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The Mystery of Good Teaching

by DAN GOLDHABER

Who should be recruited to fill the two to three million K–12 teaching positions projected to come open during the next decade? What kinds of knowledge and training should these new recruits have? These are the questions confronting policymakers as a generation of teachers retires at the same time that the so-called baby boom echo is making its way through the education system. Key to answering these questions is knowing how much influence teachers have over student achievement and what specific teacher attributes lead to higher student achievement. For instance, does holding a master's degree make one a better teacher? Do the best teachers hail from elite universities? Did they earn high GPAs in college? Did they major in the subject they are teaching? How much does experience matter? Do traditional, university-based teacher-preparation programs produce the best teachers, or are alternatively certified teachers just as good?



These questions are particularly relevant given that researchers have raised concerns about the overall quality of today's teaching workforce. As measured by standardized test scores (mainly the SAT and the ACT), students choosing to major in education tend to be drawn from the lower end of the ability distribution. In *Who Will Teach?*, Harvard University professor of education Richard Murnane and his colleagues write: "College graduates with high test scores are less likely to take [teaching] jobs, employed teachers with high test scores are less likely to stay, and former teachers with high test scores are less likely to return." On average, according to the findings of University of Massachusetts economist Dale Ballou, the higher the quality of an individual's undergraduate institution, the less likely a student is to choose a teaching career. Moreover, during the past 25 years the share of master's and doctoral degrees in education granted by top-tier public and private research universities has declined dramatically. And of students who graduated from college in 1993 and 1994, data from the Baccalaureate and Beyond survey show that those who entered the public school teaching profession averaged a 923 on the SATs; the average SAT of those entering other professions was about 80 points higher. The results are even more dramatic when one compares the SATs of teachers with those of people entering technical professions, such as engineering.

The demographic shifts of the next decade provide the opportunity to thoroughly remake the teaching profession. This is a significant opportunity, given that the evidence suggests that teacher quality is the most important school factor in

explaining differences in student performance. The difficulty from a policy perspective is that the relationship between readily quantifiable attributes—such as a teacher’s highest degree attained or level of experience—and student outcomes is tenuous at best. In other words, good teachers certainly make a difference, but it’s unclear what makes for a good teacher.

Overall Impact

Research dating back to the 1966 release of *Equality of Educational Opportunity* (the “Coleman Report”) shows that student performance is only weakly related to school quality. The report concluded that students’ socioeconomic background was a far more influential factor. However, among the various influences that schools and policymakers can control, teacher quality was found to account for a larger portion of the variation in student test scores than all other characteristics of a school, excluding the composition of the student body (so-called peer effects).

Much of the research published since the Coleman Report has confirmed the finding that high-quality teachers raise student performance—indeed, it appears that the most important thing a school can do is to provide its students with good teachers. The Coleman Report’s finding was based on the influence of a set of quantifiable teacher characteristics, such as years of experience, education levels, and performance on a vocabulary test. Since then, due in large part to the availability of new data sources that link and track teachers and students over a number of years, researchers have been able to estimate the *overall* contribution of teachers to student learning. This includes not only the effect of easily measurable attributes, such as experience and degrees obtained, but also the effect of harder to measure intangible attributes, such as a teacher’s enthusiasm and skill in conveying knowledge.

Tennessee is one of the few states with data systems in place that track teachers over time and link them to their students’ achievement scores. Researchers who have studied the Tennessee data, mainly former University of Tennessee professor William Sanders and his colleagues, found that the effectiveness of teachers has more of an influence on student achievement than any other schooling factor. They also found a wide range of effectiveness among teachers; there are some very good teachers, some very bad teachers, and a wide range of performance between them. Using the “Sanders methodology,” teachers are placed into effectiveness quintiles based on their students’ growth in achievement, or the “value added” by the teachers. Those teachers who fall into the first quintile, the least effective teachers, were found to elicit average student gains of roughly 14 percentile points a year. The most effective teachers elicited an average gain of 52 percentile points a year. The effects of teacher quality were also found to persist for years after a student had a particular teacher.

