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RAISING EDUCATIONAL PRODUCTIVITY

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INTRODUCTION

The purpose of this paper is to provide a survey of studies of educational production with emphasis on raising educational productivity. The educational sector draws upon a prodigious share of national, regional, and local resources. Industrialized countries typically allocate 6 percent or more of their national income to the provision of formal education. In countries like the United States this figure amounted to over $460 billion in 1992-93, almost 8 percent of gross domestic product, not including the foregone income of students. Schools require substantial facilities, large numbers of talented personnel, materials, equipment, and the considerable time of students that --at least for older students-- could be devoted to product work. And, education must compete for resources with other demands such as health, transportation, defense, the environment, and so on, typically under conditions of severe economic pressure.

Thus, a central question is one of educational productivity, are these resources being used efficiently to produce education? Can we obtain greater educational results by using a different set of resources or using the present set in a different way? Even small gains in efficiency, on the order of 1-2 percent, can release prodigious resources which can reduce educational costs or be used to improve education. In the U.S. such gains would amount to billions

of dollars. But, in order to begin to answer these questions, one must have information on the productivity of existing educational operations as well as insights on how to improve them. Thus, it is not surprising that economists and other social scientists have attempted to use their research tools to answer these questions. In what follows, I will provide a brief picture of these types of studies and their conclusions.

EDUCATIONAL PRODUCTION FUNCTIONS

The earliest attempts to understand educational production were based upon attempts to estimate educational production functions. These have their analogy with industry production functions which have a long history in economic research. Any particular firm in an industry produces an output which is a product or service. To produce this output, it uses inputs such as labor and capital which are transformed according to the existing technology into goods and services. To maximize profits, firms must use their resources efficiently and purchase inputs in the appropriate combinations relative to their costs and productivities in producing outputs. Using these concepts, economists have engaged in studies to estimate the characteristics of production functions for different goods and services (Shephard 1970).

Schools also produce educational outputs in the form of student achievement and other valued results. To do this they use facilities, equipment, teachers, support personnel, supervisors, and administrators. Thus, there is an obvious analogy between attempts to estimate industry production functions and the possibility of estimating educational production functions. What are the relative

productivities of different inputs relative to their costs in producing educational outcomes. The educational production function is a statistical relation between inputs and outputs. A general formulation is as follows (see Hanushek 1986):

$$A_t = f(F_t, T_t, OS_t)$$

A_t represents the achievement of a student at period t; F_t represents the family inputs of students cumulative to t that affect achievement including such indicators as parental education, income, race, and language spoken in the home which affect student achievement; T_t represents teacher inputs for a student, cumulative to t including teacher qualifications; and OS_t represents other school inputs including class size, materials, curriculum, and so on.

This function is estimated statistically using a multivariate regression model where multiple measures of each input are obtained. The most common measures of family input are race and socioeconomic status as reflected in parental income and education. The most common measures of teacher inputs include their licensing credentials, teaching experience, and education in terms of degrees completed. Other inputs typically include class size and facilities such as library books and laboratories. Although production functions do not normally include teachers' salaries or expenditures per student, sometimes these measures are substituted for the inputs that they purchase.

The earliest forms of the educational production function are found in the Coleman Report which was published almost 30 years ago (Coleman et al. 1966). This government study collected

achievement data and school inputs for over 700,000 students in the U.S. and estimated statistical relationships that reflect the production function concept. The study found that family background characteristics seemed to predict student achievement more fully than teacher and other school characteristics. However, the statistical analysis was critiqued by others who argued that the techniques of the report could not separately adequately the impact of different inputs (Bowles and Levin 1968). Further studies that were done using the data generated by this report found somewhat more evidence of school effects and particularly the apparent impact of teacher verbal skills as measured by a short vocabulary test taken by the teachers (Hanushek 1972).

Over time, many other educational production function studies were carried out using data from local school districts or states. These were summarized first by Bridge, Judd, and Moock (1978) for the U.S. and later by Hanushek (1986). A good summary is also found in Cohn and Geske (1990). Such studies have also been carried out for other societies, especially developing ones (Fuller and Clark 1994). The most influential summary was that of Hanushek (1986) which reviewed the educational production methodology and attempted to summarize the results for over 100 studies. Hanushek found that the pattern of effects of different inputs were inconsistent from study to study. He concluded that the typical input policies used by schools to improve student achievement (e.g. reducing class size, obtaining more experienced teachers or ones with higher educational qualifications, raising teachers' salaries, and raising per pupil expenditures) did not show a consistent

relation to student achievement. This publication and subsequent summaries such as Hanushek (1989) gained wide publicity and created widespread skepticism among educational policy makers that education could be improved with greater spending.

