Letters

Removal of Oil Slicks on Oceans

The wrecking of the *Torrey Canyon* off Land's End, England, points urgently to the growing problem of oil slicks on the oceans. Attempts to set fire to the slick failed—I think through failure to understand the mechanism of burning of a heavy oil, especially when the underside is cooled by water. Incendiaries, tracers, and napalm were each ineffective. The agents that are needed are wicks, not incendiaries. The old trick of lighting a lump of sugar by applying cigarette ash is an example. The safety of heavy oil used in lamps is due to the fact that a wick is needed to maintain the flame.

I suggest that experiments be tried dropping cotton wads or asbestos rope bundles pre-dampened (not soaked) with kerosene. Repeated tries will be needed to determine the optimum size, weight, and specific gravity but I have little doubt the outcome will be sustained combustion over large areas. The wick-bundles would, of course, be scattered unignited, and the necessary matches applied afterwards.

Another remedy would be the use of empty tankers equipped with suction devices to "vacuum clean" the sea surface, funneling the oil into tanks and jettisoning the water. Not only would this perform a much-needed service but it could bring rich rewards in salvage to the servicing vessel.

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Are Better Schools Better?

Many readers of the U.S. Office of Education report *Equality of Educational Opportunity* [by J. S. Coleman, E. Q. Campbell, A. M. Mood, *et al.*] have erroneously inferred from it that school quality has very little effect upon the educational achievements of the pupils. Even some reviewers of the study, among them Robert C. Nichols in *Science* (Book Reviews, 9 Dec.), have come to this erroneous conclusion.

What the text does say, and what the data reveal, is that the within-school variance of pupil test scores is much larger, by a factor of about 4, than the between-school variance of pupil test scores. This finding about variations says nothing about the amount of material learned or the rate at which material is learned. The ratio of variances could lie exactly the same whether the schools were worthless or were tremendously effective in educating our children. The finding simply says that the schools of the nation seem to be rather uniform and says nothing about whether they are uniformly bad or uniformly good. The finding comes as no surprise at all to educators. Our schools are uniform; teacher training and teaching methods are much the same everywhere in the nation; curricula are very widely standardized, as must be the case in view of the mobility of our population; school equipment and school management are much the same throughout the nation.

It should be further pointed out that the comparison of the relative sizes of the two types of variance is not equivalent to a comparison of the importance of the school factors to that of nonschool factors.

What are the causes of the variations between schools of the school average scores? They arise from: characteristics of the schools themselves—their facilities, staff, instructional programs, activities; various social, economic, ethnic, intellectual, and religious backgrounds of the families; differences between communities in geographic location, values, activities, attitudes toward education, tax support of education, and so on.

There are sometimes political or other influences that determine the assignment of students to schools, and these also comprise part of the between-school variance. In order to determine the effect of the schools themselves, it is therefore necessary in any analysis to control for family background and community influences.

What are the causes of the within-school variation of student scores? Here we find a host of possible contributors: differences in individual student abilities; differences in the family socioeconomic background of students in the same school (including parental education and interest in education); differences in school experiences of students in the same school (different teachers, texts, tracks, curriculum); differences in outside experiences of students; and error of measurement in the tests and unaccounted-for variation (this includes interaction effects).

We observe, therefore, that we cannot consider the between-school variance to be the "school effect" and the within-school variance to be the "nonschool effect." Some of the within-school variance is composed of factors which may also be classified as school effects, so the effect of the school is found in both components of the entire variance.

The relatively large size of the within-school variance is itself the function of the range of scatter of individual student abilities within schools (this is often quite large because of the normal distribution of ability). It is expected, therefore, that the within-school variance will be much larger than the between-school variance. The importance, however, of the effect of the school, inherent in both variances, is not lessened.

It is important that the between-school variance increases substantially for the lower-achieving and minority-group students. Whereas the between-school variance is about 10 percent for white-majority students in the North, it increases to about 30 percent for some of the minority-group children. The report has also demonstrated that the teacher has a greater effect on these lower-achieving students. It follows that school quality is indeed of great import, and expenditures to improve it are educationally effective.

Student attitudes toward life and schooling can probably be much more rapidly modified by alterations in the school situation than by modifications of the home environment and of society, which may well take generations. From a cost-effectiveness point of view we would expect to receive much better returns on additional investment in education if we concentrate it in the well-defined area of the instructional

process than if we diffuse our resources on the environmental factors, which are not readily amenable to manipulation. Student attitudes towards life and school have been shown to affect strongly performance in academic studies. These attitudes can be altered directly by good teachers and possibly take root in the relatively short span of the school years (especially if effective "pre-school" programs for ages 3 to 6 are developed and implemented).