More recently, researchers have sought to isolate teachers’ contribution to student performance and assess how much of their overall contribution can be associated with measurable teacher characteristics, such as experience and degree level. Economists Eric Hanushek, John Kain, and Steven Rivkin estimated that, at a minimum, variations in teacher quality account for 7.5 percent of the total variation in student achievement—a much larger share than any other school characteristic.

This estimate is similar to what my colleagues and I found: that 8.5 percent of the variation in student achievement is due to teacher characteristics. We found that the vast majority (about 60 percent) of the differences in student test scores are explained by individual and family background characteristics. All the influences of a school, including school-, teacher-, and class-level variables, both measurable and immeasurable, were found to account for approximately 21 percent of the variation

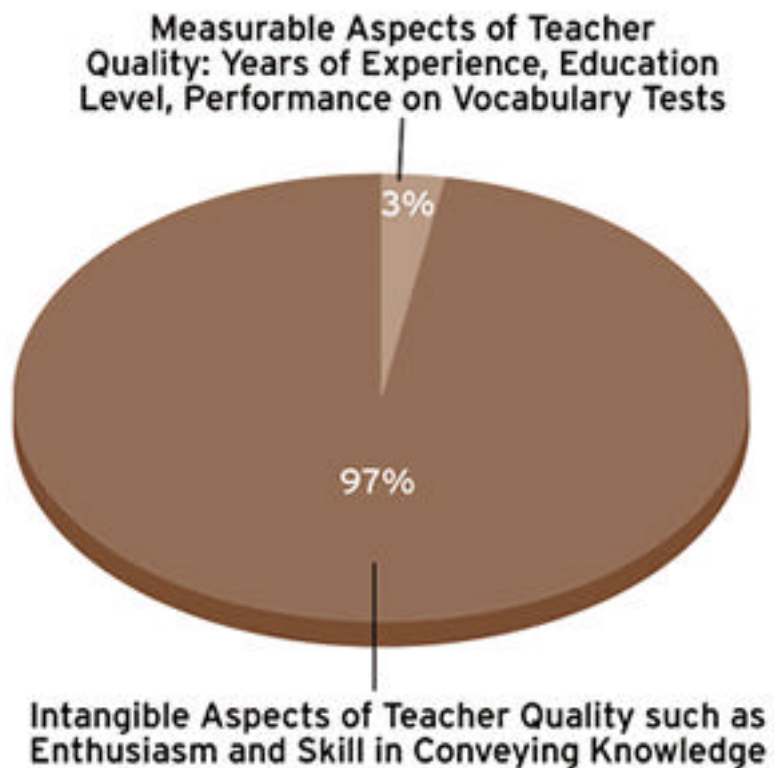
in student achievement. This 21 percent is composed mainly of characteristics that were not directly quantified in the analyses. Since we used statistical models that included many observable school-, teacher-, and class-level variables—such as school and class size, teachers’ levels of education and experience, and schools’ demographic makeup—it is clear that the things that make schools and teachers effective defy easy measurement.

Only about 3 percent of the contribution teachers made to student learning was associated with teacher experience, degree attained, and other readily observable characteristics. The remaining 97 percent of their contribution was associated with qualities or behaviors that could not be isolated and identified (see [Figure 1](#)).

Elusive Qualities (Figure 1)

The teacher characteristics that we can measure—experience, education level, certification status, and so on—only explain 3 percent of the differences in student achievement that are attributable to their teachers’ influence.

% of Teachers’ Influence Attributable to Various Characteristics



SOURCE: Dan Goldhaber et al., 1999

Which Attributes?

What does the empirical evidence have to say about specific characteristics of

teachers and their relationship to student achievement? First it is important to note that studies focus on different grade levels, subjects, and types of students taught, and in some cases the estimated effects of particular attributes are not consistent across the board. Furthermore, studies vary considerably in quality. Experiments, which provide the most credible results, are rare in education, and relatively few studies that address students' outcomes observe the professional norm of having detailed controls for students' background characteristics (including previous academic achievement). That said, here is a broad overview of the findings for various teacher attributes.

Teacher degree and experience levels : Teachers' education (degree) and experience levels are probably the most widely studied teacher attributes, both because they are easy to measure and because they are, in the vast majority of school systems, the sole determinants of teachers' salaries. However, there appears to be only weak evidence that these characteristics consistently and positively influence student learning.

