home Background; and Home Background combined with School. However, separate intercepts do seem warranted when Socio-Economic Status is the regressor variable. But there is less need for them when Family Structure is brought in (see the middle portion of the table), and no

Table D.10.—Percentage of Variation in Achievement and Motivation Associated With Home Background and School, When Stratified by Sex: Negroes

Source of Variation	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
	Socio-Economic Status							Socio-Economic Status							Socio-Economic Status						
Intercepts . .S	1	2	10	9	2	3	2	2	15	2	6	1	1	1	2	27	0	16	2	0	2
Slopes . . ....Z	95	92	84	81	11	96	18	96	78	96	81	21	99	27	98	64	99	65	19	99	26
SZ	3	2	1	2	0	0	0	0	0	0	3	0	0	0	0	0	0	2	0	0	0
Total R-square	4	6	7	9	19	12	17	7	6	17	8	20	15	17	3	3	15	3	20	15	17
Grade Level	Sixth							Ninth							Twelfth						
	Home Background							Home Background							Home Background						
Intercepts . .S	0	0	4	2	1	2	1	1	10	2	2	1	0	1	0	19	0	3	1	0	1
Slopes . . . .Z	93	92	88	87	25	96	31	96	82	96	87	29	99	34	96	71	99	76	24	99	30
SZ	3	4	1	3	1	0	1	0	0	0	2	1	0	1	3	1	0	10	1	0	1
Total R-square	10	16	11	19	20	13	17	11	7	20	14	20	16	17	5	3	16	7	20	1	17
Grade Level:	Sixth							Ninth							Twelfth						
	Home Background and School							Home Background and School							Home Background and School						
Intercepts ....S	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Slopes .....Z	95	93	92	90	41	98	62	96	92	96	89	55	99	74	95	93	97	83	61	98	86
SZ	3	4	1	3	1	0	2	2	2	1	3	1	0	2	4	2	2	10	3	1	3
Total R-square	14	20	17	25	21	26	18	17	20	23	20	21	26	18	13	22	22	14	22	29	18
Grade Level:	Sixth							Ninth							Twelfth						

NOTE.—The dependent set of variables is as follows: EXPTN Expectation for Excellence, ATTUD Attitude Toward Life, EDPLN Educational Plans and Desires, HBTS Study Habits, M Motivation (which includes the aforementioned variables), A Achievement, A M Achievement and Motivation

need at all when the school variables are also brought in (see the bottom portion).

Finally, as can be seen from an inspection of table D.11, when the four motivational variables are considered as an aspect of Family Background, neither separate slopes nor intercepts are needed. In general, then, we are inclined to conclude that separate slopes are not needed for Negro boys and girls, but that separate intercepts might be warranted for some variables, especially Attitude Toward Life. However, when the school variables are brought into the analysis, even the intercepts are no longer needed.

Table D.11.—Percentage of Variation in Achievement Associated With Family Background and School, When Stratified by Sex: Negroes

Source of Variation	Dependent Set: Achievement	Dependent Set: Family Background	Dependent Set: Achievement Family Background and School	Dependent Set: Achievement	Dependent Set: Family Background	Dependent Set: Achievement Family Background and School
Intercepts..S	1	0	0	0	0	0
Slopes .....Z	97	98	99	98	98	98
SZ ...	0	0	0	0	0	1
Total R-square ...	24	28	28	36	39	44
Grade Level: ...	6	9	12	6	9	12

D.G. VARIATIONS BY SEX FOR ORIENTAL-AMERICANS

The results of the analyses for Oriental-American students are given in table D.12. Here, the ratio of the grand slope percentage, Z, to the sum of the slope interaction percentages, SZ, shows that separate slopes are not needed, even though the SZ percentages increase greatly when the school variables are brought in. Some intercept percentages are worth noting when Socio-Economic Status becomes the regressor variable (see especially under "ATTUD" at grades 9 and 12 and "HBTS" at grade 12). However, once the school variables are brought into the analysis, the need for separate intercepts is practically eliminated. The possible exceptions, all at grade 12, are for Expectations for Excellence, the four motivational variables taken as a set, and the latter combined with Achievement.

When the four motivational variables are included as an aspect of Family Background, as they are in table D.13, neither separate slopes nor separate intercepts are needed. This is true whether the family background variables are taken alone or in combination with the school variables. We conclude that separate slopes are never warranted for Oriental-American boys and girls but that separate intercepts are, at least for some variables at some grade levels (e.g., ATTUD at grades 9 and 12 and HBTS at grade 12).

