

Teacher Testing, Teacher Education, and Teacher Characteristics

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School officials and legislators have long been concerned with the possibility of declining teacher quality (see e.g., Sean Corcoran et al., 2002). Beginning in the 1960's, states began testing prospective teachers in a direct effort to ensure that teachers meet minimum standards for basic skills and subject knowledge. By 1999, 41 states required applicants to pass some sort of standardized certification test. As a theoretical matter, however, the impact of such testing is ambiguous. Test requirements may establish a minimum achievement standard, as their proponents hope. On the other hand, testing and other certification requirements may deter some qualified applicants from teaching if these requirements are perceived as costly. This is the barriers-to-entry story first noted in the occupational licensing context by Milton F. Friedman and Simon Kuznets (1945). Another concern with job applicant testing is the possibility of an adverse impact on minority candidates, who usually do worse on tests (see David Autor and David Scarborough [2003] for a recent study).

Paralleling increased state involvement in teacher certification is the increase in teachers' educational credentials, especially in public schools. For example, in 1971, over two-thirds of public-school teachers had a B.A., while only 27 percent had a master's or education specialist's degree. By 1991, however, over half of public school teachers (52.6 percent) had a master's or education specialist's degree. In contrast, the proportion of private-school teachers

with advanced degrees remained much lower, at around 33 percent in 1993.¹ This is perhaps not surprising since private-school teachers are less experienced and less likely to be state-certified. Still, the trend is clearly one of increasing education for public-school teachers.

A controversial aspect of increasing teacher education is the fact that few teachers specialize in an academic subject; rather, their major field is typically education itself.² The value of an education major is often disputed (see e.g., Dale Ballou, 1996). Teacher education is related to teacher testing because, as with law schools and the bar exam, a central mission of teacher education programs at both the graduate and undergraduate level has become the preparation of students for state certification and tests.

This paper takes a brief look at the consequences of teacher testing for teacher quality, teacher education, and teacher characteristics. We begin with a theoretical discussion of the effect of testing on teacher quality, followed by a description of the widely used Praxis II exam, a test published by the educational testing service (ETS).³ This test appears to be a weak

¹ These are mostly master's degrees. Statistics are from the *Digest of Education Statistics 1995*, tables 66 and 68, archived at <http://nces.ed.gov/programs/digest/d95/>.

² Statistics are for 1999–2000 and from *The Condition of Education 2002*, indicator 32, archived at <http://nces.ed.gov/programs/coe/2002/section4/indicator32.asp>. The proportion of teachers with graduate degrees studying an academic subject was 7 percent among public-school teachers and 17 percent among private-school teachers.

³ Since 1998, the ETS National Teachers Examination widely used to certify education school graduates for work as teachers has been known as the Praxis II and is part of a series that includes Praxis I, also known as the Pre-Professional Skills test (PPST) which is used to screen applicants for teacher education programs, and a series of classroom performance assessments known as Praxis III. Many states (e.g., Minnesota as of September 2001) require both Praxis I and Praxis II. Sample Praxis content is available at <http://www.ets.org/praxis/download.html>. The Praxis examinations consist of dozens of subtests. Each state selects its own credentialing requirements. Some states, such as California, require a combination of Praxis

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screen that modestly favors students who attended teacher education programs as opposed to other academic programs. We then turn to a brief reduced-form state-year panel analysis of the effect of state certification requirements on teachers' educational background by type and quality of undergraduate school. Finally, we look at the relationship between testing and teacher demographic characteristics. Although tests do not improve the quality of teachers' educational background as measured by average SAT scores, they do appear to have a mild adverse effect on Hispanic applicants.

I. Background and Theoretical Framework

Most studies of the economic consequences of occupational licensing look at the medical and dental professions (see Morris M. Kleiner [2000] for a survey and Adriana Kugler and Robert Sauer [2003] for a recent example). One of the few previous attempts to estimate the effect of teacher licensing is Kleiner and Daniel L. Petree (1988). Their results show no clear relationship between licensing and pupil achievement or teacher pay. D. Goldhaber and D. Brewer (2000) link student achievement with state teacher licensing and testing requirements using cross-sectional variation only. Robert P. Strauss and Elizabeth A. Sawyer (1986) also present a cross-sectional analysis. Consistent with the entry-barriers story, Erik A. Hanushek and Richard A. Pace (1995) find that state requirements for courses and tests significantly lower the probability that prospective teachers complete training, again using cross-state variation.

