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Whether and How Money Matters in K-12 Education

Margaret
Margaret L. Plecki and Tino A. Castañeda
University of Washington, Seattle

Introduction: Why the Focus on Does Money Matter?

When policy makers make decisions about the amount, type, and distribution of revenues, they are faced with the issue of educational productivity. Given limited resources, multiple goals, and a wide range of possible approaches, policy makers must choose a course of action. Questions such as the following are key considerations in policy debates: How do we ensure that we getting the most for our educational dollar? How do we target resources to help students achieve at higher levels? What are the best strategies for better educating those students who are not being well-served by our schools? How do we eliminate existing inequities in the distribution of resources? What have we learned from prior efforts to allocate resources efficiently and effectively?

The answers to these questions are complex and variable. The nature and the extent of the educational challenges differ in important ways at each level of the policy-making system (state, district, school, and classroom) and the specific conditions for students and teachers within each level of the system vary considerably. Expected educational outcomes are multidimensional and sometimes even in conflict with one another. Attributing outcomes to specific interventions strategies is problematic, as much of student learning results from numerous types of interwoven interactions that are very difficult to model or measure. Nevertheless, the effective and efficient use of public funds is a prime expectation of the taxpayers who provide the majority of revenue for public schools, and for the policy makers who represent those taxpayers. Some have argued whether spending additional public money on education will improve student achievement or whether additional money would be wasted by inefficiencies that may exist in the education system. Thus, the question is often posed: Does money matter, and if so, in what ways? As Ladd and Hansen (1999) summarize, "There are, however no easy solutions to this challenge, because values are in conflict, conditions vary widely from place to place, and knowledge about the link between resources and learning is incomplete" (p. 1). Numerous studies have focused on the extent to which specific levels and types of investments produce positive educational outcomes. Among other issues, studies have examined the relation between student achievement and: (a) overall expenditure levels, (b) the types of resources purchased (e.g., teachers, support staff, facilities, technology, etc.), and (c) the way in which resources are allocated and used (e.g., lower student-teacher ratios, additional supports for struggling students, compensation differentials, etc.).

The focus of this chapter is to describe what we have come to understand about research on the efficient and effective allocation of resources to support the improvement of student learning in K-12 public education. There are three main sections to this chapter. The first section provides an analysis of the context and the nature of the policy debate surrounding the question: Does money matter, and if so, in what ways? It includes a portrayal of the conceptual and methodological issues involved in the research concerning this question, along with a discussion of the numerous ways in which this research has been critiqued. The second section of the chapter describes some of the common policy approaches designed to make money matter that have been implemented in one manner or another over the past two decades. The chapter concludes with a discussion of the emerging topics and methods that are shaping the future of analyses about how money matters.

Overview of Trends in the Relation between Expenditures and Student Outcomes

At the heart of the debate about whether money matters is the examination of the relationship between the level of educational expenditures and student outcomes. Put most simply, the critique is that the rise in educational expenditures has outpaced any growth in student achievement (Hoxby, 2002; Walberg, 2003). An additional critique

involves long-standing disparities that exist in educational attainment when students are grouped by ethnicity, race, and class, often referred to as the "achievement gap" (Hunter & Bartee, 2003; Harris & Herrington, 2006). National Assessment of Educational Progress (NAEP) and SAT scores are measures often used to indicate insufficient growth in student achievement. There is disagreement, however, about what change (or lack of change) in average scores on such tests signify as measures of educational outcomes. While this thorny problem about how to best measure educational outcomes will be discussed later in this chapter, there is general agreement that we expect the outcomes of our educational system to improve. Consequently, a brief review of the trends in educational expenditures is provided to frame both the historical context and current conditions.

Without question, spending for K-12 public education is a major enterprise of state and local governments, forming a large—if not the largest—share of the total budget for most state and local governments. In 2003–04, public school revenues totaled $475.5 billion, representing 4.5% of personal income and 3.8% of the nation's Gross Domestic Product (National Center for Education Statistics, 2005). In fiscal year 2006, per pupil expenditures averaged $9,154. Table 36.1 provides data about expenditure levels over a 50-year period. The data from this table indicate that growth in expenditures (as compared in constant dollars) as been steady and significant.

