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Education Productivity Research: An Update and Assessment of Its Role in Education Finance Reform

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This article begins with a critical review of alternative strategies currently in use to study educational productivity. These unfolding research programs are considered in the light of increasing public demands for improvement of productivity in education. A critique is offered of the dominant conception of the education production process that undergirds many of these studies, and alternative conceptions are offered. The effects of efforts to improve productivity are examined in the context of each of these different conceptions. The article concludes by advocating a new line of research designed to generate insight into more fundamental aspects of education production processes. This new type of productivity research places greater emphasis than is customary on the classroom as the unit of analysis.

A significant paradox is plaguing efforts to apply productivity-related research to the reform of K–12 education-financing systems. On the one hand, there is consensus that existing education production research has been largely unsuccessful at revealing the schooling inputs that dependably contribute to enhanced learning gains of students. There is no shortage of pessimistic assessments of what this literature has contributed. Hanushek's 1986 review is paradigmatic (Hanushek, 1986), but there have been others, including a pessimistic review of the productivity-related policy implications that can be derived from the High School and Beyond data set (Witte, 1990).

On the other hand, there is a drive toward raising the level of educational production (sometimes coupled with concerns over improving efficiency[1]), which is strong, is probably growing, and presupposes a nontrivial store of knowledge regarding the ability of state, district, and school officials to enhance productivity. In particular, there is an optimism about the prospects for improving educational productivity through the use of state fiscal policy that is remarkable given the disappointing results of the most recent policy-relevant research on the subject, namely the attempts to estimate education production functions. How can these two apparently paradoxical features of the modern school-finance-reform movement be reconciled?

An important policy response involves having a centralized authority—typically although not necessarily a state—focus on the outcome side of the production function, set minimum standards, and hold constituent units, be they school districts or schools, accountable for meeting the standards through a system of positive or negative incentives. Hanushek (1991), Hoenack (1988), and others propound this view. Numerous states and some school districts have implemented reforms containing outcome-based incentives (Picus, 1991). In so doing, the more centralized authority sidesteps having to spell out the ingredients of education success and can sit back and act as judge and jury of

those with the more immediate responsibility of producing the desired results.

This policy response can be viewed as a strategy, perhaps even an ingenious strategy, that successfully finesses the ignorance that characterizes our knowledge of the underlying education production function(s). Ingenious though this "outcomes-as-standards" response may be, there are serious deficiencies that are not sufficiently well appreciated. In this article, I explore these deficiencies and argue that one of their consequences is the neglect of an important and relatively unexplored line of productivity research. I discuss the properties of this alternative type of research and offer it as a promising source of insight into policy issues surrounding the production of education. The article begins with an overview of recent productivity research that pertains to education.

An Update on Education Productivity Research

This review is organized topically. I draw broad distinctions among five different approaches to the topic and deal with the substance of studies falling into each category. My chief thesis is that with only a few exceptions, the underlying model of education productivity is inadequate and has not evolved much from where it was at the outset of this research. The weakness of the conceptualization gives rise to much of the policy-making frustration in this arena. This complaint about the inadequacy of the production function model sets the stage for the alternative approach developed in the subsequent sections of the article.

Relationships Between Purchased Schooling Inputs and Outcomes

Education production function research began some 30 years ago with attempts to estimate relationships between the supply of selected purchased schooling inputs and educational outcomes, controlling for the influence of various background features. This is the traditional type of production function research. It is deductively driven, although the arguments upon which deductions are based tend to be abbreviated. Indeed, modern studies of this type tend to justify their selection of variables with references to previous studies that looked at similar variables. The approach relies on survey data, correlational research designs, and multivariate statistical analyses. Studies of this type were the focus of Hanushek's stinging critique published in 1986.

This has been a reasonably active area of research over the past 10 or so years. Since 1980, at least 18 input-outcome studies have been reported in the *Journal of Economic Literature*, and this count misses the many closely related studies published by sociologists, students of educational policy, and others over the decade.

It has also been a disappointing area of research that has been plagued by a disconcerting pattern of inconsistent and often insignificant results. Analysts seem satisfied with a highly simplified underlying conceptualization of education production. Instead of challenging the underlying model, these production function researchers have pursued a piecemeal approach that revisits old questions and explores them with modest innovation. Analysts write in apparent ignorance of some of the more serious conceptual difficulties that have been discerned (Hanushek, 1979, 1986; Levin, 1976; Monk, 1990; Murnane & Nelson, 1984). It is journeyman social science. While it is not bad social science, it is not the kind of analysis that is likely to wrest the research from its damning legacy of inconsistent and largely insignificant results.

In fact, in certain respects the research seems to be stepping backwards. During the 1970s, it was becoming clear that progress toward estimating the education production function required a more micro-approach complete with disaggregated data and a focus on decentralized levels of decision making. The studies of Murnane (1975), Summers and Wolfe (1977), and Hanushek (1971) were very influential in this regard.

There followed efforts to extend this trend toward even more micro levels. The studies by Thomas and his associates at Chicago (Thomas & Kemmerer, 1983), Brown and Saks (1986, 1987), Kiesling (1984), and Rossmiller (1986) involved data collected on the basis of classroom observations, which per-

mitted analysts to distinguish between the inputs supplied to different students within the same classroom.

These attempts were also characterized by a pattern of inconsistent and insignificant results, and there was speculation at the time that these disappointments would prompt efforts to carry the disaggregating trend even further (Monk, 1989). However, judging from the literature that emerged in the late 1980s, there is little reason to fear any large-scale attempt to reach deeper into the educational system in search of regularities, at least not by economists. Not one of the studies listed in the *Journal of Economic Literature* since 1985 involved the kind of classroom data used by Thomas, Brown and Saks, or Rossmiller. In fact, a significant number of the most recent studies reported in this journal are specified at the school district level of analysis.[2]

Evidence of this renewed (or perhaps never-lost) faith in aggregate levels of analysis can be seen in recent studies of school quality where school quality is measured by aggregated expenditure levels. There have been studies where the outcome variable is labor market success (Behrman & Birdsall, 1983; Card & Krueger, 1990; James, Alsalam, Conaty, & To, 1989), as well as studies where the outcome is the test score performance of students (Dolan & Schmidt, 1987; Fairchild, 1984; Ferguson, 1991; Margo, 1986; Sebold & Dato, 1981; Stern, 1989; Walberg & Fowler, 1987). With the exceptions of the Fairchild and Stern studies, these examinations of school quality were conducted at either the district, state, or regional levels of analysis.

The rationale for using such global measures of school quality as district expenditure levels per pupil relies heavily on the claim that new and more refined data are available that give researchers an unprecedented ability to control for distorting effects. A good example of this is provided by Ferguson (1991), who asserts that his detailed measures of Texas teachers' literacy make it reasonable to look at the effects of expenditures and achievement at the district level.

Analysts also point to the availability of new econometric and sampling techniques to handle one or another of the vexing estimation problems that have long dogged this line of research. For example, there are recent studies reporting progress with selection bias (Behrendt, Eisenach, & Johnson, 1986); simultaneity problems (Baum, 1986; Boardman, Davis, & Sanday, 1977; Montmarquette & Mahseredjian, 1985, 1989a, 1989b); uses of panel data (Boardman & Murnane, 1979); lagged effects (McNamara & Deaton, 1989); multiple outcomes (Bee & Dolton, 1985; Callan & Santerre, 1990; Chizmar & McCarney 1984; Chizmar & Zak, 1983, 1984; Gyimah-Brempong & Gyapong, 1991); and departures from efficiency criteria (Bee & Dolton, 1985; Fare, Grosskopf, & Weber, 1989).

Many of these recent production function studies are reporting optimistic results, optimistic in the sense that positive relationships are being found between schooling resources and measured educational outcomes. The school quality studies are again illustrative, since the recent studies tend to find that higher expenditures are related to higher levels of outcome.[3]

While these optimistic findings are important and worth pursuing further, there are several reasons for policymakers to retain a degree of skepticism. First, positive results are nothing new in this line of research. Hanushek (1986) found no fewer than 13 studies reporting positive relationships between expenditures per pupil and measured learning outcomes. Past positive results have been balanced by recurring nonsignificant and even negative results.

Second, there remain serious conceptual inadequacies in the underlying productivity model. Despite these studies' growing econometric sophistication, they remain fundamentally primitive black-box formulations where analysts have made little progress toward modeling what makes education distinct from other types of production more typically studied using production function techniques. In particular, scant attention has been paid to the nested nature of educational production wherein schools themselves produce inputs that are subsequently (or even simultaneously) used in the production of final outcomes. Neither has much progress

been made toward modeling dynamic aspects of educational productivity. Instructional realities are not static and do not reproduce themselves in simple ways. The failure to model the changeable nature of education production processes is a serious limitation on this line of research.

These and other conceptual shortcomings have served in the past to explain the production function approach's lack of success at demonstrating the ingredients of effective schooling. These shortcomings are less well suited for explaining why the research may be beginning to reveal positive and consistent results. For the skeptic, they can be used to predict that the recent run of positive and consistent results will be short lived. In any case, they underline the importance of attempting to replicate the recent studies before the results become the basis of public policy.

Relationships Between Nonpurchased Inputs and Outcomes

Closely paralleling these efforts to estimate the effects of purchased inputs on outcomes has been interest in assessing the influence of nonpurchased influences on learning. This research has policy implications to the degree that the nonpurchased inputs either can be manipulated themselves or can be substituted for by purchased (or otherwise manipulatable) schooling inputs.

Among the types of nonpurchased inputs that have attracted analysts' attention are the influences of peers and the influences of parents.[4] While it is not uncommon for production function studies, particularly the early studies, to include measures of peer influences alongside measures of purchased schooling inputs, it has recently been more common for analysts with these interests to focus attention directly on peer-group aspects of production. Winkler (1975) made an important early contribution to this literature. More recent work has included analysis of peer influences that operate via ability grouping and tracking within schools (Barr & Dreeben, 1983; Gamoran, 1987; Hallinan & Sørensen, 1985). A lively debate has ensued over the relative merits of grouping and tracking (see Oakes, 1985, 1990; Slavin, 1987a).

Economists have been particularly active in the second strand of this research where the focus is on parental contributions. This is due primarily to theoretical developments that can be traced back to G. S. Becker (1965, 1981) and others interested in the allocation of time in families. It was a logical extension of this earlier work to consider linkages between time and resource allocation in homes and the subsequent and concurrent learning experiences of students in schools (Hill & Stafford, 1974, 1980; Leibowitz, 1974a, 1974b, 1977; Stafford, 1987).