Table D.12.—Percentage of Variation in Achievement and Motivation Associated With Home Background and School, When Stratified by Sex: Oriental-Americans

Source of Variation	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
	Socio-Economic Status							Socio-Economic Status							Scoio-Economic Status						
Intercepts . . S . .	2	0	0	3	3	2	4	0	11	0	1	2	0	2	0	11	1	6	1	0	1
Slopes . . . . Z	87	86	96	76	29	91	35	90	84	93	89	27	94	27	85	67	86	70	24	90	23
SZ	4	3	0	4	2	0	2	5	0	3	5	1	2	1	1	3	1	5	1	0	1
Total R-square	12	18	20	23	21	28	18	12	9	21	16	20	13	17	6	5	20	12	20	11	17
Grade Level.	Sixth							Ninth							Twelfth						

Source of Variation	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
	Home Background							Home Background							Home Background						
Intercepts . . . S	2	0	1	1	3	1	4	0	5	0	0	1	0	1	1	6	0	2	1	0	1
Slopes . . . Z	79	85	90	82	52	90	58	90	79	94	93	43	93	44	86	82	85	83	40	85	40
SZ	3	1	0	1	2	0	3	2	5	1	3	4	1	4	1	2	1	1	1	3	2
Total R-square	26	42	37	41	22	39	19	23	17	29	28	21	20	18	9	10	25	26	21	18	18
Grade Level	Sixth							Ninth							Twelfth						

Source of Variation	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
	Home Background and School							Home Background and School							Home Background and School						
Intercepts . . S	0	0	0	1	1	0	2	0	1	0	0	1	0	1	2	1	0	0	2	0	2
Slopes . . . . Z	78	83	88	79	76	86	91	83	79	90	89	64	91	72	76	69	74	76	20	80	56
SZ	4	2	1	2	6	2	7	11	11	5	5	13	7	15	16	12	12	6	15	9	16
Total R-square	33	48	42	46	23	48	19	28	25	35	33	22	27	18	17	13	33	30	22	23	18
Grade Level:	Sixth							Ninth							Twelfth						

NOTE.—The dependent set of variables is as follows: EXPTN = Expectation for Excellence, ATTUD = Attitude Toward Life, EDPLN = Educational Plans and Desires, HBTS = Study Habits, M = Motivation (which includes the aforementioned variables), A = Achievement, A/M = Achievement and Motivation.

Table D.13.—Percentage of Variation in Achievement Associated With Family Background and School, When Stratified by Sex: Oriental-Americans

Source of Variation	Dependent Set: Achievement			Dependent Set: Achievement		
	Family Background			Family Background and School		
Intercepts. S	2	0	0	1	0	0
Slopes . . . . Z . .	91	92	92	87	90	89
SZ . .	1	2	4	2	5	5
Total R-square . .	50	38	44	58	43	48
Grade Level . .	6	9	12	6	9	12

However, the need for separate intercepts is virtually eliminated when the school variables are brought into the analysis.

D.7. VARIATIONS BY SEX FOR WHITE AMERICANS

The results of the analyses for white students are given in table D.14. They show that, for all the types of analysis, the slope interaction percentages are both negligible to small in an absolute sense and minuscule compared with the grand slope percentage. Hence, separate slopes are not warranted. For many of the variables, however, separate intercepts are warranted, especially at the twelfth grade. But when the school variables are brought into the analysis, the need for such intercepts is reduced if not eliminated. Similarly, when the four motivational variables are considered as an aspect of Family Background, as they are in table D.15, neither separate slopes nor separate intercepts are needed, whether the family background variables are taken alone or in combination with the school variables. In general, then, separate slopes are never needed for white boys and girls. However, separate intercepts are warranted for at least some variables at all grade levels, until the school variables are brought into the analysis, when they become unnecessary.

D.8. VARIATIONS BY SEX FOR ALL STUDENTS COMBINED[8]

The results of the analyses for all students combined, which are given in table D.16, show that, for each type of analysis, separate slopes are not needed. However, separate intercepts are warranted for at least some of the variables at each grade level, although their percentage role is greatly reduced after the school factors have been brought in. Separate intercepts, never warranted for

[8] Viz, students from the different ethnic groups combined and weighted by their sampling weights.