Characterizing educational expenditure patterns is complicated by the fact that wide variation exists between the highest and lowest spending states. For example, in fiscal year 2006, the average per pupil expenditure in New York State was $14,615 while Utah spent $5,464 on average (National Center for Education Statistics, 2008). Differential expenditure patterns also exist among districts in the same state, primarily due to the substantial variation in the fiscal capacity of school districts that requires some districts to impose much heavier tax burdens on residents to offer the same level of educational services that more wealthy districts can raise with ease. Addressing the interdistrict variation in resources has been at the heart of school finance policy and research for more than 30 years. While this research has primarily examined spending differentials as equity issue, differences in spending levels and patterns are also an integral part of the inquiry surrounding educational adequacy and productivity.[1]

Considerable differences also exist in the sources of funding for K-12 education. Numerous states have seen a dramatic shift in funding away from local sources of funds (primarily from local property taxes) towards state sources of revenue. For example, nationwide in 1919–20, state funds comprised approximately 17% of total education revenue, while in 2002–03 almost half of all education funding (49%) came from state sources. Here again, significant variation is found among states with Michigan, for example, drawing 72% of its revenue from state sources while the state share of education revenue in Illinois amounts to only 33% of all funds (National Center for Education Statistics, 2005). This shift towards state sources of funding is attributable in large part to a state's attempts to remedy longstanding disparities in the distribution of revenues. These changes in state school finance systems were often brought about through litigation, including cases such as Serrano v. Priest (1971) in California and Robinson v. Cahill (1973) in New Jersey.

These variations in total spending amounts and sources of revenue add further complexity to any overall characterization of expenditure trends over time. However, despite these considerable differences in the amounts and sources of funds, the examination of trends in the objects of expenditure reveal striking similarity across states and districts throughout the nation (Picus & Wattenbarger, 1995; Monk, Pijanowski, & Hussain, 1997). These analyses consistently indicate that the vast majority of the operating expenditures in education are allocated to pay for the cost of employing school personnel, with the largest portion of those expenditures allocated to classroom teachers. Total spending on all school personnel, including salaries and benefits, comprised 89.1% of all spending nationwide in fiscal year 2006 (National Center for Education Statistics,

TABLE 36.1
Current Expenditure per Pupil in Public Elementary and Secondary Schools

School year	Current expenditure[1] per pupil[2]		
	Unadjusted dollars	Constant 2004–05 dollars[3]	Percent increase in constant dollars from previous decade
1951–52	215	1,571	NA
1961–62	393	2,507	59.6
1971–72	908	4,228	68.6
1981–82	2,525	5,143	21.6
1991–92	5,023	6,967	26.2
2001–02	7,727	8,313	19.3

Note. [1]Current expenditures include instruction, student support services, food services, and enterprise operations but exclude capital outlay, and interest on debt. Also excludes expenditures such as community services, private school programs, adult education and other programs not allocable to expenditures per student at public schools. Beginning in 1980-81, state administration expenditures are excluded from "current" expenditures. [2]Based on fall enrollment except for data for 1951-52 based on school-year enrollment. [3]Constant dollars based on the Consumer Price Index, prepared by the Bureau of Labor Statistics, U.S. Department of Labor, adjusted to a school-year basis.
Source: National Center for Education Statistics, Digest of Educational Statistics, 2005

2008). The largest share of these personnel expenditures is comprised of salaries and benefits for teachers.

Arguably, the quality of education is ultimately dependent on the classroom teacher's ability to impact student learning (Eide, Goldhaber, & Brewer, 2004; Rice, 2008). Consequently, numerous educational improvement policies have focused on the quality of the classroom teacher as a prime consideration in improving student learning. We discuss this policy approach alongside other investment strategies attempting to produce positive educational outcomes in the next section of this chapter.

Characterizing the Debate about whether Money Matters

A variety of methods have been used in the research literature to inquire into questions of educational productivity in K-12 schooling. One of the most frequently used approaches is the education production function model. This model attempts to describe the relation between a variety of inputs into the education process with specified outcomes. Often statistical and econometric techniques are used to estimate the production function, with regression methods being the most common method used during the past 30 years. While certainly not the only way to address questions of efficiency and effectiveness in education, the production function model has dominated the research literature that addresses questions of the relation between spending and educational outcomes. Production function studies also have played a role in policy debates regarding both the level of resources that should be expended in education and the way in which resources might be productively used. We now turn to a discussion of what we have learned from these types of studies, followed by an analysis of the limitations of this type of approach. We then describe some of the alternative, but less widely used approaches to addressing questions of educational productivity.