In a recent empirical study of the home-school linkage, Hanushek (in press) used data gathered from African-American families who participated in the Gary income-maintenance experiment to assess relationships between family attributes—including size, presence of a male adult, and the work commitment of the mother—with performance gains in school. Hanushek's results suggest that children are quite resilient to developments in their homes that one might expect would affect performance in school. According to his findings, the work behavior of mothers has no impact on school performance; neither does the presence or absence of an adult male in the home. Similarly, there was no independent effect of changing schools on pupil performance. However, family size was related to achievement gains, with larger gains realized by students from smaller families. In large families, Hanushek found it was better to be born late rather than early and explained the result using investment arguments focusing on the availability of mother's time to spend with each child.

While Hanushek's study is an important contribution, it draws on the conventional production function model and deals with only one portion of the influence parents and families have on the schooling experiences of their children. In addition to the effects time allocations at home have on schooling success, which are Hanushek's foci, there are the collateral roles parents can have when they contact teachers and administrators, when they become active in parent organizations, when they interact with parents and children from other families, and, of course,

when they enter voting booths and cast ballots for school board candidates and budget referenda.

Recent theoretical developments within the sociology of education attempt to incorporate these social aspects of family into thinking about schools and schooling success. James Coleman used the term "social capital"[5] (Coleman, 1988, 1991) and built upon human capital theory to capture a number of these broader kinds of influence parents and others in a school's surrounding community can have on school success.

Coleman conceived of social capital as a schooling ingredient that itself is produced or manufactured, rather than as a discrete input or single ingredient that can be purchased in a market or donated by an individual. It is a configuration of individual ingredients and appears to be more than a sum of its parts. As such, it is a conceptually distinct type of schooling input, and as the following section makes clear, these "configurations" of inputs that transcend their ingredients have attracted a considerable amount of recent attention.

Relationships Between Configurations of Inputs and Outcomes

Much of the work in this area has focused on organizational attributes of schools. These are not the sorts of inputs that can be purchased in open markets as is the case with teacher credentials, smaller class sizes, new facilities, and so on. Rather, they are themselves the outcomes of underlying production processes. Thus, schooling becomes conceptualized as a nested production process where the ultimate production of educational outcomes presupposes the production of prerequisite organizational attributes. Research pursuing this tack can be viewed as an attempt to raise the underlying production model to a new and higher level of sophistication.

Much of this research grows out of the effective schools research tradition, which itself can be viewed as an outgrowth of early frustration with the more traditional production function studies discussed in the previous sections. In recent years attempts have been made to adapt the lessons of effective schools research to the more conventional (and policy-implication-laden) production function research methodology. Thus, we observe quasi-experimental methods, the use of survey data, and the construction of variables motivated by the case-study findings within the early effective schools research.

One of the better examples of this type of research involves the work dealing with the school community. A recurring finding of the effective schools studies was that an atmosphere conducive to learning was important, and that schools succeeding in manufacturing this atmosphere outperformed otherwise similar schools. However, these findings suffered from the standard sorts of limitations associated with effective schools research.[6] Particularly troublesome for policymakers have been the worries about effective schools results being idiosyncratic and difficult to replicate.

Thus, policy analysts faced a situation where the results of effective schools studies were intriguing but insufficient as a base for policy making. An understandable response was to employ the conventional production function estimation apparatus and use survey-generated data to estimate relationships among variables constructed to represent the organizational features found to be promising within the effective schools case studies.

The study by Bryk and Driscoll (1988) is illustrative.[7] In it they used 23 indicators drawn from the High School and Beyond data set to construct a comprehensive measure of what they called "communal school organization." Using their index, they found that communal school organization correlates with teachers' positive feelings toward the work environment, positive student attitudes and behaviors regarding schooling, and, finally, measures of academic achievement.

As intriguing as these findings are, there are difficulties. The authors acknowledge several of these, including the serious simultaneity problems that arise in their analyses. In addition, there are conceptual difficulties surrounding the notion of school community. For example, how Bryk and Driscoll balance consensus with a positive orientation toward learning is never made clear; the index they

construct has elements of both. The various actors within a school could form a strong community with shared values, a common agenda, and an "ethic of caring"[8] (the ingredients of community emphasized by Bryk and Driscoll) that is antithetical to intellectual concerns and achievement as they are conventionally conceived of. Bryk and Driscoll neglect the potential for such dysfunctional communities to develop within schools where the shared norms are opposed to the kind of orientation one ordinarily associates with schooling.

In addition, Bryk and Driscoll have not been sufficiently attentive to the internal differentiation that can characterize community in a school. They view community as a school-level attribute and thereby miss an important dimension of the education production process, one that is arguably capable of resolving much of the inconsistency surrounding productivity research in education.

The importance of internal variation in organizational features such as community has recently been recognized in a closely related area of research. Studies by Pallas (1988) and Rowan, Raudenbush, and Kang (1991) have begun to challenge the idea that a school's climate is an undifferentiated attribute that is best conceptualized at the school level.[9] The breaking apart of a construct that has long been conceived of at the school level is a significant development. It has implications for how related organizational features like community are conceptualized and offers important new insights into the properties of education production processes. The idea of internally varied organizational features plays a prominent role in the alternative approach to education productivity research that is developed in the final section of this article.

A further issue surrounding the analysis of school communities can be seen in the controversy over how best to interpret observed relationships between curricular variables and educational outcomes. It has been shown that taking high school courses is related to educational outcomes and that students who take more advanced courses in a given area perform at higher levels (Gamoran, 1987; Lee & Bryk, 1988; Meyer, 1988). But there is a problem here, and it is an important problem that applies to any configuration of inputs that might be singled out for analysis in a productivity context. As Witte (1990) put it, the issue is whether these are individual level effects or the results of the organizational feature that has been singled out, be it the structure of the curriculum, the stock of social capital, or the school's communal organization. To be more concrete, the question is whether the curricular effects on outcomes are the results of school-level decisions about how to build and supply the curriculum or whether they are due more to the individual students' willingness and ability to take advantage of curricular offerings. If the latter effect is the important one, policies designed to reform the curriculum will not in themselves result in substantial productivity improvements.

The difficulties associated with disentangling individual from organizational or group effects helped stimulate the development of new estimating techniques that promise more satisfactory decompositions of effects across levels. The resulting techniques take various forms but tend to involve the use of random coefficient models that permit analysts to estimate differences across units in the nature of phenomena occurring within the units.[10]

This is an econometric innovation that is distinct from those touched on earlier because it deals more fundamentally with a deeply rooted feature of educational production, namely the nested nature of decision making and the reciprocal nature of the relationships that exist across levels. Unfortunately, the policy implications surrounding these econometric innovations remain controversial. There are those who are impressed with the importance of the school-level effects with their attendant rich implications for public policy (see, for example, Lee & Bryk, 1988). But there are those who question the results. Witte (1990) is prominent among the latter and argues that the demonstrated school-level effects are at best marginal and that even if these effects were large, he is doubtful about the potential of uniform school-level policies to have much effect given the wide diversity that exists among schooling settings.

It is worth asking whether much conceptual progress is in fact being made here. If the reality is that several studies have found that something like course taking pays off in terms of learning gains, what is to distinguish this finding from the positive findings noted above regarding traditional inputs like aggregate expenditure levels on education? If this is the case, the tired old input-outcome model is still in the background, and perhaps what we have found is simply a series of studies revealing positive relationships. What reason is there to believe that these are different from the other positive studies that can be fished out of the sea of inconsistent and largely insignificant results?

And are these, the latest positive results, the sorts of findings that will be the substance of the technical assistance provided by state education departments to schools falling below the outcome standards? Do we really have a basis for believing that uniformly requiring deficient schools to offer more courses and requiring underachieving students to take them will pay handsome dividends? The potential for results such as these to be translated into bad social policy is real indeed.

Shifts in Methodological Strategy

Here we encounter an active and influential line of research. Like the studies reviewed in the previous section, this research can be viewed as an outgrowth of frustration with the inconclusive policy implications associated with the early production function research. There is still a nascent production function undergirding this research, but rather than pursue a deductively driven strategy, the idea is to focus on ideas that have an internal logic to them and some evidence of success to see if they can work in practice. In some of the more advanced versions of this research, the analysis takes on an actual experimental design.

A good example of an ongoing effort with these characteristics is the Success for All program based at the Center for Research on Effective Schooling for Disadvantaged Students at Johns Hopkins University. In recent reports (Slavin, Madden, Karweit, Dolan, & Wasik, 1990; Slavin, Madden, Karweit, Livermon, Dolan, in press), there is acknowledgement that few coherent models have been designed for schoolwide use in schools that serve disadvantaged students. The authors distinguish Success for All from this context and report positive results for the program during periods ranging between 1 and 2 years in eight elementary schools in Baltimore.

Other, similar approaches to the discovery of insights into the improvement of educational productivity are under way. There is, for example, the Accelerated Schools concept that Henry Levin and his colleagues have developed and are now implementing (Levin, 1989). There are also the Coalition of Essential Schools initiative that has been organized by Ted Sizer and James Comer's ideas about improving the psychosocial development of students (Comer, 1988). While these efforts differ in their substance, they all involve field-testing ideas coming from either effective schools research or elsewhere about what needs to be done to improve schools.

The state of Tennessee made a significant contribution to this line of research when it commissioned a study of class size that involved an experimental design (Finn & Achilles, 1990). Students in Tennessee were randomly assigned to different treatments (i.e., different class sizes) and their progress was tracked over time. According to the evaluators, the early evidence was quite promising in the sense that it showed that placement in smaller classes, other things equal, contributed to larger learning gains for young children. This has long been a controversial area of research, and the use of an experimental design to resolve the issue is encouraging.

Moreover, there has also been methodological progress toward dealing with the cost dimension in evaluations (Barnett, 1985; Levin, Glass, & Meister, 1984). It thus appears that our ability to conduct cost-benefit and cost-effectiveness evaluations is increasing and offers many new opportunities to explore properties of the education production function.

Lest we become too complacent, there remain problems, many of which stem from our underlying ignorance of the true education

production function. Suppose Slavin's schools for success begin to expand based on very promising early results. And suppose in their expanded form, success becomes much spottier? Perhaps Slavin would claim that the implementation is flawed and the model is not being properly followed. But how can we differentiate between this possibility and the possibility that the model itself is flawed in the sense that it only works sometimes when certain hard-to-ascertain conditions obtain?[11]

Even the experimental studies will not necessarily escape the potential for inconsistencies to be present. For example, Odden (1990) questioned the degree to which the benefits of smaller class size persisted over time in the Tennessee experiment and thereby challenged the prevailing view regarding what has been learned from the experiment.[12] Recall also the lessons of mastery learning research. The early studies were highly respected and had an experimental design (Bloom, 1976). The findings were encouraging, and not a few places, including the city of Chicago, adopted versions of the model. More recently, revisionist views have emerged (Arlin, 1984; Slavin, 1987b).

