Program on Education Policy and Governance Working Papers Series

Do Schools Districts Get What They Pay For? Predicting Teacher Effectiveness by College Selectivity, Experience, Etc.

Matthew Chingos
Harvard University

Paul E. Peterson
Harvard University

PEPG 10-08

Prepared for the PEPG Conference
Merit Pay: Will It Work? Is It Politically Viable?

Harvard Kennedy School
Cambridge, Massachusetts
June 3-4, 2010

Do School Districts Get what they Pay for?

Predicting Teacher Effectiveness by College Selectivity, Experience, Etc.

by

Matthew M. Chingos

Postdoctoral Fellow, Program on Education Policy and Governance

and

Paul E. Peterson

Henry Lee Shattuck Professor of Government

Director, Program on Education Policy and Governance

Paper prepared for the Conference on

Merit Pay: Will it Work? Is it Politically Viable?

sponsored by

Harvard's Program on Education Policy and Governance

Taubman Center on State and Local Government

Harvard's Kennedy School

June 3-4, 2010

Draft: May 25, 2010

Do School Districts Get what they Pay for?

Predicting Teacher Effectiveness by College Selectivity, Experience, Etc.

Matthew M. Chingos and Paul E. Peterson

Abstract

Holding a college major in education is not correlated with effectiveness in elementary and middle school classrooms, regardless of the university at which the major was earned. Teachers do become more effective with a few years of teaching experience, but (except in elementary reading) no gains—and some declines—in effectiveness appear in the second decade after a teacher has begun teaching. These and other results are obtained from estimations using value-added models that control for student characteristics as well as school and (where appropriate teacher) fixed effects that estimate teacher effectiveness in reading and math for Florida students in 4th through 8th grades for six school years, 2001-02 through 2006-07. The findings suggest that teacher selection and compensation policies are in need of revision.

It is standard practice in most states to certify teachers only after they have taken a sequence of university courses in education roughly equivalent to earning a college major in the subject.[1] Most teachers earn their certification or license by taking such courses prior to entering the teaching force, but in some states, including Florida, teachers may also earn an "alternative" certificate by taking these university courses in the first few years of their teaching career. Some states, including Florida, also require that teachers pass an examination before they can receive their teaching license. Once they are hired, teachers are generally compensated according to a salary schedule based on the number of years they have been a teacher within the school district and whether or not they have a master's or doctoral degree.

The design of the salary schedule for Dade County, Florida, displayed in Table 1, is typical of the practice in most districts, though exact amounts vary by district and year.[2] In

[1] Support for this research was received from the William Simon Foundation and the Searle Freedom Trust. The data were generously provided by the Florida Department of Education. We are grateful to staff members Tammy Duncan and Jeff Sellers for their assistance in this regard as well as to Antonio Wendland for administrative assistance and to Ashley Inman for research support.

[2]The salary schedule is re-negotiated periodically each year with teacher union representatives, who typically win additional increments to the entire schedule each year.

Dade, teachers who hold a bachelor's degree and have one year of experience earn $250 more than a beginning teacher, and those with two years experience earn $500 more. After three years of experience, salary jumps by $1,000, and over the next nine years, additional increments of about $300 are awarded annually. At 13 years, however, salary leaps by over $4,000, and at fifteen years, the increment is up again by $3,000. Other sizeable shifts upward come later, the most spectacular being the nearly $10,000 salary increase that comes in the 21st year of experience. By that time, a teacher with a B.A. degree is earning 77 percent more than a beginning teacher with the same credentials and no less than 62 percent more than a teacher with ten years of experience.[3] The compensation differences are undoubtedly larger if one were also to include the present value of the teacher's pension (Costrell and Podgursky 2008).

In Florida, teachers may receive an additional 10 percent of the average salary in the state annually if they are certified by the National Board for Professional Teaching Standards (National Board), though that amount may be less if the state budget is constrained. (In 2009, they received $3,800.)

The procedures for recruiting and compensating teachers are based on a number of explicit and implicit assumptions. Licensing is required because it is thought teachers are more effective if they have command of a body of pedagogical knowledge before entering the classroom. Those who hold advanced degrees—or are certified by the National Board—are given additional compensation for expertise that is expected to make them more productive employees. Salaries increase with additional years on the job on the assumption that teachers

[3] In Orange County (Orlando), Florida, teacher salaries increase by $250 each in the first two years, but by $4,003 as a teacher's experience increases 23 to 24 years, the last step on the salary schedule. The returns to experience in North Carolina are similar (Vigdor 2008).

acquire skills with on-the-job experience. A teacher with two decades of service is assumed to be of much greater value than a teacher with just one decade in the classroom.

In recent years evidence has begun to accumulate that cast strong doubt on many of these assumptions. Although there is some evidence to support policies that rely upon state subject matter examinations and National Board certification, additional compensation for advanced degrees is not supported by scholarly research that has estimated their value for classroom effectiveness. Nor is there much justification for providing additional increases in salary for additional years of experience beyond the first few years. Even the acquisition of a teaching certificate is not correlated with more effective teaching. This last finding is incomplete, however, because most studies simply identify whether a teacher has been certified or has completed an education major in college. Few, if any, have looked at training at specific universities, even though a particular institution may have developed a highly effective method for preparing teachers.

We fill that void by looking at the effectiveness of specific training programs at universities in Florida that vary in many ways, including the selectivity of their admissions policies. We also report new evidence with respect to many other policies that currently shape contemporary teacher recruitment and retention practice. Our research findings, together with those from other recent studies, indicate that current policies prevailing in Florida—and most other states—are poorly designed to recruit and retain a high-quality teaching force.

Compelling evidence on the relationship between training at particular universities and classroom effectiveness is scarce, in large part because it is difficult to obtain data sets that contain information on both teachers' classroom performance and the universities they had attended. We were able to surmount this challenge by drawing upon information from the

Florida Department of Education's K-20 Education Data Warehouse (EDW). In general, we find that the selectivity of the Florida university attended by teachers offers little information about their future classroom effectiveness. We also find little correlation between teacher effectiveness and the specific university from which a teacher graduated.

Prior Research

The growing body of research on the correlates of teacher effectiveness is contributing to the formation of a scholarly consensus that may come to guide future policies shaping teacher recruitment and compensation policy. But current policies are so widely wide practiced and deeply entrenched that it will take many replications of existing studies before those in responsible positions can be expected to take major steps in new directions. In this section we discuss the extent of the scholarly consensus, giving special attention to what is known about the effectiveness of specific teaching preparation programs.

Pre-Service Teacher Preparation

Nearly every state requires teachers to have earned both a bachelor's degree and taken a certain number of courses in the field of education in order to receive a teaching license from the state. The practice has become so pervasive that the 2002 federal law, No Child Left Behind, required that by 2006 all teachers in schools that received compensatory education funding be "highly qualified," defined as "a bachelor's degree as well as a state teaching license and demonstrated competence in the academic subject(s) he or she teaches" (Murnane and Steele 2007, p. 24). The number of required courses for certification is usually around 30 courses in the subject matter and for the specific grade (elementary, middle, or high school) being taught, about the same number that is required for a college major in the subject. School districts, in emergency situations, are able to hire temporary teachers without certification, and in some

states teachers may be hired provided they begin a set of courses leading toward what is known as alternative certification (Nadler and Peterson 2009; Hess et al. 2004).

Prior econometric research has generally failed to detect positive impacts of pre-service teacher preparation programs on student learning. In their review of the literature, Murnane and Steele (2007, p. 24) concluded that "in general, empirical studies find little or no difference in average effectiveness between those teachers who are traditionally licensed and those who enter the profession through alternative routes." In recent studies of high quality, Clotfelter et al. (2006) found no benefits from certification in North Carolina and Kane et al. (2006) found no differences in the effectiveness of certified, non-certified, TFA, or teachers recruited through a special New York City initiative.[4]

In Florida alternative training programs have been developed for teachers (Llaudet 2006, pp. 38-39; Moe 2006), and the state's department of education (2009) found that teachers who received their training in such programs were no less effective than traditionally certified teachers. However, the methodology employed in this study makes a number of highly restrictive assumptions. In another Florida study, using data similar to ours but for an earlier time period, Harris and Sass (2008) report no correlations between majoring in education and classroom effectiveness. They do find that math training may be associated with effectiveness

[4] Even if a teacher is licensed, he or she may be teaching out-of-field, despite a NCLB requirement that teachers, to be qualified, must be certified for the particular subject and grade level in which they are teaching. Approximately 10 percent of teachers are thought to be teaching outside the field for which they have a license (Podgursky 2006), and in some subjects, the percentage runs substantially higher. Ingersoll (1999) reports that "53 percent of history teachers, and 33 percent of secondary math teachers lacked degrees in the subjects they were teaching" (Murnane and Steele 2007). Out-of-subject teaching may be due to the very specific terms of many certificates, however; in Missouri, for example, there are 260 different teaching certificates and endorsements (Podgursky 2006, p. 28). The evidence on the impact of instruction by out-of-subject instructors remains scanty. A study of 12 school districts in Louisiana found negative impacts on student performance of a teacher's lack of training within the field they were teaching (Noell et al. 2008).

in teaching high school math, but they caution the reader to interpret these results cautiously because of the sample size limitations they faced (Harris and Sass 2008, p. 55).

