

of families living in low-socioeconomic school districts. The same bias would result from the practice of substituting the mean for missing data that was followed in constructing the background indices. Socioeconomic status is probably a better substitute for initial ability of majority students than it is for that of minority students, whose family social mobility is limited by various forms of discrimination.

The "school effects" that were found are precisely the effects that would be expected to result from such incomplete control of student input. "School effects" were greater for general ability measures than for measures of school-related achievement; they were associated with the average socioeconomic level of the student body rather than with measures of school quality; and their correlation with student-body characteristics was greater for minority than for majority children.

The result of all this is to reinforce the two preceding lines of evidence in indicating that the effects of variations in school quality on student achievement are minimal, even less than the authors admit.

This survey suffers from problems common to all nonexperimental studies in attempting to assess the effects of natural experiments, which are so messy that one can never be certain that all relevant variables have been taken into account or that the correlations observed in the natural setting would continue to hold if the variables were artificially manipulated. Two uncontrolled variables that come to mind as possible distorting influences in this study are student dropout and migration. If there are differential dropout rates for the various groups, loss of the less able minority students at higher grades may obscure an increasing decrement in group performance. Because of student migration, the student's present school may not be a good indicator of the quality of education to which he has been exposed, and this clouding of the independent variable may make the regression analysis less sensitive to whatever school effects may exist.

It is unfortunate that the sensitivity of the racial issue made it necessary to collect the data from the students anonymously. If each student's name could have been associated with his test scores, a retesting of the same grades in the same schools three years later would have yielded data for a longitudinal study in four segments stretching from the first through the 12th grade.

The study would also have been improved if Jews and possibly Catholics had been identified as additional minority groups, since both are probably subject to some *de facto* segregation in public schools. The higher average performance usually found among Jews would have provided a useful contrast in the attempt to understand the lower average performance of the other minorities.

In view of these shortcomings it is obvious that this is not a good study of the effects of education on minority-group performance; it is just the best that has ever been done. Moreover, it provides the best evidence available concerning the differential effects—or rather the lack of such effects—of schools. AAAS members may find it hard to believe that the \$28-billion-a-year public education industry has not produced abundant evidence to show the differential effects of different kinds of schools, but it has not. That

students learn more in "good" schools than in "poor" schools has long been accepted as a self-evident fact not requiring verification. Thus, the finding that schools with widely varying characteristics differ very little in their effects is literally of revolutionary significance.

It is not customary for educational practice in the U.S. to be based on research, and these results will likely have little influence on educational policy. The conservatism may be adaptive in this instance, because the findings are too astonishing to be accepted on the basis of one imperfect study. What seems to be required is additional study of differential school effects with better controls for input. However, until these findings are clarified by further research they stand like a spear pointed at the heart of the cherished American belief that equality of educational opportunity will increase the equality of intellectual achievement.

## Molecular Orbital Theory for Organic Chemists

When the purpose of a book is to acquaint the organic chemist with the basic principles of the molecular orbital theory and its application to organic chemistry, then the authors have set themselves a difficult but important task. The task is important because the practitioners of molecular orbital theory have been prolific and even successful. The task is difficult because molecular orbital theory, disinherited by quantum mechanics, is practiced as an odd mixture of theory and empiricism, algebra and guesswork—a black art which must be dissected if it is to be intelligently used. The simplest form of molecular orbital theory, in which wave functions for a molecule are constructed as linear combinations of atomic wave functions and obtained as solutions to a one-electron wave equation, is very easy to use, but the validity of the results is often difficult to assess.

In *Quantum Organic Chemistry* [Interscience (Wiley), New York, 1965. 366 pp., illus. \$13], Kenite Higasi, Hinoaki Baba, and Alan Rembaum introduce the reader thoroughly and concisely to the manipulations of the simple molecular orbital theory. They present a number of examples and an excellent list of references which should enable any scientist to perform his own calculations. The well-written chapters

on the applications of the method to the prediction and interpretation of physical properties of molecules and chemical reactivity will suggest many possibilities for applications of molecular orbital theory to new problems.

One looks, in a presentation of molecular orbital theory to the uninitiated, for a warning on the side of the package—*Use carefully*. The present authors are concerned with imparting proficiency and they pay little attention to the pitfalls. There is much comparison of various calculations, but the empirical basis of the method is seldom emphasized. The inherent limitations of the simple molecular orbital theory are briefly mentioned. There is a tendency to jump from a molecular orbital description to a valence bond description and back again. Readers would benefit from a clearer distinction between the two theories and between physical properties of a molecule, such as bond lengths, and properties of the model, such as free valence.

*Quantum Organic Chemistry* conveys a body of knowledge well, as does a good teacher. The judgment required to prevent the misuse of molecular orbital theory must be developed on one's own.

PETER GASPAR  
*Department of Chemistry, Washington University, St. Louis, Missouri*