Inconsistencies have also arisen in other areas of evaluation research. Maynard's (1977) experimental study is illustrative. She found that the effects of income support for impoverished families had inconsistent effects on pupil achievement across the states in her analysis. The point is that an experimental design in itself is no guarantee of consistent noncontroversial findings which translate straightforwardly into public policy.

Thus, there are signs of the familiar and disquieting pattern of inconsistent results. The fundamental problem is that we are relying on an overly simplistic input-outcome model of education production. If this model is inadequate, mere shifts in the analytical strategy so that more reliance is placed on the evaluation of demonstration projects and experimental designs will not in itself produce useful results. A risk we run is a dramatic increase in the cost of pursuing what amounts to a hit-or-miss strategy for discerning regularities in education production.

But it should also be clear that the answer is not to hold innovators hostage to the ignorance that surrounds the education production function. Rather, the answer is to keep in mind that this ignorance is real and that what we are pursuing here is a strategy for learning more about the production function. The most obvious implication of this is that it is essential to be scrupulous in keeping track of what is being found as the evaluations proceed. We can learn from the pattern of inconsistencies that emerges, but only if careful records are maintained. This is a serious weakness in this area of research, since many evaluations are conducted internally and are reported in unpublished documents that are difficult to collect.

Process Studies

An impressive amount of intellectual energy has been devoted over the past 10 or so years to the use of economic models to study schooling and classroom *processes* (Akin & Stewart, 1982; Arnott & Rowse, 1987; W. E. Becker, 1982; Brown, 1988; Brown & Saks, 1980; Correa & Gruver, 1987; Farkas & Hotchkiss, 1989; Fox, 1987; Hoenack & Monk, 1990; Lima, 1981; McKenzie, 1979; McKenzie & Staaf, 1974; Monk, 1984, 1991; Mulligan, 1984; Murnane & Nelson, 1984; Snellings, 1987). These studies conceive of one or another of the actors within educational systems as a decision maker faced with a resource allocation problem.

These studies are primarily conceptual in nature. The contributors develop economic models of decision making within the educational system and deduce either implications for policy or hypotheses for testing. The work is neither well known nor influential for several understandable, if regrettable, reasons.

First, the analyses tend to become technical very quickly. It is, in a very real sense, economists talking to other economists, and there have been few attempts to open the debate to others. (McKenzie's text is a noteworthy exception.) This is the land of Lagrangian multipliers, Kuhn-Tucker conditions, probability limits, conditional and joint density functions, and so on. Part of this problem stems from the fact that this work is at an early stage. It would be premature to make the analyses more accessible before more consensus emerges about what has and

has not been found. An additional part of the problem stems from the relative lack of economic sophistication that can be found among practitioners of public policy. The schooling process is complex, and there will be very real limits to anyone's ability to reduce it to simple terms.

Second, there is a potentially worrisome tendency to make simplifying assumptions to make analyses tractable. Theorists will do things such as assume there are two categories of instruction, whole class and individual tutoring, and thereby dismiss the many types of instruction that lie between these two poles. There is a related tendency to focus on one aspect of the phenomena at a time. When models become so stylized, concerns easily arise over how realistic and dependable they are for policy-making purposes.

Third, the testable hypotheses generated by the models tend to require data that are unavailable. Typically, these models require microlevel data about resource flows either within classrooms, within homes, or across local labor markets. The absence of empirical verification can undermine the persuasiveness of the deductions that are drawn. W. E. Becker's (1982) study is a good illustration of this. He considers the effects of national standards on college student performance and argues that such policies will be very unlikely to improve the productivity of schools, particularly those schools performing at low levels initially. This is an important result, particularly in light of the emphasis being placed today on the outcomes-as-standards strategy, and yet it seems to have been lost. One can only suspect that the absence of empirical tests of Becker's arguments makes it easier to dismiss his conclusions.

Fourth, even when data are available, as is the case for recent studies of relationships between school size and the breadth and depth of the high school curriculum (Haller, Monk, Spotted Bear, Griffith, & Moss, 1990; Monk, 1987b; Monk & Haller, in press), complaints can be raised about the immediate relevance of the findings for policy. Preoccupation with the immediate outcomes of schooling such as test scores and labor market success can crowd out more basic interests in the underlying processes. While it would be desirable to have a comprehensive model linking process and product, it should be abundantly clear by now that we have not reached this point.

Fifth, there have been missed opportunities to make connections across disciplinary bases. As indicated, these economic studies of educational processes are steeped in economic theory. There has been a parallel but largely unconnected development within the politics of education under the rubric the micropolitics of education (Ball, 1987; Blase, 1988, 1991, in press; Hoyle, 1986). Political scientists are adapting their models of bargaining to study what occurs within schools and classrooms, and there have been only a few attempts to bridge the gap that exists between these two areas of endeavor (Boyd & Hartman, 1988).

Last, but by no means least, is the special delight economists and others employing economic models seem to take in demonstrating perverse results that work to the disadvantage of sometimes influential stakeholders in the policy debate. For example, economic principles can be used to question the wisdom of equitably distributing students across classrooms (Monk, 1989; Snellings, 1987), investing in additional teacher education (Hawley, 1987), or even in improving the quality of teacher evaluation (Hoenack & Monk, 1990).

One of the recurring "perverse" results is the showing that improvements in what most would conceive of as the "quality" of education (translated as improvements in the productivity of school-supplied inputs) can easily have the effect of leaving unchanged or even decreasing the level of student performance (Becker, 1982; Correa & Gruver, 1987; McKenzie, 1979). All that is required to reach this conclusion is a recognition that student time and effort are central ingredients in education production coupled with the altogether reasonable recognition that more than conventionally measured schooling achievement contributes to students' sense of well-being.

Despite, and in some cases as a result of, these problems, the economic analysis of schooling processes is an untapped resource for those seeking to improve the productivity

of educational systems. There are lessons taught by this research that have short- as well as longer term implications. These will be drawn upon in the following discussion, where a critique is offered of the outcomes-as-standards strategy.

Critique of the Outcomes-as-Standards Policy Response

Suffice it to say that we have not succeeded at identifying the education production function. It is in reaction to this lack of success coupled with the pressures to improve productivity that policymakers have turned to the outcomes-as-standards strategy.

There are many potential problems associated with this strategy. These include a host of issues surrounding the conceptualization and measurement of the standards. There are also many problems surrounding the construction of the incentives. Incentives can be well or poorly designed. They can give rise to perverse and unexpected effects. Rosenholtz (1988), for example, paints a disturbing picture of what externally imposed test-score standards did to schools in Tennessee. See Hannaway (1992) and Picus (1991) for more on the dangers of perverse incentives.

However, the problem I see is even more fundamental and will persist even if all the technical problems surrounding the strategy are solved. It arises from our ignorance of the production function coupled with the possibility that there really is no such thing. To see the difficulty, it is useful to draw a distinction between two versions of the outcomes-as-standards strategy.

Version I is consistent with an underlying belief that there is no such thing as a tractable education production function. If there is no tractable production function, each schooling situation is highly idiosyncratic. It follows that there is no role for centralized authority in the improvement of productivity aside from the setting of targets, the dissemination of ideas that might be tried by teachers, and perhaps efforts to make it easier for teachers to try ideas out. According to this view, there is nothing to be learned from another's experience, since there is nothing systematic or regular about education production. It becomes the teacher's job to make sense of the unique reality he or she is faced with and to discover ways of reaching the agreed-upon targets.

Teacher autonomy is the central commitment of this version of the strategy. The teacher is the only person who can make sense of the instructional reality. No second-guessing from more centralized sources or even from other teachers is desirable. The key point is that there is nothing to learn from anyone else's experiences. It is every teacher for him- or herself, and the race goes to the swift.

In sharp contrast, a Version II approach retains faith in the reality of a tractable education production function and sees the outcomes-as-standards strategy as a new means of gaining insight into the function's properties. What this requires is guided experimentation, based on past experiences (both personal and otherwise), and aggressive dissemination efforts regarding these experiences, including unsuccessful ones. In contrast to Version I, there is a prominent role to be played by central authorities, and it goes far beyond simply setting targets, monitoring compliance, and acting as judge and jury.

Since we do not know whether there is in fact an education production function, it is instructive to consider the consequences of pursuing each of the two versions under alternative assumptions regarding the function's "realness." In addition to considering the two polar cases (where there is and is not a real production function), insights can be gained from considering a middle position where what might be called a "quasi-production function" best describes the underlying reality.

Implementing Version I Policies

Nonexistent education production function

If Version I policies are pursued and the reality is that no production function exists, there will be large amounts of experimental activity but no a priori reason to believe that the level of outcome produced will either increase or decrease in the aggregate. Standards will be set and teachers will experiment, but since there is nothing systematic or regular about the production process, chances of success are essentially random.

Over time, questions might arise about the wisdom of rewarding some teachers[13] for being the beneficiaries of chance. But this might also be quite acceptable, since everyone presumably has an equal chance for success, and a byproduct could well be a stronger political base for higher base salaries (Murnane & Cohen, 1986).

Quasi- but unknown education production function

In the less extreme case, reality includes a slightly tractable production function that is highly idiosyncratic but whose properties teachers have some hope of discovering and in fact can develop skills for doing so over time. In this case, it is up to the teacher each year and in each class to discover the relevant production function(s). Over time, teachers develop problem-solving skills that can make them better equipped to discover future production functions. However, each teaching situation remains inherently unique and there is not much one can learn of use from someone else. In other words, a teacher's ability to discover the relevant production function(s) is a skill developed largely if not exclusively on an individual basis. It is hard-won knowledge and not transferable to others.

If this slightly tractable production function accurately portrays the underlying reality, the pursuit of Version I policies will direct extra resources to those teachers who are more successful at developing their own capacities for discerning their unique production function(s). In this case, productivity can be expected to increase (assuming the stimulative effects of the incentives outweigh their costs), although the growth can be expected to be slow partly because the insights gained are nontransferable. Being next door to a teacher who is adept at discovering his or her unique production function(s) will have no benefits. Visions of the next-door teacher peering through the door wondering "How does s/he do it?" come to mind. The teachers who succeed will be rewarded, and if the incentives are properly structured, everyone will be trying to succeed, but there is not much help to offer, and the role of administration in all this, particularly at the local level, is quite small.

It is worth noting that there remains a role for more centralized administration to be concerned with matters like the setting of targets, the monitoring of compliance, and the structuring of incentives. The somewhat anomalous result is more teacher autonomy coupled with a more centralized administrative structure. The role of the building-level administrator, who played such a large role in the school effectiveness literature, is much diminished.