One reason certification is not associated with teacher effectiveness may be that teacher preparation programs vary in quality. If one could identify each degree program separately, one might find some to be effective and others to be ineffective.

University Selectivity

It has been generally assumed that graduates from selective institutions of higher education are superior teachers. Unless "teaching requires a very idiosyncratic set of schools," Ballou and Podgursky (1997, p. 10) have argued, it is likely that students from selective colleges outperform others, inasmuch as studies of employees in other occupations "have found a positive relationship between earnings and the quality of the college attended." Hoxby and Lehigh (2004) make a similar assumption when they conclude that the quality of the teaching force has declined after showing a drop in the proportion of women teachers graduating from selective colleges. In 1990, Teach for America (TFA), a non-profit organization, began recruiting teachers from the pool of graduates of highly selective colleges, apparently on the assumption that those talented enough to win admission to Ivy League or other selective colleges will be more effective teachers—or that education at such colleges provides better preparation for teaching.

Early studies provided some support for these claims, as a number found positive correlations between quality of university attended and teacher effectiveness (Summers and Wolfe 1977; Ehrenberg and Brewer 1994). However, Kane et al.'s (2006) study of New York teachers found little differences between teachers recruited from highly selective colleges by TFA and other teachers. However, those recruited by TFA were not certified, so the comparison

is not definitive. Clotfelter et al.'s (2006, 2007a) North Carolina studies found no relationship between college selectivity and teacher effectiveness in elementary and middle schools. However, Clotfelter et al. (2007b) did find a significantly positive relationship between college selectivity and the effectiveness of high school teachers. The State of Florida (2009) found inconsistent college impacts on effectiveness, but its estimate of teacher effectiveness has important limitations. No other study has attempted to estimate the impact of specific university degree programs.

Teacher Examinations

In recent years a number of states began to ask teachers to pass an examination before they can be granted a license to teach. Such policies are supported by early studies that identified a correlation between verbal ability and teacher effectiveness (Hanushek 1971; Ferguson and Ladd 1996). A more recent review of the literature by Hanushek and Rivkin (2003, Table 2) identified positive effects of tests on performance that were statistically significant in only 2 of 9 estimations. Specifically, Harris and Sass (2008) found no correlation between SAT performance and classroom effectiveness in Florida. Clotfelter et al. (2006), however, did find a correlation (albeit a very weak one) between licensure test performance and classroom effectiveness in North Carolina.

National Board Certification

The National Board, established in response to a 1986 Carnegie report, has gradually established itself as a small but vibrant private, non-profit certifying agency. Many states provide additional compensation to those teachers who receive Board certification. To become certified, applicants must take appropriate tests, display lesson plans and other evidence of their teaching methods, and provide videos of their classroom instruction. Roughly half the applicants

receive certification. As of December 2009, 82,000 teachers nationwide had received National Board certification; about five percent of the teachers in our sample had National Board certification.

In a study of Board-certified teachers in North Carolina, Ladd et al. (2007) found the correlation between certification and performance in that state to be quite substantial, but in Florida they found only a small correlation in reading and an insignificant relationship in math for students in grades four and five during the years 2001 to 2004. (All school years are identified in this paper by the year in which the school year ended.)

Master's Degree

Seventeen states require that school districts augment the salaries of teachers who hold a master's degree. Elsewhere, many school districts bind themselves to provide such increments in collective bargaining agreements with local teacher unions. The amounts involved are often substantial. For example, in 2010 a fifth-year Dade County, Florida teacher with a master's degree earned eight percent more than an equally experienced colleague with a bachelor's degree (Table 1). In response to such monetary incentives, almost half of elementary and secondary public-school teachers have acquired a master's degree or better (Murnane et al. 1991, p. 117; U.S. Department of Education 2009, table 68). However, little or no impact of an advanced degree on student learning has been detected (Clotfelter et al. 2006; Hanushek 1986; Harris and Sass 2008; Rivkin et al. 2005; Goldhaber 2002; Coleman et al. 1966).

Teacher Experience

It is conventionally believed that teachers improve with experience. Early estimates of the effects of experience may be upwardly biased because they do not account for attrition from the teaching force by less effective teachers. But more sophisticated studies that incorporate

teacher fixed effects into their analysis have shown smaller effects (Clotfelter et al. 2006; Harris and Sass 2008).

In sum, the research literature offers little support for many of the policies currently in place, including the state licensing of teachers, additional compensation for advanced training, or steep increases in compensation for experience beyond the first few years. However, they do suggest some benefits from certification examinations and holding a National Board certificate.

Data

Our extract from Florida's Education Data Warehouse (EDW) contains observations of every student in Florida who took the state assessments from the school years 1999 to 2007, with each student linked to his or her courses (and corresponding teachers) for 2002 through 2007. Test scores include results from both the Florida Comprehensive Assessment Test (FCAT), which is the state accountability system's "high-stakes" test, and the Stanford Achievement Test, which is a nationally norm-referenced test that is administered to students together with the FCAT. Beginning in 2001, students in grades 3 through 10 took both tests each year in math and reading. Thus annual gain scores can be calculated for most students in grades 4 through 10 beginning in 2002. The data also contain information on the demographic and educational characteristics of each student, including gender, race/ethnicity, free or reduced-price lunch eligibility, limited English proficiency status, special education status, days in attendance, and age.

The EDW data also contain detailed information on individual teachers, including their demographic characteristics, experience, and the Florida college from which they received their degree and their major field of study. No information on college attended is available for teachers who earned their degree in another state or for teachers who earned their degree in

Florida prior to 1995. Tables 2A and 2B show that the subset of teachers for whom we have college attended are younger (and thus less experienced) than the full sample of all teachers, as we would expect. However, their other characteristics are largely similar to the full sample of teachers, and both groups teach similar student populations.

We constructed a file based on course enrollment data (that matches students and teachers) in order to identify the students for which any given teacher was responsible in a particular year.[5] The teacher experience variable we construct reflects all years the teacher has spent in the profession, including both public and private schools in both Florida and other states.

Florida's EDW has made available information on the college from which teachers received their bachelor's degrees, provided that degree was earned from a Florida state college or university between 1995 and 2007. Twenty-one percent of the teachers included in our analysis graduated from one of the eleven Florida public universities listed in Table 3. As that table shows, the universities differ from one another in the degree of selectivity of their admissions policies as well as in many other characteristics.

The selectivity of colleges and universities in Florida is based upon the rankings given by *U. S. News and World Report's* ranking of institutions of higher education (2009). In our analysis, the eleven public institutions of higher education within the state are divided into three categories: very selective (*U. S. News's* "tier one"), selective (*U. S. News's* "tier 3"), and less-

[5] For fourth- and fifth-grade students, the course files do not always clearly identify the student's regular classroom teacher. In order to match the maximum number of students to their teachers, we examined students' general (e.g., self-contained classroom), math, and reading teachers and matched them to the one or two teachers with whom they spent at least 40 percent of their academic (general, math, and reading) time. We then dropped students who were matched to two teachers and students who were not matched to any teachers. A large and increasing number of fourth- and fifth-grade students in Florida appear to have more than one regular classroom teacher, perhaps reflecting an increase in team teaching. We match sixth- through eighth-grade students to their primary reading and math teachers in a similar fashion. For each subject, we linked each student to the teacher(s) with whom they spent at least 40 percent of their time in that subject and dropped students who were matched to two teachers in a given subject.

selective (*U. S. News's* "tier 4" and "non-competitive"). Peterson's Guide to Colleges and University's (2009) says that "entrance difficulty" into the three schools *U. S. News* identifies as "tier one" schools is "very difficult," while it says that entering the other colleges and universities is only "moderately difficult" and denotes St. Petersburg College as "non-competitive."

The selectivity of the university is correlated with a variety of other university characteristics. As can also be seen in Table 3, very selective and selective universities typically admit students with higher SAT scores and grade point averages than do less selective colleges and universities. For the most part, they ask in-state students to pay higher tuition. The size of the teacher preparation programs varies substantially—from as few as 92 students in 2009 at Florida A&M to 1,002 at the University of Central Florida. The percentage minority is similar, except an historically black school, Florida A&M, has a comparatively large African American student body, and Florida International University has a comparatively large Hispanic student body.

In short, higher educational institutions in Florida vary in many measurable respects. Given the range of variation, one may hypothesize that some colleges and universities are more successful in turning out graduates who will be more effective teachers.

Methodological Approach

To estimate a teacher's effectiveness, we estimate the gain or value-added in student performance over the previous year for those students who were in that teacher's classroom that year, controlling for a wide range of student characteristics as well as for school fixed effects. Such value-added estimations are said, by some, to be biased by the fact that students and teachers are not randomly assigned to classrooms. The more able students are assigned to

teachers perceived to be effective (perhaps as the result of pressure by well-informed parents). As a result, teachers appear to be adding value even though they are simply working with students inclined to learn on their own. Low-performing children are disproportionately likely to be asked to study under less effective teachers (Rothstein, forthcoming).

