

CHAPTER 6

TEACHER QUALITY

Its Enhancement and Potential for Improving Pupil Achievement

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The literature provides evidence that schools differ starkly in the average characteristics of their teachers. This chapter discusses the causes of these disparities, their likely impact on student outcomes, and the potential role of policy interventions for attracting and retaining high-quality teachers in difficult-to-staff schools. Studies of teachers' decision making suggest that teachers respond strongly to both pecuniary and nonpecuniary elements of their jobs. Thus, while teacher preferences have created disparities in the teacher workforce across schools, targeted salary increases and target policies to improve the working environments are likely to alleviate some of the evident inequities.

INTRODUCTION

Along with school choice and class-size reduction, teacher quality is at the center of current school-policy debates. The focus on teachers is partially the result of current and looming shortages. Driven by the imminent retirement of many teachers, the increased enrollment of the children of baby boomers, and the ample opportunities available for college graduates outside the teaching profession, many districts face difficulties staffing their schools. In response, recent policies aim at attracting and retaining

elementary- and secondary-school teachers. As an example, Massachusetts has adopted a statewide "signing bonus." Many states have adopted loan forgiveness programs and offered tuition credits. Even the Department of Housing and Urban Development has implemented the Teacher Next Door Program, which allows teachers to purchase HUD-owned homes in their school districts for a 50% discount.

While the focus has been partially on increasing the number of teachers available, recent policies have brought to the fore the fundamental link between quality and quantity and the importance of teachers' preferences in determining the distribution of high-quality teachers across schools. Class-size reduction in California resulted in increased demand for teachers throughout the state. Many teachers in schools with low-achieving students chose to move to higher achieving schools, leaving high-poverty districts with vacancies and unqualified instruction (Betts, Rueben, & Danenberg, 2000; Bohrnstedt & Stecher, 1999). More recent policies have tried to improve the quality of the teaching force, especially in these difficult-to-staff schools, by making teaching jobs there more attractive. At least 29 states and many localities provide bonuses and incentives for certification by the National Board of Professional Teaching Standards. In California, these incentives are larger for National Board certified teachers willing to teach in low-performing schools.

This chapter addresses the importance of teachers for student outcomes and the role of policy in attracting and retaining high-quality teachers in difficult-to-staff schools. It proceeds as follows. The second section discusses the effects of teachers on student outcomes. The next section of the chapter describes differences across schools, districts, and regions in the average qualifications of teachers. The fourth section addresses the current and potential role of policies in addressing the observed disparities and attracting and retaining high-quality teachers. It pays particular attention to policies affecting teacher salaries. The final section concludes.

DO TEACHERS IMPACT STUDENTS?

Strong evidence suggests that teachers affect student learning. Certainly, there is anecdotal evidence, but beyond this, recent papers by Rivkin, Hanushek, and Kain (2000) and Sanders and Horn (1994) have found that achievement gains by students over an academic year are strongly impacted by the teacher whose class they attend. Rivkin et al. attributed at least 7% of the total variance in test-score gains to differences in teachers, and they argued that this is a lower bound. Wright, Horn, and Sanders (in press) have found that teachers are the most important factor explaining students' test score gains. Sanders and Rivers (1996) found that the differ-

ence between attending classes taught by high-quality teachers (highest quartile grouping) and attending classes taught by low-quality teachers (lowest quartile grouping) for three years in a row is huge, approximately 50 percentile points in the distribution of student achievement. They also found residual effects of teachers in later years. That is, having a high-quality teacher in grade three increases learning not only in grade three but also in grades four and five.

Value-added measures for teachers define teacher quality by the achievement gains of the students. In a simple iteration of the value-added model (see, e.g., Sanders & Rivers, 1996), a dummy variable for each teacher in an achievement model controlling for prior test scores captures the contribution of the teacher to student achievement. The coefficient on the teacher fixed-effect measures the average achievement gain of students in that teacher's class.

This method has a lot to offer. Most importantly it defines teacher quality in a way that the public appears to care about, through student achievement on standardized tests. If we can design tests that measure the learning we care about, then we can define teacher quality in terms of this learning. However, there are a number of potential troubles with the value-added measure. First, because teacher assignments to students are not random, we may confound assignment with teacher quality. For example, some teachers may be more likely to teach students who have difficulty learning. These teachers' skills may be underestimated by value-added measures. Rivkin et al. (2000) got around this problem by averaging student gains over grades in each school, but in so doing lost potential variation among teachers within a grade.

