MAKING SCHOOLS MORE EFFICIENT: AN ECONOMIC PERSPECTIVE

by
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The costs of public education have spiraled in recent years, while the general quality of schooling has been subject to mounting criticism. The media are filled with stories on the appalling proficiency levels of pupils in the most fundamental areas—reading, writing, and arithmetic. At the same time, budget freezes and cutbacks have become the norm. To reduce costs, large cities such as Washington, New York, and Chicago have employed increases in class size, slashes in interscholastic sports and other extracurricular activities, decreases in staff through attrition and reductions in hiring and rehiring, and cuts in pupil transportation. At the extreme, some school systems have actually had to close down entirely. Although budgets are diminishing, however, demands for higher quality education and greater opportunity for the disadvantaged remain.

Do Schools Matter?

More than ever before, the effectiveness of school resources is being scrutinized and questioned. Most recent research—much of it highly controversial—has yielded results that range from counsels of discouragement to utter despair. James Coleman reported in his pioneering 1966 study[1] that (1) throughout the school years, family background is the greatest determining factor of pupil achievement, and (2) school-controlled variables barely affect achievement, and are far outweighed by the nature of the student body. A resurgent interest in the effects of racial differences on intelligence produced the most controversial contention, notably by educational psychologist Arthur Jensen,[2] —that IQ is, for the most part, genetically determined, and that schools cannot succeed in compensating for the alleged innate disparity. Christopher Jencks, also a sociologist, added to the litany of pessimism in his study of the relation of income and occupation to school and family background characteristics.[3] Jencks maintains that quality of schooling does not make a significant difference in one's future socioeconomic status.

A Recent Study

Economists Anita Summers and Barbara Wolfe[4] (the latter is a Poverty Institute staff member) examined the issue of school effectiveness using several years worth of data from the Philadelphia School District, and obtained encouraging results. They found not only that many school inputs do make a difference, but that disadvantaged pupils, especially, can be helped by particular types of inputs.

Economists are interested in how scarce resources are allocated among alternative uses. The analytic and measurement techniques of this profession are well suited to studying large social issues, such as educational quality. Contemporary educational issues have, in fact, revolved around two areas of foremost concern: efficiency (or productivity) and equity. Furthermore, gains in educational productivity reach well beyond the classroom: Increased student achievement during the school years, it may be argued, means a more productive work force in future years.

Educational achievement can be viewed as a production process, where inputs of labor, capital, and organization are applied to the relatively "unfinished" child, and an output—pupil achievement—results. The object is to generate the greatest growth in achievement using a given amount of school resources. When examining this process, economists try to isolate the impact of a specific input (e.g., smaller class size) on the output, with all other school and socioeconomic inputs held constant. Since they cannot shift about inputs at will, this requires looking at past educational histories where such inputs have shifted; and while statistical techniques cannot establish that the change in an input *caused* the change in an output, they do identify a relationship between them.

The authors constructed three-year longitudinal pupil histories, ending in 1970-71 or 1971-72, for 627 sixth grade elementary school pupils in 103 schools;[5] both schools and pupils were selected randomly. It is the use of pupil-specific data and the appropriate statistical methods, the authors maintain, that account for their results. (Most other researchers, in contrast, have used aggregated data for a school or school system, which masks the actual impact of specific school resources.) Not only were the pupil histories extremely detailed and the school sample large, but individual pupils were matched with their own teachers and with the characteristics of those teachers, with data on school-wide resources of that pupil's school, and with the pupil's estimated family income.

Equations were estimated where each pupil's change in achievement growth over the three-year period (the dependent variable) —as measured by composite achievement scores on the Iowa Test of Basic Skills—was explained by a set of independent variables. These independent variables were (1) genetic and socioeconomic characteristics, such as race, IQ, and family income, (2) pupil-specific school inputs, such as size of class and teacher's experience, and (3) peer group characteristics, such as proportion of high achievers and proportion of blacks in a class. We generally think of several factors as affecting pupil growth. The statistical procedure employed by Summers and Wolfe—multiple regression analysis—allowed them to test empirically these many relationships, and to sort out the separate effects of different factors entered into each equation. Multiple regression analysis also permitted them to estimate the magnitude of each relationship.

