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THE DETERMINANTS OF SCHOLASTIC ACHIEVEMENT—AN APPRAISAL OF SOME RECENT EVIDENCE*

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ABSTRACT

This study assesses some of the more highly publicized and controversial conclusions of *Equality of Educational Opportunity* by James S. Coleman *et al.* The Coleman Report, published by the U.S. Office of Education in 1966, concluded that per-pupil expenditures and school facilities show very little relation to student achievement levels, and the effect of a student's peers on his achievement level is more important than any other school influence. The present paper scrutinizes the data and the statistical analysis on which these findings are based. It is suggested that because of poor measurement of school resources, inadequate control for social background, and inappropriate statistical techniques used in the presence of interdependence among the independent variables, many of the findings of the Report are not supported.†

I. INTRODUCTION

In order to determine the extent of racial and ethnic discrimination in the schools, the Civil Rights Act of 1964 requested the Commissioner of

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† A comment by Mr. Coleman on the points raised by Bowles and Levin will appear in the Spring 1968 issue of *The Journal of Human Resources.*

Education to conduct a survey which would assess the degree of inequality of educational opportunity across the nation.

The Commissioner of Education responded to this request by undertaking an extensive survey which sought to determine: the extent of racial and ethnic segregation; the degree of inequality in the provision of school resources among racial and ethnic groups; the performance levels of students of different backgrounds on achievement tests; and the relationships between school and student characteristics on the one hand, and students' achievement on the other.

Complete sets of survey instruments were obtained for about 3,100 schools. These sets of data included information from the district superintendents, principals, teachers, and some 645,000 pupils from the first, third, sixth, ninth, and twelfth grades of these schools.

This huge store of information was analyzed between January and July 1966, and the 737-page report, *Equality of Educational Opportunity,* was published by the U.S. Office of Education in the summer of 1966.[1]

While the Report contains no policy prescriptions, its contents constitute a major challenge to American education. For example, the survey revealed a significant amount of segregation in the North as well as in the South, relatively minor differences in the measured characteristics of schools attended by different racial and ethnic groups, and very great differences in the achievement levels of racial and ethnic groups throughout the country. Since most of the findings have been reviewed previously, we will not discuss them here.[2]

Rather, in this study we shall confine our attention to that section of the Report which examined the relation of school and student characteristics to scholastic achievement. The Report found that:

> (1) Per pupil expenditures, books in the library and a number of other facilities and curricular measures show very little relation to achievement if the social background and attitudes of individual students and their schoolmates are held constant (p. 325); and
> (2) The effect of a student's peers on his own achievement level is more important than any other school influence (p. 325).

1 James S. Coleman *et al., Equality of Educational Opportunity* (Washington: U.S. Office of Education, 1966), hereafter referred to as the Report.

2 For example, see Robert C. Nichols, "Schools and the Disadvantaged," *Science,* Vol. 154 (December 9, 1966), pp. 1312–14; Christopher Jencks, "Education: The Racial Gap," *The New Republic,* Vol. 150 (October 1, 1966), pp. 21–26; James S. Coleman, "Equal Schools or Equal Students?" *The Public Interest,* Vol. 1 (Summer 1966), pp. 70–75; Robert A. Dentler, "Equality of Educational Opportunity: A Special Review," *The Urban Review,* Vol. 1 (December 1966), pp. 27–29.

If correct, these findings suggest a major restructuring of educational policy.

Further, the Report stated that:

> (3) There is a small positive effect of school integration on the reading and mathematics achievement of Negro pupils after differences in the socio-economic background of the students are accounted for (pp. 29–30).

It is not surprising, then, that the Report has generated considerable comment by policymakers, educational groups, and the general public. Indeed, the principal author, James Coleman, stated that while the initial intent of Congress may have been simply to identify areas of discrimination, "the intent later became less punitive-oriented and more future-oriented: i.e., to provide a basis for public policy, at the local, state, and national levels. . . ."[3] It is true that although the Commissioner of Education, Harold Howe II, was somewhat diffident about using the Report's findings as a basis for public policy, the findings concerning the determinants of scholastic achievement have quickly found their way into Congressional testimony, other government reports, legal decisions, and policy statements of a wide variety.[4]

The careful reader will see that the authors of the Report took pains to qualify their principal findings, to point to alternative explanations of the data, and to disclaim certainty on many of the results. Many commentators on the Report have been less cautious and have moved quickly to inferences about the determinants of scholastic achievement which are quite remote from the actual findings in the Report. Others have faithfully reported findings without giving adequate scrutiny to the evidence on which they are based.

In this review we will evaluate some of the principal findings by examining the analyses and the data from which they were derived. Our

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3 Coleman, "Equal Schools or Equal Students?", p. 70.