In a 1986 literature review (and in follow-up reviews in 1989 and 1997) that has framed much of the debate, Hoover Institution senior fellow Eric Hanushek showed that only a small proportion of studies find these teacher characteristics to be statistically significant in the expected direction.

Not all studies reach the same conclusion. In a 1996 meta-analysis published in the *Review of Educational Research*, Rob Greenwald and his colleagues concluded that "school resources are systematically related to student achievement and that these relations are large enough to be educationally important" and "resource variables that attempt to describe the quality of teachers (teacher ability, teacher education, and teacher experience) show very strong relations with student achievement."

It's true in both sets of reviews that many more studies found statistically significant positive effects for teacher experience than found statistically significant negative effects, but the statistically significant positive findings were found in only about 30 percent of the studies. There are also statistical shortcomings in many of the studies cited by both Hanushek and Greenwald et al.

Part of the explanation for the mixed findings may be that experience and degree level matter only in certain circumstances. For example, there is little evidence that experience beyond the first couple of years in the classroom makes one a better teacher. And teacher experience implicitly captures the effects of the prevalent graduation requirements and labor market conditions at the time when teachers were hired. Furthermore, as I describe below, the effect of degrees appears to hinge on the subjects that are taught and whether the degrees are specific to those subjects.

Subject-matter knowledge : The evidence is somewhat mixed, but it suggests that teachers' knowledge of their subject matter, as measured by degrees, courses, and certification in that area, is associated with high performance. Studies with more detailed measures of teachers' education levels and coursework in subject areas found that, at least in math and science, academic preparation does positively influence student achievement. Having an advanced degree in subjects outside of math and science, however, does not appear to affect student achievement. Taking additional courses in one's subject has some effect, but it depends on the level of the courses a teacher is teaching. Perhaps not surprisingly, in a 1994 study David Monk and Jessica King Rice found that the teaching of higher-level courses seems to require greater knowledge of subject matter than does the teaching of lower-level courses.

Teachers' pedagogical knowledge : The value of teaching teachers how to teach, or pedagogy, is more hotly debated. Since there is little research directly assessing the influence of pedagogical training on student outcomes, this debate tends to focus on the impact of teachers' performance on licensure exams and the merits of licensing teachers. A 1986 study found that the average National Teacher Exam scores of all the teachers in a school district have a strong positive correlation with the average performance of students on standardized tests. It is not clear, however, whether this reflects the influence of subject-matter knowledge or pedagogical training, since the National Teacher Exam tests both. A number of studies have found that fully certified teachers influence student achievement positively. For instance, a 1985 review by Carolyn Evertson, Willis Hawley, and Marilyn Zlotnik found that 11 of 13 studies judged regularly certified teachers to be more effective than those who held a provisional or emergency certificate. But only four of these studies were based on students' outcomes and most of them were more than 25 years old, which means they predated the "value added" methodology of assessing educational effects that is now standard practice. More recently, Stanford professor of education Linda Darling-Hammond analyzed state-level data and concluded, "The most consistent highly significant predictor of student achievement in reading and mathematics in each year tested is the proportion of well-qualified teachers in a state: those with full certification and a major in the field they teach." This study, however, potentially suffers from a statistical problem known as aggregation bias. There are many factors that influence achievement at the state level, many of which cannot be identified and controlled for, and it therefore may be inappropriate to conclude that the test-score results are linked to the proportion of teachers with specific characteristics in a state.

Dominic Brewer and I analyzed teacher certification and its relationship to student achievement at the level of individual teachers and found that teachers with standard certification outperform those who are not certified in their field, but they do not appear to be more effective than those who hold emergency credentials (teachers who have not satisfied all of the requirements necessary to obtain a standard certificate). One reason why findings are inconsistent is the lack of a standard system of licensure; each state has a unique set of requirements for individuals who wish to enter the teaching profession, and some states' requirements may be more rigorous than others.

What is to be concluded about the effect of a teacher's level of education and certification status? As Carolyn Evertson and her colleagues write, "Investigations of teacher education do not represent a strong body of research." Most of the studies that find statistically significant relationships between teacher training and student achievement find that the effects of these characteristics are small and specific to certain contexts. If a large, consistent association between teacher training and student achievement existed, it probably would not be all that hard to detect.