A large theoretical literature considers the impact of worker-screening mechanisms on wages and job assignments (see e.g., Hayne E. Leland, 1979). We use basic elements of the J. Luis Guasch and Andrew Weiss (1981) setup to discuss the theoretical impact of testing on teacher quality. Suppose prospective teachers can work in one of two occupations, teaching and nonteaching. The potential wage for nonteachers is individual-specific, denoted w_i . Teachers earn a fixed wage, w , perhaps set by

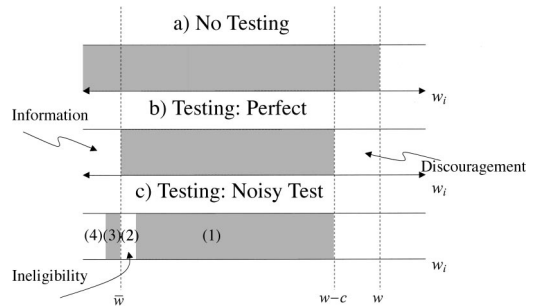


FIGURE 1. THE TEACHER-QUALITY DISTRIBUTION UNDER ALTERNATIVE TESTING REGIMES

collective bargaining. We also assume that w_i measures teachers' latent productivity or ability in teaching, though in practice, of course, ability is likely to be less than perfectly correlated across occupations. States impose a test requirement in the hopes of selecting high-ability teachers. Workers must pay a cost c to take the test.

In the absence of a test requirement, all workers with $w_i < w$ choose to teach. This is illustrated by the shaded area in the top panel of Figure 1. Suppose initially that testing accurately selects applicants with $w_i \geq \bar{w}$. That is, the test screens out low-ability applicants perfectly. This screening can be said to be a positive *information effect*. But because testing is costly, applicants will choose to teach only if $w_i < w - c$. The average ability of teachers is therefore $E[w_i | w - c > w_i \geq \bar{w}]$, which may be above or below the average ability of teachers hired without testing, $E[w_i | w_i < w]$. This *discouragement effect* is illustrated in panel b of the figure. For example, if w_i is uniformly distributed, teacher quality goes up or down according to whether the quality threshold, \bar{w} , is greater or less than the costs of testing, c , since $E[w_i | w - c > w_i \geq \bar{w}] = w/2 + (\bar{w} - c)/2$ in this case. More generally, the more costly the test, the lower is the average ability of teachers hired with testing. The figure also shows that testing discourages the highest-ability applicants from teaching since it is these applicants who will be on the margin.

Now suppose that the test measures ability imperfectly. Specifically, assume applicants pass the test if $w_i + \eta_i > \bar{w}$, where η_i is mean-zero random assessment error uncorrelated with w_i . Applicants can now be classified

tests and locally developed tests; others, such as Massachusetts, rely on a locally developed exam only.

into groups as follows, also labeled on the figure:

- (1) $w_i > \bar{w}$ and $w_i + \eta_i > \bar{w}$ (pass)
- (2) $w_i > \bar{w}$ and $w_i + \eta_i < \bar{w}$ (fail)
- (3) $w_i < \bar{w}$ and $w_i + \eta_i > \bar{w}$ (pass)
- (4) $w_i < \bar{w}$ and $w_i + \eta_i < \bar{w}$ (fail).

Schools wish to hire the applicants in groups (1) and (2), but are only legally allowed to hire applicants in groups (1) and (3). Since the average ability of applicants in group (3) is less than that in group (2), noise in testing reduces the average ability of teachers hired. This can be said to be an *ineligibility effect* since some qualified applicants are nevertheless ineligible for hire.

A more institutional interpretation of the ineligibility effect is the following. Schools observe w_i but pay a fixed wage w to all teachers, possibly the result of collective bargaining. Since applicants with $w_i < w$ can earn more from teaching than in alternative occupations, and because the union does not allow schools to lower the wage, there is a queue of applicants from which schools can choose. Schools rank teachers by w_i and hire down this list until all slots are filled. When schools cannot fill all positions with applicants from group (1), they would like to turn to group (2). But these applicants are ineligible because they fail the test. Thus, schools are forced to hire from group (3), thereby lowering the average ability of teachers hired.

II. Teacher Tests and Teacher Education

The ETS Praxis II includes a battery of basic-skills and subject tests. Most states that test teachers for licensure use at least some Praxis components. Drew Gitomer et al. (1999) matched the scores of all Praxis-takers in 1994–1997 with their SAT scores where available. The statistics discussed in the first two tables in this section are derived from their report, which

TABLE 1—CHARACTERISTICS OF PRAXIS II TEST-TAKERS AND COMPARISON GROUPS

Group	All		Females	
	Math	Verbal	Math	Verbal
Comparison groups				
All college-bound seniors	511	505	494	503
Intended education majors	479	485	—	—
All college graduates	542	543	—	—
Praxis II Takers (pass rate)				
All applicants (87)	498	511	471	509
Applicants who pass (100)	507	522	500	521
Applicants with C+ GPA (81)	473	479	—	—

Notes: The bottom panel shows the average SAT scores of applicants who took the Praxis II test between 1994 and 1997. The top panel of the table shows average SAT scores of selected comparison groups. Women comprise 75 percent of Praxis II test-takers.