Numerous education production studies have been conducted over the past three decades, and numerous reviews of this production function literature have also been undertaken. Both the studies themselves and the meta-analyses of the research have been distinguished by mixed findings. Most analysts of the literature in this field point to the 1966 report, *Equality of Educational Opportunity* (Coleman et al., 1966) as a seminal piece which concluded that a variety of factors, most notably peer characteristics, influence student achievement. The report concluded that variables outside the purview or control of schools have a bearing on student success in school. Findings from the Coleman report prompted numerous additional studies that focused on identifying those variables which are most consistently and significantly associated with improved student achievement. Eric Hanushek (1986, 1989, 1991, 1996, 1997) published several analyses of the research on educational productivity in which he concluded that there is little evidence of a systematic relationship between the level of funding and student outcomes. Hanushek's method for conducted his meta-analysis (called vote-counting) was challenged by Hedges, Laine, and Greenwald (1994) in their analysis of the same body of literature. Using a different method for conducting the meta-analysis (called combined significance), these authors arrive at the conclusion that money does indeed matter. They found that teacher education, ability, and experience, along with small schools and lower teacher-pupil ratios, are all positively associated with student achievement.

Others who have reviewed prior production function research (Ferguson & Ladd, 1996) claim that many of the earlier analyses did not critically sort out the methodologically weak studies from consideration, thus casting doubt on the validity of the conclusions being drawn. This classic debate regarding whether money matters continues today in both research and policy contexts. Numerous other scholars have provided additional critiques of educational productivity research and have offered suggestions in an attempt to improve the extent to which these types of studies can be used to help inform educational investment and improvement policies (Monk, 1992; King & MacPhail-Wilcox, 1994; Burtless, 1996; Card & Krueger, 1992; Ladd, 1996; Odden & Clune, 1995: Grissmer, 2001; Rice, 2001; Rolle, 2004).[2]

Conceptually, the lack of agreement about the elements of a theoretically sound "theory of production" in education plagues the research in this area. In other words, the forces and conditions that comprise the human "equation" of student learning are neither obvious nor fully understood. The lack of agreement is understandable, given that education is characterized by interactive and developmental processes and conditions stretching across many years of schooling, and individuals vary in multiple and important ways along a number of dimensions which are extraordinarily difficult to fully and reliably capture (Cullen, Jacob, & Levitt, 2005; Goldhaber & Brewer, 1997). Given this lack of an agreed-upon theory of educational production, it is little wonder that technical issues abound, such as the specification and measurement of proxies to best represent the important elements in the educational process. A further complication exists in the predominance of linear models in production function studies when most education processes and complex and non-linear in nature. Hence, the choice of inputs and their metric specifications may rest on other than strong theoretical grounds, further contributing to inconsistent research results. Thus, the selection of variables to use in these types of studies is inconsistent and less than fully reliable. Instead of using generally agreed-upon elements of production which might characterize work in other fields of study, production function researchers in education typically choose particular input or output measures because information is readily available, the variable has some policy relevance, or because the variable is intuitively plausible (Monk, 1990). The constraints surrounding the availability of data are particularly problematic and may obscure differences among students, teachers, and schools which may be important to consider (Hanushek, Rivkin, &

Taylor, 1996). For example, information about the amount of time students spend learning a particular subject, the quality of texts and curricula, and the contributions made by parents and volunteers in school settings are typically not include in these studies, primarily due to the lack of access to this type of data.

Murnane (1991) provides two critiques of studies of the relation between school resources and student outcomes that lend support to his observation that, while useful, "it is simply indefensible to use the results of quantitative studies of the relationship between school resources and student achievement as a basis for concluding that additional funds cannot help public school districts" (p. 457). His first concern is that education production function studies do not address questions of causation. This issue of implied causality is echoed by Rolle and Fuller (2007) in a similar review conducted more recently than that of Murnane. The second critique is that some productivity studies in education presume that waste or inefficiency exists when spending levels do not appear as being positively related to student outcomes. To support this claim, Murnane (1991) draws from examples of studies in private sectors that document how firms often pay for inputs that do not show a direct positive relationship to productivity but these findings are not interpreted as evidence that the firm is inefficient. Rather, the interpretation is that firms have a rationale for these expenditures, even if their reasons are not obvious.

In a later analysis of production function research, Taylor (2001) describes five types of differences that exist among the various studies of school inputs and student outcomes. Taylor finds that productivity studies vary in: (a) the identification of variables and the way in which variables are measured, (b) the level of analysis (e.g., state, district, school), (c) the geographic scope of schools under analysis, (d) the specification of the particular model under consideration, and (e) the analytic techniques employed.