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. . . Nichols contends in his review (i) that no inferences can be drawn from the USOE data regarding the effects of desegregation on Negro achievement, and (ii) that the data show differences in educational opportunity (that is, quality of schooling) to be of no importance as a factor in racial differences in achievement. I think his conclusions are unwarranted in both instances.

Regarding the first point: It is true that the USOE data consists entirely of correlations between measurements at a single point in time, and that only a longitudinal study of achievement, involving repeated measurements of pupils who were randomly assigned to different types of schools, could provide a definitive test of the effects of desegregation. However, when longitudinal studies are not feasible, carefully designed *ex post facto* research can and should be used as a basis for drawing qualified inferences about causality. To deny this would be to discard much—perhaps most—of the accumulated empirical knowledge of the social sciences.

In the USOE survey, cross-tabulations on indicators of socioeconomic status showed that differences in Negro achievement associated with extent of desegregated schooling were not accounted for by measured family-background factors. Admittedly, there may have been important background factors that were not measured. But such assumed differences among families of similar socioeconomic status would have to account for the following obtained trends:

1) The earlier the grade during which the child first experiences desegregation, the stronger the apparent gain in achievement.

2) The greater the proportion of white classmates at the time of testing, the stronger the apparent gain in achievement.

3) The higher the grade in school, the closer the relationship between proportion of whites in a school and Negro achievement.

It seems to me unreasonable to argue that these relationships merely reflect undetected differences in the family backgrounds of Negro pupils. I am informed that in further cross-tabulations of the data, done for the U.S. Civil Rights Commission, Negro pupils were divided into two groups according to educational level of their own families, and into three according to educational level of their classmates' families, and that for virtually all combinations of categories there were linear trends toward higher Negro achievement as (i) proportion of white classmates increased and (ii) the grade in which desegregation was first experienced was lowered.

For his opinion that the data show the differences in average performance of racial groups not to be the result of differences in educational opportunity, Nichols cites two lines of evidence: (i) the racial gap in achievement, as measured by standard scores on tests, remains quite constant in the Northeast at different grade levels; (ii) the proportions of total variance in achievement accounted for by between-school differences and within-school differences remain constant at different grade levels.

First of all, it should be noted that in the South the racial gap does grow larger at higher grade levels, a showing consistent with the notion of a cumulative effect of inferior educational services. Why in the South, but not in the Northeast? One regional difference is obvious. In the South, racial comparison is tantamount to comparing Negro schools and white schools, since over 90 percent of Negro children in the South are in *de facto* segregated schools. But in the North almost 50 percent of all Negro pupils are in predominantly white schools. Therefore, the data cited by Nichols (racial averages in test scores) are not relevant to the question of the effects of school quality on racial differences in the North. The relevant data would have to compare performance through time of Negro children in predominantly

Negro schools with white performance in predominantly white schools, and of course, for the sake of completeness, Negro children in white schools, and white children in Negro schools. (As I indicated above, the effect on Negro pupils of attendance in white schools does appear from the USOE report to be cumulative. Moreover, an additional tabulation by the Civil Rights Commission shows that in the 12th grade the average northern Negro child of low socioeconomic background in a school with a predominantly low-status Negro enrollment is reading at the 7th-grade level, whereas the comparable Negro child in a high-status white school is reading at the 11th-grade level.) Note also that the percentage of Negroes in predominantly white schools in the North increases greatly (about doubles) in the higher grades. If the white schools are better schools (and they clearly are in at least one important respect—the verbal ability of teachers), this factor could easily wash out any tendency toward enlargement of the racial gap at higher grades.

Nichols' second argument is that if differences in school quality contribute to racial differences in average achievement, between-school differences in average performance, relative to within-school differences in individual performance, should increase with increasing grade level. This assumes there are no factors within schools that have a cumulative effect on differences between pupils. If differences within schools were also increasing with grade level, increasing differences between schools would not be apparent, since the relative contributions to total variance would tend to remain unchanged.

There is one likely candidate as a within-school factor having cumulative effects on performance—ability grouping. Over 60 percent of white and Negro children in the Northeast (80 percent of Negro children in the South) are in schools that practice some form of ability grouping. There is enough evidence of a "self-fulfilling prophecy" phenomenon associated with ability grouping to warrant rejecting the comparison of within-school and between-school variance as a test of whether differences in educational opportunity affect achievement.

In short, I find Nichols' conclusion—that variations in educational opportunity (including the opportunity to go to school with children of different backgrounds) have no material effect on Negro achievement—unwarranted on the basis of the evidence he presents. On the contrary, the Coleman data suggest the opposite.