Table D.11.—Percentage of Variation in Achievement and Motivation Associated With Home Background and School, When Stratified by Sex: Whites

Source of Variation		EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
		Socio-Economic Status							Socio-Economic Status							Socio-Economic Status						
Intercepts	S	3	0	0	23	5	3	5	0	8	2	17	6		6	1	17	8	29	10	2	10
Slopes	Z	95	98	98	77	20	97	26	99	91	97	81	35	99	38	99	83	91	70	31	98	32
	SZ	0	1	1	0	0	0	0	0	1	0	2	1	0	1	0	0	0	2	0	0	0
Total R-square		3	8	12	12	20	17	17	11	8	28	14	21	21	18	7	4	26	10	21	17	17
Grade Level		Sixth							Ninth							Twelfth						
		EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
Source of Variation		Home Background							Home Background							Home Background						
Intercepts	S	2	0	0	7	5	2	5	0	7	2	13	6	1	6	0	14	8	26	10	2	10
Slopes	Z	95	97	98	80	26	97	31	98	89	97	81	39	98	42	99	85	91	72	33	98	34
	SZ	1	1	1	0	0	0	0	1	2	1	3	1	0	1	0	1	0	3	1	0	1
Total R-square		6	12	13	15	20	18	17	13	9	28	18	21	22	18	8	5	27	12	21	17	17
Grade Level		Sixth							Ninth							Twelfth						
		EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
Source of Variation		Home Background and School							Home Background and School							Home Background and School						
Intercepts	S	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	1
Slopes	Z	96	98	97	84	40	98	53	97	92	97	82	53	98	62	97	90	90	75	48	97	57
	SZ	1	1	2	1	1	0	1	1	2	1	3	1	0	1	2	2	1	3	1	1	1
Total R-square		9	15	16	18	21	24	18	15	15	30	20	22	25	18	12	10	29	14	22	21	18
Grade Level		Sixth							Ninth							Twelfth						

NOTE: The dependent set of variables is as follows: EXPTN = Expectation for Excellence; ATTUD = Attitude Toward Life; EDPLN = Educational Plans and Desires; HBTS = Study Habits; M = Motivation (which includes the aforementioned variables); A = Achievement; A/M = Achievement and Motivation.

Table D.15.—Percentage of Variation in Achievement Associated With Family Background and School, When Stratified by Sex: Whites

Source of Variation	Dependent Set: Achievement	Family Background	Achievement	Family Background and School	Achievement	
Intercepts	S	1	1	0	0	0	0
Slopes	Z	97	97	98	97	97	97
	SZ	0	0	0	0	0	0
Total R square		30	38	39	36	42	44
Grade Level		6	9	12	6	9	12

Achievement, are quite appropriate for some of the motivational variables, especially Study Habits at all grade levels, and Educational Plans and Desires at the twelfth grade.

When the four motivational variables are treated as an aspect of Family Background, as they are in table D.17, neither separate slopes nor separate intercepts are needed for boys and girls, whether the school variables are included with the family background variables or not. Accordingly, for analyses that involve all students combined, boys and girls never differ enough to require the construction of separate slopes, although they do differ enough on some variables at each grade level to require separate intercepts. Among these variables are: Study Habits, at all grade levels; Educational Plans and Desires, at the twelfth grade; and Motivation (both alone, and when combined with Achievement), also at the twelfth grade.

D.9. VARIATIONS BY SEX AND ETHNICITY FOR ALL STUDENTS COMBINED

In this section, we shall perform analyses identical to those in the preceding section except that Racial-Ethnic Group Membership (RETH), our variable denoting ethnicity, is included at each step. Since the first step includes ethnicity alone, it may help to clarify the results if the composition of the regressor sets at each step is outlined as follows.