The critique is not implausible, but the value-added models have survived a variety of validity tests. Most importantly, their estimations of teacher effectiveness have been shown to resemble the estimations obtained from experiments in which students and teachers have both been randomly assigned to classrooms (Nye et al. 2004; Kane and Staiger 2008). Other external validity checks strengthen the case for the validity of the value-added approach. Harris and Sass (2007) find a correlation between principal evaluations of teacher effectiveness and those generated by value-added models. In another validity test, Chingos and West (2010) correlate the effectiveness of teachers with their earnings after they left the profession.

It is worth mentioning, however, that value-added models appear to have the greatest validity when the estimations control for a variety of student background and classroom characteristics while also controlling for school fixed effects so that all comparisons of teacher effectiveness compare the teacher with others at the same school. For this reason, the preferred models presented in this paper include both school fixed effects and multiple controls for student and classroom characteristics. Student-level controls include prior-year test scores (in both subjects, along with squared and cubed terms), gender, race/ethnicity, free and reduced lunch, English Language Learners, special education, migrant, non-structural move, structural move, days absent previous year, and whether repeating the grade. Classroom-level controls include the previous variables aggregated to the classroom level (with the exception that prior-year test scores are replaced with percent proficient on the FCAT in reading and math in the prior year)

and class size. Teachers in classes in which 25 percent or more of the students were in special education were excluded from the analysis.[6]

The model, then, is

$$A_{ist} = \alpha_1 Selective_t + \alpha_2 VerySelective_t + \omega A_{i,t-1}, + \beta X_{it} + \gamma C_{ist} + \delta_s + \pi_{it} + \epsilon_{ist},$$

where A_{it} is the test score of student *i* in school *s* in year *t* (standardized by grade and year to have a mean of zero and standard deviation of one); $Selective_t$ and $VerySelective_t$ are dummy variable indicating whether the teacher attended a selective of very selective university (as compared to a less selective university); $A_{i,t-1}$ includes the student's prior-year test scores in both subjects (and their squared and cubed terms); *X* and *C* are student- and classroom-level characteristics; δ_s is a vector of school fixed effects; π_{it} is a vector of grade-by-year fixed effects, and ϵ_{ist} is a standard zero-mean error term adjusted for clustering at the teacher level. We estimate this equation separately by for reading and math performance for students in grades four and five, which are referred to as elementary grades, as well as for students in sixth through eighth grades, which are referred to as middle school, as most Florida students attend such schools at these grade levels. We also estimate versions of this equation that include teacher characteristics, such as experience, college major, race/ethnicity, and gender.

Our estimates of the relationship between classroom effectiveness and various teacher characteristics should not be interpreted as causal, as teachers choose their college major, the university they attend, and whether or not they wish to seek National Board certification. In the absence of random assignment to these conditions, we know only whether the characteristic is associated with classroom effectiveness, not whether any association is causal. For example, although the correlation between National Board certification and effectiveness shown below

[6] We obtain qualitatively similar results when we include classes with a large share of special education students.

likely indicates the true difference in the effectiveness of board-certified vs. non-board-certified teachers, it does not indicate whether better teachers sought board certification or the certification process itself induced higher performance.[7]

Results

Our results are reported in standard deviations. In interpreting the size of the effects reported in the tables, it is worth bearing in mind that the effectiveness in math and reading of the elementary grade teachers included in our sample has a standard deviation of 0.11 and 0.05 student-level standard deviations, respectively. In other words, students taking a class from a teacher whose effectiveness is one standard deviation above the average teacher will learn 0.11 standard deviations more in math and 0.05 standard deviations more in reading. Among middle school teachers, the standard deviation of effectiveness is smaller—0.08 and 0.03 standard deviations for the two subjects, respectively, perhaps because no one teacher in these grades has as sustained a relationship with the students in middle school as in elementary school.[8]

Table 4 shows the relationship between teacher effectiveness and many of the teacher characteristics previously examined in the literature. Our results are broadly consistent with this literature. We find no difference in the classroom effectiveness of those with an education major and those with a major in another subject (which in the absence of a master's degree means the person is not certified or has alternative certification). We do find that teachers who are certified in education, but outside the field of elementary education, are less effective as teachers of students in the elementary grades, but that finding should be interpreted cautiously as only four

[7] We do interpret our value added estimates of teacher impacts on student performance as causal, however, even though our data is observational, not experimental, because, as discussed above, our value added models have been validated by experimental estimations.

[8] The standard deviation of teacher effectiveness is calculated using the method described in Chingos and West (2010).

percent of the teachers at those grade levels had an education degree other than one in elementary education.[9]

We also find a fairly strong positive relationship between certification exam performance and classroom effectiveness (except for the math performance of elementary students). But the policy significance of that finding is diminished considerably when one considers that only two percent of all the teachers in our sample found a way to fail the test one or more times. Certification by the National Board is correlated with achievement in elementary school math (but not in reading) and for both subjects in middle school. So, contrary to Ladd et al.'s (2007) findings for Florida, our findings lend some support for the policy of giving extra compensation given to Florida teachers who pass the National Board examination.[10]

Our results are consistent with the conventional wisdom that advanced degrees—both masters' degrees and doctoral degrees—do not make for better teachers.[11]

Table 4 shows a positive relationship between student achievement and the number or years of service a teacher has provided. However these effects attenuate noticeably when bias introduced by the higher attrition rate of less effective teachers is eliminated by taking teacher

[9] For teachers of sixth- to eighth-grade students, we find a slight negative impact on reading performance of having a middle-school education major (relative to teachers with a degree in English education), and a slight positive impact of having an elementary school major (relative to those having a math education major) on math performance, but the effects are too modest and too inconsistently observed to be taken as a guide to policy.

[10] Ladd et al. (2007) find significant correlations between National Board certification in North Carolina. Why their Florida results do not yield the same results as ours for elementary math teachers is unclear, because our data sets overlap, though not perfectly. It may be that the National Board procedures have improved with time. Or it may be that estimations are sensitive to model differences when the percentage of teachers having National Board certification is only six percent of the total. In any case, our findings should be interpreted cautiously.

[11] We do find a statistically significant relationship between holding a master's degree and middle school gains in reading achievement, but the correlation is so small (.004 standard deviations) as to be substantively meaningless, especially given the fact that all other estimations are statistically insignificant.

fixed effects into account (Figures 1a and 1b).[12] Figure 1a shows that in elementary school reading there may be student achievement returns to as many as 20 years of additional teacher experience, but in elementary school math, those returns from teacher experience disappear within the first ten years. For middle school teachers, there is little evidence of returns to experience beyond the first ten years, and experience beyond 20 years is negatively correlated with effectiveness.

University Selectivity

The correlation between the selectivity of the university from which teachers received their degree and average gains in achievement in math and reading during the year students were in their classrooms is statistically insignificant, except in one instance where the relationship is the opposite sign from what one would expect. Table 4 shows that fourth- and fifth-grade students performed 0.018 standard deviations less well on the math examination if they had a teacher from a selective college rather than a less selective one. That accounts for nearly 20 percent of a standard deviation in teacher effectiveness in elementary math instruction, a non-trivial finding, but the coefficient is the only one that is significant out of eight estimated in Table 4, raising questions as to whether it occurred by chance, especially since the relationship seems perverse.

The model presented in Table 4 may be inappropriate for estimating the relationship between university selectivity and teacher effectiveness, however. For one thing, it may suffer from omitted variable bias in that it does not include controls for teacher race/ethnicity and gender, which could be correlated with university selectivity and effectiveness in the classroom.

[12] In some models, the effects of teacher experience vary depending on the selectivity of the university a student attended, with those from more selective universities showing a greater capacity to learn from experience. However, we draw no conclusions from these results because they are not robust to alternative specifications of university selectivity.

We exclude teacher race/ethnicity and gender from Table 4 in order to focus solely on qualifications, but it may be desirable to control for these characteristics when estimating the effects of university selectivity.

At the same time, a number of the variables presented in Table 4 may not be appropriately included in models estimating the connections between university selectivity and effectiveness on the grounds that they themselves may also be consequences of the higher education experience a student has had. Passage of the certification examination, the pursuit of a master's or doctoral degree, and National Board certification could all be a function of the college one attended. To include them in the selectivity model may alter the estimated relationship between selectivity and effectiveness.

To ascertain whether results are sensitive to the specific model that is estimated, five models are presented in Tables 5A and 5B.[13] Model 1, the naïve model, reports the simple relationship between selectivity and effectiveness with no controls for any teacher, student or school characteristics whatsoever (except for grade-by-year fixed effects). As can be seen in the column 1 of these two tables, administrators who rely on a naïve model would conclude that they are recruiting better teachers if they obtain them from more selective institutions of higher education. All coefficients in the naïve model are statistically significant and some are very large, as much as 0.12 standard deviations.

In column 2, however, one finds estimations that control for student and classroom characteristics and school fixed effects. Once these controls are introduced, the size of the coefficients dwindles to insignificant levels, with many of the signs becoming negative, one of

[13] These models are also estimated only based on teachers for whom data on college attended are available, whereas Table 4 included all teachers and controlled for a dummy variable identifying those for whom data on college attended were not available.

which is significant (as discussed above). The prospective teacher coming from a well-regarded university appears to have first chance at preferred teaching positions; their apparent accomplishments appear to be due more to the situation in which they find themselves than the training they have received.