4 See Daniel P. Moynihan, "The Crisis of Confidence," statement presented to the Subcommittee on Executive Reorganization of the U.S. Senate Committee on Government Operations, December 13, 1966; Jim Leeson, "Some Basic Beliefs Challenged," *Southern Education Report* (May 1967), pp. 3–10; Jencks, "Education: The Racial Gap"; U.S. Commission on Civil Rights, *Racial Isolation in the Public Schools,* Vol. I (Washington, 1967); and Floyd McKissick, "Is Integration Necessary?" *The New Republic,* Vol. 155 (December 3, 1966), pp. 33–36. See also the legal briefs filed in behalf of Julius Hobson *et al.,* plaintiffs, and Carl F. Hansen and the Board of Education of the District of Columbia, defendants, Civil Action #82–66, U.S. District Court for the District of Columbia, as well as the opinion on the case that was handed down by Judge J. Skelly Wright, June 19, 1967.

critique of the findings is directed towards two types of limitation: those pertaining to the survey itself, and the specific limitations that apply to the more widely publicized findings concerning the relation of school and student characteristics to achievement. In the following section, we will describe some inadequacies of the data. In Section III we will show that the finding concerning the ineffectiveness of school inputs must be seriously questioned; in Section IV we will evaluate the apparently significant effect of student peers on achievement; and in Section V we will discuss the findings concerning the effect of integration on achievement.

II. THE DATA

We would like to suggest first that the poor sample response, with its uncertain pattern, and the large numbers and questionable treatment of nonresponses on particular items of the questionnaire provide grounds for suspecting significant errors in the results.

While the sample of schools was carefully selected, the sample response left much to be desired. Complete sets of survey instruments were returned for only 59 percent (689 out of 1,170) of the high schools. Moreover, there is reason to believe that the pattern of sample nonresponses is not random. One characteristic contributing to this bias is the fact that a disproportionately large number of big cities refused to participate in the survey. Thus, in an analysis of metropolitan data one finds an over-representation of suburban relative to city schools.[5] This factor makes the samples on which the analyses were based somewhat questionable as replicas of the populations which they supposedly represent.

A second source of error is represented by the large number of nonresponses (no answer, or "don't know") on particular questionnaire items and the survey's treatment of them.

These nonresponses were simply given the arithmetic mean of the

5 In the largest metropolitan areas, schools with over 25 percent nonwhite enrollment had about a one in five chance of being sampled, schools enrolling between 10 and 25 percent nonwhites had about a one in ten chance of being selected. See the Report, p. 552. Since most of the schools with high nonwhite enrollments are found in central cities, the refusal to participate by even one superintendent of schools in a central city could impart a severe bias to the metropolitan data. If a large city did not cooperate in the survey, 20 or more city schools might be eliminated from the sample, whereas if a small district refused to cooperate, only one or two schools were sacrificed. (Because of the confidential nature of the survey information, we are unable to identify the cities that declined to participate.) An attempt to measure the extent of bias due to sample nonresponse was far too limited in scope to make a proper assessment. See the Report, pp. 565–68.

responses, an ingenuous treatment which has probably created severe measurement errors in the data. Although the survey made no attempt to analyze the nonresponses,[6] we can still draw a number of inferences about nonresponse biases.

The nonresponse rates for mother's and father's education are particularly important since parents' education represented a prime control for student's social class. Nonresponses on father's education were about 50 percent for first graders, 40 percent for third graders, 41 percent for sixth graders, 21 percent for ninth graders, and 11 percent for twelfth graders.[7] Nonresponse rates for mother's education were as high as those for father's education at grades 1 and 3, and represented 33 percent, 15 percent, and 7 percent at the higher grades. Nonresponse rates for other background variables were also high.

In addition to the fact that nonresponse rates were substantial, there is definite evidence that these missing items were not randomly distributed among the populations under study. Preliminary analyses show the achievement test scores of nonrespondents on these particular items to be significantly below the means of the respondents, with few exceptions. For example, the mean achievement score for twelfth grade nonrespondents on father's education was 43, compared with a mean of 50 for the entire sample and a mean of 45 for those students whose fathers were in the lowest schooling category, "none or some grade school." Likewise, on almost every question that was examined among the nonrespondents, nonwhites were vastly over-represented relative to their numbers in the sample. But despite the high rates and biased pattern of nonresponses on the parents' education and encyclopedia ownership items, these variables were used to control for student background. The significance of these biases will be cited later in an appraisal of a key finding of the study.

III. SCHOOL RESOURCES AND THEIR EFFECT ON ACHIEVEMENT

The Report found that most of the conventional measures of school resources—per-student instructional expenditure, facilities, pupil-teacher ra-

6 In fact the only effort that was made to check measurement errors was one which compared the responses of 700 students in two school districts in Tennessee with information that was gleaned from school records and from the students' parents. An appraisal was made in order to see if the matched pairs of data for each item were "in agreement." For example, if both sources gave a "don't know" response, the responses were "in agreement."

7 Nonresponse rates were provided to us by the U.S. Office of Education.

tio, and curriculum—accounted for very little of the variance in achievement scores of students. By combining this finding with the fact that family background accounts for a relatively large portion of the variance, the Report concluded "that schools bring little influence to bear on a child's achievement that is independent of his background and general social context."[8]

When one considers that children possess a wide range of inherited abilities and are products of different preschool environments and other social influences, this finding is not as surprising as it might appear at first glance. But while one would certainly expect student background to be a powerful determinant of pupil achievement, it might also be anticipated that school characteristics have a significant influence on performance levels. Yet the evaluation apparatus that was constructed in the Report was not neutral with regard to which possible influences might account for variations in achievement. It will be shown below that both in the measurement of variables and the statistical procedures used, the research design was overwhelmingly biased in a direction that would dampen the importance of school characteristics. Further, we would like to stress that the evidence in the Report on the effectiveness of school inputs is far from uniform, and that despite the biases in the design of the analysis, some school inputs appear to have significant effects on achievement.