Regressor Set	*Dependent Set*
1. Ethnicity alone	1. Achievement and Motivation
2. Ethnicity and Socio-Economic Status	2. Achievement and Motivation
3. Ethnicity and Home Background, i.e.:	3. Achievement and Motivation

Table D.16.—Percentage of Variation in Achievement and Motivation Associated With Home Background and School, When Stratified by Sex: Total Students

Source of Variation		EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
		Socio-Economic Status							Socio-Economic Status							Socio-Economic Status						
Intercepts	S	1	1	0	17	4	1	4	0	5	1	11	4	0	4	0	8	7	25	8	1	7
Slopes	Z	97	97	97	83	20	99	32	99	94	98	86	34	99	42	99	92	92	73	28	99	36
	SZ	2	1	2	1	0	0	1	1	0	1	2	1	0	1	1	0	0	2	0	0	0
Total R square		5	10	12	13	20	23	17	11	11	26	14	21	28	18	6	7	23	9	21	24	17
Grade Level		Sixth							Ninth							Twelfth						
		Home Background							Home Background							Home Background						
Intercepts	S	1	0	0	10	4	1	4	0	4	1	7	4	0	4	0	7	7	19	8	1	7
Slopes	Z	94	94	96	86	31	99	42	98	93	97	87	40	99	48	98	93	92	77	32	99	39
	SZ	2	2	2	1	1	0	1	1	1	1	2	1	0	1	1	0	1	3	1	0	6
Total R-square		10	17	15	20	21	26	18	14	13	26	20	21	39	18	6	8	23	12	21	25	18
Grade Level		Sixth							Ninth							Twelfth						
		Home Background and School							Home Background and School							Home Background and School						
Intercepts	S	0	0	0	2	1	0	1	0	1	1	2	1	0	1	0	1	2	3	2	0	2
Slopes	Z	95	95	96	88	45	99	74	98	95	97	89	63	99	86	97	96	91	80	61	99	87
	SZ	2	2	2	1	1	0	1	1	2	2	2	1	0	2	2	1	2	3	5	0	2
Total R square		13	21	18	25	21	39	18	18	23	30	23	22	39	19	13	20	28	15	22	36	19
Grade Level		Sixth							Ninth							Twelfth						

NOTE: The dependent set of variables is as follows: EXPTN = Expectation for Excellence; ATTUD = Attitude Toward Educ.; EDPLN = Educational Plans and Desires; HBTS = Study Habits; M = Motivation (which includes the aforementioned variables); A = Achievement; A/M = Achievement and Motivation.

(*a*) Socio-Economic Status
(*b*) Family Structure and Stability

4. Ethnicity, Home Background, and School, i.e.:
   (*a*) Two home background variables
   (*b*) Ten school variables [9]

4. Achievement and Motivation

5. Ethnicity and Family Background, i.e.:
   (*a*) Two home background variables
   (*b*) Four family process variables [10]

5. Achievement

6. Ethnicity, Family Background, and School, i.e.:
   (*a*) Six family background variables
   (*b*) Ten school variables

6. Achievement

[10] These are the four motivational variables that, when included as an aspect of Family Background, are called Family Process.

[9] These are the five student body variables and five teaching staff variables, as described in chapter 2.

It will be recalled that, since RETH captures the mean differences among ethnic groups, we are in effect regressing the dependent variables against ethnic group membership, which is first treated singly and then in combination with the other regressor variables. The results of these analyses, given in table D.18, show that the slope interaction percentages, *SZ*, are always small relative to the percentage for the grand slope, *Z*. They are largest for Educational Plans and Desires at each grade level, when only RETH is included as a regressor variable. Hence, when RETH is the regressor, separate slopes are not need-

Table D.17.—Percentage of Variation in Achievement Associated With Family Background and School, When Stratified by Sex: Total Students

Source of Variation	Dependent Set: Achievement			Dependent Set: Achievement, Family Background and School		
	Family Background					
Intercepts..S	1	0	0	0	0	0
Slopes .....Z	97	97	97	98	97	98
SZ ...	1	1	0	0	0	0
Total R-square ...	34	42	40	47	52	53
Grade Level: ...	6	9	12	6	9	12

Table D.18.—Percentage of Variation in Achievement and Motivation Associated With Home Background and School, When Stratified by Sex: Ethnicity for Total Students

Source of Variation		EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
		Ethnicity (RETH)							Ethnicity (RETH)							Ethnicity (RETH)						
Intercepts	S	2	1	1	40	4	1	1	0	8	6	34	4	1	4		8	77	69	8	1	8
Slopes	Z	91	95	88	59	6	99	27	96	90	76	66	10	99	28		93	13	33	10	98	31
	SZ	6	3	10	0	1	0	1	3	1	17	0	1	0	1		1	10	0	0	0	9
Total R-square		2	3	3	5	19	22	17	2	8	2	5	19	22	17	0	8	2	3	20	20	17
Grade Level		Sixth							Ninth							Twelfth						