If all the other characteristics of a teacher are in some way influenced by the university a teacher attended, the models presented in columns 2 of these tables are the preferred models, as they do not includes any of the teacher characteristics presented in Table 4. In column 3, that strong assumption is relaxed somewhat by also including indicators of a teacher's years of experience. In column 4, results are presented from a model that controls for the teacher's college major—whether or not they are an education major as well as the other distinctions presented in Table 4. And in column 5 estimations include controls for teacher race/ethnicity and gender. Across all these models, the results remain essentially the same as those reported in the models whose results are reported in the second column. In almost all cases, estimations not only show no significant effects but the coefficients are also precisely estimated. Only one significant effect is observed, and it runs contrary to the selectivity hypothesis. One can thus rule out with a good degree of confidence any positive relationship between attendance at a selective Florida university and student performance on the FCAT.

Individual University Programs

Lumping together Florida's eleven different universities into three clusters based on the institution's selectivity may obscure a more specific connection between university training and classroom effectiveness. To explore this possibility, the relationships between teacher effectiveness and training at 11 specific universities in Florida is estimated. Results for both reading and math are reported in Table 6A for students in elementary grades and in Table 6B for

students in the middle school grades. Estimations from the five models discussed previously are reported, and indicate the average difference in effectiveness between the listed university and the University of Florida. Note that, if one were to rely strictly on the naïve model presented in column 1, which does not take into account student characteristics and school fixed effects, one would conclude that students learn more from teachers who had attended Florida's flagship university, the University of Florida, the most selective of all public institutions of higher education in the state. Thirty-five out of 40 coefficients in the four columns headed by the label (1) in Tables 6A and 6B are negative, and 20 of those 35 are statistically significant. But just as the Yankees appear to have the best management team in baseball if one ignores the money available to bid for talent, so the University of Florida appears to be providing the best teacher education in the state of Florida, if one ignores the context in which teachers subsequently find themselves.

But when adjustments are made for student characteristics and school fixed effects, as is done in the results from the models presented in columns headed by (2) in these same tables, the picture changes dramatically. All statistically significant relationships vanish, and the number of coefficients that show lower effectiveness at other universities drops to 17, less than half of the 40 estimations. We are unable to reject the null hypothesis that all of the coefficients are equal to zero, with p-values of this F test in the 0.13–0.93 range. In other words, once student and school characteristics are taken into account, the University of Florida advantage disappears.

Nor does it regain a decisive edge when the other three models are estimated, as presented in columns headed 3, 4, and 5. True, teachers from Florida A&M appears to be less effective in middle school math than teachers from the University of Florida unless controls for teacher race and gender are introduced. But no other relationship passes the significance test.

Because the numbers of observations are smaller when the effects of individual institutions are estimated, results are not as precisely estimated as when grouping institutions by their degree of selectivity. Yet the pattern of results is so consistent across models and across institutions that one can be quite confident that no institution of higher education in Florida produces teachers that systematically secure higher levels of student achievement on the FCAT.

Still, it is possible that some teachers are excellent instructors in ways not captured by FCAT, the state accountability test which holds schools accountable. If some teachers are "teaching to the test" in ways counter-productive to learning math and reading more generally then our results could be misleading. To check to see whether results change when a norm referenced test not used for accountability purposes is used to measure teacher effectiveness, we estimated effects using model 5 on the Stanford Achievement Test, which is also administered to all Florida students in these grades. The results are reported in Table 7. As one can see, no consistent pattern of statistically significant relationships emerges, except for the fact that Florida Atlantic University appears to have a more effective teacher preparation program for elementary school and middle school reading teachers than Florida's flagship university (or else it recruits more students who will become effective teachers). This finding is the one reasonably consistent finding to emerge as to the possible effectiveness of a particular university, but it hardly gives comfort to those who prize attendance at a selective university, as Florida Atlantic is one of the state's less selective institutions. (The statistically significant negative coefficient in middle-school reading for St. Petersburg College should not be interpreted one way or the other, especially since the null hypothesis of no university effects in middle-school reading cannot be rejected.)

Admittedly, these results do not isolate the effectiveness of a university's teacher preparation programs, in part because they include students who did not receive a major in education (though models 4 and 5 do control for that). To check the possibility that differences among universities might appear if teachers with education majors are isolated, we show in Table 8 the results from model 5 for only those graduates who had a degree in education. Once again, almost all relationships are statistically insignificant. Some programs appear to be relatively weak at turning out students in particular subjects for specific grade levels—Florida Gulf Coast University and Florida International University in math instruction of those in the older grades, or the University of West Florida in reading instruction for these same grades. But whenever 40 relationships are estimated, two will appear to be statistically significant at the five percent level by chance alone, so we cannot rule out that these findings could have occurred by chance, especially since the findings are isolated to a specific subject in a particular set of grades.

Interpretations and Conclusions

Current teacher recruitment and retention policies are based on the theory that it is easier to train good teachers than to identify them once they have entered the teaching force. Districts are expected to recruit teachers who hold a state teaching license or to ask them to obtain such a license within a short time after beginning teaching. Districts typically reward teachers with additional compensation if they obtained an advanced degree. They compensate teachers for training that occurs on-the-job with each additional year of service, especially after teachers have been in service for ten years. If the practice in Dade County is an indicator of a more general practice, the second decade of experience is rewarded more substantially than the first decade.

Yet our research—and most other recent research—suggests that it is easier to identify good teachers than to train them. Certified teachers are no more effective than uncertified ones,

regardless of the public university in Florida the teacher attended. Teachers are not more effective, if they hold a master's degree or even a doctorate. Nor do teachers learn much from more than a few years of on-the-job training that comes with each year of teaching experience. Indeed, teachers appear to become less effective, especially in math instruction, after 10 years in the classroom. A revisit of the design of teacher recruitment and compensation policies seems to be in order, given what is currently know about the factors associated—and not associated—with effective teaching.

References

Ballou, Dale and Michael Podgursky. 1997. *Teacher Pay and Teacher Quality*. Kalamazoo, Michigan: W. E. Upjohn Institute for Employment Research.

Coleman, James, et al. 1966. *Equality of Educational Opportunity*. Washington, D. C.: Government Printing Office.

Clotfelter, Charles T, Helen F. Ladd, and Jacob L. Vigdor. 2006. "Teacher-Student Matching and the Assessment of Teacher Effectiveness." Cambridge MA: National Bureau of Economic Research. Working Paper No. 11936.

Clotfelter, Charles T., Helen F. Ladd and Jacob L. Vigdor. 2007a. "How and Why Do Teacher Credetnials Matter for Student Achievement?" Working Paper No. 2. Washington, D. C.: CALDER.

Clotfelter, Charles T., Helen F. Ladd and Jacob L. Vigdor. 2007b. "Teacher Credentials and Student Achievement in High School: A Cross-Subject Analysis with Student Fixed Effects." Working Paper No. 11. Washington, D. C.: CALDER.

Costrell, Robert and Michael Podgursky. 2008. "Peaks, Cliffs, and Valleys: The Peculiar Incentives of Teacher Pensions." *Education Next* 8(1): 22-28.

Ferguson, Ronald F. and Helen F. Ladd. 1996. "How and Why Money Matters: An Analysis of Alabama Schools." In Holding Schools Accountable: Performance-Based Education Reform, edited by Helen F. Ladd (Brookings), 265-98.

Ehrenberg, Ronald G. and Dominic J. Brewer. 1994. "Do School and Teacher Characteristics Matter? Evidence from high School and Beyond." *Economics of Education Review* 13(1): 1-17.

Goldhaber, Dan. 2002. "The Mystery of Good Teaching." *Education Next* 2 (Spring): 50-55.

Hanushek, Eric. 1971. "Teacher Characteristics and Gains in Student Achievement: Estimation Using Micro Data." *American Economic Review* 61(2): 208-88.

Hanushek, Eric. 1986. "The Economics of Schooling." *Journal of Economic Literature* 24(3): 1141-1177.

Hanushek, Eric A. and Steven G. Rivkin. 2003. "How to Improve the Supply of High Quality Teachers." Paper prepared for the Brookings Papers on Education Policy. Washington, D. C.

Harris, Douglas N. and Tim R. Sass, "Teacher Training, Teacher Quality and Student Achievement." Department of Economics, Florida State University, 2008

Harris, Douglas N. and Tim R. Sass, "What Makes for a Good Teacher and Who Can Tell?" Department of Economics, Florida State University, 2007.

Hess, Frederick M., Andrew J. Rotherham, and Kate Walsh. 2004. *A Qualified Teacher in Every Classroom: Appraising Old Answers and New Ideas*. Cambridge, Mass: Harvard Education Press.

Hoxby, Caroline M. and Andrew Leigh. 2004. "Pulled Away or Pushed Out? Explaining the Decline of Teacher Aptitude in the United States." *American Economic Review* 94(2): 236-240.

Ingersoll, Richard M. 1999. "The Problem of Underqualified Teachers in American Secondary Schools." *Educational Researcher*, 28(2): 26-37.

Kane, Thomas J., Jonah E. Rockoff, and Douglas O. Stagier. 2006. "What Does Certification Tell Us About Teacher Effectiveness? Evidence from New York City." NBER Working Paper No. 12155. Cambridge, Mass.: National Bureau for Economic Research.