Source: Tables 5–7 in Gitomer et al. (1999) and the College Board web site.

also reports SAT (and ACT) scores for some non-Praxis comparison groups.⁴ Among college-bound seniors, those intending to study education have lower scores. This well-known fact is reproduced in the top half of Table 1. For example, the average math score of intended education majors is 479, while the average score for college bound seniors is 511 and for college graduates 542.

The bottom half of Table 1, for Praxis-takers only, reports SAT scores in different applicant groups, and the corresponding pass rates. Praxis-takers are roughly comparable to other college-bound seniors, and applicants who passed had SAT scores higher than those who failed. On the other hand, most applicants passed (87 percent), high in comparison with pass rates on bar exams. Even among those with a C+ grade point average (GPA), 81 percent passed the Praxis. Thus, while grade point average is highly correlated with SAT scores (compare an SAT verbal score of 479 for the C+ group with the unconditional verbal average of 511), grades are not highly correlated

⁴ In work in progress, we are analyzing the Praxis/SAT matched micro data.

TABLE 2—PASS RATES AND SAT SCORES BY TYPE OF INSTITUTION OR PROGRAM

Institution or program type	All		Females	
	Math	Verbal	Math	Verbal
Education program (pass rates)				
Current/former (90)	497	510	506	520
Never attended (74)	502	513	520	535
NCATE-accredited (pass rates)				
Yes (97)	496	508	503	517
No (83)	500	513	512	528

Notes: The top panel of the table shows the SAT scores and pass rates for Praxis II test-takers, separately for those who graduated from or currently attend a teacher education program, and for those who never have. The bottom panel shows the same outcomes for those who attended an NCATE-accredited education program and for those who attended a nonaccredited program. Fourteen percent of Praxis applicants and 12 percent of passers have never attended a teacher education program; 47 percent of Praxis applicants and 44 percent of passers attended a non-NCATE institution.

Source: Tables 9 and 10 in Gitomer et al. (1999).

with Praxis pass rates. This suggests that Praxis is not screening for the sort of academic qualifications measured by grades.

How does an applicant's prospect on the Praxis test vary with his or her college background, in particular, whether the applicant attended a teacher education program? Table 2 shows that applicants who never attended a teacher-education program had somewhat higher SAT scores than those with a teacher-education background (the difference is slight for men, but more marked for women). On the other hand, those with a teacher-education background were much more likely to pass the Praxis. This suggests that teacher-education programs successfully prepare relatively weak students for the test, though it may also reflect differential selection of some sort. A similar pattern is observed when applicants are compared according to whether they attended a National Council for the Accreditation of Teacher Education (NCATE)-accredited teacher-education program. This is consistent with NCATE's stated goal of ensuring that teachers who graduate from NCATE-accredited schools are better prepared for initial licensing and

TABLE 3—ESTIMATED EFFECT OF TEST REQUIREMENTS ON TEACHERS' EDUCATIONAL BACKGROUND

Variable	Inexperienced teachers		First-year teachers	
	Mean (i)	Coefficient (ii)	Mean (iii)	Coefficient (iv)
Undergraduate education degree	0.600	-0.019 (0.016)	0.569	0.027 (0.026)
Graduate education degree	0.079	0.012 (0.012)	0.062	-0.028 (0.014)
Education degree, any level	0.646	-0.008 (0.017)	0.611	-0.005 (0.029)
Master's degree or higher	0.109	0.019 (0.015)	0.100	-0.021 (0.015)
Research university or liberal-arts college	0.221	-0.011 (0.026)	0.243	-0.006 (0.021)
Average SAT at undergraduate school	906.6	-6.42 (6.57)	910.6	1.44 (3.72)

Notes: Each entry of columns (ii) and (iv) reports the estimated effect of a state required test for teacher licensure. Regressions control for state and year fixed effects as well as a quadratic in the state unemployment rate, district enrollment, and city, suburb and rural dummies. Regressions are run at the district level. In the left column, teacher characteristics are aggregated to the district level for teachers with less than four years of experience. In the right column, teacher characteristics are aggregated to the district level for first-year teachers only. Sample sizes differ across columns. College characteristics variables do not include data for 1991. Standard error estimates (reported in parentheses) correct for state-by-year correlation in the error term.

advanced board certification (see NCATE, 1997).⁵

Given the apparent advantage applicants with a teacher-education or accredited background have on the Praxis exam, it seems worth asking whether state certification requirements appear to have had an effect on the type of training teachers receive. We explore this question in Table 3, which reports the coefficient on a dummy indicating states with a test requirement

⁵ The National Council for Accreditation of Teacher Education is a group made of representatives from schools and departments of education, teachers' unions, and professional associations (see <http://www.ncate.org/ncate/conslist.htm>). A statement of goals appears online at http://www.ncate.org/ncate/fact_sheet.htm.