Source of Variation		EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
		Ethnicity and Socio-Economic Status							Ethnicity and Socio-Economic Status							Ethnicity and Socio-Economic Status						
Intercepts	S	1	1	1	16	4	1	4	0	5	1	11	4	0	4	0	6	7	25	8	1	7
Slopes	Z	96	97	96	83	21	99	44	99	94	97	86	39	100	57	99	95	92	73	37	99	57
	SZ	3	2	3	1	1	0	1	1	1	2	2	1	0	1	1	1	1	2	1	0	1
Total R-square		5	11	13	14	20	34	18	11	14	26	15	21	36	18	7	10	24	9	21	33	18
Grade Level		Sixth							Ninth							Twelfth						

Source of Variation		EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
		Home Background							Home Background							Home Background						
Intercepts	S	1	0	0	9	4	1	4	0	4	1	7	4	0	3	0	5	7	19	7	1	7
Slopes	Z	94	95	95	86	31	99	53	98	94	97	87	45	99	63	98	95	92	77	40	99	60
	SZ	2	2	2	1	1	0	1	1	1	2	2	1	0	1	1	1	1	3	1	0	1
Total R square		10	17	15	20	21	35	18	14	15	27	20	21	37	18	8	11	25	12	21	33	18
Grade Level		Sixth							Ninth							Twelfth						

Source of Variation		EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M	EXPTN	ATTUD	EDPLN	HBTS	M	A	A/M
		Home Background and School							Home Background and School							Home Background and School						
Intercepts	S	0	0	0	2	1	0	1	0	1	0	2	1	0	1	0	1	3	3	6	0	2
Slopes	Z	95	95	95	88	46	99	76	98	95	97	88	63	99	88	97	96	91	80	21	99	89
	SZ	2	2	3	1	1	0	1	1	2	2	2	2	0	2	2	1	2	4	2	0	2
Total R-square		13	21	19	25	21	41	18	17	23	30	23	22	41	19	13	20	28	15	22	37	19
Grade Level		Sixth							Ninth							Twelfth						

NOTE: The dependent set of variables is as follows: EXPTN Expectation for Excellence, ATTUD Attitude Toward Life, EDPLN Educational Plans and Desires, HBTS Study Habits, M Motivation (which includes the aforementioned variables), A Achievement, A/M Achievement and Motivation

ed for differences by sex. Further, the percentages that do exist tend to become smaller as more factors are brought in relating to the students' socio-economic status, family background, and school. Accordingly, separate slopes are not required for any of these types of analysis.

This is not true of the intercepts. Indeed, when RETH is the sole regressor variable, the intercept percentages for Study Habits (at all grades) and for Educational Plans and Desires (at the twelfth grade) are dramatically large. However, as other background and school variables are brought into the analysis, the need for separate intercepts is greatly reduced. But it remains warranted to a degree at all grades in the case of Study Habits, and at the twelfth grade in the case of Educational Plans and Desires.

When the four motivational variables are included as an aspect of Family Background, as they are in table D.19; separate slopes and intercepts are not warranted. This applies whether the family background variables are taken alone or in conjunction with the school variables. For these analyses, then, separate slopes for boys and girls are never warranted but separate intercepts are, especially, for: Study Habits, at all grade levels; Educational Plans and Desires, at the twelfth grade; and Motivation (both alone and combined with Achievement), also at the twelfth

Table D.19.—Percentage of Variation in Achievement Associated With Family Background and School, When Stratified by Sex: Ethnicity for Total Students

Source of Variation	Dependent Set: Achievement			Dependent Set: Achievement Family Background and School		
	Family Background					
Intercepts..S	0	0	0	0	0	0
Slopes .....Z	98	97	98	98	98	98
SZ	0	0	0	0	0	0
Total R-square ...	43	48	49	49	53	54
Grade Level: ...	6	9	12	6	9	12

grade. However, such intercepts are needed less and less as more and more school, family, and social background variables are brought into the analysis.

D.10. SUMMARY

In this appendix, we have attempted to examine the role of differences by sex and ethnic group in achievement and motivation. The motivational variables were treated both singly and in combination to ascertain their power as classificatory variables. The analytic model employed allowed us to ascertain the extent to which different slopes and intercepts might be appropriate for each group so classified.