However, more recently a reassessment using the statistical techniques of meta-analysis was applied to the same studies used in the Hanushek analysis (Hedges et al 1994). This reanalysis found that contrary to Hanushek's findings the traditional input strategies were found to show a pattern of expected relationships with student achievement with a particularly large impact for per-pupil expenditures. The apparent impact of raising per student expenditures was found to be substantial. A 10 percent rise in per-pupil expenditures was associated--across studies--with about two-thirds of a standard deviation increase in achievement, a gain in achievement equal to about seven months of schooling at the elementary level. This is equivalent to raising achievement scores from the 50th percentile to almost the 76th percentile. Since they use a more sophisticated analysis of the same body of studies used by Hanushek, it appears that standard inputs do make more of a different in student achievement than Hanushek asserted. However, as we will see in later studies, there is great room for increased efficiency in how schools use their resources.

In general, the educational production literature has found that teacher experience and qualifications and class size can be statistically related to achievement, although not always. Further, teacher education and teacher proficiency as measured by test scores on teacher examinations can also be important. However,

such studies do not provide insights into which inputs represent more effective strategies for increasing achievement within a given budget constraint. In order to fulfill that goal, it is necessary to compare the costs and effectiveness of the different inputs or strategies. The first such study represented an attempt to use the results of production functions to compare the regression coefficients (marginal products or effects) of hiring more experienced teachers or teachers with higher verbal achievement relative to the costs of these strategies (Levin 1970). It found that hiring more verbally able teachers provided five to ten times as much increase in student achievement as hiring more experienced teachers. More recent cost-effectiveness studies have compared the impacts of reduced class size, computer-assisted instruction, peer tutoring, and a longer school day (Levin, Glass, and Meister 1987). Peer tutoring followed by computer-assisted instruction were found to be far more cost-effective in increasing student achievement in mathematics and reading at the elementary level than were reductions in class size and expansions in the length of the school day. However, there are still relatively few cost-effectiveness studies in education.

A further refinement of the educational production function has been the search for frontier production functions. The typical production function represents a statistical fit between inputs and output among a sample or population of schools. In this sense, the educational production relation that is estimated is an "average" among a sample of schools with different levels of productive efficiency rather than among efficient schools. But, if the

educational production function is to reflect the maximum output that can be produced with each and every combination of inputs, it should be fitted only to those schools that are maximally efficient, that is, operating at the production frontier. Instead of using a statistical procedure to estimate the equation, the frontier function requires the use of mathematical programming or data envelopment analysis which fits only the extremals. The earliest application of this technique to education found that the marginal products of the different input variables differed considerably when one compared those at the frontier with those for the average statistical production function (Levin 1974). Later work using the frontier approach to measure the relative efficiency of schools has found high variability in efficiency among samples of schools (Bessent et al. 1982; Grosskopf et al.1992). But, one must be cautious in drawing policy conclusions from this work because the results are highly susceptible to measurement errors and other vagaries (Silkman 1986).

In addition to these issues, there are difficulties in interpreting educational production functions for policy purposes. The normal industry production function assumes that with a given technology the presence of a given set of inputs can produce a given output. Such an assumption is predicated upon the close monitoring of labor productivity through supervision and the ability to recontract with workers (e.g. Alchian and Demsetz 1972; Williamson 1975). In contrast, it is difficult to monitor the work of teachers, since most of it takes place behind closed doors; outputs are largely psychological, produced over the long term, and measurement is

highly problematic; and teacher contracts are long-term and difficult to modify on an individual basis. Further, teachers are not inert inputs into production and can use their defacto property rights in ways that may not support the objectives of the school. Therefore, school policies that attempt to control teacher activity are important mediating devices in transforming teacher inputs into specific educational outcomes, but these are almost never considered in educational production functions (Levin1980). In addition, educational production functions are probably subject to management bias in which more efficient managers use more of some inputs than others. Although it may appear that certain input combinations are more efficient statistically, they may simply be a proxy for more efficient managers (Massell 1967).