One can hardly expect to discover the true relationship between school resources and achievement without developing adequate measures of the school resources themselves. Yet the measurement of school resources in the survey was inadequate. Consider first the treatment of instructional expenditure-per-pupil. Theoretically, the measure of per-pupil expenditure should reflect differences among students in the amount of instructional resources devoted to their education. Actually, the survey derived no such data, either on an individual student or individual school basis. The measure used in the regression analysis was an average of instructional expenditure per student within an entire school district. School-to-school differences *within* a district (even differences between secondary and elementary schools) were simply ignored.[9]

The averaging of expenditures among all of the schools in a district imparts a severe bias to the data, for the available evidence indicates that

8 The Report, p. 325.

9 While the survey amassed complete sets of data for about 3,100 schools, expenditure data were collected for only the 500 or so school *districts* in which these schools were located. (Some of the metropolitan school districts that were included in the survey had 50 or more schools in the sample that was used for the analysis.)

the variation in expenditures among schools within a district is likely to follow a systematic pattern.[10] The schools that are attended by disadvantaged children are characterized by substantially lower expenditures than are those attended by advantaged students. Accordingly, the average per-student expenditure for the school district probably overstates the actual expenditures for schools attended by students from the lower class and understates expenditures for schools attended by students from the higher social classes. The limited variation in per-pupil expenditure that is imposed by averaging expenditures over an entire school district reduces the variance in test scores that is potentially accounted for by school expenditures, and thus results in an understatement of the effect of per-pupil expenditure.

In fact, the Report yields evidence that seems to contradict the finding that per-pupil instructional expenditure shows little relation to achievement, for it found that measures of teacher quality, which the survey data show to be highly correlated with the level of teachers' salaries, do in fact exert a significant effect on achievement. We suggest that the source of the apparent contradiction is to be found in the fact that, unlike the per-pupil expenditure data which were obtained for school districts only, teachers' characteristics were measured individually and averaged for each school.

The Report states that teacher characteristics accounted for a ". . . higher proportion of variation in student achievement than did all other aspects of the school combined excluding the student body characteristics . . . ," (p. 316) and that they are comparable in importance to the latter (p. 318). We suggest below that the regression approach used in the Report has probably led to a significant understatement of the importance of teacher characteristics and other school resources. But for

10 The survey collected expenditure data for the 1964–65 school year. Since that time, some equalization of school resources may have taken place under Title I of the Elementary and Secondary Education Act of 1965. For verification of the inequalities of school resources within school districts, see the following literature: for Atlanta and Chicago high schools, see Jesse Burkhead with Thomas G. Fox and John W. Holland, *Input and Output in Large City High Schools* (Syracuse, New York: Syracuse University Press, 1967). For the elementary schools of Chicago, see Eric C. Thornblad, *The Fiscal Impact of a High Concentration of Low Income Families Upon the Public Schools* (Doctoral dissertation, University of Illinois, Urbana, 1966). For the City of Boston, see Martin Katzman, *Distribution and Production in a Big City Elementary School System* (Doctoral dissertation, Yale University, 1967). For nonfinancial measures of the intradistrict variation in school resources, see Patricia Sexton, *Education and Income* (New York: Viking Press, 1961). Also see *Hobson v. Hansen, op. cit.*

the present we need only note that according to the survey's own analysis, teacher traits such as verbal facility, educational level, experience, and the educational level of the teacher's mother account for significant variations in achievement.[11]

But the same teacher characteristics that account for significant variations in achievement relate directly to instructional expenditures. In a multiple regression analysis using the survey data, teachers' characteristics explain about three-quarters of the variance in teachers' salaries.[12]

The implication of this evidence is that higher expenditure on teachers' salaries does indeed lead to higher achievement levels among students. Since teachers' salaries dominate the instructional expenditures category,[13] the evidence in the Report strongly suggests that a school-by-school expenditure measure would have shown a stronger statistical association with achievement.[14]

A number of measures of school resources were collected by the survey at the school-by-school level. This procedure avoids the gross aggregation errors imposed by use of the district as the unit of observation, but it is far from perfect, as inequalities in school resources for students of different races or social classes *within* a given school are obscured.[15] In big city schools with racially heterogeneous school populations and tracking, the distortions arising from the exclusion of intraschool variation in school resources are likely to be particularly severe.[16]

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11 See Table 3.25.2, the Report, p. 318.

12 This finding is based upon our analysis of the zero-order correlations found in the *Supplemental Appendix to the Survey on Equality of Educational Opportunity*.

13 Data provided by the U.S. Office of Education suggest that about 90 percent of instructional expenditures are accounted for by teachers' salaries.

14 If teachers' salaries and the pupil-teacher ratio showed strong positive correlations, the relationship between teacher quality and per-pupil instructional expenditure could be weakened despite the above evidence. Yet in the majority of cases for grades 6, 9, and 12 (those grades for which the expenditures analysis was carried out), the relation was negative, thus strengthening the relationship between teacher quality and per-pupil instructional expenditures. See the correlation tables in the *Supplemental Appendix* to the Report.

15 Admittedly, collecting resource data on a student-by-student basis poses formidable problems of definition and administration.

