The Relationship between Principal Characteristics, School-Level Teacher Quality and Turnover, and Student Achievement

Ed Fuller, Ph.D.
University Council for Educational Administration
The University of Texas at Austin
edfuller@mail.utexas.edu

Bruce D. Baker, Ed.D.
Department of Teaching and Leadership
bbaker@ku.edu

Michelle Young, Ph.D.
University Council for Educational Administration
The University of Texas at Austin

The Relationship between Principal Characteristics, School-Level Teacher Quality and Turnover, and Student Achievement

Abstract

One of the most important roles principals play in determining the quality of their schools is the selection and retention of well-qualified teachers. The preponderance of evidence from the economic and education policy literature indicates that teachers with stronger academic backgrounds and teachers assigned in-field produce better student outcomes than other teachers. Further, the available evidence suggests that teacher turnover tends to have a deleterious effect on student achievement. We hypothesize that principals have a direct effect on student achievement through various strategies such as effective instructional leadership, creating a positive school culture, providing adequate time and materials for teachers to be effective, and buffering teachers from outside influences. Further, we believe that these strategies and behaviors can be influenced through high-quality preparation programs. However, we believe that the primary strategies by which principals affect student achievement are the hiring and retention of high-quality teachers.

This study used state databases from Texas on schools, teachers, and principals to examine the characteristics of principals associated with measures of school-level teacher quality and turnover as well as the association between the characteristics of principals, teacher quality, teacher turnover, and school-level student achievement. We found that principal characteristics were associated with both school-level teacher quality and teacher turnover. Further, we found that principal characteristics, school-level teacher quality, and school-level teacher turnover were associated with increased school achievement on the state-mandated tests.

Introduction

This study explores the relationships between school principals' characteristics, the school-level measures of teacher quality and turnover, and school-level student achievement on the state-mandated Texas Assessment of Knowledge and Skills (TAKS). Numerous studies have explored the relationship between principals' attributes, leadership styles, leadership practices and behaviors, and student outcomes (Bitsa & Glasman, 1998; Hallinger & Heck, 1996; Heck, 1992; Heck, Larsen & Marcoulides, 1990). Brewer (1993), using High School and Beyond data from the early 1980s, found that principals do affect student achievement, noting in particular the principals' roles in selecting high-quality teachers. Of particular relevance to this study, Brewer stated that "The greater the percentage of teachers appointed by a principal with high academic goals, the higher the student test score gains; the greater the percentage of teachers appointed by a principal with low academic goals, the lower are student test score gains" (p. 287). Similarly, Strauss (2003) used extensive records on Pennsylvania school administrators to test the relationship between a variety of administrator characteristics and student achievement. Strauss' findings, regarding the, While his findings about the link between administrator characteristics and student outcomes were somewhat mixed, he did conclude that "indirectly through the teacher hiring process, the nature of administrative choice can make a difference in student achievement" (p. 2).

A handful of recent studies have been highly critical of the way in which public school districts select teachers, emphasizing in particular, the preference of local administrators to hire locally or to favor those most familiar to them over recruiting the best possible candidates. Strauss, et al. (2000) surveyed 510 Pennsylvania school districts, finding: (a) only 25% of districts advertised outside the state; (b) a high percentage (40%) of teachers obtained their high school diploma or attended high school in districts where they worked; (c) about 33% of districts filled full-time openings from substitutes or part-time teachers whom they already knew (p. 404); (d) despite an oversupply of teachers, districts tended to hire teachers from local colleges; (e) teachers produced by these colleges often had had very low levels of performance on NTE (National Teachers Exam) exams—sometimes the average performance was below the state's already very low passing standard; and (d) cities often hired teachers with NTE scores in the bottom one-third of test-takers nationally. The authors conclude that these hiring practices lead to reductions in student performance. Ballou (1996) similarly concluded:

> To summarize, evidence from the SRCG[1] indicates that important indicators of a strong academic background and cognitive ability do little to improve the prospects of an applicant for a public school teaching position. The overall quality of the college … is at best unimportant, at worst a drawback." (p. 120)

Balter and Duncombe (2006) also found emphasis by hiring school districts on increasing local supply of teachers to be "either unrelated or negatively related with the level of teacher qualifications."[2]

[1] Survey of Recent College Graduates.