EFFECTIVE SCHOOLS METHODOLOGY

Although the educational production function approach continues to be pursued, three decades of results have provided little consistency in findings. Family inputs are always important statistically in explaining student achievement, but there is wide variability from study-to-study in terms of which teacher and other school inputs are related to achievement. As noted above, one explanation is that inputs in a complex production organization such as a school that produces psychological outputs through a largely psychological transformation process can never be converted routinely and that a variety of organizational characteristics determine their effectiveness (Levin 1980). Unfortunately, these characteristics vary considerably among schools and in ways that are not easily measured using the production function method. Thus,

it is not surprising that alternative methods for understanding and improving educational production have been sought.

One of the most influential of these in both the U.S. and U.K. has been the effective schools methodology. This approach grew out of a realization that schools with similar student populations were achieving very different results. The focus of the research was to compare the operations of effective schools with ineffective ones to understand the differences and employ that to improve school effectiveness. In general, this meant carrying out a statistical analysis of school achievement for schools with similar students to see which had achievement that was substantially higher or lower than the average achievement for the schools (Brookover and Lezotte 1979; Edmonds 1979; Rutter et al. 1979; Mortimore et al. 1988). High achieving schools were compared with low achieving schools to see how they differed. These differences were called effective school correlates, and it was asserted that if ineffective schools could adopt these correlates they would become effective.

In the U.K. researchers studied a group of secondary schools and concluded that the following were correlates of effective schools: group management in the classroom, high expectations, positive teacher models, feedback on student performance, consistency of school values, and pupil acceptance of school norms (Rutter et al 1979). A study of elementary schools by Mortimore et al (1988) tended to overlap with these characteristics, but added a number of additional ones. Early studies in the U.S. by Edmonds (1979) focused on strong leadership of the principal, emphasis on mastery of basic skills, a clean and orderly school environment, high

teacher expectations of student performance, and frequent assessments of student progress. In an influential article evaluating the earlier effective schools literature, Purkey and Smith (1983) identified a number of other organizational and process features.

The effective school methodology has been heavily criticized on a number of counts. Typically, the test scores of students with similar socioeconomic backgrounds are compared among different schools. Schools with test scores that differ substantially from the expected values (e.g. one standard deviation above and below the mean) are identified. The high-achieving schools are compared with low achieving schools to see how they differ. These differences are typically identified through surveys of school characteristics. Those characteristics that differentiate high achieving from low achieving schools are considered to be the correlates of effective schools. These correlates are then used to set up interventions that are designed to transform ineffective schools into effective ones.

Among the criticisms of the methodology are the following. Which schools are found to be effective are highly sensitive to which grade levels and subject areas are tested (e.g. Madaus, Kellaghan, Rakow and King 1987; Reynolds 1982). . Further, the results differ from year-to-year, even for the same grade level. The correlates of effectiveness vary among studies, and there is little evidence that schools can be "taught" to be effective by receiving training in the correlates. Although about half of the schools in the U.S. had taken or were planning to take training in the effective schools correlates (U. S. General Accounting Office 1989), a

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systematic search of sources on the subject was unsuccessful in finding evaluations documenting that ineffective schools had become effective as a result of the effective schools interventions (Felton 1990). The result is that effective schools research has become less prominent, and the effective schools training has given way to a merger with total quality management (TQM) as a way of improving schools. TQM represents an attempt to apply the quality improvement techniques that statistical sampling expert Edward Deming made famous for improving performance in industry. The emphasis is on worker involvement in continuous improvement by providing a focus on client needs and on problem-solving on a regular basis to improve product quality. There is virtually no research that could be identified on the efficacy of this process to improving education, but there is a groundswell of involvement on the part of school personnel in attending workshops and reading materials on TQM.

MARKET SOLUTIONS

The lack of progress in using production function and effective school approaches to improve education in the seventies and eighties led to a new search for educational productivity solutions. A general departure was that of educational choice in order to get schools to compete for students and to tailor their offerings for particular student needs. This was less a research-based approach than a theoretical approach for improving public education. This perspective is premised on the view that if schools compete for students rather than requiring them to attend in their local neighborhoods and school districts, parents will seek the best

education and schools for their students. The result will be that schools will become more client-oriented and will tailor their offerings to student needs and compete for students by trying to offer the best educational services consistent with their resources.