Kane, Thomas J. and Douglas O. Staiger. 2008. "Estimating Teacher Impacts on Student Achievement: An Experimental Evaluation." NBER Working Paper No. 14607. Cambridge, Mass: National Bureau for Economic Research.

Ladd, Helen F., Tim R. Sass, and Douglas N. Harris, "The Impact of National Board Certified Teachrs on Student Achievement in Florida and North Carolina." Evidence prepared for the National Academies Committee on the Evaluation of the Impact of Teacher Certification by the National Board for Professional Teaching Standards, 2007.

Llaudet, Elena. 2006. "Eight Years of Reform." In Paul E. Peterson, ed. *Reforming Education in Florida*. Hoover Institution Press, pp. 25-48.

Moe, Terry, 2006. "Quality Teachers." In Paul E. Peterson, ed. *Reforming Education in Florida*. Hoover Institution Press, pp. 135-148.

Murnane, Richard J., Judith D. Singer, John B. Willett, James J. Kemple, and Randall J. Olsen. 1991. *Who Will Teach? Policies that Matter*. Harvard University Press.

Murnane, Richard J. and Jennifer L. Steele. 2007. "What is the Problem? The Challenge of Providing Effective Teachers for All Children." In *The Future of Children: Excellence in the classroom*, 17(1): 15-43.

Nadler, Daniel and Paul E. Peterson, 2009. "What Happens when States have Genuine Alternative Certification?" *Education Next* 9 (Winter), 70-74.

Noell, George H., Bethany A. Porter, R. Maria Patt, and Amanda Dahir. 2008. "Value-added assessment of teacher preparation in Louisiana: 2004-2005 to 2006-2007." Report to the Lousiana Department of Education. Department of Psychology, Louisiana State University.

Nye, Barbara, Spyros Konstantopoulos, and Larry V. Hedges. 2004. "How Large are Teacher Effects?" *Educational Evaluation and Policy Analysis* 26(3): 237-57.

Podgursky, Michael. 2006. “Is there a ‘Qualified Teacher Shortage?’” *Education Next* (Spring) 6(1):26-33.

Rivkin, Steven G., Eric A. Hanushek, and John F. Kain. 2005. “Teachers, schools, and academic achievement.” *Econometrica* 73: 417-458.

Rothstein, Jesse. Forthcoming. “Teacher Quality in Educational Production: Tracking, Decay, and Student Achievement.” *Quarterly Journal of Economics*.

State of Florida, Department of Education. 2009. Teacher Effectiveness in Reading and Mathematics 2008-09. Report. Available at: www: ????

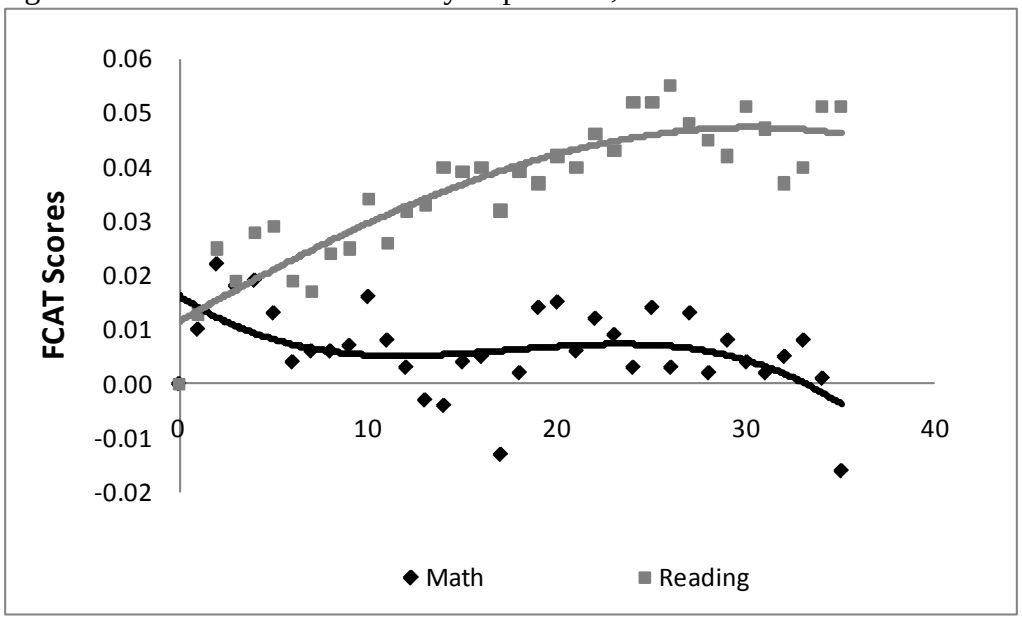
Summers, Anita and Barbara Wolfe. 1977. “Do Schools Make a Difference?” *American Economic Review* 67(4): 639-52.

U. S. Department of Education, Institute of Education, *Digest of Education Statistics*, 2009.

U. S. News & World Report, 2009.

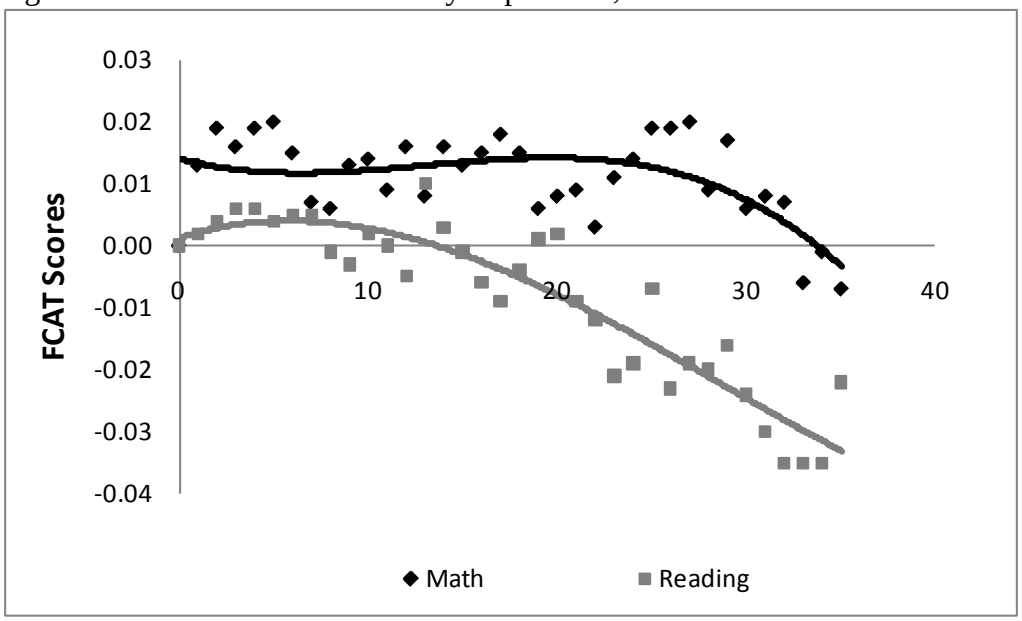
Vigdor, Jacob. 2008. “Scrap the Sacrosanct Salary Schedule.” *Education Next* 8(4): 36-43.

Figure 1a. Teacher Effectiveness by Experience, with Teacher*School Fixed Effects, Grades 4-5



Notes: Regression line is a polynomial function with squared and cubed terms.

Figure 1b. Teacher Effectiveness by Experience, with Teacher*School Fixed Effects, Grades 6-8



Notes: Regression line is a polynomial function with squared and cubed terms.

Table 1. 2009-2010 Base Teacher Salary Schedule, Miami-Dade County

Step	Bachelor's	Master's	Ed Specialist	Doctorate
1	$38,500	$41,600	$43,650	$45,700
2	$38,750	$41,850	$43,900	$45,950
3	$39,000	$42,100	$44,150	$46,200
4	$40,000	$43,100	$45,150	$47,200
5	$40,300	$43,400	$45,450	$47,500
6	$40,602	$43,702	$45,752	$47,802
7	$40,907	$44,007	$46,057	$48,107
8	$41,214	$44,314	$46,364	$48,414
9	$41,523	$44,623	$46,673	$48,723
10	$41,834	$44,934	$46,984	$49,034
11	$42,148	$45,248	$47,298	$49,348
12	$42,464	$45,564	$47,614	$49,664
13	$42,782	$45,882	$47,932	$49,982
14	$42,782	$45,882	$47,932	$49,982
15	$47,000	$50,100	$52,150	$54,200
16	$47,000	$50,100	$52,150	$54,200
17	$50,300	$53,400	$55,450	$57,500
18	$50,300	$53,400	$55,450	$57,500
19	$53,100	$56,200	$58,250	$60,300
20	$54,350	$57,450	$59,500	$61,550
21	$58,350	$61,450	$63,500	$65,550
22	$68,225	$71,325	$73,375	$75,425

Source: http://salary.dadeschools.net/Schd_Teachers/ (10-month schedule).