[2] http://www-cpr.maxwell.syr.edu/faculty/duncombe/teaching-survey/aefa2006.pdf

Teacher Turnover

In addition, the limited number of available studies on the relationship between teacher turnover at the school level and student achievement consistently found that increased turnover has a negative effect on student achievement. For example, in their review of the literature on mathematics and science teacher turnover and student achievement, Levy, Fields, and Jablonski (2007, p. 3) found that "all of [the 9] studies found that higher rates of teacher turnover were associated with poorer student outcomes—the relationship between these variables was direct and negative."

Based on a fairly large body of recent literature on teacher quality and a smaller body of literature on teacher turnover, this study posits that the most important strategy a principal can employ toward improving schooling quality, especially in poor urban schools, are to recruit and retain high-quality teachers. To substantiate this assertion, we note that some recent studies have shown teaching quality to be associated with as much as 7% of the overall variance in student value-added achievement gains (Rivken, Hanushek & Kain, 2000). Further, Sanders and Rivers (1996) found that the difference between attending classes taught by high-quality teachers (highest quartile grouping) and attending classes taught by low-quality teachers (lowest quartile grouping) was substantial--approximately 50 percentile points in the distribution of student achievement (cited in Lankford, Loeb & Wyckoff, 2002).

Measuring Teacher Quality

A controversial aspect of studying the recruitment and selection of high-quality teachers is defining and measuring teacher quality. Sanders and colleagues measure directly teaching quality by associating student value-added achievement gains with specific teachers over time and assigning teacher quality ratings as a function of student outcomes (Sanders & Rivers, 1996). Increasingly, other scholars are now adopting similar approaches (Hanushek, Kain, O'Brien, Rivken, 2005; Goldhaber et. al, 2007).

Practitioner literature on school leaders' preferences toward teacher candidates often focuses on difficult-to-measure teacher qualities like "strong work ethic, people and communication skills, and enthusiasm for teaching" (Trimble, 2001).[3] Such qualities are typically evaluated subjectively in secondary phases of hiring, after prescreening of more easily measured attributes has already occurred. Research on the effectiveness of secondary screening policies and practices in selecting the "best" teachers most often measures success by the administrators' perceptions of teacher performance (Emley & Ebmeier, 1997). Rarely are more objective measures of teaching quality, like student outcome data, included in these analyses.

Large-scale education policy studies focus on relationships between easily classifiable teacher background attributes and student outcomes. Among those attributes are indicators of teacher certification status, content area and educational preparation, teacher degree levels, teachers' own test scores and undergraduate and graduate

[3] Other variations on this theme include "commitment, dedication, individualized perception, caring, involvement with students, empathy, positivity, student advocacy, student stimulation capacity, input, and learning concept" (Gordon, 1999) and "happy people who genuinely like kids, are team players, like to teach" (Slosson, 1999).

institution quality. To date, empirical analyses of the relationship between state level teacher certification status and student outcomes are inconclusive at best (Goldhaber & Brewer, 2000; Darling Hammond, Berry & Thoreson, 2001; Goldhaber & Brewer, 2001; Laczko-Kerr & Berliner, 2002).

The economic literature relating teacher attributes and student outcomes is surprisingly consistent. Studies have repeatedly found the following indicators of teachers' own academic abilities to be positively associated with their students' outcomes: Teachers own prior test scores, especially those related to verbal ability (Coleman, 1966; Ehrenberg & Brewer, 1995); and the selectivity or competitiveness of the undergraduate institution attended by the teacher (Lankford, Loeb & Wyckoff, 2001; Ehrenberg & Brewer, 1994; Reback, 2002; Figlio, 2002; Angrist & Guryan, 2003). Indeed, one might assume some overlap between those teachers who do well on tests of verbal ability, and those who are perceived by their interviewers to have strong communication skills, suggesting that preferred quantifiable measures in economic and education policy research are not entirely different from preferred attributes recognized in school personnel literature.

Decker, Mayer and Glazerman (2004), in a nationwide randomized controlled study, found that teachers participating in *Teach for America* (TFA) yielded greater gains in student mathematics achievement than their control group peers. Student reading gains were comparable between control and TFA teachers. The most notable difference between TFA participants and control group teachers was that 70% of TFA participants had attended highly or most selective colleges, compared to only 3.7% of their novice teaching peers.