The general movement towards educational choice has stimulated a large number of choice plans (Clune & Witte 1990). In some cases, magnet schools are designed to attract students with particular interests or learning needs. In other cases, parents are given the choice of any school within a district or a more restricted range of choices depending upon transportation provisions and the racial compositions of available schools. In other cases yet, the are permitted to draw upon higher educational alternatives at the secondary level or to select a school district for their children beyond the borders of the one that they live in. The most ambitious approaches to choice are those that would create a market of educational alternatives in which private schools would be eligible for public subsidies.

Milton Friedman (1962) proposed such a plan over three decades ago. Under his plan, students would be eligible for vouchers that could be used at any school that met minimal requirements in curriculum. Eligible schools would be able to redeem their vouchers with the state, and would have incentives to meet student needs by competing for their vouchers. Momentum for creating an educational market based upon vouchers was stimulated in the decade of the eighties by research comparing the achievement in public and private schools. Coleman and Hoffer (1987) found that achievement for apparently comparable students (adjusting for race and social

class) was higher in private high schools than in public ones. Their conclusions that private schools were more efficient than public schools were challenged with three arguments (Haertel 1987; Witte 1992): (1) First, it was asserted that children who go to private schools are more educationally oriented and come from more highly motivated families then children in private schools, even after adjusting for race and family income. The detractors were not convinced that private school advantages in achievement were due to school effects rather than selection effects. (2) This argument was strengthened by the very small difference in achievement between public and private schools, about 3 - 4 percentiles which could easily be accounted for by selection effects. Moreover, such small differences in achievement were unlikely to have a strong impact on employment, earnings, or admission to a more selective university. (3) Finally, the interpretation was questioned by further analysis of the data. Bryk and Lee (1992) found that there were no obvious sectoral differences between public and private schools that could not be accounted for by differences in school practices in either sector. Thus, although differences in school operations in either sector had an apparent influence on student achievement, there was no difference between the two sectors beyond these practices. Thus, it was not surprising to find that more than 46 percent of public school students were performing above the average of private school students, even if private school achievement was slightly higher, on average, than that of public schools.

The argument has also been made that a large segment of private schools are less costly than public ones, even though the

most elite segment of independent schools is considerably more expensive (Levin 1991a). But, the problem is that the comparisons are made between private school tuition and fees and public school expenditures rather than a careful accounting of total costs in the two sectors. Further, the output mix differs considerably with private schools less likely to require expensive remedial, bilingual, and special educational services. Unfortunately, rigorous studies attempting to measure costs in a consistent manner and adjusting for different service mixes are nonexistent.

Research on the effects of educational choice approaches to schooling provide largely ambiguous results. Relatively few parents take advantage of such choices, unless they are required to send their child to a choice school. Moreover, the results have been ambiguous in terms of effects of choice on student achievement. However, a prominent publication by Chubb and Moe (1990) in combination with the earlier research on public-private differences did stimulate considerable political activity to create voucher arrangements for financing education in the U. S. In several states, voter initiatives were initiated to get support for vouchers, but all were defeated soundly. However, the Wisconsin Legislature established such a plan for poor students in Milwaukee. After three years it appears that students who took advantage of vouchers did not perform better academically than students in the Milwaukee Public Schools and that only about half of the eligible places in private schools were actually used by students (Witte, Bailey, and Thorn 1993). On a more positive note the parents and students

expressed greater satisfaction with their schools than comparable respondents in the public school system.

TRANSFORMING SCHOOL ORGANIZATIONS

Historically, then the attempt to improve educational productivity has comprised two fundamentally different approaches. Early attempts were based upon research that might uncover the most efficient combinations of inputs from a cost-effectiveness perspective through educational production function studies or studies of effective school practices through effective school studies. These led to prescriptive policies with regard to the types of inputs that are most efficient or school practices that are correlated with effectiveness. In contrast to this prescriptive approach, the emphasis on developing choice strategies through educational vouchers and public choice policies focused on changing the environment within which schools operated. That is, choice approaches represented attempts to change schooling by modifying the incentives for both family and school behavior. The view underlying these strategies is that if schools were to become more client-oriented because of their need to attract students for survival and profitability, they would discover the most efficient practices and appropriate output mixes to maintain clientele. In this case, those who wish to improve productivity should worry less about prescribing internal school policies than in creating the conditions that will induce schools to search continuously for ways to improve their operations. According to this view, it is more important to establish efficient systems of educational choice with provisions for information and (if necessary) transportation than to

address the internal operations of schools. Successful schools will have incentives to search for and identify those practices on a continuous basis in order to compete successfully for students.