16 In fact, in schools where students are grouped according to ability, the Equal Opportunity data show a statistically significant direct correlation between verbal facility of teachers and the level of ability of students to whom they are assigned. See Henry M. Levin, "Recruiting Teachers for Urban Ghetto Schools" (manuscript in process). Evidence of social class inequalities in the attention and resources devoted to individual children within a given school

A second weakness in the measurement of school facilities is the limited range of facilities measures actually used in the analysis. In a recent review of some policy implications of the Report, the principal author concluded that "Per-pupil expenditure, books in the library, and a host of other facilities . . . show virtually no relation to achievement. . . ," if other aspects of the school are held constant.[17] Yet the host of other facilities measures used in the regression analysis of verbal achievement turns out to have been rather limited. At grades 1, 3, and 6, the *only* facilities measure used was volumes-per-student in the school library. At grades 9 and 12, the library variable was supplemented by one representing the presence of science laboratory facilities. We find it difficult to understand why science laboratories should have an effect on verbal achievement, but in any case, it is unlikely that the effect of the entire physical plant, instructional aids, and other facilities on educational achievement can be assessed properly by considering only science labs and library books.[18]

A particularly glaring example of the incomplete measurement of school characteristics is the absence of a measure of class size in the regression analysis. According to the Report, the pupil-teacher ratio in instruction ". . . showed a consistent lack of relation to achievement among all groups *under all conditions*."[19] This statement is misleading. Since it is the pupil-teacher ratio in the classroom which seems primarily relevant to achievement, the Report's pupil-teacher ratio has been interpreted by some as representing class size.[20] Such an interpretation is in error, for the Report obtained its pupil-teacher ratio by dividing the enrollment of the school by the number of teachers. Yet, schools with the same enrollment-teacher ratios may have significantly different class sizes depending on the average number of hours of teaching required of the instructional staff.

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can be found in A. B. Hollingshead, *Elmtown's Youth* (New York: John Wiley, 1949), pp. 163–204. Less conclusive but highly suggestive further evidence can be found in Max Wolff and Annie Stein, *Six Months Later, A Comparison of Children Who Had Head Start, Summer, 1965, with their Classmates in Kindergarten* (mimeo, 1966), p. 51. Wolff and Stein found that within a given classroom, the more "able" students received much more attention from the teacher. In their sample, non-Puerto Rican whites were more likely to have higher measured "ability" than either Negroes or Puerto Ricans.

17 Coleman, "Equal Schools or Equal Students?" p. 73.

18 If science labs and library books were intended to serve as proxies for the whole range of school inputs, the case should have been made explicitly along with evidence to support such a contention.

19 The Report, p. 312, emphasis supplied.

20 See Robert Dentler, "Equality of Educational Opportunity . . . ," p. 29.

The survey's unpublished data suggest that the teaching load per school varies from a low of about four to a high of six hours per day. This range of teaching loads implies a potential difference of as much as 50 percent in class size for schools with the same pupil-teacher ratio. Thus the Report could not possibly answer the question of how class size affects learning, for class size was never used in the analysis, nor was even the cruder measure of enrollment-teacher ratio subjected to scrutiny "under all conditions," as the Report implies.[21]

A third shortcoming of the measurement of school resources arises because the survey collected information solely on current school inputs; thus, the analysis necessarily ignores the effects of past influences on present achievment levels. We would expect achievement in the beginning of a school year (when the survey was implemented) to reflect the cumulative impact of past influences rather than simply the school characteristics and attitudes observed at the time of the survey. It cannot be assumed that the characteristics of schools that students were attending at the time of the survey are similar to those of the schools that they have attended in the past. Secondary schools are likely to receive pupils from feeder schools of widely varying quality. To the extent that in a given high school, disadvantaged children attended feeder schools that were less well endowed with educational inputs than those attended by more fortunate youths, the exclusion of past school inputs biases the analysis against finding school resources to be an important determinant of scholastic achievement, because measures of social background will serve to some extent as proxies for the excluded influence of past school inputs.

Although we have no concrete evidence on this point, we suspect that in addition to their direct cumulative effects on achievement, past school characteristics have an effect on student attitudes, and thus they influence indirectly current achievement levels. The teacher attitudes, curriculum, and even one's own perception of personal success or failure in the earlier years of school may have major effects on the development

21 The Report might have been more circumspect in asserting "a lack of relation (of pupil-teacher ratio in instruction) to achievement under all conditions." Class size is likely to be a significant factor in the teaching of some subjects and an insignificant one in the teaching of others; and while substantial changes in class size may show some effect on achievement levels, very small changes in class size may not show much impact at all. But the Report examined only the relation between the enrollment-teacher ratio for the school and a single criterion, verbal achievement. Thus it could not possibly tell us about the relation of class size to achievement in physics or remedial reading, and so on.

of a child's self-image and sense of personal efficacy.[22] Yet, while recognizing this problem, the authors of the Report chose a research strategy which necessarily ignored the effects of past school experience on current attitudes.

Although the data on school inputs are far from ideal, a careful statistical treatment might have salvaged some major substantive findings. In our opinion, however, the analysis contains a number of conceptual and methodological flaws which, along with the shortcomings of the data, render many of the key findings of questionable validity. Specifically, we will show that:

a. The underlying, highly restrictive model of the relation between school inputs, background, attitudes, and achievement is implausible; and,
b. The criterion that is used to assess the influence of different characteristics on achievement—addition to the proportion of explained variance in achievement scores—is inadequate for the task.

The basic statistical tool that is used to relate achievement to student background and school characteristics is the linear regression model. Current school inputs and the social background and attitude characteristics of the students and their peers ($X_1, \ldots, X_n$) are used to predict current school outcomes, as measured by an achievement score (Q).