One of the most contested issues of productivity studies is the manner in which outcome measures of student achievement are defined and treated. Student scores on standardized tests are measures that are used most frequently (Burtless, 1996). Critics of this approach to identifying student outcomes point to the numerous other goals of education that the public typically hold as important. Improved physical and mental health, ability to participate in a democracy, competitiveness in a global economy, crime reduction, and improved race relations are a few of the nonacademic student outcomes that are expected of elementary and secondary schools. However, even if the decision is made to focus more narrowly on the widely held expectation that schools should, at a minimum, contribute to increases in the academic performance of students, serious disagreements exist as to the extent to which the test scores that are available for use by researchers actually capture what is most important to uncover about student achievement (Ladd & Hansen, 1999; Monk, 1997). In a recent discussion of the use of student test scores in the examination of school performance, Stiefel, Schwartz, Rubenstein, and Zabel (2005) note both psychometric and policy-related cautions about the use of student test scores. These include issues of refraining from the use of test scores for purposes other than intended, and caveats surrounding how test scores are aggregated. In particular, some forms of aggregation may mask important differences or distinctions among districts, schools, or subgroups of students. Figlio (2005) notes three ways in which states often approach the aggregation of test score data in designing accountability systems: across time, across subject areas, and across sub-groups. Each of these types of aggregation strategies addresses different approaches to characterizing student achievement levels. These dynamics and potential pitfalls in how test scores are treated can influence the policy implications of productivity studies.

A number of productivity studies have employed a more microanalytic approach using disaggregated data (Murnane, 1975; Summers & Wolfe, 1977; Thomas, Kemmerer, & Monk, 1982; Brown & Saks, 1987; Rossmiller, 1986; Monk, 1989). These studies have focused on school and classroom levels, in contrast to the analyses which have used more global measures from macro-level databases. Findings from the microanalytic studies reveal a similar pattern of mixed results. However, several production function studies in this tradition have demonstrated positive relationships between teachers' ability levels (often a measure of verbal aptitude) and student achievement (Ehrenberg & Brewer, 1995; Summers & Wolfe, 1977). Ferguson (1991) examined school districts in Texas and concluded that there are systematic relationships between educational inputs and student outcomes which he estimated to account for between one-quarter and one-third of student achievement differences. Ferguson and Ladd (1996) examined Alabama schools and concluded that there is evidence that the input variables of teacher's test scores, the percentage of teachers with master's degrees, and small class size are positively associated with student test scores. These authors and others (Rice, 2001; Schwartz & Stiefel, 2001) assert that the use of more methodologically sound analytic techniques (e.g., value-added specification)[3] combined with a more disaggregated and longitudinal analyses can address some of the perplexing problems which have been associated with production function research.

In addition to the challenges with productivity studies described above, other concerns have been raised regarding research on the relation between resources and student outcomes. A recent critique of productivity studies (Rolle & Fuller, 2007) points to the inadequacy of using family income, race, and ethnicity to "control" for differences in background characteristics of students. The authors assert that this variable cannot capture the important ways in which families and communities, especially in communities of color, may contribute in a positive way to students' educational attainment.

The upshot of these lines of thinking and research to date are that we know less about the productive impact of policy makers' investments in education than we might wish. To be

sure, some analyses highlight certain variables that appear to bear some relationship to student learning. Other studies establish no clear or discernible relationships. The lack of connections and the mixed nature of results across studies may be due to the weaknesses in underlying theory or specification of measures. Or, these models have yet to represent adequately important variables intervening between allocation of resources and their enactment in practice. By a similar argument, production function models take little account of the actual allocation and expenditure dynamics within public education systems, and hence we are unable to tell whether increased levels of resource investment overall were actually targeted to inputs of immediate relevance to improved classroom performance (Stiefel et al., 2005).

In one manner of thinking, education productivity research might be best considered as a means rather than an end in itself. It can serve as an analytic tool to help uncover not only the types and levels of resources that might make a difference, but also to better understand the ways in which those resources can be effectively used in pursuit of specific education goals. Based in part on results from productivity research, educators and policy makers have been pursuing some specific strategies to improve the effectiveness of resource allocation and use. These policy approaches are discussed in the next section of this chapter.

Policy Approaches to Making Money Matter

Numerous state, district, and school level policies are aimed at improving student learning in effective ways. Some of the most common approaches in recent years fall into the following categories: (a) improving teacher quality, (b) lowering pupil-teacher ratios, (c) expanding early childhood programs, (d) improving high school, (e) decentralizing spending authority, and (f) providing incentives to improve performance. While each of these types of policy strategies have numerous goals, each strategy involves either providing additional resources or altering the way in which existing resources are used to improve student performance. A description of each policy strategy follows.