More fundamentally, value-added teacher quality measures place a heavy burden on tests to capture the contributions of teaching that we care about, not only overall but also at each level of academic achievement. Curriculum-based tests may do just that, but they may not. We need to worry about the incentives inherent in the accountability policies used to assess school performance when applying student test scores to teacher performance. For example, in Texas, schools are assessed on the pass-rates of all students on the Texas Assessment of Academic Skills (TAAS), specifically of low-income and minority students. This system creates incentives for schools to focus their test preparation on students at risk of failing the test and not on improving the scores of students who would pass without additional help (see Carnoy, Loeb, & Smith, 2001, for evidence that this is the case). Students who do not need additional help are more likely to receive instruction in material not covered by the TAAS. If we use gains in the TAAS to assess the quality of teaching, we will then attribute higher quality to those teachers working with students at risk of failing. This is unlikely to

represent the true distribution of teacher quality either within or among schools.

The value-added approach to measuring teacher quality, then, provides strong evidence that teachers play a central role in student learning. It is one important measure for assessing good teaching. Limitations arising from non-random assignment of teachers to classes and from dependence on imperfect test instruments suggest that value-added measures may best be used in combination with alternative measures that capture other contributions of teachers to student outcomes.

Measurable Teacher Characteristics

While there is general agreement that specific teachers strongly impact student learning, there is less agreement over the effect of particular teacher attributes. When assessing teacher effects, many studies have employed measures of years of education, years of teaching experience, whether or not the teacher holds a master's degree, and whether or not the teacher is certified. These production function studies often use methods that are inappropriate for estimating the relationships of interest, not accounting for the reasons that schools differ in the characteristics of their teachers. Moreover, these teacher characteristics are weak measures of teaching ability. Studies have tended not to find consistent impacts of these measurable teacher characteristics on student outcomes (Hanushek, 1986, 1997). However, studies with richer detail on teachers and studies using more appropriate methods have often been able to find positive effects. For example, Ferguson (1991) found that in Texas, teacher performance on a statewide certification exam was positively related to student outcomes; Ehrenberg and Brewer (1994) found that the selectivity of the college a teacher attends positively influenced test-score growth, and Monk (1994) found a positive effect of teachers' subject area preparation on student learning.

Rivkin et al. (2000) saw little correlation between "value-added quality" and teacher attributes, suggesting that true teaching skill may not be reflected in measurable characteristics of teachers. It is possible that while some teachers do consistently better than others, measurable teacher attributes do not capture these differences in quality. However, the teacher characteristics these authors employed, such as teacher experience, were similar to those that have been found not to be strong predictors of student success. Perhaps with other measures of teacher attributes, these authors would have found a stronger correlation between attributes and value-added quality. In addition, there is concern that value-added quality measures may be inaccurate and that this inaccuracy may lead to an under-

estimation of the relationship between value-added quality and other teacher characteristics.

While it appears that some measurable characteristics of teachers are not related to student learning, other factors, such as teacher test scores and the quality of teachers' education, may in fact be important. The benefits of these "input measures" of teacher quality over the value-added measures are that they are not confounded with teacher assignment to students and are not based on a student test likely to capture only a small part of the student outcomes that parents and the community care about.

HOW ARE TEACHERS DISTRIBUTED ACROSS SCHOOLS, DISTRICTS AND REGIONS?

Recent studies have documented substantial average differences in teacher characteristics across schools and across districts. In California, for example, Betts et al. (2000) discovered large differences across districts in the percentage of teachers who lacked a full credential, lacked a master's degree, and had taught for fewer than three years. In 10 out of every 100 elementary schools, more than 30% of teachers lacked full teaching credentials, while in many schools all the teachers were fully certified. The interquartile ratio for the percentage of teachers with two or fewer years of experience is less than .5, indicating that the school at the 25th percentile (not very far out on the tail of the distribution) had twice as many inexperienced teachers as the school at the 75th percentile.