The long-term viability of such a differential system of rewards is less than obvious and depends, one suspects, on the underlying distribution of teachers' abilities to discover their respective relevant production functions. If only a few teachers have this ability, the larger number of less gifted teachers could rebel against a system that systematically excludes them from benefits. However, this would have to be balanced against whatever positive effects the differential reward system might have on the base salaries of all teachers (again, see Murnane & Cohen, 1986).

In the long run, the presence of the incentives could select people into teaching who are more rather than less adept at discovering these production functions. Those teachers who discover they are not skilled in this regard could be expected to leave the system, particularly if the rewards for those who are successful were substantial.

Real but unknown education production function

Finally, suppose Version I policies are pursued and there is in fact an underlying production function that is quite tractable. In other words, suppose there are regularities to instruction. They may not have been revealed by the research just reviewed, but this cannot count as proof that such regularities are nonexistent. In this case, experimentation will proceed. Some teachers will discover successful combinations of ingredients, and other teachers could benefit from this knowledge if they hear about it. However, since we are talking here about Version I policies, which place emphasis on teacher autonomy and the freedom to experiment unhindered by restrictions imposed by others, there is no guarantee that the insights gained will be

disseminated. Granted teachers will have an incentive to seek this information so that they too realize the benefits of success, but they will be operating within a highly decentralized system, and the costs of acquiring the desired information could be very high. Also, depending on how the incentives are structured, it could be in the interests of those teachers enjoying success to restrict access to what they have discovered.

Implementing Version II Policies

Recall that Version II views the outcomes-as-standards strategy as a promising means of discerning the underlying production function(s). In keeping with this, Version II policies contain aggressive efforts to keep track of, codify, and make sense of the results of the many experiments fostered by the outcomes-as-standards approach.

Nonexistent education production function

Suppose Version II policies are pursued and the reality is that there is no such thing as a tractable education production function. The result will be a never-ending pattern of inconsistent results with no rhyme or reason. Eventually policymakers may be forced to conclude that either they are not codifying properly or there is no education production function. The problem is that there is no way to know which is true, and the experimentation could go on forever. If the conclusion is reached that there is in fact no production function, the role for central administration ought to shrink significantly.[14] Moreover, under these conditions, productivity will not improve (and may even decrease to the degree that new resources enter the system to finance the incentives and to keep track of the results). As we saw before, some teachers will benefit from the incentives, but it is due exclusively to luck.

Quasi- but unknown education production function

Here the result would be a likely decline in productivity since investments will be made in developing a network that by assumption will not be of use to teachers. Yes, there will be workshops and brochures trumpeting successes, but by assumption these will be perfectly useless.

However, this is also the case where local administrative interventions designed to make it easier for teachers to discover their production functions would be consistent with the approach and potentially have considerable merit. For example, adding students to a class throughout the year can be viewed as having disastrous effects on a teacher's ability to discover the relevant production function(s) within the class. The exiting of students can have similar effects (Barth 1980, 1990; Pauly, 1991). A locally designed administrative intervention intended to buffer teachers from such changes could have salutary effects.[15] Similar efforts to respect the integrity of the classroom (e.g., minimize interruptions from the p.a. system, minimize the comings and goings of students occasioned by pull-out programs, minimize the incidence of gypsy teachers[16]) could also be expected to pay productivity dividends.

Real but unknown education production function

Here there is an even clearer role for local administration than is the case with the quasi-education production function, since by assumption there is something here for teachers to learn from one another. Local administration can play a key role in facilitating this type of exchange.[17] The net result could be a substantial improvement in productivity.

The point could be reached where enough is known about the education production function to make the outcomes-as-standards strategy obsolete. Why? Because a reasonable goal would be to avoid the false starts that the outcomes-as-standards strategy will involve. The idea would be to restrict the use of methods that are discovered to be ineffective, even if a teacher takes issue with the finding and wishes to employ the method. The more things that are discovered to be ineffective, the more restrictive central administration would become. It does not follow that locally originated experimentation would cease; rather the bottom end would be roped off. If this view is pushed to its logical extreme, the point will be reached where there is perfect knowledge of the education production function. Once the production function is known, the outcomes-as-stan-

dards approach can be abandoned, and a centralized authority can begin to dictate method.

However, even if this perfect knowledge obtains, it does not follow that experimentation would cease, since production functions evolve as technology and understanding improve. The interesting question here concerns the structuring of the experimentation. An efficiency case could be made for restricting the experimentation to carefully selected laboratory schools populated with teachers and others who have demonstrated an ability to avoid false starts and to make good progress at improving benefit-cost performances.

Drawing Conclusions

If there is no such thing as an education production function, Version I is the preferable approach. If there is a quasi-production function, Version II is preferable since there is an administrative role, namely, making it easier for teachers and others to discover the properties of the relevant production functions. If there is a real production function, Version II policies are significantly more desirable than Version I policies.

Thus, the implications for policy making depend directly on whether or not the production function is real. This is a frustrating result, since knowledge about the reality of education production functions is precisely what we lack. However, there are at least three reasons for concluding that it is premature to dismiss the reality of education production functions.

First, despite the disappointments in the existing empirical research, it is not possible to point to this research as proof that production functions do not exist. It may simply be that analysts have not been looking in the right places for the regularities to emerge. We have not yet discerned the pattern to the results of previous studies. Future work may reveal regularities that are real but thus far undetected.

Second, the abandonment of the production function idea has significant implications for the organizational structuring of schools. As was pointed out above, if there is no production function, there is a much diminished administrative role (particularly at the local level) in efforts to improve productivity. The practical reality is that we are already deeply committed to retaining an administrative role.[18] Given this orientation, a case can be made for doing all that is possible to make it bear fruit before abandoning it.

Third, even if the production function does not exist today, it could be made to exist tomorrow. A belief in the reality of production functions does not require a belief in an immutable set of relationships handed down from some divine source. Production functions themselves can be thought of as the outcomes of production processes. The recognition that people learn how to learn carries with it the corollary belief that how people learn can be manipulated. If the manipulation proceeds in the direction of fostering regularities that can then become the basis of future administrative efforts to improve productivity, there is a real sense in which tractable education production functions can be manufactured.

If it is premature to reject the reality of education production functions, it follows that Version II policies are preferable over Version I. Yet what I observe in contemporary education policy making is a preference for Version I over Version II types of initiatives. There is a strong push today toward decentralizing decision making and offering teachers more autonomy, both as individuals and as members of collectives. Many of these initiatives arise out of commitments to increasing the professionalization of teaching.

To the degree that we grant greater discretion to teachers and give them freer reign in their classrooms, and to the degree that we conceive of good administration as simply getting out of the way of teachers, we will be pursuing policies at whose core is a fundamental denial of the education production function.

In contrast, to the degree that teacher's autonomy is limited by guidance stemming from lessons learned from past experimentation elsewhere, where the experiences of others and the evaluations of demonstration projects are carefully collected, analyzed, and disseminated in ways that influence practice, we will be pursuing policies at whose

core lies a commitment to the idea of an education production function and a belief that progress can and should be made toward discerning its properties.

We can also conclude that it is premature to call off alternative strategies for identifying education production functions. It is erroneous to conclude from the existing research that the only remaining viable strategy is to set teachers and others loose at the local level and monitor the results. A role remains to be played by deductively driven research. Indeed, as I argue below, the existing research base points in a promising direction for a new strand of deductive research.

To summarize, (a) it is premature to conclude that the production function lacks meaning within education contexts; (b) Version II approaches to the outcomes-as-standards policy-making response have merit and involve increased efforts to monitor and make sense of the experimentation that occurs; and (c) the embrace of the outcomes-as-standards response ought not to crowd out alternative, more deductively driven strategies for discovering the properties of education production functions. In the final section of this article, I sketch what one such strategy would entail.

An Alternative Strategy: Deducing the Relevant Properties of Classrooms

The pattern of inconsistent and largely insignificant results reported in this article points in a promising direction for future productivity research in education, and this direction involves raising the classroom to a higher level of importance in the conduct of productivity research. Thus, I am calling for a more disaggregated approach than has been characteristic of recent attempts to estimate production functions. I am also raising a concern over placing too much emphasis on school-level analyses, something that I believe has happened as a byproduct of early effective schools studies. And I am arguing that more can be done with the economically oriented process studies that I reviewed earlier. My goal here is to motivate a classroom-oriented line of inquiry into education production that is deductively driven and that complements the already developed school-oriented studies.

Making Sense of Previous Research

One of the recurring and most compelling findings within the corpus of production function research is the demonstration that how much a student learns depends on the identity of the classroom to which that student is assigned (Armor et al., 1976; Brown & Saks, 1986; Hanushek, 1971, in press; Murnane, 1975; Murnane & Phillips, 1981).[19] These are terribly important findings, but it appears that their significance has been lost. Production function analysts seem to have retreated to more macro-levels and school effectiveness research, and the more recent survey-based attempts to test effectiveness findings more rigorously have placed a heavy emphasis on school-level phenomena.

This is not to deny the importance of a school focus, since another recurring finding is that it matters what school a student is assigned to (see, e.g., Murnane, 1975). But it does not make sense to focus on the school to the exclusion of the classroom, especially in light of the differentiation found among classrooms within the same schools.

Second, there are any number of inconsistent findings when classrooms are lumped together. In a recent critique of school-based prescriptive attempts to increase education productivity, Pauly (1991) argues that what has been neglected is the potential for school-level initiatives to be transformed in unpredictable ways within individual classrooms. These internal transformations may well lie at the heart of the inconsistencies found when classroom data are pooled. Pauly contends that until we recognize more directly that these transformations occur, we stand little chance of gaining insights and accomplishing systemic change.

Third, there is no shortage of teacher descriptions of variation in their experiences within classrooms. Teachers talk freely about the "chemistry" of a class and how some classes are much easier and more satisfying to teach than are others. The following comment from a teacher is illustrative:

> It is the neatest class! I said, last year God knew what he was doing. He gave me eighteen children . . . and I would go home at night and feel I was not really meeting all of

> their needs, and it really frustrated me. And this year I have 22 . . . and I said (this year) I have more children and it seems like less. They're just the neatest kids! (Haller & Monk, 1992).

It seems clear that classrooms vary substantially, even when the grade level, curriculum, and the typical sorts of features that are attended to when classes are formed (e.g., the balance of sexes, races, and the distribution of ability levels)[20] remain the same.

Fourth, there is some limited empirical evidence suggesting that teachers perform at different levels in different classes. Hanushek's recent study of parental inputs is relevant (Hanushek, in press). He reports evidence of variation among the performance levels of a given teacher's different classes. In other words, he found that the same teacher does not always perform at the same level. Also, Pauly reports on efforts Murnane made to examine teachers' ability to repeat success (Pauly, 1991, p. 31). Finally, Brophy and Good (1986) examined research focused on the stability of teachers' performances across time and reported that success in one year correlates only modestly with success in subsequent years.