Linking Teacher Quality, Mobility & Attrition

Recent studies have cast doubt on the likelihood that school improvement will result from an influx of teachers with stronger academic preparation. First, Boyd and colleagues (2006) show that alternatively certified teachers with strong academic backgrounds such as those from TFA in New York City, tend to leave teaching at an alarming rate, even before reaching experience levels where the advantage of these teachers is measurable. Other recent studies have yielded similar findings, showing that teachers with the strongest academic backgrounds, measured either by undergraduate institution characteristics or by teachers own test scores are simply much more likely to leave teaching.

These findings have led to a flurry of new studies that attempt instead to measure whether teachers who produce higher student outcomes are also more likely to leave. One might suspect that if teachers with stronger backgrounds both produce higher student outcomes and are more likely to leave, that teachers who produce higher outcomes are more likely to leave. Yet, studies of exit and move behavior of teachers in New York (Loeb et al., 2007); North Carolina (Goldhaber et al., 2007) and Texas (Hanushek et al., 2006) suggest that teachers who produce higher outcomes – measured by individual students value added achievement – are not necessarily more likely to leave teaching or even to leave teaching in their current school. Goldhaber et al. also find that teachers who produce higher student gains are more likely to stay in high poverty schools. The implication of these recent, consistent findings has been that teacher attrition is perhaps

not producing the degrees of disadvantage in high poverty, high minority concentration schools previously thought.

Yet, one cannot necessarily draw this conclusion from the finding that teachers who experience success in high poverty schools are more likely to stay than those who don't. We suspect that a much lower percentage of teachers experience success in certain schools – high poverty and high minority ones in particular. The large body of literature on the lower achievement outcomes and gains of children in these schools dictates as much. As such, the current back tracking on attrition and teacher quality may be unwarranted.

While these recent findings are interesting, they tell us little about the team of teachers that make up any one school, whether that team is a high quality or lower quality team and whether that team suffers significant annual turnover. Further, we suspect that the composition of the team, including team turnover, strongly influences a variety of school level outcomes.

Schools, Teams of Teachers and School Leadership

This study shifts the emphasis toward evaluating the team of teachers in schools, rather than individual teachers. In particular, we explore team average qualifications and team turnover rates and the relationship between those attributes and student outcomes. Of primary interest is what role school principals play in shaping their teacher team over time, and whether principals with certain attributes are more or less likely to build strong and stable teams.

Brewer (1993) measured directly the link between principals' attributes, including a survey response regarding academic standards, and student outcomes. Brewer included a measure of the percentage of teachers hired by the principal with high or low standards, but did not measure teacher attributes directly. Again, Brewer found that student outcomes were better in schools where larger shares of teachers were hired by principals with high standards.[4] Our intent is to clarify the relationship between principals' attributes and the attributes of teachers hired by those principals, emphasizing teacher qualities found to be related with student outcomes.

Baker and Cooper (2005), using national data from the Schools and Staffing Survey, revealed a statistical match between principals undergraduate backgrounds and teachers undergraduate backgrounds, finding that even in high poverty schools principals who attended more selective colleges were likely to attract teachers of similar background. Yet, Baker and Cooper rely heavily on this single measure of principal and teacher background (undergraduate college selectivity) that has more recently been scorned by those who once endorsed it. Yet, Baker and Cooper's findings along with those of Brewer (1993) still suggest the likelihood that principals play some role in shaping their teams of teachers.

Objectives

This study explored the relationship between principal characteristics and student achievement in two ways. First, we examined the direct relationship between principal

[4] p. 287

characteristics on changes in school-level student achievement over a 4–year time period after controlling for school characteristics (demographics, size, and urbanicity), aggregate school-level teacher characteristics (percentage of novice teachers, percentage of teachers not certified, and teacher turnover rate). Second, we examined the relationship between principal characteristics and the intervening variables of teacher quality and teacher turnover.

We hypothesized that while principal characteristics may directly impact changes in student achievement, a more likely scenario - following directly from the conclusions and policy implications of Brewer (1993) - was that principal characteristics influence teacher quality and turnover, which in turn impact changes in student achievement.