Similar disparities are evident in New York State (Loeb, 2000): 5 out of every 100 schools (5th percentile) had fewer than 3% of their teachers with a master's plus 30 units of credit or more, while another 5 out of every 100 schools (95th percentile) had more than 60% of teachers with this level of educational attainment. Five percent of schools had fewer than 50% of teachers fully certified, while 10% of schools (90th percentile) had more than 90% fully certified. Many New York schools did not employ any teachers who have failed certification exams, but in at least 5% of the schools, more than one third of all teachers who had taken the NTE exams have failed them.

These school average teacher characteristics are correlated with each other. Schools with less qualified teachers by one measure tend to have less qualified teachers by other measures. In New York State, schools with teachers who failed one exam were more likely to have teachers who failed the other exams (correlations of approximately .78), schools with high proportions of teachers who failed exams were more likely to have teachers from less competitive colleges (correlations of approximately .35), schools with teachers from less competitive colleges were more likely to have teach-

ers with no more than a bachelor's degree (correlation of .17), and schools with teachers with no more than a bachelor's degree were less likely to have teachers with tenure (correlation of -0.66). These strong correlations suggest that schools are not trading off one type of qualification for another in their hiring practices. Instead, some schools simply employ more qualified teachers than other schools.

While the research on the impact of measurable teacher characteristics on student performance is weak, the technical difficulties in estimating these effects leave open the possibility that these characteristics are correlated with teaching ability. In any case, we may be concerned by the substantial differences that are evident across schools in all teacher measures available.

The differences across schools in teacher qualifications are related to measurable characteristics of the schools. Urban schools differ from suburban and rural schools; schools with high proportions of minority students differ from schools with low proportions of minority students; schools with many children in poverty differ from schools with few children in poverty. In New York State, for instance, urban schools have been shown to have fewer tenured teachers, more uncertified teachers, fewer fully certified teachers, more teachers who have failed the NTE communication skills and general knowledge exams, and more teachers who attended the least competitive colleges (Loeb, 2000). Lankford (1999) and Lankford, Wyckoff, and Papa (2000) found that New York City teachers were substantially less qualified than teachers in the surrounding suburbs and the rest of the state as indicated by a variety of factors. For example, a third of all New York City teachers taking the New York State Liberal Arts and Sciences Test for certification failed the exam at least once, compared to only 4.7% outside New York City.

Schools with a higher proportion of Black or Hispanic students also had less qualified teachers. Estimates for New York state imply that schools with 10% more Hispanic students had, on average, 2.8% fewer fully certified teachers. Schools with 10% more Black students had, on average, teachers whose average scores were 5.7 points (almost one standard deviation) lower on the NTE general knowledge exam than schools with more White students. A similar trend emerged with value-added measures of teacher quality. Sanders and Rivers (1996) found that Black students were more likely to be assigned to the poorest teachers and less likely to be assigned to the most effective teachers.

Where the Differences Lie

To determine the causes of inequities across schools, it is useful to know whether the differences we observe are among schools within districts,

among districts within regions, or among regions within the country. Both Betts et al. (2000) and Loeb (2000) discovered substantial variation within districts. This intradistrict variation is driven primarily by differences within large urban school districts.

Within districts, teacher differences have been correlated with school characteristics and student demographics much as they are across all schools. In both New York and California, within districts, schools with a higher proportion of Black or Hispanic students or a higher proportion of children receiving free or reduced-price lunch have shown lower average teacher qualifications. These intradistrict differences are unlikely to be driven by differences in wage schedules or district policies such as hiring practices. However, they may be driven by differences between schools, such as differences in student demographics and working conditions and by teachers' preferences for school characteristics.

We can gain further insights into the contributing factors behind teacher qualification differences by knowing whether the differences across districts are primarily between regions or labor markets or whether they are within labor markets. While some potential teachers may search nationally for a job, most are likely to limit their search to a restricted geographic area. Because of this search restriction, potential teachers will be especially influenced by the alternative occupational opportunities in the region they are considering. Large differences in average characteristics of teachers across regions may be the result of labor-market factors such as differences in the availability of jobs in alternative occupations or of the wages of those jobs. Labor-market characteristics are likely to affect the overall teacher workforce in the region but not the sorting of teachers within that region.