The authors postulated an extremely simple relationship between achievement on the one hand and current school resources and student characteristics on the other. Their model implies that a student's achievement level is merely the sum of the independent effects of each school resource and background variable, plus a constant, or that

$$Q = a + b_1X_1 + b_2X_2 + \ldots + b_nX_n$$

where a and b_i, $(i = 1, 2, \ldots n)$ are constants.

As a description of the process of education, the above formulation leaves much to be desired. The form of the equation implies that the

22 The authors of the Report did seek to determine the relationship between their measures of current attitudes and current school resources. They report (on p. 323) that the school inputs explain "almost none" of the variation in the measures of "self image" and "control of environment" beyond that explained by social background characteristics of the students. Because of the intercorrelations of social background and availability of school resources, one cannot infer from this finding that current school resources exert "almost no" causal influence on attitudes.

effect on achievement of an incremental unit of a given input does not depend at all on how much of that input is utilized; nor does the effect depend on how much of other inputs are used.

Moreover, in undertaking this analysis, the authors presumably did intend to say something about the unique effects on achievement of school and student characteristics. And despite its conceptual shortcomings, the model chosen by the authors does allow an estimate (b_i) of the unique effect on achievement associated with a unit change in each of the explanatory variables taken separately, the other influences being held constant. Yet while these estimates are an integral part of the regression analysis, they are not disclosed in the Report.

Without the estimates of the regression coefficients (and their standard errors), the educational decision-maker cannot compare the relative effectiveness of different school inputs. Given the fact that schools always operate with limited budgets, the educational decision-maker is presumably interested in the relative effectiveness of those inputs over which he has control. Yet without these regression coefficients, the Report does not yield the relevant information that might assist the decision-maker in choosing the most effective policies. For example, one cannot determine from the analysis which policy is more effective per dollar of expenditure: hiring better teachers or buying more books for the library. Both alternatives are a priori reasonable, but it is likely that one will represent a more efficient device for raising achievement than will the other. The Report yields almost no insights which will aid this type of decision-making.

The most severe deficiency of the regression analysis is produced by the addition to the proportion of variance in achievement scores explained (addition to R^2) by each variable entered in the relationship as a measure of the *unique* importance of that variable. For example, assume that we seek to estimate the relationship between achievement level, Q, and two explanatory variables, X_1 and X_2. The approach adopted in the Report is to first determine the amount of variance in Q that can be statistically explained by one variable, say X_1, and then to determine the amount of variation in Q that can be explained by both X_1 and X_2. The increment in explained variance (i.e., the change in the coefficient of determination, R^2) associated with the addition of X_2 to the explanatory equation is the measure used in the Report for the unique effect of that variable on Q. Thus, if X_1 explained 30 percent of the variance in Q and X_1 and X_2 together explained 40 percent, the difference, or 10 percent, is the measure of the unique effect of X_2.

If X_1 and X_2 are completely independent of each other (orthogonal), the use of addition to the proportion of variance explained as a measure

of the unique explanatory value of X_1 and X_2 is not objectionable. X_1 will yield the same increment to explained variance whether it is entered into the relationship first or second, and vice versa. But when the explanatory variables X_1 and X_2 are highly correlated with each other, as are the background characteristics of students and the characteristics of the schools that they attend, the addition to the proportion of variance in achievement that each will explain is dependent on the order in which each is entered into the regression equation. By being related to each other, X_1 and X_2 share a certain amount of explanatory power which is common to both of them. The shared portion of variance in achievement which could be accounted for by either X_1 or X_2 will always be attributed to that variable which is entered into the regression first. Accordingly, the explanatory value of the first variable will be overstated and that of the second variable understated.

The relevance of this problem to the analysis in the Report is readily apparent. The family background characteristics of a set of students determine not only the advantages with which they come to school; they also are associated closely with the amount and quality of resources which are invested in the schools. As a result, higher status children have two distinct advantages over lower status ones: First, the combination of material advantages and strong educational interests provided by their parents stimulate high achievement and education motivation; and second, their parents' relatively high incomes and interest in education leads to stronger financial support for and greater participation in the schools that their children attend. This reinforcing effect of family background on student achievement, both directly through the child and indirectly through the school, leads to a high statistical correlation between family background and school resources.[23]

The two sets of explanatory variables are so highly correlated that after including one set in a regression on achievement, the addition to the fraction of total variance explained (R^2) by the second set will seriously understate the strength of the relationship between the second variables and achievement. Yet the survey made the arbitrary choice of first "controlling" for student background and then introducing school resources into the analysis. Because the student background variables—even though crudely measured—served to some extent as statistical proxies for school resources, the later introduction of the school resource variables them-

23 The authors of the Report were of course aware of this problem and went to some length to warn the reader about the possible resulting biases. Cf. p. 327.

selves had a small explanatory effect.[24] The explanatory power shared jointly by school resources and social background was thus associated entirely with social background. Accordingly, the importance of background factors in accounting for differences in achievement is systematically inflated and the role of school resources is consistently underestimated.