Summary of Findings

The major finding to emerge from this study is that certain school inputs do make a difference in achievement growth. While some school resources have a positive impact on all pupils, others are especially effective for particular types of pupils. First let us consider *socioeconomic inputs:*

Income and race. Much interaction between school input and type of pupil was discovered. For many school resources, the effect on some types of pupils is very different from the effect on other types of pupils. This explains why

Anita Summers and Barbara Wolfe, "Do Schools Make a Difference?" *American Economic Review* 67 (September 1977): 639-652. Also a forthcoming Institute for Research on Poverty Reprint.

Barbara Wolfe, "A Cost-Effectiveness Analysis of Reductions in School Expenditures: An Application of an Educational Production Function," *Journal of Education Finance* 2 (Spring 1977): 407-418. Also a forthcoming Institute for Research on Poverty Reprint.

other studies have concluded that school inputs have little or no effect on achievement. But targeting a resource at the pupil group it will benefit most can increase learning.

Sex. Males do more poorly than females in elementary school. Only low-ability males lag behind low-ability females in junior high school, but in senior high school males of average ability or lower do better than equivalent females.

Starting scores (on first grade test of verbal ability). A pupil's abilities strongly determine achievement growth at every level of schooling.

Motivation. As proxied by unexcused absences and lateness, motivation has a significant bearing on learning. Pupils with more unexcused absences and lateness grew less.

While socioeconomic factors are not within the immediate control of administrators and teachers, *school inputs* are:

Teacher's education and experience. Teachers with B.A.'s from higher-rated colleges have a positive effect on low-income and middle-income pupils. Years of teaching experience has a positive effect on average and above average pupils, no effect on pupils somewhat below grade level, and a negative effect on pupils well below grade level. This may be due to newer teachers' having greater enthusiasm for working with poor learners.

Class size. Low-achieving students do worse in classes of more than 28 pupils, high achievers do better. Class size seems to have no effect on those performing at grade level, up to a size of 33; above that, it has a negative effect.

School size. School size affects blacks and nonblacks differently. Small schools benefit all, but have an even greater positive effect on the achievement growth of blacks.

Peer group effects—racial balance. In the elementary schools, both black and nonblack students experienced the greatest growth in achievement when they were in schools with a 40-60% black student body, all other school characteristics held unchanged.

Peer group effects—achievement mixture. In the sample for this study there is a very low proportion of high-achieving pupils and, in about half of the elementary schools, more than half of the student body achieve at very low levels. Pupils performing at grade level or lower perform distinctly better when they are in a school with more high achievers; pupils performing above grade level are little affected by the achievement mix. In general, then, the more heterogeneous the student body in race and achievement, the better that population will fare in basic skills learning.

This study, then, concludes that school resources influence learning growth, that some of the race and family income effects can be at least mitigated by specific school inputs, and that low achievers, blacks, and low-income students, especially, respond to certain school inputs. This information can be used to make schools relatively more efficient while operating within budget constraints. That is, redirecting some educational resources is likely to produce productivity gains.

Three further pieces of work have developed from this initial research. Summers and Wolfe are working on a replication of the original study using data on about 2,000 School District of Philadelphia students who were in the sixth through eighth grades over the period studied. Their intent is to emphasize the importance of replication as the major tool of empirical verification in policy work, and to develop techniques for "correcting" data that are not perfectly comparable when experiments are repeated. Summers is also currently working with the School District of Philadelphia on a study evaluating the effects of fourth grade reading programs on reading achievement; many measurements reflecting the classroom situation and the school characteristics are included. And Wolfe has analyzed budget data for the School District, drawing on the original study. A closer look at the last project follows.