Data

This study relies on 5 extracts of data from Texas that were merged together to create a final data set that included 657 schools and their principals. The first set of data includes the principal employment data for all Texas principals from 1995 through 2006. The data link each school with a principal as well as the demographics of the principals (race/ethnicity, gender, and age). The second data set includes principal certification data for all individuals obtaining principal certification after 1992. This data set includes the preparation program from which the individual obtained certification. The third set of data includes the 1994 Carnegie classification for all university-based principal preparation programs.

The fourth set of data includes the certification scores for all teachers and administrators taking a certification examination since 1987. The fifth data set includes teacher employment data for all teachers in Texas public schools from 1995 through 2006. This data set links teachers and schools and also includes teacher demographics (race/ethnicity, gender, and age). The sixth data set includes the certification status of each teacher in every Texas public school from 2003 through 2006. The final data set includes the percentage of students passing all of the TAKS tests at all grade levels for each Texas public school from 2003 through 2006.

These data sets were merged together so that teachers and principals were linked to schools for 1995 through 2006. Further, the teacher certification status data was aggregated to the school level for 2003 through 2006. Because the TAKS is administered in English language arts, mathematics, science, and social studies, the school aggregate teacher certification status data was aggregated only for teachers in the 4 subject areas. The teacher employment data sets used to calculate the overall turnover rates for each school from 2003 through 2006. All teachers were included in the turnover rate calculation. Turnover was defined as the percentage of teachers leaving a school for any reason from one year to the next.

To create the final data set of 657 schools and principals, we identified all schools with a newly hired principal for the 2003-04 school year. We then identified the schools which had the same principal for the next three academic years. These two selection criteria narrowed the number of schools from almost 8,000 across the entire state to the 657 schools included in the analysis.

Methodology

We organize the analyses in two major parts. In one set of models, we are concerned primarily with teacher team characteristics that are associated with school aggregate performance. That is, what measures of teacher team characteristics are associated positively or negatively with state assessment performance? We estimate a series of regression models for the dependent variable of school aggregate test performance, controlling for prior performance (Model 1).

Next, we are concerned with leadership attributes that might be associated with teacher team characteristics and changes in team characteristics. Therefore, we estimate a series of regression models on teacher team attributes in 2006, given principal characteristics such as experience and education, controlling for teacher team attributes in 2003 (Model 2).

Model 1: Relationship between Teacher Team Attributes and School Outcomes

In our first model, the dependent measure is the percentage of students passing all TAKS examinations in all grade levels in the spring of 2006. While the percentage of students passing iss a crude measure of student achievement, the data were readily available from the state website. Creating gain scores using scale scores requires purchasing student-level data and aggregating the data to the school level. Subsequent analyses will apply student level measures, to evaluate specifically, achievement gains of *stayer* students.

Because the dependent variable is continuous, we employ ordinary least squares regression to test the association between school characteristics, aggregate school-level teacher quality and turnover, and principal characteristics with student achievement. We control for prior levels of achievement by including the percentage of students passing all TAKS examinations in all grades in the spring of 2003.

The dependent variable is the percentage of students passing all TAKS examinations at all grade levels in 2006. Because of differences in passing rates across school levels, this analysis was restricted to elementary schools only. The final number of schools included in the analysis was 385.

The first block of variables includes the following school characteristics: the percentage of economically disadvantaged students enrolled in the school in 2003, the change in the percentage of economically disadvantaged students from 2003 to 2006, and the percentage of African American students greater than 15%, the percentage of bilingual education students greater than 20%, school size less than 400, school size greater than 750, whether the school was located in an urban district, whether the school was located in a rural district, and the percentage of economically disadvantaged students participating in TAK testing in 2006.

The second block of variables includes the following school aggregate teacher characteristics: the percentage of novice (less than 3 years of experience) teacher full-time equivalents (FTEs) in the school in 2003, the teacher turnover rate from 2003 to 2004, the percentage of teacher FTEs not fully certified in 2003, the change in the teacher

turnover rate from 2003-04 to 2005-06, and the percentage of teacher FTEs at the school in 2003 failing any certification examination at any time.

The third block of variables includes principal characteristics: whether the principal failed at least on certification examination at any point in time, the education experience of the principal was less than 10 years, the education experience of the principal was greater than 20 years, the principal was employed as a principal in some year between 1995 through 2003, the principal was White, the principal was female, the principal graduated from a [principal preparation program with a Carnegie classification of regional comprehensive university (Carnegie classification number of 21), and the principal graduated from a principal preparation program that was a University Council of Educational Administration (UCEA) institution.