The same technique was pursued in the analysis of the unique effect of particular school resources and student body characteristics.[25] Similar problems arise in the interpretation of these results, for if any two variables in the analysis are significantly correlated, the unique contribution of *both* of them will be negligible, *whatever the underlying causal relationship*. The appearance of a relatively large unique contribution for a particular school characteristic is a measure of both its effect on achievement and the degree to which it is independent of the other variables included in the analysis. Thus, for example, the fact that the unique contributions of curriculum, teacher quality, and teacher attitudes are zero in all three cases for white twelfth graders may indicate *either* the ineffectiveness of these inputs *or* a significant overlapping of these variables with each other or with other variables in the analysis. The method used in the Report does not readily allow us to distinguish between these two interpretations, although the authors of the Report appear to accept the first.[26]

A further reason why the effect of student background was probably overstated and that of school resources was understated involves the criterion of achievement that was used. All tests of achievement used in the survey give an advantage to students who are enrolled in academic and college preparatory curricula relative to those enrolled in basic, general, commercial, vocational, and technical curricula.

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24 Given the authors' decision to utilize the increase in the proportion of variance explained as the main criterion of significance for each variable, it would have been desirable to first control for school resources and then include student backgrounds in the analysis in order to see what the latter might add after accounting for the former. Unfortunately the authors "controlled" for background variables first on the basis of the truism: ". . . background differences are prior to school influence, and shape the child before he reaches school . . ." (p. 298). This rationale is misleading since the regression analysis that was used in the Report does not take into account—in any way—the time sequence of the explanatory variables.

25 The Report, pp. 303–304.

26 Fortunately we can do better than speculate about the magnitude of the biases introduced by the statistical procedures used, for we were able to examine the computer runs underlying some of the tables in the Report itself. For example, preliminary analysis of both the size and the levels of statistical significance of the regression coefficients underlying Table 3.25.2 of the Report suggest a strong relationship of school resources to achievement, particularly for Negro

On the one hand, a high proportion of advantaged students are enrolled in an academic curriculum, a course of studies which concentrates on the development of the very skills which were tested by the survey. On the other hand, a disproportionately large number of disadvantaged children are enrolled in job-oriented curricula,[27] comparatively expensive courses of study that put relatively little emphasis on reasoning, mathematics, reading comprehension, and other verbal skills. For these latter students, job-oriented tests or post-school employment success are more appropriate measures of the effectiveness of their schools. Obviously, one would not want to exclude consideration of the usual achievement scores, but the reader should be made aware of the specific biases involved in using them exclusively to measure performance.

In view of the shortcomings in the measurement of both school resources and achievement and the biases in the statistical techniques and conceptual model of the educational process used, it is surprising that school resources showed any association with achievement at all. Accordingly, we conclude that a much more careful assessment of the importance of different characteristics on achievement is warranted before any policy conclusions can be drawn about the relative effectiveness—or ineffectiveness—of school resources. The findings of the Report are particularly inappropriate for assessing the likely effects of radical changes in the levels and composition of resources devoted to schooling because the range of variation in most school inputs in this sample is much more limited than the range of policy measures currently under discussion.

IV. THE INFLUENCE OF FELLOW STUDENTS ON ACHIEVEMENT

One of the more widely discussed findings in the Report is that ". . . 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."[28] Accordingly, the Report suggested that ". . . schools

children. Because of the measurement problems described above and the absence of good estimates of the relative prices of school inputs, it would be inappropriate to make specific policy prescriptions on the basis of the regression coefficients underlying the Report. We are currently pursuing research on the educational production function and the relative prices and effectiveness of the various dimensions of the school input structure.

27 For some interesting evidence on this phenomenon, see Sexton, *Education and Income,* p. 177, and also the Report, pp. 95–96.

28 The Report, p. 325.

appear to have an effect that is dependent upon the average family background in the school—an effect through the student body not through the characteristics of the school itself."[29] We find that an evaluation of the evidence presented in the Report does not support these conclusions, and that the apparent "effects" of the student body on individual achievement can be equally well explained by the deficient statistical controls for social class.

The authors derived their findings on the influence of fellow students from a set of regressions which showed that after controlling for the student's background, his attitudes, and the curriculum, facilities, and staff characteristics of his school, characteristics of his fellow students accounted for a significant increase in the proportion of variance in achievement that was explained. For example, on page 303 it is shown that the unique contribution of student body quality to the proportion of variance in individual achievement that was explained was about 7 percent for Negroes (addition to R^2 of .0677) and about 2 percent for whites (addition to R^2 of .0201) at grade 12.[30]

In general, the individual's social class and achievement are highly correlated with the social characteristics and achievement levels of his classmates. Because of existing residential patterns and the conscious selection of schools by parents, students tend to go to schools with other students of similar backgrounds and achievement levels.

This commonly observed phenomenon is strongly supported by the following table from the Report (p. 296) which shows the percent of total variance in individual verbal achievement that is "accounted for" by the mean score of the school, at grades 1 and 12:

	Grade 1	Grade 12
Negro, South	23.21	22.54
Negro, North	10.63	10.92
White, South	18.64	10.11
White, North	11.07	7.84

In the above tabulation, the school average for verbal achievement is as highly correlated with individual verbal achievement at grade 1 as it is at grade 12. Yet, it is not possible to attribute high correlations at

29 The Report, p. 311.

30 The measure of student body quality in this particular regression includes verbal and nonverbal mean test scores for the student body, as well as four other items. (See the Report, p. 575.)

grade 1 to the influence of fellow students since the tests were administered at the beginning of the first school year.[31]