The first set of analyses classified students as to: (*a*) sex; (*b*) ethnicity, viz, self-reported membership in one of six ethnic groups. Accordingly, there were twelve groups in all. Analyses with these groups showed that separate slopes were not required for any of the dependent variables at any of the grade levels. Separate intercepts by sex were not warranted either, although they were for the differences by ethnic group on some of the dependent variables. The need for even these separate intercepts was much reduced as progressively more school, family, and social background factors were brought into the analysis. The variables for which separate ethnic intercepts might have been used were: Achievement, both alone and when combined with the four motivational variables; the four motivational variables taken as a set; Educational Plans and Desires; and (to a lesser extent) Expectations for Excellence.

In the remaining analyses we examined differences between boys and girls in each ethnic group, both separately and for all ethnic groups combined. For virtually all these analyses, separate slopes for boys and girls were not required. The only exception was for Indian Americans at the twelfth grade. Here, the dependent variable of Attitude Toward Life might have warranted separate slopes for some of the regressors. But even this no longer applied when the school variables were brought in. As a consequence, we are inclined to conclude that, for all these groups and variables at all these grade levels, separate slopes by sex are unnecessary.

We went on to ask if separate intercepts were any more necessary for boys and girls than separate slopes. At times, substantial intercept differences were observed. But it was universally the case that, as more background and especially more school variables were brought into the regressor set, the need for separate intercepts was often vastly reduced if not eliminated. The variables for which, in our opinion, separate intercepts might well be used when both Home Background and School are included as regressor variables, are as follows:

Group	*Intercepts Warranted* [11]
1. Indian American	1. Educational Plans and Desires (grade 12 only), and Motivation, both alone and combined with Achievement (grade 12 only)
2. Mexican-American	2. Educational Plans and Desires, Study Habits, and Motivation (grade 12 only)
3. Puerto Rican	3. Educational Plans and Desires, Motivation, and Motivation combined with Achievement (grade 12 only)
4. Negro	4. Attitude Toward Life (until School is included)
5. Oriental-American	5. Expectations for Excellence, Motivation, and Motivation combined with Achievement (grade 12 only)
6. White	6. Most variables (until School is included) [12]
7. Total	7. Study Habits (all grade levels), Educational Plans and Desires, Motivation, and Motivation combined with Achievement (grade 12 only)

[11] Based on a cutoff point of 2 percent or more.
[12] The support for these intercepts was not strong, however.

APPENDIX E

INDEX RELIABILITIES

Tables E.1 and E.2 present reliability coefficients for the different indexes. Before examining these coefficients in detail, we shall describe how they were computed. Since all the indices were themselves weighted composites, we wanted a computational rationale that would allow for the weights in question. With this in mind, coauthor Beaton developed the following procedure:

Where

C=an mth-order covariance matrix

W=an mth-order column vector of weights

$SUMC=W^TCW$, where W^T denotes the transpose of W

$SUMD=W^TD_cW$, where D_c is a matrix containing the diagonal elements of C, and zeros elsewhere

Then the weighted reliability coefficient, rc, is given by:

$$rc = \frac{m}{m-1}\left(1-\frac{SUMC}{SUMD}\right)$$

Where m=the number of variables.

With this equation, we computed reliability coefficients for several sets of weights in order to determine if weights other than those used would yield similar results. Beaton has suggested that, when unit weights are used together with an item covariance matrix, C, then rc is identically "ceofficient alpha," and that when the weights are those from the first principal component, rc is "maximum alpha" ("alpha max" for short). Accordingly, we computed rc for two of these cases. However, we used correlation rather than covariance matrices, because intercorrelations had been used in deriving the indices. We also computed rc for a number of other sets of weights, selectively by grade level. Their meaning can be best explained in the context of the grade-level results, as follows.