Model 2: Relationship between Leadership Attributes and Teacher Team Attributes

The second model includes six different ordinary least square regression analyses. The six dependent variables include: the percentage of novice teachers in 2006, the teacher turnover rate from 2005 to 2006, the percentage of teachers not certified in 2006, the percentage of teachers in-field in 2006, the percentage of teachers failing a certification examination in 2005 and the percentage of teachers with a pedagogy certification examination score in the top 10% of all scores in 2005. In each case, the prior level of the measure was controlled for by including the same measure in 2003.

The independent variables include principal characteristics, preparation program location, school demographics, and school level. The first block of variables include principal characteristics. The principal characteristics include a dummy variable indicating whether a principal had failed any certification examination at any point in time, a dummy variable indicating whether a principal had graduated from a preparation program located at a research or doctoral university, years of education experience of the principal, and a dummy variable indicating whether the principal had been employed as a teacher between 1995 and 2003.

The third block of variables included school-level student demographics. Specifically, the variables included the percentage of LEP students in 2004, the percentage of economically disadvantaged students in 2004, and the percentage of African American students in 2004. The final block of variables included three dummy variables indicating three school levels: both elementary/secondary schools, middle schools, and high schools.

Finally, following the approach of Baker and Cooper (2005) these models include a dummy variable for each of 20 geographic regions within Texas on the assumption that both teachers and administrators are most likely to sort within relatively small geographic regions, or labor markets, and that graduate preparation opportunities for principals are limited within geographic regions. In short, labor pools and preparation pipelines are relatively local.

Findings: Distribution of Teacher and Principal Characteristics

Percentage of Minority Students in the School

As shown below in Table 1, predominantly minority schools had greater percentages of novice teachers, teacher FTEs not certified, and teachers failing certification examinations than predominantly White schools. In addition, predominantly minority schools had greater turnover rates and lower percentages of teacher FTEs assigned in-field.

With respect to principal characteristics, predominantly minority schools had older principals, and principals with more education experience than low-poverty schools. In addition, a greater percentage of principals in predominantly minority than in predominantly White schools failed a certification examination and failed the principal certification examination. A greater percentage of principals in predominantly minority schools than in predominantly White schools were female, non-White, and from a preparation program that was a member of UCEA. A lower percentage of principals in predominantly minority schools than in predominantly White had principal certification scores that were in the top 10% of all test-takers. Finally, principals in predominantly minority schools had less teaching experience from 1995 through 2003 than principals in predominantly White schools.

Table 1: Means and Standard Deviations for Teacher and Principal Characteristics for Predominantly Minority and Predominantly White Elementary Schools

Measure	% of Minority Students Enrolled in the School					
	00.0-25.0%			75.1-100%		
	N	Mean	Std. Dev.	N	Mean	Std. Dev.
Teacher Characteristics						
% Novice Tchrs 2003	58	12.8	9.1	155	27.8	18.7
% Novice Tchrs 2006	62	12.9	9.7	165	25.5	16.1
% FTEs not certified 2003	58	3.3	4.4	155	15.9	16.6
% FTEs not certified 2006	62	2.8	3.3	165	8.7	13.2
% FTEs in-field 2003	58	95.0	5.1	155	81.1	18.4
% FTEs in-field 2006	62	95.7	4.6	165	84.8	16.9
FTE: % turnover 03 to 04	58	17.4	9.9	155	24.0	17.4
FTE: % turnover 05 to 06	62	13.5	10.8	167	19.2	14.2
% tchrs failing cert exams 2003	58	21.4	10.3	156	37.8	15.1
% tchrs failing cert exams 2006	62	20.2	10.2	167	36.4	14.9
Principal Characteristics						
Average age in 2003	62	42.4	8.3	167	44.0	7.4
Yrs of education experience	62	15.1	7.3	167	17.1	7.6
Failed any cert exam	61	8.2	27.7	166	18.7	39.1
Failed principal cert exam	60	3.3	18.1	161	5.6	23.0
Top 10% of scores on principal cert exam	60	21.7	41.5	161	15.5	36.3
White	62	96.8	17.8	167	35.9	48.1
female	62	69.4	46.5	167	79.6	40.4
UCEA affiliation	62	14.5	35.5	166	24.7	43.3
years as teacher in 1995 thru 2003	62	4.3	2.7	167	3.3	2.5

Percentage of Economically Disadvantaged Students in the School

As shown below in Table 2, high-poverty schools had greater percentages of novice teachers, teacher FTEs not certified, and teachers failing certification examinations than low-poverty schools. In addition, high-poverty schools had greater turnover rates and lower percentages of teacher FTEs assigned in-field than low-poverty schools.