Table 2A. Descriptive Statistics, Teachers in Grades 4-5

	All Teachers	Teachers Matched to College			
		All	Less Selective	Selective	Very Selective
Teacher Characteristics					
BA in Elementary Education	-	82%	86%	84%	73%
BA in Other Education Field	-	4%	3%	4%	4%
BA in Non-Education Field	-	14%	11%	11%	23%
Failed certification exam at least once	2%	0%	1%	0%	0%
Certification exam score unknown	50%	25%	20%	24%	33%
National Board Certified	6%	5%	5%	4%	5%
Average Experience	9.2	2.4	2.4	2.4	2.2
Master's Degree or Higher	39%	28%	27%	22%	38%
Age	40.5	31.7	32.6	31.9	29.7
Male	13%	12%	13%	12%	11%
Black	15%	14%	23%	7%	10%
Hispanic	10%	13%	25%	7%	5%
Students' Characteristics					
Prior-year FCAT Math Scores	0.03	0.01	-0.04	0.04	0.06
Prior-year FCAT Reading Scores	0.04	0.02	-0.07	0.05	0.11
Share Black	25%	27%	33%	20%	28%
Share Hispanic	22%	23%	31%	21%	13%
Share Eligible for Free/Reduced Lunch	54%	55%	60%	52%	51%
Share Special Ed	15%	16%	14%	17%	16%
Share Limited English Proficient	36%	39%	45%	36%	35%
Class Size	21.3	21.1	21.6	20.9	20.7
Number of Teachers	31,968	7,169	2,682	2,860	1,627

Note: Data cover period from 2002 to 2007.

Table 2B. Descriptive Statistics, Math and Reading Teachers in Grades 6-8

	All Teachers	Teachers Matched to College			
		All	Less Selective	Selective	Very Selective
Teacher Characteristics					
BA in Math or English Education	-	9%	4%	12%	9%
BA in Middle or Secondary Education	-	3%	3%	1%	5%
BA in Elementary Education	-	21%	28%	21%	15%
BA in Other Education Field	-	29%	29%	35%	21%
BA in Math or English (Not Education)	-	17%	19%	9%	23%
BA in Other Non-Education Field	-	49%	50%	42%	58%
Failed certification exam at least once	2%	1%	2%	0%	1%
Certification exam score unknown	53%	35%	33%	31%	41%
National Board Certified	4%	3%	3%	3%	3%
Average Experience	8.9	2.3	2.2	2.6	2.0
Master's Degree or Higher	41%	28%	30%	24%	32%
Age	42.1	32.4	32.9	33.7	30.1
Male	24%	21%	21%	20%	21%
Black	20%	22%	34%	14%	18%
Hispanic	8%	10%	21%	5%	5%
Students' Characteristics					
Prior-year FCAT Math Scores	-0.26	-0.28	-0.33	-0.32	-0.18
Prior-year FCAT Reading Scores	-0.24	-0.26	-0.34	-0.29	-0.14
Share Black	29%	29%	35%	24%	30%
Share Hispanic	20%	21%	29%	19%	14%
Share Eligible for Free/Reduced Lunch	53%	54%	60%	53%	50%
Share Special Ed	25%	26%	24%	32%	22%
Share Limited English Proficient	35%	38%	42%	36%	35%
Class Size	12.0	12.0	12.3	10.8	13.1
Number of Teachers	38,683	7,405	2,433	2,743	2,229

Note: Data cover period from 2002 to 2007.

Table 3. Characteristics of Florida Institutions of Higher Learning

Tier and Institution Name	National Ranking	Entrance Difficulty	Avg. SAT Score	Avg. HS GPA	In-State Tuition	# Education BAs, 08-09	% Education BAs, 08-09	Percent Black	Percent Hispanic
Very Selective (Tier 1)									
University of Florida	47	Very difficult	1270	4.1	$4,373	258	3%	10%	14%
Florida State University	102	Very difficult	1200	3.7	$2,933	515	7%	11%	12%
University of North Florida	49	Very difficult	1115	3.5	$4,193	328	11%	10%	7%
Selective (Tier 3)									
Florida Gulf Coast University	Not ranked	Moderately difficult	1030	3.3	$4,437	168	12%	4%	12%
University of Central Florida	Not ranked	Moderately difficult	1180	3.7	$4,526	1,002	11%	9%	14%
University of South Florida	Not ranked	Moderately difficult	1140	3.7	$4,503	498	8%	12%	14%
Less Selective (Tier 4 and Non-competitive)									
Florida A&M University	Not ranked	Moderately difficult	910	2.9	$3,047	92	6%	94%	1%
Florida Atlantic University	Not ranked	Moderately difficult	920	3.4	$3,367	494	11%	18%	19%
Florida International University	Not ranked	Moderately difficult	1150	3.7	$4,580	382	7%	12%	64%
St. Petersburg College	Not ranked	Non-competitive	NA	NA	$2,596	185	28%	10%	6%
University of West Florida	Not ranked	Moderately difficult	1060	3.5	$3,649	265	15%	10%	5%

Notes: Tier and national ranking are from U. S. News and World Report (2009). Entrance difficulty is from Peterson's Guide to Colleges and Universities. Number and percent of Education BAs and percent black and Hispanic are from IPEDS. Averaged SAT score is calculated as the mean of the 25th and 75th percentiles reported by the Princeton Review. At two of the universities, more students take the ACT than the SAT, but using the average ACT score (converted to the SAT scale) would not change the average score by more than 10 points.

Table 4. Relationship Between Teacher Characteristics and Student FCAT Scores

	Grades 4-5		Grades 6-8	
	Math	Reading	Math	Reading
BA College (relative to Less Selective)				
Selective	-0.018	-0.003	0.010	-0.004
	[0.006]**	[0.004]	[0.006]	[0.005]
Very Selective	-0.008	-0.004	0.012	-0.001
	[0.007]	[0.005]	[0.006]	[0.005]
BA Major (relative to Elementary Education [4-5] or Math/English Education [6-8])				
Other Education	-0.041	-0.046	-0.002	-0.000
	[0.015]**	[0.012]**	[0.010]	[0.010]
Field other than Education	-0.008	-0.005	0.009	0.002
	[0.007]	[0.005]	[0.008]	[0.005]
Middle or Secondary Education			0.021	-0.022
			[0.013]	[0.009]*
Elementary Education			0.017	0.001
			[0.008]*	[0.010]
Math/English (Not Education)			0.002	-0.005
			[0.009]	[0.005]
Failed certification exam one or more	-0.042	-0.005	-0.027	-0.032
times (relative to never failing)	[0.014]**	[0.012]	[0.009]**	[0.009]**
National Board Certified	0.025	0.017	0.028	0.019
	[0.004]**	[0.003]**	[0.005]**	[0.003]**
Total experience (relative to 0 years)				
1-2 years experience	0.027	0.020	0.020	0.005
	[0.003]**	[0.003]**	[0.003]**	[0.002]
3-5 years experience	0.037	0.032	0.027	0.005
	[0.003]**	[0.003]**	[0.003]**	[0.003]*
6-12 years experience	0.043	0.037	0.033	0.013
	[0.004]**	[0.003]**	[0.003]**	[0.003]**
13-20 years experience	0.060	0.052	0.044	0.020
	[0.004]**	[0.003]**	[0.004]**	[0.003]**
21+ years experience	0.059	0.062	0.040	0.021
	[0.004]**	[0.003]**	[0.004]**	[0.003]**
Highest degree (relative to BA)				
Master's	0.004	0.002	0.004	0.004
	[0.002]	[0.002]	[0.002]	[0.002]*
Doctorate	-0.009	0.003	-0.005	0.001
	[0.012]	[0.009]	[0.008]	[0.007]
Observations (Student*Year)	1,381,536	1,383,365	2,193,591	1,583,185
Observations (Unique Teachers)	30,366	30,369	12,270	15,090
R-squared	0.66	0.64	0.71	0.65

Notes: * significant at 5%; ** significant at 1%; robust standard errors adjusted for clustering at the teacher level appear in brackets. All models include school fixed effects, a dummy variable identifying teachers for whom university attended and major are not available, and a dummy variable identifying teachers for whom certification exam data are not available. Student-level controls include prior-year test scores (in both subjects, along with squared and cubed terms), gender, race/ethnicity, free lunch, LEP, special education, migrant, non-structural move, structural move, days absent previous year, and whether repeating the grade. Classroom-level controls include these variables aggregated to the classroom level (with the exception that prior-year test scores are replaced with percent proficient on the FCAT in reading and math) and class size. Data cover period from 2002 to 2007.