It stands to reason that a teacher's performance will vary depending on the characteristics of the class being taught. As Smith and O'Day put it, "It may be that teachers cannot sustain success on a regular basis, or that the nature of teachers' classrooms change dramatically from year to year and teachers are not uniformly effective across different classrooms" (Smith & O'Day, 1989, p. 7). Moreover, the fact that within a short period of time a given teacher teaches a number of perhaps highly variable classes provides an excellent opportunity for a careful study of how teacher performances vary. In the case of secondary teachers, multiple classes are frequently taught the same subject matter in a single year. Over a 2- or 3-year period, a rich classroom-level store of data can be collected. Schools routinely collect this kind of information. There are class rosters, attendance records, records of those students who were added as well as those students who left, performance records, and so forth. Since the time period need not be lengthy, it would be possible to design the study to include teacher reflections on particular classes and thereby combine survey-data research methods with the more qualitative research approach that proved to be so useful within effective schools studies.

Thus, I am envisioning a retrospective classroom-specific study that combines existing measures of classroom attributes with interview data collected from teachers. The interviews with teachers could be conducted with the attribute data already in hand. The availability of these data would help the teacher recollect experiences with each of the classes being studied.

Such a study needs to be more than an unguided search wherein researchers laboriously assemble retrospective classroom-level data and prompt teachers to talk endlessly about their memories. It is here that I propose to identify a series of class attributes that are likely to make a significant difference for teachers. The reasoning will have its roots in the economic process studies reviewed earlier and the teacher will be viewed as a purposeful decision maker who pursues goals in the face of sometimes very binding constraints.

Toward a Conceptual Orientation

My presumption is that teachers have an important holistic response to each of their classes, meaning that their approach to an entire class will depend on their overall impression of how well a class is functioning. Moreover, I draw a distinction between two rather different responses on the part of the teacher. On the one hand, a teacher may find a class engaging and genuinely enjoyable to teach. On the other hand, a teacher may find a class very frustrating and be forced to balance the frustration and whatever resulting desire there may be to limit involvement with the class against his or her sense of professional responsibility for the educational welfare of the individual students located within the class. I shall use the term "engaged" to describe the first response and the term "accommodating" to describe the second. When a teacher accommodates a class, the teacher recognizes that difficulties exist but has decided to live with the difficulties rather than

to resolve them. It is primarily a matter of working to rule and cutting one's losses.

My chief thesis is that these two responses on the part of teachers are very real and have significant consequences for how much students learn within classes. My further thesis is that individual teachers vary in how they respond to their classes, so that for any given teacher over a period of time there will be a track record that includes both responses. My final thesis is that a teacher's response to a class has a systematic quality to it and is to a significant degree related to features of the class that are generated by decision making at the school level.

The Rationality of Accommodating Classes

Under reasonable assumptions, it can be rational for teachers to accommodate one or more of the classes they teach. An accommodating response from a teacher is more likely if (a) costs are associated with overcoming whatever is frustrating about a particular class; (b) the teacher is teaching additional classes and variation exists in how difficult the teacher perceives the classes to be; (c) the teacher believes that the frustrating class is an aberration and is unlikely to reappear in the foreseeable future; and (d) the teacher believes that bearing the costs associated with overcoming whatever is frustrating about the class will not yield insights that will make future teaching yield higher benefits relative to costs.[21]

My presumption is that teachers' efforts and energies are limited and that they must make decisions about how to allocate these resources across teaching endeavors. It can be rational to accommodate a class when the conditions listed above hold. Condition b involves a triage argument where the teacher is accepting less for one class for the sake of others. The willingness to engage in this sort of sacrifice is all the more likely when the occurrence is perceived to be an aberration (condition c). The teacher can then reason that there is not much point to making the effort to solve the production problems in the frustrating class because it is very unlikely that similar frustrations will present themselves in the immediate future. Moveover, in this kind of setting, concern for the welfare of the students can be dampened by the realization that the students also are unlikely to find themselves in a frustrating class in the future. Thus, we obtain an intriguing but somewhat anomalous result: The less often frustrating classes present themselves, the more likely it is for teachers to accommodate the few that do appear.

Teacher excellence plays an interesting role here. Teacher excellence can make the accommodating response more likely. The excellent teacher could reason: "I am already an excellent teacher. My reputation is intact. This class is not functioning smoothly, but that is more a reflection on the class than on me. Hence, my best response is to simply wait out the storm and look forward to next year (or the next class) when the class will return to normal and operate more smoothly."

Sources of Teacher Frustration With Classes

Classes have been referred to rather loosely on the basis of how frustrating they are to teachers. For this approach to have success, it will be necessary to deduce what the sources of this frustration are.

I seek to divorce subject matter taught from the degree to which a class is engaging or frustrating to teach. In other words, I shall presume that within a given subject area, be it advanced mathematics, freshman English, or third grade social studies, teachers encounter both enjoyable and frustrating classes. I am less interested in making comparisons across subject matter, although such extensions of the approach would be possible.

I am also interested in exploring the school-level origins of teacher frustration at the classroom level. This has the desirable effect of linking school and classroom phenomena. The nested nature of education production makes it important to deal explicitly with these linkages.

Toward this end, I identify a series of classroom attributes that derive from resource allocation decisions made at the school level. For each I offer reasons for believing that the attribute will be a source of teacher frustration.

Churning

The coming and going of students exists at several levels. Students can revolve in and out of classes because of regularly scheduled "pull-out" programs for either remediation or enrichment. Students also come and go as families change residences and/or schools during the year. Churning also arises as a byproduct of both student and teacher absences (Monk & Ibrahim, 1984).

My presumption is that churning makes teaching more difficult and frustrating, all else equal. Teachers may or may not be conscious of the churning going on within their classes. Churning may also vary substantially among the classes a teacher teaches. In the case of a secondary teacher, one algebra class might have much more churning associated with it than a second, otherwise equivalent class. For a primary school teacher with a self-contained class, variation could exist from one year to the next.

The incidence of excess-demand students

Excess-demand students exist in several varieties. Their common denominator is that they place demands for extra resources of one sort or another. While it is simplest to conceive of them as a stock that exists at the school level and that is allocated among classes, it is also possible to recognize interaction possibilities such that the level and nature of the extra demands vary depending on the classroom placement. I contend that the presence of these students within classrooms has important effects on teachers' classroom-specific levels of frustration and enjoyment. In what follows, I identify several types of excess-demand students.

The intellectually accomplished student. In some cases, intellectually accomplished students demand additional instructional resources, as in cases where a student asks large numbers of questions and dominates the class. When this occurs, the remaining students in a class turn into spectators, and while this may be problematic, it is not altogether disagreeable from the teacher's perspective.

The teacher, however, can be expected to be torn in such a situation. On the one hand, this can be a delightful kind of student to have. It can make a class a "joy to teach." On the other hand, this kind of student can demand additional work on the teacher's part. The teacher has to be well prepared and able to respond to penetrating questions. The intellectually accomplished student can see through shoddy preparation, and the teacher can be embarrassed. Moreover, the teacher may feel some envy toward this student. We can hypothesize that the teacher's response will depend on (a) how bright and well prepared the teacher is at the outset, (b) how many concurrent outside demands there are on the teacher's time and energy, and (c) how genuinely interested the teacher is in the subject matter.

The gregarious but vacuous student. A student can dominate a class but have relatively little to contribute intellectually. Here a teacher faces a significant temptation. On the one hand, the talkative student in a recitation format can fill the time. Something is happening, and the teacher can reduce his or her investment of time and effort. The discourse may not be terribly beneficial, but others in the class presumably do not realize this and will probably be tolerant. Moreover, the teacher can comfort him- or herself with the fiction that this demanding student is more intellectually accomplished than is the case. The class may not be frustrating in the sense described earlier, but it does provide the teacher with an opportunity to accommodate rather than engage the class.

The disruptive student. This student, by definition, can wreak havoc with a class and seriously interfere with instruction. Discovering a means of successfully delivering instruction in the presence of these students can be very difficult, and teachers can be tempted by options designed to exclude these students from the larger group. Time-out rooms, seat-time arrangements, and the like are not atypical.

What is interesting about the distribution of these students among classes is that from the individual teacher's perspective there can be very little incentive to face squarely the instructional problem that is posed. The potential for teachers to accommodate classes containing such students on the grounds that the problem arises only periodically, that the

cost of facing the problem is not worth the benefit, and that the other students are not unduly harmed because they too can look forward to future classes unlikely to be populated with disruptive students is very real indeed.

Of course, this presumes that disruptive students are in the small minority and that they are distributed randomly among classes. If the incidence rises or if they are systematically supplied to certain types of teachers, there may be different results. However, it is interesting to note that even if the practice is to assign the disruptive students to novice teachers, the knowledge that the receipt of such students is a temporary phenomenon cuts down on even the novice teacher's incentive to invest in learning how to overcome the instructional challenges these students pose.

The passive but externally favored student. This might be a regular student with an excessively demanding parent, the child of a colleague, administrator, or school board member. Or the student might have a handicapping condition and be placed in a class as part of a mainstreaming effort being spearheaded by an external committee. These external influences could require a teacher to structure the class in ways the teacher finds objectionable, and the net result could be a level of frustration that gives rise to the accommodating response.

The match between teacher subject-matter preparation and teaching assignments

If a teacher is "misassigned" in the sense of teaching outside his or her area of subject-matter competence, the teacher's response will logically depend on the perceived length of the assignment (Monk, 1991). If the assignment is temporary and in response to an unusual set of external events, the accommodating response can be expected. An accommodating response can also be expected if the practice is to link assignment preferences to seniority so that novice teachers are the most likely to be misassigned. It is only when the long-term prospects are that the misassignment will continue into the foreseeable future than an engagement rather than the accommodation response becomes more likely.

The Resolution of Teacher Frustration

My premise is that school-level administration can, but typically does not, play an important role in limiting whatever tendencies there are for teachers to accommodate their classes. Rather, the school-level involvement seems to be one of benign neglect: some tacit recognition that class accommodations occur from time to time coupled with the further belief that there is not much that can be done administratively. The thinking seems to be that periodically frustrating classes are a necessary part of a teacher's professional life. Everyone experiences them from time to time. It becomes a matter of keeping a stiff upper lip and not whining to excess.

If these periodically frustrating classes were taken more seriously and if teacher accommodation were recognized for the limit on student achievement that it may be, there are two types of school-level policies that could be pursued.