Investments in Teacher Quality As discussed earlier in this chapter, the largest share of expenditures in education is on personnel. Thus, policies that invest in human resources are a particular focus for policy makers. In addition, results from a number of productivity studies suggest that the quality of the teacher is one of the most important variables in producing improved student learning (Hanushek, Kain, O'Brien, & Rivkin, 2005; Eide et al., 2004; Rice, 2008; Sanders & Rivers, 1996). However, the specific ways in which particular teacher attributes impact student learning is still under debate (Clotfelter, Ladd, & Vigdor, 2007). Some of the lack of clarity in the research findings can be traced to the complexities involved in measuring teacher quality. At least three elements are involved in understanding how investments in teachers impact student learning: (a) the quality of the teacher workforce, typically measured in terms of degrees, experience, verbal aptitude, etc.; (b) the quality of the interaction between the teacher and the learners; and (c) the quality of support for teachers' work, including school working conditions and teachers' collaborative efforts. However, for the most part, attention has been focused in the first category regarding individual teacher attributes (Plecki, 2000; Plecki & Loeb, 2004).

In an analysis of the literature on teacher quality, Rice (2003) emphasizes the complexities encountered when attempting to identify the specific qualifications of teachers that make the greatest contributions to student learning. For example, variations in teacher effects were found by school level (i.e., elementary school as compared to high school) and by subject matter (e.g., greater effects for mathematics as compared to reading achievement). She found evidence to support the following general observations: (a) teacher experience makes a difference, as higher performance is associated with those teachers who have more than 5 years of experience; (b) teachers with advanced degrees in mathematics and science had a positive influence on high school student achievement in those subjects, but mixed results were found for the elementary level; (c) no clear impact exists for those teachers trained through alternative routes to teacher certification as compared to traditional routes; and (d) measures of teacher verbal ability are associated with higher levels of student achievement.

An important dimension emerges in the literature about teacher quality and its relation to student learning with respect to the inequity of distribution of qualified teachers across schools and classrooms. Numerous studies have pointed to the need to examine the extent to which less experienced and less qualified teachers (e.g., teachers assigned to courses for which they lack proper certification, training, or subject matter knowledge) are located in high-poverty schools or schools serving larger proportions of students from racial and ethnic minorities and the extent to which these schools experience higher teacher turnover than schools which serve a more advantaged population of students (Lankford, Loeb, & Wyckoff, 2002; Boyd, Lankford, Loeb, & Wyckoff, 2003; Ingersoll, 2001; Clotfelter, Ladd, & Vigdor, 2005).

As already mentioned, some consensus has emerged that the effects of teacher quality on student performance in mathematics is higher than that for reading (Hanushek et al., 2005). In a recent study using 10 years of data on North Carolina teachers, Clotfelter, Ladd, and Vigdor (2007) found that teachers' experience, test scores, and licensure status were all positively related to student achievement measures, with larger effects for mathematics achievement than for reading. They go on to state that these effects are greater than those found for changes in class size or in indicators of socio-economic factors such as parental education level.[4] While policy makers have primarily relied on identifiable teacher traits such as education level, certification status, and years of experience as measures of teacher quality, results from research studies do not consistently find these attributes as predictive of teacher effectiveness (Goldhaber, 2007).

Another important development regarding research on teacher quality involves using more precise data that matches teachers and students as well as more longitudinal approaches to assessing teacher effects. For example, recent work by Rivkin, Hanushek, and Kain (2005) noted the following: (a) teachers have significant effects on reading and mathematics achievement, (b) little of the variation in mathematics and reading achievement is explained by experience or education levels, and (c) the benefits of improving teaching quality are greater than reducing class size by 10 students.

Class Size[5] Reducing class size is a popular education policy reform of educators, parents, and policy makers. It is also one of the most costly policy strategies aimed at improving student learning. However, the impact of class size on student achievement has been debated by researchers for several decades (Glass & Smith, 1979; Odden, 1990; Grissmer, 1999; Peevely, Hedges, & Nye, 2005; Krueger, 2003). Many of these studies point to other factors which may need to accompany class size reduction, such as changes in pedagogical approaches and placing well-qualified teachers in each classroom (Imazeki, 2003). An important distinction to bear in mind when examining the evidence about class size is the difference between class size and student-teacher ratios. For example, a body of research has found that a class size of 15 in the primary grades is associated with improved student learning, particularly from low-income families and students from racial and ethnic minority groups (Achilles, 1996; Finn & Achilles, 1999; Grissmer, 1999, 2001; Laine & Ward, 2000). This form of class size reduction is not the same as a class of 30 with a teacher and a full-time instructional aide (Gerber, Finn, Achilles, & Boyd-Zaharias, 2001). Nor is it equivalent to classes of 18–20 students that also have access to certificated instructional coaches or specialized teachers that provide additional small group instruction for targeted students for a part of the school day. However, in policy and practice, the most common metric for class size is the number of students per certificated staff member.