The authors of the Report were aware of the difficult statistical problem of separating the unique impact of school social class from that of individual social class and prudently suggested that any finding showing a strong association between characteristics of fellow students and achievement of an individual:

> . . . must be subject to special scrutiny, because it may be confounded by the student's own educational background and aspirations, which will generally be similar to those of his fellow students. For this reason, throughout the analysis except where indicated, his own background characteristics are controlled to reduce such an effect.[32]

Therefore, the validity of the Report's findings concerning the effects of student peers on achievement balances delicately on the adequacy of the statistical controls for the student's own background. The Report used several measures of student background, but this is clearly a case where the quality of the control variables is more important than sheer numbers of measures. For example, items in the home, the Report's measure of economic status, showed an inconsistent association with achievement, varying from positive to negative among the different grades and racial groups.[33] Of the three most important dimensions of social class—education, income, and occupation—only education of parents was used in this Report.[34] Its sole inclusion—without occupation and income—omits important dimensions of social class. Parent's level of education tells us little about the income, occupational, and other characteristics of the family, and further, tells us less about a Negro family's social class than about that of a white

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31 The authors of the Report attempt to show (p. 306) that student body characteristics explain more variation in achievement scores in grades 9 and 12 than in the earlier grades. Their findings for the upper and lower grades are not comparable, however, because the measures that were used as explanatory variables at the upper grades are different from those used at the lower levels.

32 The Report, p. 303.

33 The Report, Table 2.221.5, p. 303. The explanatory power of the items in the home measures may have been reduced by the limited variability in response among students. For example, a detailed study of the responses of white sixth graders in the Northeast revealed that of those children who answered all of the relevant questions, over three-fifths claimed to possess *all* of the items.

34 For an excellent review of the dimensions of social class and their measurement, see Joseph A. Kahl, *American Class Structure* (New York: Rinehart, 1957). Also see Albert Reiss, Jr., *Occupations and Social Status* (New York: Free Press of Glencoe, 1961). Although data on father's occupation were collected in the survey, they were *not used* in the analysis.

family.[35] The association between educational level on the one hand, and income and other dimensions of social class on the other, appear to be much less strong for Negroes than for whites.[36]

Thus, the use of parents' education as a primary control for social class background is particularly poor for Negro students. It is no surprise, then, to find that "family background" is a much less powerful predictor of achievement among Negroes than among whites (p. 321). Conversely, given the fact that individual social class, characteristics of fellow students, and the adequacy of school resources are all highly correlated, the particularly defective control for Negro social class may explain why both the characteristics of fellow students and school resources are better predictors of achievement among Negroes than among whites.[37]

If, as we suggest, the controls for the student's own social class are inadequate, the observed association between individual achievement and characteristics of fellow students may denote either an internal influence of student body characteristics on individual performance (as claimed in the Report); or alternatively, it may reflect the fact that, due to the inadequacies of the student background measures, the average achievement test score in a school or the proportion of students who intend to go to college conveys a considerable amount of additional information about the social class of a student in that school, even after controlling for variables purporting to measure individual background. That is, measures of the attributes of fellow students serve in the analysis as reasonably good statistical proxies for the attributes of the student himself. If this explanation is valid, much of the variance in achievement scores "explained" by characteristics of fellow students is in fact associated with the traits of the individual student.

Even if the controls for individual social class were adequate, one would still find difficulty in distinguishing the student peer effect from a

35 Giora Hanoch found that the years of schooling explained less than one-third of the variance in the earnings among males of the same region, race, and age bracket, as reported in the 1/1000 sample of the 1960 Census. See Hanoch, *Personal Earnings and Investment in Schooling* (Doctoral dissertation, University of Chicago, 1965), p. 42.

36 Walter Fogel found that the correlations between years of education and housing, income, and consumption characteristics in the Los Angeles Census tracts were much stronger for whites than for Negroes. For whites, Pearson correlation coefficients between years of schooling on the one hand, and housing units with all the plumbing, income, and availability of two or more autos on the other were about .62, while for Negroes, the highest coefficient was .264. "The Effects of Low Educational Attainment on Incomes: A Comparative Study of Selected Ethnic Groups," *The Journal of Human Resources,* Vol. 1 (Fall 1966).

37 The Report, pp. 317, 319, 313, and 303.

community effect. This problem exists because the social class and other attributes of one's schoolmates serve as indicators of the type of community in which the student and his family reside, and the statistical procedures used in the Report are incapable of distinguishing between these two effects.[38]

V. THE EFFECT OF INTEGRATION ON NEGRO ACHIEVEMENT

It is unfortunate that one of the most extensively discussed inferences from the Report is one about which the Report is highly ambiguous. In the widely circulated summary of the Report, the authors assert that:

> Those (Negro) pupils who first entered integrated schools in the early grades record consistently higher scores than the other groups, although the differences are . . . small.
>
> No account is taken in these tabulations of the fact that the various groups of pupils may have come from different backgrounds. When such account is taken by simple cross-tabulations on indicators of socioeconomic status, the performance (of Negroes) in integrated schools and in schools integrated longer remains higher. Thus, although the differences are small, and although the degree of integration within the school is not known, there is evident, even in the short run, an effect of school integration on the reading and mathematics achievement of Negro pupils (p. 29).

and in fact they further suggest that:

> It is possible that more elaborate analyses looking more carefully at the special characteristics of Negro pupils and at different degrees of integration within schools that have similar racial compositions may reveal a *more definite effect* (p. 30, emphasis added).