Prevention

The first involves trying to prevent the formation of classes that pose the kinds of difficulties sketched above for teachers. Complete prevention requires an understanding of education productivity that goes well beyond what is currently available, but there are stop-gap measures that show some promise. For example, assuming churning is a real source of difficulty for teachers, the school-level policies described earlier, where teachers are buffered from the arrival of new students during the year, could reduce accommodating behavior on the part of teachers.

A second stop-gap measure involves the use of time-out rooms to permit the exclusion of disruptive students from classes. Time-out rooms and other exclusionary devices can be used to excess with the result that difficult students find themselves systematically and extensively excluded from learning opportunities. It is a triage that can be difficult to defend given any sort of commitment to the interests of those being excluded. Some schools are responding to the excess use of exclusionary devices by encouraging teachers to make less use of time-out rooms, in-school suspensions, and so forth. What this analysis

suggests is that teachers may respond to the increased presence of disruptive students in their classrooms by relying more heavily on accommodation.

Anticipatory vigilance coupled with emergency aid

A promising alternative to the prevention approach involves treating the problem much as we treat natural disasters. The idea is to maintain vigilance and be prepared to respond appropriately when the difficulty arises.

To continue with the natural disaster analogy, our public policy goal is not to train mayors and other local officials so that they can single-handedly withstand the battering of a major hurricane. Yet this is not unlike how we think about teachers. An excellent teacher is one whose excellence is undifferentiated, who can handle any challenge that might arise, for whom no teaching situation is too challenging. We pay considerable homage to these people and labor mightily to identify and reward them. And then we are frustrated when the identification and rewarding become problematic (Odden & Conley, 1991).

We also labor mightily to train and retrain teachers so that they can achieve such lofty levels of undifferentiated excellence. Our only concession to the limits of excellence arises in the contentious debate surrounding subject-matter specialization. Yes, we seem to say, you cannot expect a given teacher to be excellent in every realm of knowledge. But we refuse to recognize the equally plausible claim that you cannot expect teachers to be undifferentiatedly excellent with respect to every possible combination of students in instructional settings. We need to move away from thinking of the excellent teacher as invincible. This is an overly romantic idea that plays much mischief. The limits to excellence are real, and it does not take much to reach the limits of excellence for all but the most phenomenal of teachers.

It would be preferable to pay less homage to excellence and pay more attention to developing the versatility and basic competencies of the vast majority of altogether fine, competent if not excellent, teachers we currently employ and are likely to employ in the future. While excellence can be nurtured, it is unwise to seek its maximum. It is prudent to understand the limits to excellence and to apportion resources accordingly.

Policy needs to change from a raise-every-one-to-some-level-of-excellence approach to a more humane recognition that we are dealing with something that is thoroughly and marvelously complex and that situations will inevitably arise that test the limits of excellence. We need to be prepared to respond.

It seems entirely right and proper to develop a means of identifying instances where difficulties have arisen within a classroom and make supplementary resources available to the teacher involved. When a disruptive student is knowingly placed in a teacher's classroom, it is not acceptable to sit back and hope that somehow the teacher will be able to handle the situation, or to think that it is time for this teacher to pay his or her dues since the teacher has not had a disruptive student for quite some time. Why not give the affected teacher access to a central bank of resources that is established precisely for such needs? Again, we do not expect communities to single-handedly recover from the battering of a hurricane. Emergency state and federal resources are made available once the hurricane hits and even when forecasts are made of where the hurricane is likely to hit. Cannot a similar administrative structure be erected within schools?

Effects of Teacher Accommodating Behaviors

The final piece in the argument is the claim that accommodating behaviors on the part of teachers have implications for how well students within classes perform. In other words, accommodating behavior on the part of teachers is not innocuous and has significant implications for the productivity of educational systems. According to this view, it is foolhardy to see accommodation as an inevitable part of teaching, something every teacher engages in from time to time, something that is part of paying one's dues as a teacher. We need to deal more forthrightly with the variation in teacher performance that we have reason to believe exists within our schools.

Conclusion

Research is needed to explore these ideas further. I have only sketched what a deductive classroom-oriented research program might entail. On its face, it appears to be promising. It embraces the idea of an education production function; it takes advantage of reasonably available longitudinal data; it can combine quantitative and qualitative research methodologies; it has more of a dynamic dimension than effective schools research; and it can capitalize on some of the hypotheses being generated by the economically oriented classroom and school-process studies.

Nevertheless, much more work needs to be done on the conceptualization of the approach, and ultimately the ideas will have to be tested empirically. If they prove to be valid, there will be significant implications for school-level administration and the role the state plays in improving education productivity. This kind of research is a necessary complement to the more inductively oriented inquiries that need to accompany the outcomes-as-standards policies currently so in vogue.

Notes

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[1]The difference between the level of outcomes produced by an educational system and the efficiency with which these outcomes are produced is important and is sometimes lost sight of in policy discussions. A high level of outcome can be produced quite inefficiently if there is a willingness to supply high levels of resources. More concretely, the nation could achieve the goals of America 2000, but could do so by spending more than is necessary to achieve the result.

[2]See, for examples, Baum, 1986; Callan and Santerre, 1990; Dolan and Schmidt, 1987; Fare, Grosskopf, and Weber, 1989; and Strauss and Sawyer, 1986.

[3]See, for examples, Behrman and Birdsall, 1983; Card and Krueger, 1990; Dolan and Schmidt, 1987; Fairchild, 1984; Ferguson, 1991; Margo, 1986; and Sebold and Dato, 1981. Stern (1989) finds that expenditures per pupil on teachers' salaries are not related to learning outcomes until the expenditures are decomposed into their components. Only some components, teacher seniority and education to be specific, are positively related.

[4]Attention has been paid to other school attributes that are not explicitly purchased. For example, a number of recent studies have examined the impact of grading practices on pupil achievement (Farkas & Hotchkiss, 1989, Montmarquette & Mahseredjian, 1989a). These studies also deal with significant aspects of how teachers allocate instructional resources and thus have relevance for the later discussion about economically oriented analyses of schooling processes.

[5]For an earlier treatment of the term "social capital," see Bourdieu, 1986. See Coleman and Hoffer (1987) for empirical analyses of how measures of social capital are related to schooling outcomes.

[6]For a review of effective schools research, see Olsen (1986). For some of the better known critiques, see Purkey and Smith, 1983, and Rowan, Bossert, and Dwyer, 1983.

[7]Eberts and Stone (1988) used a national sample of data collected from elementary schools during the 1970s for the U.S. Office of Education by the System Development Corporation to study relationships between a broad array of principal attributes and the learning gains of students. This study is also illustrative of the recent interest in testing hypotheses emerging from effective schools research using nationally representative data bases.

[8]Bryk and Driscoll borrowed this term from Noddings (1988).

[9]For an even broader critique of the school climate conceptualization, see Miller and Fredericks (1990).

[10]The development and application of hierarchical models has become a veritable growth industry in educational research. For discussion where the primary emphasis is on statistical issues, see Aitkin and Longford, 1986; Goldstein, 1986; Goldstein and Silver, 1989; Kreft and De Leeuw, 1991; and Raudenbush, 1988. For discussion where there is emphasis on education applications, see Aitkin, Bennett, and Hesketh, 1981; Bidwell and Kasarda (1980); Bryk and Raudenbush, 1988; Burstein, 1980a, 1980b; Cheung, Keeves, and Sellin, in press; Floden et al., 1988; Heyneman, 1989; Lee and Bryk, 1988; Lockheed and Komenan, 1989; Lockheed and Longford, 1988; Raudenbush and Bryk, 1986; Riddell, 1989; and Rowan, Raudenbush, and Kang 1991. For a textbook treatment, see Bryk and Raudenbush, 1992.

[11]Indeed, this sort of questioning has already begun to appear. Michael Kirst claims that "recent data, for example, indicate significant pupil achievement declines in New Haven, Connecticut, in the schools where Comer intervened" (Kirst, 1991, p. 27).

[12]Also see Shapson, Wright, Eason, and Fitzgerald (1980) for an earlier experimental study that produced mixed results regarding the effects of small class sizes on achievement.

[13]This may be individual teachers, groups of teachers within schools, or entire faculties at the school level.

[14]Alternatively, centralized authorities could conclude that their proper role is to modify the existing system so that a tractable production function comes into existence. Phrases like "teacher-proofing the curriculum" are consistent with this sort of thinking.

[15]The incoming students could be added to a new multi-aged class. Additional resources could be provided to this class to compensate for its wide range of interests and capabilities. The idea would be to buffer the regular classroom teachers and to facilitate these teachers' discovery of their unique education production function(s).

[16]A gypsy teacher is a teacher without a regularly assigned space in which to teach. These are the teachers who forever roam the schools teaching in other teachers' rooms.

[17]I am less concerned here with who performs the administrative function than I am with pointing out that there is an administrative task to perform. Teachers themselves could function to facilitate the exchange of the valuable information.

[18]As evidence of a continued commitment to an administrative role, consider the provisions for mandatory "technical assistance" that are typically part of recent moves in the direction of outcomes-as-standards policies. More centralized authorities are reluctant to simply punish underperforming schooling units. There remains a faith in the value of "technical assistance" that is remarkable given the disappointing results of efforts to discern the ingredients of good schooling.

[19]For a review of research on teaching that reaches a similar conclusion regarding the importance of classroom-level differences, see Smith and O'Day (1989).

[20]For more on the formation of classes in elementary schools, see Monk 1987a.

[21]Notice that condition d refers to the nature of the education production function. If there is none (meaning that there is nothing to learn from bearing the costs associated with the present difficult class), accommodation is all the more likely a response.

References

Aitkin, M., Bennett, S. N., & Hesketh, J. (1981). Teaching styles and pupil progress: A reanalysis. *British Journal of Educational Sociology, 51*, 170–186.

Aitkin, M., & Longford, N. (1986). Statistical modelling issues in school effectiveness studies. *Journal of the Royal Statistical Society, A, 149*, part 1.

Akin, J. S., & Stewart, J. F. (1982). The time allocation decision and achievement patterns of young children. *Economics of Education Review, 2*, 307–330.

Arlin, M. (1984). Time variability in mastery learning. *American Education Research Journal, 21*, 103–120.

Armor, D., Conry-Oseguera, P., Cox, M., King, N., McDonnell, L. M., Pascal, A., Pauly, E., & Zellman, G. (1976). *Analysis of the school preferred reading program in selected Los Angeles minority schools* (pp. 17–35). Santa Monica, CA: RAND.

Arnott, R., & Rowse, J. (1987). Peer group effects and educational attainment. *Journal of Public Economics, 32*, 287–305.

Ball, S. J. (1987). *The micro-politics of the school: Towards a theory of school organization*. London: Methuen.

Barnett, S. W. (1985). Benefit-cost analysis of the Perry Preschool Program and its policy implications. *Educational Evaluation and Policy Analysis, 7*, 333–342.