Table 5A. Relationship Between Selectivity of Teacher's BA Institution and Student FCAT Scores, Grades 4-5

	Math				
	(1)	(2)	(3)	(4)	(5)
BA College (relative to Less Selective)					
Selective	0.033	-0.023	-0.018	-0.017	-0.016
	[0.013]**	[0.008]**	[0.008]*	[0.008]*	[0.008]
Very Selective	0.040	-0.007	-0.002	0.000	0.002
	[0.015]**	[0.008]	[0.008]	[0.008]	[0.008]
Include student, classroom, and school controls?	No	Yes	Yes	Yes	Yes
Control for Teacher Experience?	No	No	Yes	Yes	Yes
Control for Teacher BA Major?	No	No	No	Yes	Yes
Control for Teacher Race and Gender?	No	No	No	No	Yes
Observations (Student*Year)	318,147	288,033	274,670	274,670	274,650
Observations (Unique Teachers)	7,164	7,033	6,836	6,836	6,835
R-squared	0.00	0.66	0.66	0.66	0.66

	Reading				
	(1)	(2)	(3)	(4)	(5)
BA College (relative to Less Selective)					
Selective	0.092	-0.010	-0.008	-0.007	-0.007
	[0.012]**	[0.006]	[0.006]	[0.006]	[0.006]
Very Selective	0.122	-0.005	-0.001	0.001	0.001
	[0.014]**	[0.006]	[0.006]	[0.006]	[0.006]
Include student, classroom, and school controls?	No	Yes	Yes	Yes	Yes
Control for Teacher Experience?	No	No	Yes	Yes	Yes
Control for Teacher BA Major?	No	No	No	Yes	Yes
Control for Teacher Race and Gender?	No	No	No	No	Yes
Observations (Student*Year)	318,637	288,437	275,062	275,062	275,042
Observations (Unique Teachers)	7,165	7,035	6,838	6,838	6,837
R-squared	0.00	0.63	0.63	0.63	0.63

Notes: * significant at 5%; ** significant at 1%; robust standard errors adjusted for clustering at the teacher level appear in brackets. All regressions include grade-by-year fixed effects. Student-level controls include prior-year test scores (in both subjects, along with squared and cubed terms), gender, race/ethnicity, free lunch, LEP, special education, migrant, non-structural move, structural move, days absent previous year, and whether repeating the grade. Classroom-level controls include these variables aggregated to the classroom level (with the exception that prior-year test scores are replaced with percent proficient on the FCAT in reading and math) and class size. School controls are school fixed effects. Data cover period from 2002 to 2007.

Table 5B. Relationship Between Selectivity of Teacher's BA Institution and Student FCAT Scores, Grades 6-8

	Math				
	(1)	(2)	(3)	(4)	(5)
BA College (relative to Less Selective)					
Selective	0.114	0.004	0.005	0.007	0.004
	[0.025]**	[0.009]	[0.009]	[0.009]	[0.009]
Very Selective	0.123	0.011	0.013	0.016	0.012
	[0.028]**	[0.007]	[0.007]	[0.007]*	[0.007]
Include student, classroom, and school controls?	No	Yes	Yes	Yes	Yes
Control for Teacher Experience?	No	No	Yes	Yes	Yes
Control for Teacher BA Major?	No	No	No	Yes	Yes
Control for Teacher Race and Gender?	No	No	No	No	Yes
Observations (Student*Year)	385,795	344,372	325,833	325,833	325,833
Observations (Unique Teachers)	3,003	2,292	2,194	2,194	2,194
R-squared	0.01	0.70	0.70	0.70	0.70

	Reading				
	(1)	(2)	(3)	(4)	(5)
BA College (relative to Less Selective)					
Selective	0.074	0.000	-0.001	-0.003	-0.003
	[0.023]**	[0.006]	[0.007]	[0.007]	[0.007]
Very Selective	0.082	-0.001	-0.001	0.000	0.000
	[0.023]**	[0.006]	[0.006]	[0.006]	[0.006]
Include student, classroom, and school controls?	No	Yes	Yes	Yes	Yes
Control for Teacher Experience?	No	No	Yes	Yes	Yes
Control for Teacher BA Major?	No	No	No	Yes	Yes
Control for Teacher Race and Gender?	No	No	No	No	Yes
Observations (Student*Year)	357,694	319,170	301,852	301,852	301,752
Observations (Unique Teachers)	4,364	3,209	3,055	3,055	3,054
R-squared	0.01	0.63	0.63	0.63	0.63

Notes: * significant at 5%; ** significant at 1%; robust standard errors adjusted for clustering at the teacher level appear in brackets. All regressions include grade-by-year fixed effects. Student-level controls include prior-year test scores (in both subjects, along with squared and cubed terms), gender, race/ethnicity, free lunch, LEP, special education, migrant, non-structural move, structural move, days absent previous year, and whether repeating the grade. Classroom-level controls include these variables aggregated to the classroom level (with the exception that prior-year test scores are replaced with percent proficient on the FCAT in reading and math) and class size. School controls are school fixed effects. Data cover period from 2002 to 2007.

Table 6A. Relationship Between Teacher's BA Institution and Student FCAT Scores, Grades 4-5

	Math					Reading				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
BA College (relative to University of Florida)										
Very Selective										
Florida State University	-0.013	0.009	0.005	0.007	0.006	-0.005	0.009	0.013	0.015	0.015
	[0.027]	[0.012]	[0.012]	[0.012]	[0.012]	[0.025]	[0.009]	[0.009]	[0.009]	[0.009]
University of North Florida	-0.119	0.020	0.013	0.012	0.010	-0.028	0.023	0.021	0.021	0.021
	[0.028]**	[0.015]	[0.016]	[0.016]	[0.016]	[0.025]	[0.012]	[0.013]	[0.013]	[0.013]
Selective										
Florida Gulf Coast University	-0.083	-0.031	-0.021	-0.022	-0.025	-0.069	-0.008	0.001	0.001	0.001
	[0.035]*	[0.021]	[0.021]	[0.021]	[0.021]	[0.032]*	[0.016]	[0.015]	[0.015]	[0.015]
University of Central Florida	-0.005	-0.011	-0.011	-0.011	-0.012	0.005	0.001	0.002	0.002	0.003
	[0.022]	[0.011]	[0.011]	[0.011]	[0.011]	[0.020]	[0.008]	[0.008]	[0.008]	[0.008]
University of South Florida	-0.085	-0.007	-0.012	-0.013	-0.014	-0.079	0.002	-0.002	-0.001	-0.001
	[0.022]**	[0.011]	[0.011]	[0.011]	[0.011]	[0.021]**	[0.009]	[0.009]	[0.009]	[0.009]
Less Selective										
Florida A&M University	-0.294	0.015	0.001	-0.001	-0.009	-0.283	0.018	0.013	0.013	0.012
	[0.029]**	[0.014]	[0.015]	[0.015]	[0.016]	[0.028]**	[0.011]	[0.011]	[0.011]	[0.012]
Florida Atlantic University	0.010	0.017	0.013	0.011	0.010	-0.079	0.010	0.006	0.005	0.005
	[0.024]	[0.011]	[0.011]	[0.011]	[0.011]	[0.022]**	[0.009]	[0.009]	[0.009]	[0.009]
Florida International University	-0.149	0.021	0.013	0.012	0.010	-0.216	0.021	0.018	0.018	0.017
	[0.027]**	[0.016]	[0.016]	[0.016]	[0.016]	[0.025]**	[0.013]	[0.013]	[0.013]	[0.013]
St. Petersburg College	-0.236	-0.017	0.013	0.011	0.009	-0.213	-0.005	0.025	0.025	0.026
	[0.069]**	[0.034]	[0.034]	[0.034]	[0.034]	[0.063]**	[0.026]	[0.026]	[0.025]	[0.025]
University of West Florida	-0.031	-0.011	-0.024	-0.024	-0.027	0.033	-0.003	-0.007	-0.006	-0.005
	[0.029]	[0.018]	[0.018]	[0.018]	[0.018]	[0.028]	[0.014]	[0.014]	[0.014]	[0.014]
Joint significance of BA College (p-value)	0.000	0.134	0.322	0.302	0.238	0.000	0.513	0.524	0.489	0.516
Include student, classroom, and school controls?	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Control for Teacher Experience?	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Control for Teacher BA Major?	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Control for Teacher Race and Gender?	No	No	No	No	Yes	No	No	No	No	Yes
Observations (Student*Year)	318,147	288,033	274,670	274,670	274,650	318,637	288,437	275,062	275,062	275,042
Observations (Unique Teachers)	7,164	7,033	6,836	6,836	6,835	7,165	7,035	6,838	6,838	6,837
R-squared	0.01	0.66	0.66	0.66	0.66	0.01	0.63	0.63	0.63	0.63

Notes: * significant at 5%; ** significant at 1%; robust standard errors adjusted for clustering at the teacher level appear in brackets. All regressions include grade-by-year fixed effects. Student-level controls include prior-year test scores (in both subjects, along with squared and cubed terms), gender, race/ethnicity, free lunch, LEP, special education, migrant, non-structural move, structural move, days absent previous year, and whether repeating the grade. Classroom-level controls include these variables aggregated to the classroom level (with the exception that prior-year test scores are replaced with percent proficient on the FCAT in reading and math) and class size. School controls are school fixed effects. Data cover period from 2002 to 2007.