The Importance of Early Intervention[6] Scholars have documented the gap that exists between children living in poverty and their more economically advantaged peers in terms of their readiness to learn when they begin kindergarten (Lee & Burkham, 2002). States, cities, and school districts are increasingly investing in pre-kindergarten programs, and evidence exists to support the wisdom of that investment. One of the most extensive longitudinal studies of the impact of a quality preschool program is the High/Scope Perry Preschool Project. The study began in the 1960s and used random assignment to a treatment and a control group to assess the effects of a preschool program for at-risk children. Evaluation of the follow-up data on these individuals through childhood and into adulthood (up to age 27) showed that gains for those participating in the preschool program outweighed the cost of the program by a factor of seven (Barnett, 1996). Additional follow-up conducted on these same individuals who were reaching the age of 40 indicated that gains continue to be sustained over time, particularly in higher lifetime earnings and lower criminal activity, as well as reduced societal costs in terms of welfare and other social costs (Nores, Belfield, Barnett, & Schweinhart, 2005). Nores and colleagues (2005) estimated that the program repaid $12.90 for every $1.00 invested in the program. Other research has confirmed this finding of the long-term individual and social benefits of high-quality preschool programs, particularly for children living in poverty (Barnett, 1998; Currie & Neidell, 2007; Temple & Reynolds, 2007; Barnett & Masse, 2007). An important policy concern about the capacity to provide high quality preschool programs is the difficulty in recruiting and retaining well-qualified teachers, as wages for preschool teachers are significantly lower than elementary and secondary teachers.

Improving High School Significant policy attention nationwide has been focused on the matter of improving high school education. One of the most popular improvement strategies is to create smaller schools or learning environments that provide students with more personalized attention. The question of whether smaller schools impact student learning is a matter that has been examined by scholars for many years, often in an effort to determine if there is an optimal school size (Barker & Gump, 1964; Cohn, 1968; Riew, 1986; Fowler & Walberg, 1991; Monk, 1984; Lee & Smith, 1997). For some time, larger schools were viewed as more cost-effective and potentially more comprehensive given economies of scale that could potentially be realized. However, while improved curricular comprehensiveness is theoretically possible in larger high schools, evidence exists that this potential is not fully realized in practice (Monk, 1987; Haller, Monk, Spotted Bear, Griffith, & Moss, 1990).

It has been suggested that high school size should be within a range of 400–600 students (Lee & Smith, 1997). This range is much smaller than most comprehensive high schools across the nation. However, it is also important to note that the relationship between high school size and student outcomes is an indirect one (Lee, 2004), and simply creating smaller schools does not guarantee positive outcomes in student learning. Additional concerns have been raised about whether or not smaller high schools would be more costly. However, some microanalytic research that examines budgetary implication of high school size (Stiefel, Berne, Iatarola, & Fruchter, 2000) uses a cost per graduate approach and concludes that smaller academic high schools have about the same cost per graduate as larger high schools.

Decentralizing Spending Authority While many factors influence and contribute to student learning, leadership in all its forms is often cited as a factor that contributes to the learning process (Leithwood & Riehl, 2003). In recent

years, attention has been focused on the extent to which leadership is distributed throughout the education system, including providing additional decision-making authority and responsibility at the school level, as well as distributing leadership roles within a school. The central idea is that those who are closest to the point of instruction are better positioned to make decisions tailored to the needs of individual schools, classrooms, and students. One emerging strategy for making money matter more is to provide school principals with more control and discretion over school budgets. For example, budgeting practices in the United Kingdom, Canada, and Australia allow for the majority of operational funding (85–90%) to flow directly to individual schools (Committee for Economic Development, 2004). In the United States, several urban districts are implementing this approach of providing more site-level authority for school budgets, including Chicago and New York City. However, this additional authority comes with new responsibilities for school principals and others at the school site to pay closer attention to and assume accountability for additional resource-related matters. It also implies that school leaders have the knowledge, skills, and supports that are needed to make well-informed decisions about budget and finance (Plecki, Alejano, Knapp, & Lochmiller, 2006).