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The two foregoing letters support the major conclusion of my review, which was that available data are inadequate to answer the important questions asked of them.

Mood, Spitzer, Stoller, and Weinfeld rightly emphasize the difficulty of isolating the role of differences among schools in bringing about individual differences in ability among students. However, they seem overly to minimize the significance of their regression analysis in which little relationship was found between student achievement and school quality when family background was statistically controlled. The conclusion of the report, "that schools bring little influence to bear on a child's achievement that is independent of his background and general social context" (p. 325), can be contested on methodological grounds, but I know of no better evidence that would suggest the opposite conclusion.

The increasing racial gap and increasing between-school variance with increasing grade level that might be expected if school differences were a major source of individual differences in student performance were not observed in the Coleman study. Katz and Mood *et al.* have indicated several reasons why this is not conclusive evidence for the absence of school effects. Student migration and dropout and differential test validity at the different age levels are additional sources of error that could obscure the evidence of school effects. But simply explaining away the negative evidence does not establish a strong case for the existence of substantial school effects.

Katz points out that "differences in Negro achievement associated with extent of desegregated schooling were not accounted for by measured family-background factors," but neither were they accounted for by measures of school quality or of racial balance. They could be accounted for either by the higher socioeconomic level of the other students in integrated schools (the conclusion of the USOE report) or by incomplete control of family background (a possibility mentioned in my review).

I agree with Katz that the data do

not warrant the conclusion "that variations in educational opportunity . . . have no material effect on Negro achievement," but neither do they warrant the opposite conclusion.

The question of the extent to which differences among schools are responsible for differences in student performance is too important to rest on quibblings over inadequate evidence. At a time when we talk matter-of-factly about sending men to the moon, I find it hard to accept Katz's statement that "longitudinal studies (of educational effects) are not feasible." The Equality of Educational Opportunity survey has demonstrated that well-financed, large-scale studies can provide data relevant to important questions concerning educational effects; but, as a first attempt organized on a crash basis, it has raised more questions than it has answered. Much more research on a similar scale is needed, particularly studies incorporating longitudinal data. The great variation in educational practices in the U.S. provides a vast and continuing natural experiment. Analyses to isolate the effects of the many variables involved can be done at a relatively low cost. We can no longer afford to pass up such a research bargain.

In addition to evaluating the effects of existing differences in educational programs, promising new ideas should receive a fair trial. The educational establishment is so conservative, however, that it is extremely difficult to introduce changes. To get an innovation accepted, such a strong emotional argument for it must be advanced that it then becomes impossible to deny it to anyone who wants it. Thus, the effects of changes in the educational system are never evaluated. Proposed changes in educational programs should be tried in the natural setting, on an adequate scale, on an experimental basis with the control groups and measurements that are necessary to assess the effects of the change. Then a rational decision could be made either to expand or to abandon the program.

As Mood *et al.* point out, we have been questioning the differential effects of schools, not the absolute value of education. As a whole the schools have undoubtedly improved in effectiveness over the years. However, we may be nearing the upper limit on improvement that can be achieved by common sense and experience alone. Future enhancement of the effects of education will increasingly depend on the objective

evaluation of the effects of educational programs, so that the effective can be expanded and the ineffective abandoned.

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Christian Impact on Ecology

In "The historical roots of our ecological crisis" (10 Mar., p. 1203) White helpfully pointed out that "Since the roots of our trouble are so largely religious, the remedy must also be essentially religious, whether we call it that or not. We must rethink and refeel our nature and destiny." Fine! A better general conclusion has rarely been formulated even though his handling of the historical data of Christianity and Scripture leaves much to be desired. He seems to feel that what Christians have said and done adequately represents Christianity. To speak of "orthodox Christian arrogance toward nature" is to miss the heresy and blasphemy and label it normative. Not everything Christians do is Christian in character. . . . The most undeveloped and misunderstood teaching of Scripture relevant here is the cultural mandate given Adam by God. White described some of the data of the mandate but missed the thrust, as have most Christians over the centuries. The cultural mandate makes man the responsible steward of the universe, not its spoiler and looter. Responsible stewardship, not exploitation, is the keynote. As steward of the universe, man is challenged to develop natural resources to benefit all creatures, aesthetically and materially, and by so doing to honor his Creator and Redeemer. Such Christian stewardship of natural resources does not include exploitation for selfish gain at the expense of society, nor pollution of land, air or water.

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The historical impact of Christianity upon ecology has depended not on what we, individually, at present, may think that Christianity should have been, but rather upon what the vast "orthodox" majority of people who called themselves Christians have in fact thought it was. Feenstra, like St. Francis, is trying to reform Christianity.