Barr, R., & Dreeben, R. (1983). *How schools work*. Chicago: University of Chicago Press.

Barth, R. (1980). *Run school run*. Cambridge, MA: Harvard University Press.

Barth, R. (1990). *Improving schools from within: Teachers, parents, and principals can make the difference*. San Francisco: Jossey-Bass.

Baum, D. N. (1986). A simultaneous equations model of the demand for and production of local public services: The case of education. *Public Finance Quarterly, 14*, 157–178.

Becker, G. S. (1965). A theory of the allocation of time. *Economic Journal, 75*, 493–517.

Becker, G. S. (1981). *A treatise on the family*. Cambridge, MA: Harvard University Press.

Becker, W. E. (1982). The educational process and student achievement given uncertainty in measurement. *American Economic Review, 72*, 229–236.

Bee, M., & Dolton, P. J. (1985). Educational production in independent secondary schools. *Bulletin of Economic Research, 37*, 27–40.

Behrendt, A., Eisenach, J., & Johnson, R. (1986). Selectivity bias and the determinants of SAT scores. *Economics of Education Review, 5*, 363–371.

Behrman, J. R., & Birdsall, N. (1983). The quality of schooling: Quantity alone is misleading. *American Economic Review, 73*, 928–946.

Bidwell, C. E., & Kasarda, J. D. (1980). Problems of multilevel measurement: The case of school and schooling. In K. Roberts & L. Burstein (Eds.), *Issues in aggregation: New directions in methodology for social and behavior research* (D. W. Fiske, Series Editor, No. 6, pp. 53–64). San Francisco, CA: Jossey-Bass.

Blase, J. (1988). The teachers' political orientation vis-a-vis the principal: The micropolitics of the school. In J. Hannaway & R. Crowson (Eds.), *The politics of reforming school administration: The 1988 yearbook of the politics of education association* (pp. 113–126). New York: Falmer.

Blase, J. (1991). The micropolitical perspective: A brief overview. *Politics of Education Bulletin, 17*(3), 1–2.

Blase J. (Ed.). (in press). *The politics of life in schools: Power, conflict, and cooperation*. Newbury Park, CA: Sage.

Bloom, B. S. (1976). *Human characteristics and school learning*. New York: McGraw-Hill.

Boardman, A. E., Davis, O. A., & Sanday, P. R. (1977). A simultaneous equation model of the educational process. *Journal of Public Economics, 7*, 23–49.

Boardman, A. E., & Murnane, R. J. (1979). Using panel data to improve estimates of the determinants of educational achievement. *Sociology of Education, 52*, 113–121.

Bourdieu, P. (1986). The forms of capital. In J. G. Richardson, (Ed.), *Handbook of theory and research for the sociology of education* (pp. 241–258). New York: Greenwood.

Boyd, W. L., & Hartman, W. T. (1988). The politics of educational productivity. In D. H. Monk & J. Underwood (Eds.), *Microlevel school finance* (pp. 271–308). Cambridge, MA: Ballinger.

Brophy, J., & Good, T. L. (1986). Teacher behavior and student achievement. In M. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 328–375). New York: Macmillan.

Brown, B. W. (1988). The microeconomics of learning: Students, teachers, and classrooms. In D. H. Monk & J. Underwood (Eds.), *Microlevel school finance: Issues and implications for policy* (pp. 183–205). Cambridge, MA: Ballinger.

Brown, B. W., & Saks, D. H. (1980). Production technologies and resource allocation within classrooms and schools: Theory and measurement. In R. Dreeben & J. A. Thomas (Eds.), *The analysis of educational productivity* (Vol. 1, pp. 53–117). Cambridge, MA: Ballinger.

Brown, B. W., & Saks, D. H. (1986). Measuring the effects of instructional time on student learning. *American Journal of Education, 94*, 480–500.

Brown, B. W. & Saks, D. H. (1987). The microeconomics of the allocation of teachers' time and student learning. *Economics of Education Review, 6*, 319–332.

Bryk, A. S., & Driscoll, M. E. (1988). *The school as community: Theoretical foundations, contextual influences, and consequences for students and teachers*. Madison, WI: National Center on Effective Secondary Schools.

Bryk, A. S., & Raudenbush, S. W. (1988). Toward a more appropriate conceptualization of research on school effects: A three-level hierarchical linear model. *American Journal of Education*, 97, 65–108.

Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models*. Newbury Park, CA: Sage.

Burstein, L. (1980a). The analysis of multilevel data in educational research and evaluation. In D. C. Berliner (Ed.), *Review of Research in Education* (Vol. 8, pp. 158–233). Washington, DC: American Educational Research Association.

Burstein, L. (1980b). The role of levels of analysis in the specification of education effects. In R. Dreeben & J. A. Thomas (Eds.), *The analysis of educational productivity* (Vol. 1, *Issues in microanalysis*, pp. 119–190). Cambridge, MA: Ballinger.

Callan, S. J., & Santerre, R. E. (1990). The production characteristics of local public education: A multiple product and input analysis. *Southern Economic Journal, 57*, 468–480.

Card, D., & Krueger, A. (1990). *Does school quality matter? Returns to education and the characteristics of public schools in the United States* (Working Paper No. 3358). Washington, DC: National Bureau of Economic Research.

Cheung, K. C., Keeves, J., & Sellin, N. (in press). Multi-level analysis in educational research, *International Journal of Educational Development*.

Chizmar, J. F., & McCarney, B. J. (1984). An evaluation of a "trade-offs" implementation using canonical estimation of joint educational production functions. *Journal of Economic Education, 15*, 11–20.

Chizmar, J. F., & Zak, T. A. (1983). Modeling multiple outputs in educational production functions. *American Economic Review, 73*, 17–22.

Chizmar, J. F., & Zak, T. A. (1984). Canonical estimation of joint education production functions. *Economics of Education Review, 3*, 37–43.

Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology, 94*, S95–S120.

Coleman, J. S. (1991). *Parental involvement in education*. Washington, DC: U.S. Department of Education.

Coleman, J. S., & Hoffer, T. B. (1987). *Public and private schools: The impact of communities*. New York: Basic Books.

Comer, J. P. (1988). Educating poor minority children. *Scientific American, 259*(5), 42–48.

Correa, H., & Gruver, G. W. (1987). Teacher-student interaction: A game theoretic extension of the economics theory of education. *Mathematical Social Sciences, 13*, 19–47.

Dolan, R. C., & Schmidt, R. M. (1987). Assessing the impact of expenditure on achievement: Some methodological and policy considerations. *Economics of Education Review, 6*, 285–299.

Eberts, R. W., & Stone, J. A. (1988). Student achievement in public schools: Do principals make a difference? *Economics of Education Review, 7*, 291–299.

Fairchild, H. H. (1984). School size, per-pupil expenditures, and school achievement. *Review of Public Data Use, 12*, 221–229.

Fare, R., Grosskopf, S., & Weber, W. L. (1989). Measuring school district performance. *Public Finance Quarterly, 17*, 409–428.

Farkas, G., & Hotchkiss, L. (1989). Incentives and disincentives for subject matter difficulty and student effort: Course grade determinants across the stratification system. *Economics of Education Review, 8*, 121–132.

Ferguson, R. F. (1991). Paying for public education: New evidence on how and why money matters. *Harvard Journal on Legislation, 28*, 465–498.

Finn, J. D., & Achilles, C. M. (1990). Answers and questions about class size: A statewide experiment. *American Educational Research Journal, 27*, 557–577.

Floden, R. E., Porter, A. C., Alford, L. E., Freeman, D. J., Irwin, S., Schmidt, W. H., & Schwille, J. R. (1988). Instructional leadership at the district level: A closer look at autonomy and control. *Educational Administration Quarterly, 24*, 96–124.

Fox, J. N. (1987). An analysis of classroom spending: Or where do all the dollars go? *Planning and Changing, 18*(3), 154–162.

Gamoran, A. (1987). The stratification of high school learning opportunities. *Sociology of Education, 60*, 135–155.

Goldstein, H. (1986). Multilevel mixed linear model analysis using iterative generalized least squares. *Biometrika, 73*, 43–56.

Goldstein, H., & Silver R. (1989). Multilevel and multivariate models in survey analysis. In C. J. Skinner & T. M. F. Smith (Eds.), *Analysis of Complex Surveys* (pp. 221–225). Chichester, Eng.: Wiley.

Gyimah-Brempong, K., & Gyapong, A. (1991). Characteristics of education production functions: An application of canonical regression analysis. *Economics of Education Review, 10*, 7–17.

Haller, E. J., & Monk, D. H. (1992). *Crisis and opportunity: Rural schools in transition*. Manuscript submitted for publication.

Haller, E. J., Monk, D. H., Spotted Bear, A., Griffith, J., & Moss, P. (1990). School size and program comprehensiveness: Evidence from high school and beyond. *Educational Evaluation and Policy Analysis, 12*, 109–120.

Hallinan, M. T., & Sørensen, A. B. (1985). Class size, ability group size, and student achievement. *American Journal of Education, 94*, 71–89.

Hannaway, J. (1992, March). *Higher order skills, job design and incentives: An analysis and proposal*. Paper presented at the annual conference of the American Educational Finance Association, New Orleans.

Hanushek, E. A. (1971). Teacher characteristics and gains in student achievement: Estimation using micro data. *American Economic Review, 61*, 280–288.

Hanushek, E. A. (1979). Conceptual and empirical issues in the estimation of education production functions. *Journal of Human Resources, 14*, 351–388.

Hanushek, E. A. (1986). The economics of schooling: Production and efficiency in the public schools. *Journal of Economic Literature, XXIV*, 1141–1178.

Hanushek, E. A. (1991). When school finance "reform" may not be good policy. *Harvard Journal on Legislation, 28*, 423–456.

Hanushek, E. A. (in press). The trade-off between child quantity and quality. *Journal of Political Economy*.

Hawley, W. D. (1987). The high costs and doubtful efficacy of extended teacher preparation programs: An invitation to more basic reforms. *American Journal of Education, 95*, 275–298.

Heyneman, S. P. (1989). Multilevel methods for analyzing school effects in developing countries. *Comparative Education Review, 33*, 498–504.

Hill, C. R., & Stafford, F. (1974). Allocation of time to preschool children and educational opportunity. *Journal of Human Resources, 9*, 323–323.

Hill, C. R., & Stafford, F. (1980). Parental care of children: Time diary estimates of quantity, predictability, and variety. *Journal of Human Resources, 15*, 219–239.

Hoenack, S. A. (1988). Incentives, outcome-based instruction, and school efficiency. In D. H. Monk & J. Underwood (Eds.), *Microlevel school finance* (pp. 113–142). Cambridge, MA: Ballinger.