Providing Incentives to Improve Performance An issue often debated by policy makers concerns the role of incentives in educational improvement. Examples of incentive-related policies include merit pay for teachers and other forms of performance-based rewards, bonuses for teachers locating in hard-to-staff schools, and differentiated pay for teachers working in subject matter shortage areas. A number of these incentive-based approaches imply departures from the traditional approach to determining teacher salaries that relies almost exclusively on years of teaching experience and college degrees and credits earned (Odden & Kelley, 1997; Kelley, 1997). While economic theory suggests that merit pay could help attract able people into teaching and serve to motivate individuals to be more productive (Goldhaber & Player, 2005; Ballou & Podgursky, 2001), early attempts at merit pay strategies were problematic, particularly regarding the subjective nature of teachers' performance evaluations and the limited nature of the cases in which merit pay was attempted (Murnane & Cohen, 1986; Freiberg & Knight, 1991; Firestone, 1991; Cornett & Gaines, 1994). As an alternative to individual-based rewards, another incentive-based approach focuses on group-based rewards for improved performance in which all those working at a school that meet specified performance improvement targets receive additional compensation or increased funds allocated to the school (Mohrman, Mohrman, & Odden, 1996; Kelley, Heneman, & Milanowski, 2002). Such an approach may not adequately account for conditions that are not within the control of those at the individual school level (Goorian, 2000).

Yet another approach that is being attempted in a limited number of locations is some type of knowledge and skills-based pay structure (Milanowski, 2003). These pay systems provide additional compensation for teachers who demonstrate they have particular expertise in areas that have been identified as particularly critical by the school or school district, such as the ability to teach English-language learners or advanced-placement physics. In the case of teachers who have received certification from the National Board for Professional Teaching Standards (NBPTS), several states have provided incentives for those NBPTS-certified teachers to work in hard-to-staff or low-performing schools (Humphrey, Koppich, & Hough, 2005). Other types of incentives are also being considered such as loan forgiveness programs and housing assistance as a means to attract teachers to districts and schools in need. However, non-monetary factors and conditions in the workplace also serve to shape teachers' motivation and job satisfaction (Loeb & Page, 2000; Boyd, Lankford, & Loeb, 2004). School factors such as well-behaved students, supportive principals, and strong collaborative working environments may be just as or more important to teachers than increased compensation or other forms of monetary incentives (Farkas, Johnson, Foleno, Duffett, & Foley, 2000).

Emerging Topics and Future Directions in the Field

A substantial portion of the suggestions for improvement in the field of education productivity research can be characterized as falling into three main categories: (a) inadequacies regarding the statistical techniques employed; (b) the quality, specificity, and timeliness of data to accurately address aspects of education production thought to be important; and (c) the assumptions and theoretical underpinnings of how the issue of improving productivity in education is framed. These issues are outlined in this final section of the chapter.

As previously discussed, numerous scholars have pointed to the inadequacy of statistical strategies used in much of the productivity literature and have posited that improvements in measurement and methodology would yield more accurate and useful results. For example, Alexander (1998) describes the central issue as follows:

> More poorly designed studies that use inaccurate determinations of input and productivity measures frequently result in the finding that money doesn't matter, not because no relationship exists, but rather because of improperly specified research models. Imprecise research designs usually produce results that tend toward randomness resulting in erroneous conclusions that fail to identify relationships that may well exist. (p. 239)

Some advances in recent years have attempted to address these concerns through the use of statistical techniques other than multiple regression. One of those techniques is hierarchical linear modeling (HLM). A number of scholars find HLM to be particularly well-suited for examining the nested nature of classroom, school, and district effects (Raudenbush, 1988; Raudenbush & Bryk, 2002; Odden,

Borman, & Fermanich, 2004). Advocates of HLM techniques point to ways in which this approach can model the contexts and conditions in which the educational process typically occurs (i.e., within states, districts, schools, and classrooms, each with its own unique influences). Statistical and methodological techniques in addition to HLM that are emerging in this field of inquiry include data envelopment analysis (Rubenstein, 2005) and stochastic frontier analysis (Rolle & Fuller, 2007). The promise and the limitations of these emerging techniques are being debated.[7] As they develop, these methodological advances represent a means for improving the degree to which productivity analyses can contribute to our knowledge of the effectiveness of a variety of educational investments.