The majority of the variation in teacher characteristics appears to exist within regions, though some exists between regions as well. That is, most of the variation in teacher qualifications results from the sorting of teachers among districts (and schools) within a region, not from differences in the average qualifications of teachers in different regions. Analysis of metropolitan areas within the U.S. has shown that both within and between labor markets (as defined by these Metropolitan Statistical Areas), districts with higher proportions of Black students and students in poverty have teachers with lesser qualifications (Loeb, 2000).

WHAT DRIVES THE DISPARITIES THAT WE SEE?

What drives the differences that we see in teacher characteristics across schools? They may be driven simply by differences in the preferences of district residents. That is, one district may strive to hire one type of teacher

and another may strive to hire a different type of teacher. Even if both districts are choosing from the same pool of potential teachers, they will end up with teaching staffs that differ systematically. As an example, schools with a high percentage of minority students may benefit from having more teachers with similar racial and ethnic backgrounds. These teachers may have attended lower ranked undergraduate institutions and may have scored lower on teacher exams than other teachers of *similar quality*. If this were the case, then we would see teachers with poorer qualifications as measured by test scores and school ranking in high-percentage-minority schools, even though the teachers in these schools were not of lower quality. However, the high correlation between average teacher measures and the similar trends across measures (including experience and certification status) brings the importance of this sorting mechanism into question. It is difficult to imagine that any district is seeking uncertified teachers with lower test scores, less competitive degrees, less training beyond a bachelor's, and less experience. Moreover, even after adjusting for racial and ethnic differences, schools with large populations of students from poor families are particularly likely to have less-qualified teachers. These differences are unlikely to be due to preferences for high-quality teachers with low measurable attributes.

With our current knowledge, there is every reason to conclude that the differences we observe in teacher qualifications across schools reflect differences, though not perfectly measured, in average teacher quality. The strong correlation among the various teacher measures, combined with the reliability of many of the individual measures such as test scores, strongly suggests that the differences we see in qualifications reflect differences in teacher quality. The limited information on the distribution of teacher quality, as measured by student value-added performance, supports this conclusion.

Districts may differ not in their preferences but in the efficiency of their hiring practices. Inefficiencies in hiring will lead to systematic difference in teachers across districts. Districts with effective hiring practices like aggressive recruiting and spring job offers will obtain higher quality teaching staffs, although they are initially faced with the same pool of potential teachers. Few studies have explored the influence of district hiring practices (see Pflaum & Abramson, 1990 for an example). District inefficiencies in hiring impact the sorting of teachers across districts, though they are less likely to impact the substantial within-district sorting.

Within districts, schools vary in the political power they exert in the district. For example, schools with strong parental input may not accept low-quality teachers. Bridges (1990) found that when parents and students complained about poor teachers, the teachers were likely to be transferred to schools with high student-transfer rates, large numbers of students

receiving free or reduced-price lunches, and large numbers of minority students.

While efficient hiring and district assignment may contribute to the disparities observed in the data, teacher preferences are likely to be particularly influential. Potential teachers prefer one type of district to another, and within districts, they prefer one school to another. In Texas, Hanushek, Kain, and Rivkin (1999) found teachers moving to schools with high-achieving students. In New York City, Lankford (1999) found experienced teachers moving to high-socioeconomic-status (SES) schools when positions became available. Teacher preferences result in the uneven distribution of teaching skills across schools, with low-performing schools and schools with many students in poverty having the greatest difficulty attracting teachers.

The actions of teachers moving away from low-performing schools may reflect preferences for certain types of students or for working conditions that are correlated with student characteristics but are not directly a function of students. That is, teachers may be equally happy to teach high- and low-SES students, or they may be equally happy to teach students who come into schools with high- or low-achievement levels. However, the facilities, supplies and collegial interactions may be so much more appealing in schools with high-SES, high-achieving students that teachers move toward these schools. The poor working conditions in many low-performing schools in combination with limited data available on working conditions confound our ability to assess the factors affecting teachers' decisions. However, it is far from inconceivable that teachers, on average, prefer to teach high-achieving, high-SES students and that these preferences drive the distribution of high-quality teaching across schools.

WHAT ROLE DO WAGES PLAY IN TEACHER SORTING?