However, at this point neither approach has produced a consistent and substantial base of empirical support for improving educational productivity (Economics of Education Review1992). In both cases, the empirical research is based upon correlational analysis which has tried to identify conditions for educational effectiveness. In order to test the knowledge base, it is necessary to establish interventions under somewhat controlled conditions to see if the recommendations from such research actually improves educational productivity. Clearly the proactive transformation of schools along lines suggested by results from educational production functions and effective schools research has not borne demonstrable results. Even what evidence we have on educational choice is not promising in terms of stimulating substantial improvement in educational results.

More recent work has begun to address the issue of educational productivity by pursuing a different strategy, the organizational transformation of schools to make them more efficient, whether in the public or private sector. This work redesigns schools along the lines of productive firms, while taking account of the special nature of educational activities. It then proceeds to establish a process of change for schools that will incorporate the new design. The goal is to identify features of efficient production organizations outside of the educational arena and to make those features integral to the design and operations of schools.

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Organizational Conditions for Efficiency

Economic analysis suggests that efficient firms must meet the following conditions of which more detail is found in Levin (forthcoming):

1- A clear objective function with measurable outcomes.

2- Incentives that are linked to success on the objective function.

3- Efficient access to useful information for decisions.

4- Adaptability to meet changing conditions.

5- Use of the most productive technology consistent with cost constraints.

Every efficient firm must be clear about what it is attempting to achieve in the sense that there is a widespread understanding by all participants of what needs to be done as well as a collective focus on that objective. Moreover, this objective must be associated with measurable outcomes in order to appraise how well the firm is doing (Cyert 1988). Schools seem far removed from this standard as the objectives of the school often vary from teacher to teacher with some placing more emphasis on some subjects than others and some pushing for rote memorization while others stress thinking skills and problem-solving. There is also considerable evidence that many schools set different goals for different groups of students according to the ethnicity, race, and socio-economic origins, practices that are encrusted in tracking or streaming of students, each track associated with different expectations (Oakes 1985).

The principal strategy for inducing employees to pursue the objectives of the firm is to link employee rewards to their performance in contribution to those objectives. In the case of

schools there is little evidence of incentives tied to student success. Salary increases are provided according to seniority and qualifications, not effectiveness. Incentives can be intrinsic (e.g. a sense of accomplishment) or extrinsic (e.g.financial rewards or recognition); they can be individual or collective. But, even if individual teachers receive some intrinsic satisfaction from their accomplishments of their students, the fact that there is little connection among teachers efforts or objectives means that school outcomes are likely to be poorer than could be produced with a highly articulated effort towards a single objective function.

To succeed, firms need continuous and systematic information on their overall success to see if they are meeting objectives. They need rapid feedback on challenges, problems, bottlenecks, and impending obstacles as well as changes in market environments, productions, technologies, and prices that may affect them. Comparable information in schools is not readily available at the school level. Indeed, schools rarely have accurate information on alternatives or strategies and channels to obtain that information. Even the test score data on students are usually not available until the end of the school year or the beginning of the following one, limiting the ability to learn through trial and error as suggested by Murnane and Nelson (1984).

Firms that are in situations where their markets, products, technologies, costs and prices are largely stable do not need to adapt to succeed and survive. They can continue to follow the same practices that have brought them success in the past. In contrast, firms facing rapid changes in these dimensions must be prepared to

adapt to meet changing conditions. This becomes even more challenging when the technology of production is uncertain and requires considerable trial and error to get it right (Murnane and Nelson1984). Many schools typically face unstable and unpredictable situations with changes in student populations as neighborhoods change; precipitous changes in budgets from year-to-year; rapid changes in electronic technologies and their capabilities; changing teacher supplies as relative salaries change (Murnane et al. 1991), and new demands such as AIDS education. But, schools are typically faced with centrally-adopted curricula, rules, regulations, and mandates which create obstacles to change and no internal decision mechanism which could adapt to change, even if greater in decision-making were permitted. . Schools need to have the ability to make decisions on resource allocation in order to adjust to disequilibria (Schultz 1975).