Hoenack, S. A., & Monk, D. H. (1990). Economic aspects of teacher evaluation. In J. Millman & L. Darling-Hammond (Eds.), *Handbook of teacher evaluation: Assessing elementary and secondary school teachers* (2nd ed., pp. 390–402). Newbury Park, CA: Sage.

Hoyle, E. (1986). *The politics of school management*. London: Hodder & Stoughton.

James, E., Alsalam, N., Conaty, J., & To, D. (1989). College quality and future earnings. *American Economic Review, 79*, 247–252.

Kiesling, H. J. (1984). Assignment practices and the relationship of instructional time to the reading performance of elementary school children. *Economics of Education Review, 3*, 341–350.

Kirst, M. W. (1991). View on America 2000—New American schools component of President Bush's education strategy. *Educational Researcher, 20*, 27–28.

Kreft, I. G. G., & De Leeuw, J. (1991). *Using random coefficient models*. Unpublished manuscript. Los Angeles: University of California at Los Angeles.

Lee, V. E., & Bryk, A. S. (1988). A multilevel model of the social distribution of high school achievement. *Sociology of Education, 60*, 172–192.

Leibowitz, A. (1974a). Education and home production. *American Economic Review, 64*, 243–250.

Leibowitz, A. (1974b). Home investments in children. *Journal of Political Economy, 82*, S111–S131.

Leibowitz, A. (1977). Parental inputs and children's achievement. *Journal of Human Resources, 12*, 242–251.

Levin, H. M. (1976). Concepts of economic efficiency and educational production. In J. T. Froomkin, D. T. Jamison, & R. Radner (Eds.), *Education as an industry* (pp. 149–191). Cambridge, MA: Ballinger.

Levin, H. M. (1989). Financing the education of at-risk students. *Educational Evaluation and Policy Analysis, 11*, 47–60.

Levin, H. M., Glass, G. V., & Meister, G. R. (1984). *Cost-effectiveness of four educational interventions* (Report 84-A11). Palo Alto, CA: Stanford University Institute for Research on Educational Finance and Governance.

Lima, A. K. (1981). An econometric model of teaching effectiveness. *American Economic Review, 71*, 1056–1059.

Lockheed, M. E., & Komenan, A. (1989). Teaching quality and student achievement in Africa: The case of Nigeria and Swaziland, *Teaching and Teacher Education, 5*(2), 93–113.

Lockheed, M. E., & Longford, N. T. (1988). *Multi-level models of school effectiveness in Thailand*. Washington, DC: World Bank, Population and Human Resources Department.

Margo, R. A. (1986). Educational achievement in segregated school systems: The effects of "separate-but-equal." *American Economic Review, 76*, 794–801.

Maynard, R. A. (1977). The effects of the rural income maintenance experiment on the school performance of children. *American Economic Review Proceedings, 67*, 370–375.

McKenzie, R. B. (1979). *The political economy of the educational process*. Boston: Marinus Nijhof.

McKenzie, R. B., & Staaf, R. I. (1974). *An economic theory of learning*. Blackburg, VA: University Publications.

McNamara, K. T., & Deaton, B. J. (1989). *Education and rural development* (F89-55). Athens, GA: University of Georgia, Department of Agricultural Economics.

Meyer, R. H. (1988). *Applied versus traditional mathematics: New econometric models of the contribution of high school courses to mathematics proficiency*. Washington, DC: National Assessment of Vocational Education.

Miller, S. I., & Fredericks, J. (1990). The false ontology of school climate effects. *Educational Theory, 40*, 333–342.

Monk, D. H. (1984). Interdependencies among educational inputs and resource allocation in classrooms. *Economics of Education Review, 3*, 65–73.

Monk, D. H. (1987a). Assigning elementary pupils to their teachers. *Elementary School Journal, 88*, 167–187.

Monk, D. H. (1987b). Secondary school size and curriculum comprehensiveness. *Economics of Education Review, 6*, 137–150.

Monk, D. H. (1989). The education production function: Its evolving role in policy analysis. *Educational Evaluation and Policy Analysis, 11*, 31–45.

Monk, D. H. (1990). *Educational finance: An economic approach*. New York: McGraw-Hill.

Monk, D. H. (1991). Microeconomic aspects of schooling: An overview with implications for policy. In D. A. Verstegen & J. G. Ward (Eds.), *Spheres of justice in education* (pp. 149–170). New York: HarperCollins.

Monk, D. H., & Haller, E. J. (in press). Predictors of high school academic course offerings: The role of school size. *American Education Research Journal*.

Monk, D. H., & Ibrahim, A. (1984). Patterns of absence and pupil achievement. *American Educational Research Journal, 21*, 295–310.

Montmarquette, C., & Mahseredjian, S. (1985). Functional forms and educational production functions. *Economics Letters, 19*, 291–294.

Montmarquette, C., & Mahseredjian, S. (1989a). Could teacher grading practices account for unexplained variation in school achievements? *Economics of Education Review, 8*, 335–343.

Montmarquette, C., & Mahseredjian, S. (1989b). Does school matter for educational achievement? A two-way nested-error components analysis. *Journal of Applied Econometrics, 4*, 181–193.

Mulligan, J. G. (1984). A classroom production function. *Economic Inquiry, 22*, 218–226.

Murnane, R. J. (1975). *The impact of school resources on the learning of inner city children*. Cambridge, MA: Ballinger.

Murnane, R. J., & Cohen, D. K. (1986). Merit pay and the evaluation problem: Why most merit pay plans fail and a few survive. *Harvard Educational Review, 56*(1), 1–17.

Murnane, R. J., & Nelson, R. R. (1984). Production and innovation when techniques are tacit: The case of education. *Journal of Economic Behavior and Organization, 5*, 353–373.

Murnane, R. J., & Phillips, B. (1981). What do effective teachers of inner-city children have in common? *Social Science Research, 10*, 83–100.

Noddings, N. (1988). An ethic of caring and its implications for instructional arrangements. *American Journal of Education, 96*, 215–230.

Oakes, J. (1985). *Keeping track: How schools structure inequality*. New Haven, CT: Yale University Press.

Oakes, J. (1990). *Multiplying inequalities: The effects of race, social class, and tracking on opportunities to learn mathematics and science*. Santa Monica, CA: RAND.

Odden, A. (1990). Class size and student achievement: Research-based policy alternatives. *Educational Evaluation and Policy Analysis, 12*, 213–227.

Odden, A., & Conley, S. (1991). *Restructuring teacher compensation systems to foster collegiality and help accomplish national education goals*. Los Angeles: University of Southern California, School of Education.

Olsen, L. (1986, January 15). Effective schools. *Education Week, 5*, 11–21.

Pallas, A. (1988). School climate in American high schools. *Teachers College Record, 89*, 541–553.

Pauly, E. (1991). *The classroom crucible*. New York: Basic Books.

Picus, L. (1991, April). *Using incentives to stimulate improved school performance: An assessment of alternative approaches*. Unpublished manuscript. Los Angeles: University of Southern California.

Purkey, S. C., & Smith, M. S. (1983). Effective schools: A review. *Elementary School Journal, 83*, 427–453.

Raudenbush, S. W. (1988). Educational applications of hierarchical linear models: A review. *Journal of Educational Statistics, 13*(2), 85–116.

Raudenbush, S. W., & Bryk, A. S. (1986). A hierarchical model for studying school effects. *Sociology of Education, 59*, 1–17.

Riddell, A. R. (1989). An alternative approach to the study of school effectiveness in Third World countries. *Comparative Education Review, 33*, 481–497.

Rosenholtz, S. J. (1988). The effects of education reform on the professionalization of teachers. In D. H. Monk & J. Underwood (Eds.), *Micro-level school finance* (pp. 31–62). Cambridge, MA: Ballinger.

Rossmiller, R. A. (1986). *Resource utilization in schools and classrooms: Final report*. Madison

WI: University of Wisconsin–Madison, Wisconsin Center for Education Research, School of Education.

Rowan, B., Bossert, S. T., & Dwyer, D. C. (1983). Research on effective schools: A cautionary note. *Educational Researcher, 12*(4), 24–31.

Rowan, B., Raudenbush, S. W., & Kang, S. J. (1991). Organizational design in high schools: A multilevel analysis. *American Journal of Education, 99*, 238–270.

Sebold, F. D., & Dato, W. (1981). School funding and student achievement: An empirical analysis. *Public Finance Quarterly, 9*, 91–105.

Shapson, S. M., Wright, E. N., Eason, G., & Fitzgerald, J. (1980). An experimental study of the effects of class size. *American Educational Research Journal, 17*, 141–152.

Slavin, R. (1987a). Ability grouping and student achievement in elementary schools: A best-evidence synthesis. *Review of Educational Research, 57*, 293–336.

Slavin, R. (1987b). Mastery learning reconsidered. *Review of Educational Research, 57*, 175–213.

Slavin, R., Madden, N. A., Karweit, N. L., Dolan, L., & Wasik, B. A. (1990). *Success for all*. Baltimore, MD: John Hopkins University, Center for Research on Effective Schooling for Disadvantaged Students.

Slavin, R., Madden, N. A., Karweit, N. L., Livermon, B. J., & Dolan, L. (in press). Success for all: First-year outcomes of a comprehensive plan for reforming urban education. *American Educational Research Journal*.

Smith, M. S., & O'Day, J. (1989). *Teaching policy and research on teaching*. Palo Alto, CA: Stanford University, CERAS.

Snellings, E. C. (1987). Classrooms as commons. *Atlantic Economic Journal, 15*(3), 76.

Stafford, F. P. (1987). Women's work, sibling competition, and children's school performance. *American Economic Review, 77*, 972–980.

Stern, D. (1989). Educational cost factors and student achievement in Grades 3 and 6: Some new evidence. *Economics of Education Review, 8*, 149–158.

Strauss, R. P., & Sawyer, E. A. (1986). Some new evidence on teacher and student competencies. *Economics of Education Review, 5*, 41–48.

Summers, A., & Wolfe, B. (1977). Do schools make a difference? *American Economic Review, 67*, 639–652.

Thomas, J. A., & Kemmerer, F. (1983). *Money, time, and learning*. Albany, NY: State University of New York at Albany, School of Education.

Walberg, H. J., & Fowler, W. J., Jr. (1987). Expenditure and size efficiencies of public school districts. *Educational Researcher, 16*(7), 5–13.

Winkler, D. R. (1975). Educational achievement and school peer group composition. *Journal of Human Resources, 10*, 189–210.

Witte, J. F. (1990, August). *Understanding high school achievement: After a decade of research, do we have any confident policy recommendations?* Paper presented at the annual meeting of the American Political Science Association, San Francisco.

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