Current Wage Effects

Teacher preferences are key to understanding the current distribution of teachers across schools. Both salaries and working conditions influence teachers' assessment of the relative benefits of one job against another.

Teacher salary schedules rarely vary within districts. Thus, teacher wages cannot be playing a large part in either contributing to or alleviating the disparities we see across schools within the same district. Variation in salary does exist among districts within regions. To help assess whether these differences are likely to be contributing to teacher sorting, it is useful to get a sense of their scale. Loeb (2000) found that within New York state, approximately 10% of districts had starting wages lower than \$28,000, while

another 10% had starting wages higher than \$42,000 (1998–99 academic year). Some of these salary differences are likely to reflect differences in alternative job opportunities for teachers across regions. In assessing the attractiveness of teaching jobs, we should look at wages relative to alternative wages. If we look within regions or labor markets, we do not need to worry about differences in the alternative wage. Within regions of New York, the differences in starting salaries between districts at the 90th percentile and those at the 10th-percentile range from \$4,477 to \$9,962. These differences are economically substantial and may be contributing to sorting among districts within a region. Moreover, within these regions, districts with higher proportions of students receiving free or reduced-price lunch tend to pay lower salaries.

Wages vary substantially across regions as well. The Schools and Staffing Surveys suggest that 75% of the variation in starting salaries across metropolitan districts in the United States is among, not within, metropolitan regions (Loeb, 2000). However, since the variation in teacher qualifications is primarily within regions, much of the wage differentials across regions are likely to be reflecting differences in alternative opportunities. In general, metropolitan areas with higher wages for nonteaching female college graduates pay teachers higher wages as well.

Teacher Responses to Salary

There is a large literature suggesting that teachers respond to wages. Studies using the National Longitudinal Study of the High School Class of 1972 (Manski, 1987; Stinebrickner, 2000), High School and Beyond (Hanushek & Pace, 1995), and comparable data from the U.K. (Dolton, 1990; Dolton & Makepeace, 1993) have found that individuals are more likely to choose to teach when starting teacher wages are high relative to wages in other occupations. Other studies have used similar national survey data to assess teacher transfers and quits (Baugh & Stone, 1982; Dolton & van der Klaaw, 1999; Rickman & Parker, 1990; Stinebrickner, 1998, 1999). Baugh and Stone, for example, found that teachers were at least as responsive to wages in their decision to quit teaching as were workers in other occupations. Teachers were more likely to quit when they work in districts with lower wages. Many more papers have employed administrative data to study teacher quits and transfers. Findings by Brewer (1996), Mont and Rees (1996), Murnane, Singer, and Willett (1989), Theobald (1990), and Theobald and Gritz (1996) have underscored the importance of higher teacher wages, especially relative to alternative wage opportunities.

These findings may appear to contradict qualitative studies (such as Berliner, 1987; Feistritz, 1992; Murphy, 1987; Wise, Darling-Hammond, &

Praskac, 1987) which tend to find that ideology and the value individuals place on education for society are important in decisions whether and where to teach. However, because individuals' answers to questions may not reflect their actions, factors less emphasized by respondents, such as wages and job stability, may still be relatively important to teachers.

The research clearly suggests that wages can be influential in attracting college graduates to teaching. However, we cannot conclude that wage increases will increase the quality of teachers in a school. First, while wage increases may increase the number of available teachers, they may not increase the quality of available teachers. If, in the extreme, only low-quality teachers responded to pay raises, then increasing the wage would not increase quality. There is no indication that this is the case. However, there is also little indication that increasing the wage draws higher quality teachers disproportionately (Hanushek & Pace, 1995; Manski, 1987). Wage increases are likely to increase the pool of all teachers. In order to increase teacher quality, districts need to be selective in their hiring. We know little about how effective districts are in their hiring decisions. There is some evidence that many districts do not select teachers well (Ballou, 1996; Ballou & Podgursky, 1995, 1997; Murnane, Singer, Willet, Kemple, & Olsen, 1991).

Assessing the effect of teacher salaries on the quality of teachers a school is able to attract is difficult because wages are not randomly distributed across districts. Some schools pay higher wages to compensate partially for characteristics of the school that teachers do not like. If we did not take this into account, we would see lower-quality teachers at these high-paying schools. Similarly, if districts in labor markets in which teachers can receive higher wages in alternative occupations partially compensated for these better opportunities with higher salaries, we again would see lower quality teachers in higher paying schools.