Finally, efficient firms need to adopt the most productive technologies consistent with cost constraints. Unfortunately, schools tend to follow historical approaches despite attempts to change them through educational reforms (Cuban 1990). Although most schools still use approaches that require students to simply memorize material as it is presented, considerable research finds that this is an inefficient teaching and learning technique (e.g. Peterson 1989; Gardner 1983; Gardner and Hatch 1990; Knapp, Shield, and Turnbull 1992). A more effective approach seems to be to provide active learning situations in which students can build on previous experiences and engage in new activities which allow them to construct their own understanding through research, hands-on

projects, and other applications. In many respects, this is the approach used for gifted and talented students, but it is becoming increasingly recognized that it works effectively for all students (Feldhusen 1992).

Accelerated Schools

According to the five dimensions of a firm that are generally considered to be required for an efficient productive organization, schools seem to be ill-equipped to produce educational services efficiently. The Accelerated Schools Project was designed to improve school productivity dramatically by altering these five dimensions. Starting with only two pilot schools in 1986-87, the Project comprised more than 500 elementary and middle schools in 33 states in the U.S. by 1993-94. The Project was designed to transform public schools with high concentrations of at-risk students, students who are unlikely to succeed educationally because of poverty, minority or immigrant status, broken families, and so on. These schools have relied primarily on remedial education and have been notoriously unsuccessful in bringing these students into the educational mainstream.

Schools are provided with a process to establish a unity of purpose among all staff, parents, and students around accelerated academic outcomes for all children. This unity was buttressed with a system of decision-making that provides input and incentives for all of the participants to become actively engaged in problem-solving methods that will lead to those outcomes. In addition, the entire school staff with student and parent participation is provided with training in problem-solving and group dynamics with a focus on

assessment of results and the use of powerful learning strategies. Thus, schools develop an objective function, collective incentives to address that objective, shared information, and an ability to adjust to disequilibria. In addition, the accelerated agenda shifts the school to a more powerful technology of learning, that which is usually reserved only for the most gifted and talented students in traditional schools and which is built upon constructivist learning approaches (Brooks and Brooks 1993).

In order to induce these deep changes, schools are introduced to a philosophy and set of practices which require deep changes in the values and expectations of all participants, a substantial transformation of school culture (Hopfenberg, Levin, et al. 1993). Such changes in school culture have been found to be particular problematic in the past (Sarason 1982, 1990). However, Finnan (1992; 1994) has documented such a cultural transition in Accelerated Schools. Moreover, evaluations of Accelerated Schools indicate impressive improvements in student achievement, attendance, and parent participation and reductions in costly policies such as students retained in grade and special education placements. Moreover, the costs of these reforms are rather minimal with a typical cost of about $30 a year per student in the first year of school transformation and less in ensuing years as most of the changes are accomplished through reallocation of existing resources.

It would seem that the transformation of school organizations, or what is called broadly, school restructuring (Fullan 1991; Hallinger and Murphy 1993), is the most promising direction to go to

improve educational productivity, a phenomenon that might also be extended to higher education (Levin 1991b). Such changes will require major policy alterations in the educational system, whether reforms are contained in the public sector or a shift to a market environment. That is, issues of educational choice through exit mechanisms or public school transformation through greater voice mechanisms (Hirschman 1970) will both require decentralization and a supportive infrastructure to provide information, technical assistance, and assessment of results.

It is unlikely that schools will be able to make the organizational changes without corresponding changes in their environments. Whether such changes should be done in the public sector or through the creation of a publicly-funded educational marketplace is a source of great debate (e.g. compare Levin 1991 a & c with West 1991 a & b) Of particular controversy is the degree to which public schools produce greater social benefits than private schools and the value of those additional social benefits. Also under debate is whether private schools have intrinsic characteristics which enable them to be more productive than public schools The general issues are found in comparisons of public and private schools in James and Levin (1988) and Haertel, James, and Levin (1987) and specific theoretical arguments are found in the contrast between Brown (1992) and Frey (1992) on the one hand and Coleman (1987), Coons and Sugarman (1978), Chubb and Moe (1990), and Friedman (1962).

What is particularly important to note, in summary, is that educational production has peculiar characteristics which do not

simply fit into the standard production function and cost minimization literature. Definitions and measurements of inputs and outputs, understanding of the technology of production, and the distributional implications of student composition for both educational production and outcomes are just three areas in which there is great controversy and little, robust empirical evidence. Clearly, the same glaring gaps in knowledge underlie the debate over market approaches to educational production. It is readily apparent that continuing research will be necessary to provide a better understanding for policy directions.

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