Table 6B. Relationship Between Teacher's BA Institution and Student FCAT Scores, Grades 6-8

	Math					Reading				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
BA College (relative to University of Florida)										
Very Selective										
Florida State University	-0.014	0.010	0.007	0.010	0.010	-0.004	0.001	0.001	-0.001	-0.002
	[0.045]	[0.011]	[0.011]	[0.011]	[0.011]	[0.035]	[0.007]	[0.007]	[0.007]	[0.007]
University of North Florida	-0.128	-0.005	-0.006	-0.016	-0.020	-0.082	-0.008	-0.011	-0.007	-0.008
	[0.056]*	[0.017]	[0.017]	[0.017]	[0.017]	[0.036]*	[0.008]	[0.009]	[0.009]	[0.009]
Selective										
Florida Gulf Coast University	-0.110	-0.007	-0.005	-0.023	-0.026	-0.224	0.011	0.013	0.012	0.013
	[0.063]	[0.023]	[0.023]	[0.025]	[0.025]	[0.068]**	[0.022]	[0.025]	[0.025]	[0.025]
University of Central Florida	-0.022	0.000	0.001	0.001	0.002	0.019	-0.003	-0.004	-0.008	-0.008
	[0.039]	[0.011]	[0.011]	[0.011]	[0.011]	[0.032]	[0.007]	[0.007]	[0.007]	[0.007]
University of South Florida	-0.053	-0.010	-0.013	-0.013	-0.013	-0.055	0.005	0.002	-0.001	-0.001
	[0.042]	[0.010]	[0.010]	[0.010]	[0.010]	[0.033]	[0.007]	[0.008]	[0.008]	[0.008]
Less Selective										
Florida A&M University	-0.304	-0.025	-0.031	-0.031	-0.026	-0.287	0.004	0.002	-0.001	-0.003
	[0.048]**	[0.013]	[0.013]*	[0.013]*	[0.014]	[0.046]**	[0.010]	[0.011]	[0.011]	[0.011]
Florida Atlantic University	-0.039	-0.001	-0.004	-0.009	-0.006	-0.032	0.002	0.001	-0.001	-0.001
	[0.046]	[0.012]	[0.012]	[0.012]	[0.011]	[0.039]	[0.009]	[0.009]	[0.010]	[0.009]
Florida International University	-0.250	0.005	0.001	0.001	0.004	-0.109	-0.003	-0.002	-0.004	-0.002
	[0.053]**	[0.014]	[0.014]	[0.014]	[0.014]	[0.038]**	[0.010]	[0.010]	[0.010]	[0.011]
St. Petersburg College	0.049	0.038	0.042	0.045	0.044	-0.173	0.029	0.043	0.033	0.033
	[0.193]	[0.034]	[0.034]	[0.034]	[0.034]	[0.135]	[0.026]	[0.032]	[0.034]	[0.034]
University of West Florida	-0.108	-0.009	-0.005	-0.016	-0.015	-0.010	-0.005	0.000	0.001	0.001
	[0.043]*	[0.022]	[0.022]	[0.022]	[0.022]	[0.046]	[0.015]	[0.016]	[0.016]	[0.016]
Joint significance of BA College (p-value)	0.000	0.306	0.181	0.084	0.143	0.000	0.928	0.874	0.966	0.964
Include student, classroom, and school controls?	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Control for Teacher Experience?	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Control for Teacher BA Major?	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Control for Teacher Race and Gender?	No	No	No	No	Yes	No	No	No	No	Yes
Observations (Student*Year)	385,795	344,372	325,833	325,833	325,833	357,694	319,170	301,852	301,852	301,752
Observations (Unique Teachers)	3,003	2,292	2,194	2,194	2,194	4,364	3,209	3,055	3,055	3,054
R-squared	0.02	0.70	0.70	0.70	0.70	0.01	0.63	0.63	0.63	0.63

Notes: * significant at 5%; ** significant at 1%; robust standard errors adjusted for clustering at the teacher level appear in brackets. All regressions include grade-by-year fixed effects. Student-level controls include prior-year test scores (in both subjects, along with squared and cubed terms), gender, race/ethnicity, free lunch, LEP, special education, migrant, non-structural move, structural move, days absent previous year, and whether repeating the grade. Classroom-level controls include these variables aggregated to the classroom level (with the exception that prior-year test scores are replaced with percent proficient on the FCAT in reading and math) and class size. School controls are school fixed effects. Data cover period from 2002 to 2007.

Table 7. Relationship Between Teacher's BA Institution and Student Stanford Achievement Test Scores

	Grades 4-5		Grades 6-8	
	Math	Reading	Math	Reading
BA College (relative to University of Florida)				
Very Selective				
Florida State University	0.010	0.015	0.020	0.009
	[0.011]	[0.009]	[0.010]	[0.010]
University of North Florida	-0.001	0.009	-0.022	0.006
	[0.014]	[0.013]	[0.017]	[0.014]
Selective				
Florida Gulf Coast University	-0.004	-0.009	-0.027	0.024
	[0.020]	[0.018]	[0.025]	[0.034]
University of Central Florida	-0.004	0.004	0.001	0.007
	[0.010]	[0.008]	[0.011]	[0.010]
University of South Florida	0.006	0.006	-0.013	0.007
	[0.010]	[0.009]	[0.011]	[0.011]
Less Selective				
Florida A&M University	-0.012	0.000	-0.023	0.009
	[0.015]	[0.013]	[0.013]	[0.015]
Florida Atlantic University	0.029	0.018	-0.002	0.028
	[0.010]**	[0.009]*	[0.010]	[0.014]*
Florida International University	-0.020	0.010	-0.006	0.010
	[0.015]	[0.011]	[0.013]	[0.015]
St. Petersburg College	0.010	-0.028	0.046	-0.094
	[0.034]	[0.028]	[0.064]	[0.047]*
University of West Florida	0.001	0.006	-0.035	0.007
	[0.018]	[0.017]	[0.021]	[0.020]
Joint significance of BA College (p-value)	0.017	0.475	0.007	0.513
Include student, classroom, and school controls?	Yes	Yes	Yes	Yes
Control for Teacher Experience?	Yes	Yes	Yes	Yes
Control for Teacher BA Major?	Yes	Yes	Yes	Yes
Control for Teacher Race and Gender?	Yes	Yes	Yes	Yes
Observations (Student*Year)	272,378	272,715	322,206	301,785
Observations (Unique Teachers)	6,834	6,836	2,193	3,056
R-squared	0.61	0.61	0.67	0.39

Notes: * significant at 5%; ** significant at 1%; robust standard errors adjusted for clustering at the teacher level appear in brackets. All regressions include grade-by-year fixed effects. Student-level controls include prior-year test scores (in both subjects, along with squared and cubed terms), gender, race/ethnicity, free lunch, LEP, special education, migrant, non-structural move, structural move, days absent previous year, and whether repeating the grade. Classroom-level controls include these variables aggregated to the classroom level (with the exception that prior-year test scores are replaced with percent proficient on the FCAT in reading and math) and class size. School controls are school fixed effects. Data cover period from 2002 to 2007.

Table 8. Relationship Between Teacher's BA Institution and Student FCAT Scores, Education Majors Only

	Grades 4-5		Grades 6-8	
	Math	Reading	Math	Reading
BA College (relative to University of Florida)				
Very Selective				
Florida State University	-0.004	-0.009	0.003	-0.026
	[0.014]	[0.011]	[0.018]	[0.021]
University of North Florida	0.006	0.026	-0.013	-0.032
	[0.017]	[0.014]	[0.026]	[0.023]
Selective				
Florida Gulf Coast University	-0.039	-0.004	-0.087	0.002
	[0.024]	[0.017]	[0.042]*	[0.032]
University of Central Florida	-0.024	-0.013	0.018	-0.017
	[0.013]	[0.009]	[0.017]	[0.021]
University of South Florida	-0.023	-0.012	-0.021	-0.011
	[0.012]	[0.010]	[0.020]	[0.019]
Less Selective				
Florida A&M University	-0.016	0.004	-0.028	-0.011
	[0.017]	[0.013]	[0.023]	[0.025]
Florida Atlantic University	0.009	-0.005	-0.004	-0.013
	[0.013]	[0.010]	[0.017]	[0.019]
Florida International University	-0.006	0.017	-0.042	0.014
	[0.018]	[0.014]	[0.021]*	[0.024]
St. Petersburg College	0.005	0.017	0.012	0.010
	[0.034]	[0.026]	[0.039]	[0.037]
University of West Florida	-0.033	-0.018	-0.063	-0.076
	[0.020]	[0.015]	[0.035]	[0.028]**
Joint significance of BA College (p-value)	0.114	0.156	0.049	0.224
Include student, classroom, and school controls?	Yes	Yes	Yes	Yes
Control for Teacher Experience?	Yes	Yes	Yes	Yes
Control for Teacher BA Major?	Yes	Yes	Yes	Yes
Control for Teacher Race and Gender?	Yes	Yes	Yes	Yes
Observations (Student*Year)	245,635	245,920	182,921	135,091
Observations (Unique Teachers)	5,908	5,909	1,139	1,377
R-squared	0.66	0.63	0.70	0.64

Notes: * significant at 5%; ** significant at 1%; robust standard errors adjusted for clustering at the teacher level appear in brackets. All regressions include grade-by-year fixed effects. Student-level controls include prior-year test scores (in both subjects, along with squared and cubed terms), gender, race/ethnicity, free lunch, LEP, special education, migrant, non-structural move, structural move, days absent previous year, and whether repeating the grade. Classroom-level controls include these variables aggregated to the classroom level (with the exception that prior-year test scores are replaced with percent proficient on the FCAT in reading and math) and class size. School controls are school fixed effects. Data cover period from 2002 to 2007.