

D. Measurement

How well do measures of teachers' knowledge and skills predict student achievement outcomes?

Part of the justification for creating new systems of teacher compensation is to reward teachers who are most effective at increasing student learning, rather than those with the most years of experience and the highest degrees earned, since research suggests that these teacher attributes link only weakly to student performance. While advancements in value-added measurement have lent legitimacy to the practice of rewarding teachers on student achievement gains, the fact that no single measure of performance is a perfect indicator of teacher effectiveness makes the inclusion of other measures of teacher quality important. As diversified compensation programs become increasingly popular—including knowledge and skills-based compensation—the important question becomes which kinds of teacher knowledge and skills contribute most to student learning gains and should be rewarded.

One research focus has been the connection between teacher academic ability (as measured by teachers' own test scores) and student achievement (see Berry, Daughtrey, & Wieder 2010; Rice, 2003; Wayne & Youngs, 2003). Podgursky and colleagues' (2002) review of the research literature reveals that a number of studies find positive statistical relationships between student learning gains and teachers'

scores on the ACT (Ferguson & Ladd, 1996), tests of teachers' verbal skills (Ehrenberg & Brewer, 1994; Ferguson, 1991; Hanushek, 1971), and tests of teachers' general academic ability (Greenwald, Hedges, & Laine, 1996). Studies examining the relationship between teacher scores on a licensure test, the National Teacher Examination (NTE), and student outcomes show mixed results. Summers and Wolfe (1977) found a small negative and statistically significant relationship, while Strauss and Sawyer (1986) found a modest and statistically significant positive relationship. Sheehan and Marcus (1978) also found a positive significant relationship between teachers' NTE scores and student achievement test scores, but no effect when teacher race was a control variable (see Mitchell, Robinson, Plake, & Knowles, 2001). Other researchers find that the selectivity of the college that teachers attended (often considered a proxy for teachers' academic ability), is associated with measures of student achievement (Clotfelter, Ladd, & Vigdor, 2007; Ehrenberg & Brewer, 1994; Summers & Wolf, 1977; Winkler, 1975).

Another research focus has been the relationship between teacher subject matter expertise and student achievement. Monk's (1994) analysis of high school data from the Longitudinal Study of

American Youth, for example, revealed that the more college-level courses that teachers had taken in mathematics or science (or math or science pedagogy), the better their students did on math and science assessments. Teacher experience and educational attainment, on the other hand, were unrelated to student achievement. Goldhaber and Brewer (1996) found similar results, using another large-scale database, the National Educational Longitudinal Study of 1988. The only teacher input that they examined that pertained significantly to student mathematics achievement was whether the teacher's major was mathematics. Goldhaber (2007) found little or no relationship between scores on the PRAXIS II content test and student achievement, but a small positive relationship between scores on the curriculum test (measuring pedagogical knowledge) and student achievement. Interestingly, a more recent study of the effectiveness of programs that prepare teachers for New York City schools found that more teacher coursework in mathematics improved the outcomes of students of second-year teachers, but not first-year teachers (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2008). The researchers found a similar association in English language arts. They concluded that,

“taken with the findings on the actual work of teachers, these estimates suggest that inexperienced teachers may make use of their preparation sequentially. Teachers with stronger preparation in day-to-day issues are relatively more effective in their first year, while those with stronger content knowledge are able to make use of that knowledge by their second year.”

In 2009, the Gates Foundation launched the Measures of Effective Teaching Project, an initiative that tests new approaches to measuring effective teaching. One of the five measures included in the study is a test of teachers' pedagogical content knowledge. The Educational Testing Service in collaboration with the University of Michigan's Learning Mathematics for Teaching Project developed a new assessment specifically for this purpose. The new test focuses on “specialized knowledge that teachers use to interpret student responses, choose instructional strategies, detect and address student errors, select models to illustrate particular instructional objectives, and understand the special instructional challenges faced by English language learners” (Gates Foundation, 2010). The results of this study will be published in 2011. If this test proves to be a reliable measure of teacher performance, it may pave the way for using teacher assessments as an evaluation tool.

A popular measure of gauging teacher skills and knowledge has been certification from the National Board for Professional Teaching Standards (NBPTS). Thus far, research has been mixed as to whether National Board-certified teachers produce greater student achievement gains than others. Cavalluzzo (2004), for example, found that National Board certification was an effective signal of teacher quality in 9th- and 10th-grade mathematics. Goldhaber and Anthony (2007) found that National Board-certified teachers were generally more effective than teachers who had never applied to the program, but results differed significantly by grade level and by student subgroups. Contrary to some of these earlier studies, Harris and Sass (2009) found only a few isolated cases in which National Board certification was an accurate

gauge of a teacher's contribution to student achievement. A recent summary of research on National Board certification by the National Research Council (2008) concluded that students of National Board-certified teachers did make higher gains in achievement compared to teachers who did not apply or who applied but were not certified.

Overall, there is evidence that teachers' general intelligence, verbal skills, and subject matter expertise do affect student achievement. However, the measures typically used as proxies for skill when determining teacher pay—years of teaching experience and degrees earned—are not particularly good predictors of student achievement. The research on degrees suggests little relationship with student achievement, and the research on teacher experience suggests that the effect peaks after about three to five years. Moreover, the research on advanced-level teacher qualification measures and student achievement has been inconclusive. Additional research in this area would help policymakers decide how best to apportion resources and design incentives to reward teacher productivity.

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