A Cost-Effectiveness Analysis

Wolfe carried analysis of the data further to do a detailed examination of the cost-effectiveness benefits to be derived from shifting around budgets in accord with the above findings. Her simulation results show greater efficiency and output from selective reallocation than from across-the-board cuts, cuts by attrition, and cuts in areas where they are most politically expedient. In addition to the appropriate pupil and financial data, such an analysis requires a clear definition of goals and a systematic analysis relating inputs to these goals.

The results from the initial "production function" study, which relates school inputs to student achievement, were combined with the Philadelphia School System cost data for 1975-1976.[6] This procedure allows one to determine not only in which areas cuts are least damaging and how the budget should be redistributed, but also whether the various reallocations need to be of a certain magnitude in order to be effective. Tradeoffs that are revealed among achievement groups from a study such as this one will require reconsideration of the school system's goals. In addition, non-achievement-related goals, which can also be important, may be tied to inputs which do not seem to yield a difference in achievement growth (e.g., whether teachers have education beyond the B.A., according to the results of this study).

By way of illustrating cost-effectiveness analysis, Wolfe analyzes and compares four alternative school expenditure scenarios: (1) the current budget is maintained, with the option of reallocating up to one-third of each resource among achievement subgroups, (2) the current budget is maintained, with the option of reallocating up to one-third

of each resource among a combination of school inputs and achievement subgroups, applying the cost-effectiveness technique, (3) make an across-the-board budget reduction of $30 per pupil, and (4) make a cost-effectiveness budget reduction of $30 per pupil.

Several recommendations arise from the analysis, with the investigator's caveat that the results should be taken as illustrative rather than definitive:

1. Application of the cost-effectiveness technique can improve a school's efficiency.
2. Pupil achievement growth is not directly tied to expenditure per pupil; by altering expenditure patterns, current resources can be better exploited.
3. A systematic budget cut, which increases expenditures on certain inputs and decreases them on others, is more effective than an across-the-board cut.

It is well to bear in mind that teachers and administrators will vary in their willingness to accept the reallocations that a cost-effectiveness analysis may suggest, and costs may change as hiring and usage patterns differ.

Policy Implications

The findings of this research have several important policy implications. First, proper allocation of public school resources can be used to attain greater equity in educational opportunity. At a time when courts and legislatures are doing battle with the concept of equality of educational opportunity, this research suggests that educational equity might be measured best in terms of *output*—achievement growth—rather than inputs—such as expenditures per pupil—which has been the traditional approach.

A second implication concerns educational productivity. School efficiency, it would seem, can be increased without increasing expenditures by shifting resources away from unproductive inputs and toward those inputs that help increase achievement for school subgroups, especially the low achievers.

A third policy implication is tied to use of the cost-effectiveness technique in times of budget cuts and reductions in enrollment. Resources generally need to be reallocated in such instances. By combining the educational productivity results with cost figures, the effectiveness of educational dollars can be increased.

A fourth policy issue relevant to this discussion is the notion of accountability. If specific school resources can be linked to greater growth in achievement, then taxpayers, parents, and the courts could hold school administrators responsible for producing a specified output. But most important are the possibilities for improved learning and the fuller realization of children's academic potential.

[1]James S. Coleman et al., *Equality of Educational Opportunity* (Washington, D.C.: Government Printing Office, 1966).

[2]Arthur R. Jensen, "How Much Can We Boost I.Q. and Scholastic Achievement?" *Harvard Educational Review,* Winter 1969, pp. 1-123.

[3]Christopher Jencks et al., *Inequality: A Reassessment of the Effect of Family and Schooling in America* (New York: Basic Books, 1972).

[4]Anita Summers is a Research Officer and Economist at the Federal Reserve Bank of Philadelphia. Barbara Wolfe is a Research Affiliate at the Institute for Research on Poverty and Assistant Professor of Economics and Preventive Medicine at the University of Wisconsin-Madison.

[5]Data were similarly gathered for eighth and twelfth grade pupils. The eighth grade sample produced similar results to those for the sixth grade; the twelfth grade results were based on an inadequate sample.

[6]An assumption was made of homogeneity or stability in the input-output relationship.