However, later in the Report, the authors heavily qualify this finding:

> The effects of the student body environment upon a student's achievement appear to lie in the educational proficiency possessed by that student body, whatever its racial or ethnic composition (p. 307).

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38 The fact that the fraction of variance in individual achievement scores explained by the average achievement score of fellow students is as high at grade 1 as at grade 12 is consistent with the interpretation that the apparent student peer effects are at least in part community effects operating outside the schools. However, see Alan B. Wilson, "Educational Consequences of Segregation in a California Community," in U.S. Commission on Civil Rights, *Racial Isolation in the Public Schools,* Vol. II Appendices, p. 202.

And in fact Coleman has emphatically stressed that the survey revealed no unique effect of racial composition on the achievement levels of nonwhites. Despite the latter qualification, the initial assertion of a specific racial effect has received wide currency. Because of the apparent confusion caused by the difference in emphasis in different parts of the Report, we will attempt to clarify exactly what the Report does show in its analysis of the effect of school racial composition on Negro achievement levels. After controlling for student background and school variables, the inclusion of a variable representing the proportion of students in the school who were white added a small amount to the explained variance in achievement scores. For Negroes in grade 12, the increase in the percent of variance explained was about two-thirds of 1 percent (i.e., addition to $R^2 = .0068$ by including proportion white as an explanatory variable).

This minuscule increase may be attributable to the fact that, as we noted above, the control on student background was particularly poor for Negroes. In general, Negroes who are attending predominantly white schools are representatives of a considerably higher socioeconomic class than are students in all, or largely Negro schools. The higher the proportion white in a school, the more likely the school is to be located in a residential suburban area or white neighborhood of the city; and if a city school, it is more likely to require entrance examinations (e.g., New York City's Bronx High School of Science or Brooklyn Tech, Music and Arts, etc.). Thus the processes of residential and academic selection imply that those Negroes who attend predominantly white schools are drawn from higher social strata and exhibit higher performance levels than those who are found in schools with lower concentrations of whites. On the other hand, the predominantly Negro schools are generally found in the lower class, core areas of the city or in rural areas. They are not generally selective, nor do they have high proportions of students who will go to college. The proportion white in a school thus represents an approximate measure of the social class of Negro students attending the school; the higher the proportion white, the higher—on the average—the social class of any nonwhites in attendance.

Accordingly, the small, residual, statistical correlation between proportion white in the schools and Negro achievement is likely due, at least in part, to the fact that the proportion white in a school is a measure of the otherwise inadequately controlled social background of the Negro student.[39]

39 A specific racial effect is also stressed in the 1967 report of the U.S. Commission on Civil Rights, *Racial Isolation in the Public Schools,* Vol. 1 (Washington, 1967), pp. 113–14. In the Commission's own analysis of the Equality of Educational Opportunity data, the only control for social class was the education of parents, which was termed low (less than high school graduation),

Thus we find that the conclusion that Negro achievement is positively associated with the proportion of fellow students who are white, once other influences are taken into account, is not supported by the evidence presented in the Report.

We would like to make it clear that the failure of the Report to substantiate this relationship should not lead us to embrace the opposite position, namely, that in terms of achievement, integrated schools are worse (or no better) for Negroes than segregated ones. The Report simply does not provide conclusive evidence one way or the other.

VI. CONCLUSION

In this appraisal we have attempted to show that some of the Report's most widely publicized findings concerning the determinants of scholastic achievement, namely, those relating to the ineffectiveness of school resources, the influence of student peers, and the effects of integration, are not substantiated by the evidence. We have attempted to show that both the measurement of the school resources and the control of social background of the student were inadequate, and that the statistical techniques used were inappropriate. By no means do we wish to suggest that the actual relations are the opposite of what the Report concludes or that further research will not substantiate some of the Report's findings; but until better evidence is found, we will have to remain agnostic about which relationships prevail.

Equality of Educational Opportunity addressed itself to some of the most difficult questions that our society faces: what are the determinants of different educational outcomes, and what is the relative importance of each of the relevant influences? Unfortunately, the survey that led to the Report was handicapped by a severe time constraint. It was also hampered by a more serious impediment, for the learning processes by which different influences alter achievement are largely unknown, and no set of data

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medium (high school graduation), or high (more than high school graduation). Accordingly, the analysis of the Civil Rights Commission is also plagued with inadequate control for students' social class. See also the separate appendices to the Commission's report, Vol. II. Wilson, in his study done for the U.S. Commission on Civil Rights, found that after controlling for other factors, the racial composition of the school had no significant direct association with Negro achievement. The apparent "effect" of integration had arisen because "the Negro students who attended integrated schools had higher mental maturity test scores in their primary grades, and come from homes better provided with educative materials." See Wilson, "Educational Consequences of Segregation . . . ," p. 185.

and statistical analyses can easily compensate for a missing theoretical framework.

The Report has a distinct contribution to make, but not directly in the arena of educational or social policy. Rather, its strength lies in the fact that it has stimulated a great deal of thought and new research efforts to uncover the largely unknown and complex relationships among family, school, and community influences on one hand, and educational outcomes on the other. Further, it has provided some of the necessary data to test the new hypotheses that it has stimulated. In short, while the Report did not provide the answers, it has brought us closer to being able to use large scale research efforts as a basis for making intelligent policy decisions for our schools.