One way to assess whether wages can be used to attract higher quality teachers is to look at the effects of wages on student outcomes. In a paper looking across states in the United States from 1960 to 1990 and across districts in California from 1975 to 1995, Loeb and Page (2000) found that student educational attainment increased most in states and districts that increased their wages. This adds to the strong evidence that wages can be effective in attracting teachers.

Potential Wage Effects

Large inequities in teaching resources exist among schools. Across-the-board wage increases and even wage increases targeted at particular districts are unlikely to alleviate this inequity substantially. Across-the-board increases may attract more high-quality college graduates into teaching

and may benefit students in the long run, but they are unlikely to affect the distribution of quality across schools. Teachers have preferences, and these preferences create disparities. Teachers appear, on average, to prefer high-performing schools with few children in poverty. In order to attract teachers to other schools, policies need to create incentives that offset these preferences. Targeted wage increases are one such incentive.

While targeted increases are likely to be considerably more efficient than across the board ones, we do not know whether targeted increases are the most efficient means for addressing the differentials. We know very little about the impact of alternative policies. Moreover regulations or policies that force teachers to teach in schools without sufficient compensation are unlikely to be effective. Teachers with superior alternative opportunities will simply quit. Yet there may be feasible alternatives.

Districts, for example, may be able to increase teacher quality through expenditures on facilities or teaching benefits at a lower cost than wage increases. It may be more efficient in attracting and retaining high-quality teachers for a school to spend an additional \$20,000 improving facilities or providing safe and accessible parking, than to increase each of 20 teachers' salaries in the school by \$1,000. While administrative data sets do often have good information on schools and districts, only a small number of studies have examined the effect of school resource allocation on teacher quality or teacher retention. Theobald and Gritz (1996) found that increasing expenditures for supervisory salaries substantially increased the likelihood beginning teachers would transfer to another school district from their first teaching position. They also found that increasing expenditures for teaching materials decreased the likelihood that a male teacher would transfer to another school district from his first teaching position. Theobald (1990) found that extremely large pupil-staff ratios were detrimental to staff retention. Brewer (1996) found that district mean salary of new administrators relative to a teacher's own salary had a negative effect on the probability of quitting the district. These findings underscore the importance of school and district attributes as determinants of teacher quits. Further research into the effects of resource allocations and non-wage school characteristics on teacher choice would help inform effective policy development.

Local school officials may be able to judge the relative benefits of different approaches. Because of this, decentralized decision making may facilitate the efficient use of resources. However, this assumes that the goals of district and school administrators are aligned with the goals of the community. While this may be the case in most districts, it is unlikely to be the case in all districts. The implications of this misalignment may be particularly severe in the lowest performing schools that have the most difficult time attracting teachers.

CONCLUSION

This chapter has discussed differences in teacher quality across schools, the causes of these differences, and their potential impact on student outcomes. The literature provides evidence that schools differ starkly in the average characteristics of their teachers. It also suggests that teachers respond strongly to both pecuniary and nonpecuniary elements of their job. Across districts there are substantial wage differences. Some wage variation compensates for differences in alternative wages, but other variation appears to contribute to district differences in average teacher quality. Salary schedules differ little within districts, yet there is large variation in teacher characteristics among schools within the same district. Current salaries can be neither driving nor alleviating these differences. Variation in teacher quality appears to be driven primarily by teachers' preferences for high-achieving, high-SES students or by working conditions in these students' schools. Targeted salary increases and targeted improvements in working conditions in difficult-to-staff schools are needed to draw high-quality teachers to low-performing schools and to alleviate disparities in the quality of the teaching workforce.

Teacher preferences have created disparities in schools' ability to attract and retain high-quality teachers. Teachers, like most workers, value high salaries. However, they also care about the types of students they teach and the environments in which they work. While schools can all pay the same amount for a textbook or a computer, the same teacher will cost different schools different amounts. If schools with unattractive working conditions wish to hire and retain the same quality teachers as other schools, they will need to improve these conditions or pay higher salaries.

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