Addressing data insufficiencies have also been an important part of improving our understanding of the relationship between school resources and student learning. Much has been written about the need for more detailed data that captures a larger and more sophisticated picture of the factors that impact student learning (Monk, 1997). For example, a more robust portrayal of teaching quality, leadership, and district support might further our understanding of the necessary conditions that help make investments matter more (Grubb, 2006). A number of states have worked on improving the quality of their data systems to build capacity for more detailed and timely analyses, such as value-added and longitudinal approaches to examining student learning and related factors and conditions. Results from a survey of states conducted by the Data Quality Campaign and the National Center for Educational Accountability (2006) identified 10 data elements essential to developing robust longitudinal analyses, including the ability to match teachers to students and to examine student performance data over time and across key databases.

In addition to the development of more detailed and sophisticated methodological techniques and improved data capacity, policy makers have noted an increasing preference for randomized trial studies and other "scientifically-based" evidence of the impact of investments on outcomes (Boruch & Mosterller, 2001; Raudenbush, 2002). However, in a critique of the role of randomized trials in education, Murnane and Nelson (2005) assert that the methodology of randomized trials is more effective in guiding very troubled schools than in helping average-performing schools in their efforts to become high-performing organizations. The authors also question the common assumption that the advances made in medical practice have come primarily from discoveries in laboratories using randomized control trials and that education should adopt this approach to advance knowledge as is done in the field of medicine.

Some scholars who have been examining the state of education productivity research have adopted a critical framework that calls into question some of the traditional conceptual and philosophical underpinnings of the constructs that guide the design and conduct of analyses about making money matter (Rodriguez & Rolle, 2007). For example, Rolle and Fuller (2007) call for the design of productivity studies that help us understand the full inequity of efficiencies in education instead of just focusing on average efficiency which may well be masking inequities. They recommend that measures of efficiency used in productivity studies "…should focus on relative comparisons of the best observed performers to the worst." (p. 76). Rodriguez (2007) uses the case of California's school finance system to examine the theoretical and conceptual challenges involved in traditional school finance theory and points out how diverse students and communities are most likely to be represented only from a perspective that identifies their deficiencies. For example, school finance models typically provide additional resources to districts and schools that serve higher percentages of students living in poverty in an effort to provide greater equity. However, this approach also carries an assumption of cultural deficiency that is rarely explicitly surfaced as a consideration in policy design. She offers the following observation:

> In the case of school finance policy, the key issue that would benefit from the introduction of critical analysis is the persistence of disappointing or frustrating results from the educational system despite years of reform in the distribution of financial and non-financial resources to public schools. Moreover, the repetitive cycle involves the stigmatized characterizations of large (and growing) numbers of students—those who are from low-income backgrounds and/or of color—such that their potential as learners and contributors to our society is obscured and remains untapped. (p. 118)

These perspectives challenge both researchers and policy makers to consider the underlying assumptions and theoretical constructs that shape how student ability and performance is gauged and how variation across states, districts, communities, schools, classrooms, and families is considered. While the puzzles regarding the precise ways in which money matters for improving student learning are not yet solved, progress has been made in informing our understanding about the vital role that resources play. Through the use of improved data and more finely tuned methods, substantial progress has been made in the past two decades, and a greater focus is now on understanding the ways in which money makes a difference, rather than simply debating the importance of resources. Certainly, more work remains to be done in order for research to become more closely tied to informing policy and practice. Significant challenges persist in addressing the ways in which students who have not fared well in our education system can be effectively and equitably served. Research can continue to contribute to the continuous improvement of the decisions that are made in policy design and in practice regarding effective, equitable, and efficient resource allocation and use.

Notes

1. For a detailed discussion of financial equity and adequacy please refer to Baker and Green, this volume.

2. For a recent detailed discussion of a variety of methods in productivity studies, including production functions, adjusted performance measures, cost functions, and data envelopment analysis, please see Stiefel, Schwartz, Rubenstein, and Zabel (2005).
3. A significant amount of contemporary research provides an alternative for measuring growth in student performance. This approach, often called "value-added," measures gains in student learning based on the prior performance of the individual student rather than the performance relative to a uniform aggregate standard (Sanders, 1998).
4. For additional discussion of teacher quality, please see Loeb and Béteille, this volume.
5. For a detailed discussion of the topic of class size, please see Ahn and Brewer, this volume.
6. For a detailed discussion of early childhood education, please see Schweinhart and Fulcher-Dawson, this volume.
7. See, for example, Ruggiero (2006) for a critique of data envelopment analysis.

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