When we computed index scores for the twelfth grade, we used the weights from the varimax rotations at the ninth grade (called "V-max 9"). This was done in order to avoid introducing differences between the ninth and twelfth grades through the index weights alone (the weights for the two grade levels had been found in the School Study to be highly similar). However, we did compute rc with the varimax weights for the twelfth grade ("V-max 12"), merely to see how much of a difference

Table E.1.—Reliability of Individual Student Indices Computed From Different Weights, by Grade

Grade Level	Index	Weights			
		PC12	V-max 12	V-max 9	Unit
Twelfth	Socio-Economic Status	.71	.70	.69[a]	.71
	Family Structure and Stability	.61	.59	.60[a]	.61
	Expectations for Excellence	.79	.79	.79[a]	.79
	Attitude Toward Life	.65	.66	.66[a]	.65
	Educational Plans and Desires	.86	.86	.86[a]	.86
	Study Habits	.59	.47	.57[a]	.59
	Achievement[b]	.90	–	–	.90
		PC9	V-max 9	Unit	
Ninth	Socio-Economic Status	.71	.69[a]	.71	
	Family Structure and Stability	.56	.57[a]	.56	
	Expectations for Excellence	.74	.75[a]	.74	
	Attitude Toward Life	.67	.68[a]	.67	
	Educational Plans and Desires	.84	.85[a]	.84	
	Study Habits	.60	.58[a]	.60	
	Achievement	.91[a]	–	.91	
		PC6	Unit		
Sixth	Socio-Economic Status	.66[a]	.66		
	Family Structure and Stability	.38[a]	.38		
	Expectations for Excellence	.82[a]	.82		
	Attitude Toward Life	.44[a]	.44		
	Educational Plans and Desires	.39[a]	.39		
	Study Habits	.40[a]	.40		
	Achievement	.89[a]	.89		

[a] Designates the reliability for the weights actually used in computing the index.

[b] Actually, the ninth-grade principal component weights were used to compute this index. They yielded a value of 0.90.

Table E.2.—Reliability of Macroanalytic Indices Computed With Principal Component Weights, by Grade

Macroanalytic Index	Grade Level 12	9	6	3	1
Individual Student Social Background (4)	.54	.65	.55	53	.48
Individual Student Family Process/Motivation (4)	.70	.80	.82	.51	[b]
Individual Student Achievement/Motivation (5)	.75	.82	.81	[a]	[b]
Student Body Social Background (3)	.82	.89	.88	[a]	[b]
Student Body Motivation (4)	.66	.91	96	[a]	[b]
Student Body Achievement/ Motivation (5)	.69	.91	:94	[a]	[b]

[a] Not computed.
[b] Not available.

they might have made. Comparison of the "V-max 9" and "V-max 12" columns in table E.1 shows that their differences range from negligible to zero save in the case of Study Habits, where the ninth-grade weights yield a higher value. The weights from the first principal component of the item intercorrelations at the twelfth grade (called "PC-12") yielded values that are basically the same as, if not identical to, those obtained from the varimax weights at the ninth grade. Similarly, the unit weights yielded values that are identical to those obtained from the principal component at the twelfth grade. Hence, the ninth-grade varimax weights yielded *rc* values of a satisfactory magnitude overall. In fact, the weights obtained from the first principal component at grades 9 and 12, as well as the unit weights, all yielded values of 0.90.

For the ninth grade only, we used unit weights, ninth-grade principal component weights, and varimax weights. They all yielded values that were similar, if not identical, and of a sufficient magnitude. For Achievement, the principal component and unit weights yielded the same values, viz, 0.91.

At the sixth grade, varimax weights were not available. This was because, when we were developing the indices, we found that there were not as many items available at the sixth grade as at the higher grade levels. Hence, when varimax rotations were attempted at the sixth grade, many of the expected indexes coalesced. As a consequence, the intercorrelations of the marker items (i.e., those available at the sixth grade that were also available at the higher grades, and could be used to "mark," or define a given index) were subjected to a principal components analysis. The resultant weights were then used to compute index scores. The *rc* values resulting from these analyses (called "PC-6") are the same as those obtained with unit weights. Some of these values (e.g., those for Family Structure, Educational Plans and Desires, and Study Habits) are somewhat lower than is often considered desirable. They undoubtedly reflect the smaller number of items used to represent the indices, as well as, perhaps, a lesser tendency of students at this grade to discriminate along these dimensions. But this obviously does not apply to such variables as Socio-Economic Status, Expectations for Excellence, and Achievement.

We did not carry out such computations for the 6 ethnic, 2 sex, or 10 regional groupings of individual students. The cost of the necessary computer time and programing would have been prohibitive.

Finally, table E.2 shows the *rc* values for the macroanalytic indices used in chapter 11. They were computed with the weights from the first principal component of the variables used to define them. The computational rationale was the same as the one outlined above.

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