in a regression using district-level data from the Schools and Staffing Surveys (SASS) for 1987–1988, 1990–1991, 1993–1994, and 1999–2000. The regression includes an “any test” dummy (subject or basic), state and year effects, as well as a quadratic in the state unemployment rate, district enrollment, and city, suburb and rural dummies. The table also reports dependent-variable means, and the analysis is reported separately for samples of inexperienced (less than four years) and new (first-year) teachers.⁶

The introduction of a state test requirement does not appear to increase the likelihood that teachers have a teacher-education background, either at the undergraduate or graduate level. There is also no relation between test requirements and the prevalence of teachers with master’s degrees. On the other hand, there is no evidence that state imposition of a testing requirement increases the quality of teachers’ educational background, as measured by whether teachers attended a research university or a liberal-arts college (as opposed to, say, a junior college). There is also no evidence that testing increases the average SAT score of a teacher’s undergraduate institution. The effect of testing on SAT scores is negative, though not significantly different from zero.

III. Teacher Tests and Teacher Characteristics

Another measure that we might expect to be affected by testing is the likelihood teachers teach in their academic subject area (our measure here is based on undergraduate major, and defined for English, math, and science teachers only). Table 4, which reports results for teacher characteristics using models similar to those used to construct the estimates in Table 3, shows no relationship between state test re-

TABLE 4—ESTIMATED EFFECT OF TEST REQUIREMENTS ON TEACHERS’ CHARACTERISTICS

Characteristic	Inexperienced teachers		First-year teachers	
	Mean (i)	Coefficient (ii)	Mean (iii)	Coefficient (iv)
Majored in subject	0.352	0.005 (0.032)	0.343	-0.009 (0.052)
Alternative certification	0.328	-0.019 (0.024)	0.412	-0.041 (0.040)
Fraction black	0.026	-0.003 (0.007)	0.034	0.006 (0.009)
Fraction Hispanic	0.035	-0.010 (0.005)	0.044	-0.021 (0.009)

Notes: Each entry of columns (ii) and (iv) reports the estimated effect of a state required test for teacher licensure using models similar to Table 3. In the left column, teacher characteristics are aggregated to the district level for teachers with less than four years of experience. In the right column, teacher characteristics are aggregated to the district level for first-year teachers only. Sample sizes differ across columns. Standard error estimates (reported in parentheses) correct for state-by-year correlation in the error term.

quirements and whether teachers majored in their teaching subject. We also looked at whether the introduction of tests is associated with the increased use of “alternative certification,” which might effectively circumvent the tests. The estimates in the second row of Table 4 show little evidence of a connection between the use of tests and alternative certification.

The bottom two rows present evidence on the relationship between the proportion of black and Hispanic teachers and testing requirements. This relationship is of interest because black and Hispanic applicants are less likely to pass the Praxis II and perhaps other teacher tests as well. For example, Gitomer et al. (1999) report a pass rate of 91 percent for whites, in contrast with 69 percent for blacks and only 59 percent for Hispanics, the ethnic group with the highest Praxis failure rate. Consistent with the low pass rate for Hispanics, there is a statistically significant negative effect of state testing on the proportion of new and inexperienced teachers who are Hispanic. For example, the estimates for first-year teachers show a negative effect of 2.1 percent, almost half the proportion Hispanic. On the other hand, the proportion of teachers who are black appears unrelated to testing requirements.

⁶ The SASS collects data from samples of teachers, districts, and schools. Ours is a district-level analysis, with teacher characteristics averaged up to the district level using teacher weights, and district-level observations weighted by district weights. This leads to a subtle difference in weighting that accounts for differences between descriptive statistics reported in our table and those in NCES reports. The proportion of districts in states requiring a test increased from 54 percent to 82 percent over our sample period. A state requirement is associated with about a 50-percentage-point increase in the likelihood a district requires a test. See our working paper for details (Angrist and Guryan, 2003).

IV. Concluding Comments

Recent years have seen an acceleration in the use of standardized tests to certify teachers. Proponents hope these measures will increase quality, but economists have long been skeptical of entry barriers that may shift supply and discourage otherwise qualified applicants. Tests interact with the American system of teacher education since many teacher-education programs focus on getting students certified. Although students of accredited and other teacher-education programs do better on the widely used Praxis test, our estimates show no impact of testing on the type or affiliation of teachers' undergraduate program or school. This is perhaps desirable if teacher-education programs are seen as insufficiently rigorous. On the other hand, there is also no evidence that testing hurdles have raised the quality of new and inexperienced teachers, at least as measured by undergraduate background. The lack of an effect on quality is of special concern in light of the fact that tests appear to reduce Hispanic representation in teaching.

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