Other teacher attributes : Recent studies suggest that measures of teachers' academic skills, such as SAT or ACT scores, tests of verbal ability, or the selectivity of the colleges they attended, may predict their effectiveness more accurately than the characteristics discussed above. However, here too the evidence and the estimated relationships are relatively weak. Greenwald et al.'s 1996 meta-analysis found that teachers' academic skills were shown to have a positive relationship to student achievement in 50 percent of the studies they analyzed, a much higher proportion than for teacher education or experience. Studies by Ronald Ferguson and Helen Ladd found positive relationships between aggregate teacher scores on the ACT, literacy examinations, or states' licensure examinations and aggregate student performance on standardized tests. However, the fact that these studies were done at the aggregate (school or school district) level casts some doubt on them. It's unclear

whether higher-scoring teachers lead to higher-scoring students or whether affluent districts, which tend to have higher-achieving students, also tend to hire teachers with higher scores.

In a 1994 study, Ronald Ehrenberg and Dominic Brewer found that students score higher on standardized exams if their teachers attended more selective undergraduate institutions. In a separate study, Ehrenberg and Brewer reexamined the Coleman data and found a significant positive association between teachers' verbal ability and student outcomes. As Hanushek wrote in 1989, "Perhaps the closest thing to a consistent conclusion across studies is the finding that teachers who perform well on verbal ability tests do better in the classroom."

Little Guidance

Good teaching is clearly important to raising student achievement. In fact, most research suggests that the benefit of improving the quality of the nation's teaching workforce is far greater than other policy interventions, such as lowering class size.

However, while we know that good teaching is important, it's far less clear what makes for a good teacher. The measures of teacher quality that are used by most public school systems to screen candidates and determine compensation—certification, experience, and education level—have been well researched, but there is little definitive empirical evidence that these characteristics, defined in general terms, are associated with higher student achievement. Teachers' educational levels appear to make a difference when the education is related to the subject taught, but advanced degrees do not appear to serve as a good measure of quality in general. There is also some evidence that experienced teachers are more effective with students, but the benefits of additional years of experience appear to level off early in a teacher's career. Measures of teachers' academic skills, such as their verbal ability, may more accurately predict their effectiveness, but there is far less evidence on this issue, and these findings are also not conclusive. There is little evidence on the issue of teacher certification as well, and the evidence that does exist is mixed.

What does the empirical evidence imply for policymaking? First, the importance of teacher quality cannot be overstated. Teachers can have a profound effect on students, and school systems make a significant long-term investment when they hire teachers. Unlike other education investments, such as class size, which may be easily altered from year to year, the tenure system implies that the employment of an individual teacher is near permanent. For these reasons, the selection of teachers is of paramount importance. I would argue that this function of school systems receives too little attention at the local level.

Second, the lack of clear evidence on the effectiveness of teacher certification suggests that policymakers should continue experiments, such as Teach for America, that allow individuals to enter the teaching profession through alternative routes. To the degree that superintendents, principals, and hiring committees accurately identify top-notch candidates through these alternative routes, such programs may serve as an important supply of future teachers. Alternative-route programs should be studied to determine the extent to which state-level restrictions on entry into the market are justified.

Finally, the compensation structure used by virtually all school districts is not well aligned to promote the acquisition of skills found to influence student outcomes. For instance, data from the National Center for Education Statistics show that salary schedules provide pay premiums of about 11 percent for master's degrees and 17

percent for a doctorate. Generally, these premiums are received regardless of whether degrees are specific to the subjects in which teachers teach, despite the evidence that out-of-field degrees contribute little toward student achievement. The compensation structure also does not provide policymakers with tools to address areas of shortage, to reward job performance or the acquisition of skills deemed to be important, or to compensate for the difficulty of a teaching assignment. Do alternatives to the compensation structure currently in place in public schools work? Unfortunately, there is very little evidence to answer this question. However, given the concern about the quality of the existing teacher workforce, experimenting with alternative pay structures may be worthwhile.

—Dan Goldhaber is a senior research associate at the Urban Institute in Washington, D.C.

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