With respect to principal characteristics, high-poverty schools had slightly older principals and principals with more education experience than low-poverty schools. In addition, a greater percentage of principals in high-poverty than in low-poverty schools had failed any certification examination and failed the principal certification examination. A greater percentage of principals in high-poverty schools than in low-poverty schools were female, non-White, and from a preparation program that was a member of UCEA. A lower percentage of principals in high-poverty schools than in low-poverty had principal certification scores that were in the top 10% of all test-takers. Finally, principals in high-poverty schools about the same teaching experience from 1995 through 2003 than principals in low-poverty schools.

Table 2: Means and Standard Deviations for Teacher and Principal Characteristics for High- and Low-Poverty Elementary Schools

Measure	% of Eco Disadv Students Enrolled in the School					
	00.0-25.0%			75.1-100%		
	N	Mean	Std. Dev.	N	Mean	Std. Dev.
Teacher Characteristics						
% Novice Tchrs 2003	40	16.3	10.0	140	27.1	19.1
% Novice Tchrs 2006	47	16.5	14.0	146	24.2	16.9
% FTEs not certified 2003	40	5.1	5.3	140	15.8	17.0
% FTEs not certified 2006	47	3.4	3.8	146	8.4	13.8
% FTEs in-field 2003	40	93.8	5.7	140	81.3	18.8
% FTEs in-field 2006	47	95.3	4.9	146	84.5	17.8
FTE: % turnover 03 to 04	40	18.4	10.5	140	23.0	17.2
FTE: % turnover 05 to 06	47	16.1	10.3	148	18.1	14.8
% tchrs failing cert exams 2003	40	18.1	7.9	141	39.0	14.8
% tchrs failing cert exams 2006	47	16.6	7.4	148	37.9	14.7
Principal Characteristics						
Average age in 2003	47	42.3	8.6	148	43.3	7.3
Yrs of education experience	47	15.2	6.9	148	16.5	7.4
Failed any cert exam	46	6.5	25.0	147	17.7	38.3
Failed principal cert exam	45	0.0	0.0	143	5.6	23.1
Top 10% of scores on principal cert exam	45	26.7	44.7	143	14.7	35.5
White	47	87.2	33.7	148	36.5	48.3
female	47	78.7	41.4	148	80.4	39.8
UCEA affiliation	47	21.3	41.4	147	25.2	43.5
years as teacher in 1995 thru 2003	47	3.6	2.3	148	3.3	2.5

Quintiles of the Change in the Percentage of All Students Passing All TAKS Examinations: 2003 to 2006

As shown below in Table 3, teacher and principal characteristics were generally more favorable in the schools with the lowest gains in achievement as compared to those

with the highest gains in achievement. For example, a greater percentage of novice teachers, teacher not fully certified, and teachers failing certification examinations were employed in the schools with the greatest gains in achievement as compared to schools with the lowest gains in student achievement. This often tends to be the case when examining gains in achievement without controlling for the initial level of achievement. In general, schools with initially lower percentages of students passing a test will have greater gains in achievement over time when compared to schools with high initial levels of achievement.

Table 3: Means and Standard Deviations for Teacher and Principal Characteristics for Elementary Schools with Selected Ranges of Gains in Achievement

	Change in the % of All Students Passing All TAKS Exams: 2003 to 2006									
	< 12.1		12.1-17.1		17.2-22.9		23.0-29.5		>29.5	
Measure	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Number of Schools	67		69		65		67		67	
Teacher Characteristics										
% Novice Tchrs 2003	18.2	11.5	20.1	14.5	21.8	16.6	21.2	14.1	24.6	20.9
% Novice Tchrs 2006	18.7	11.1	17.2	10.4	22.6	17.9	18.3	12.3	22.7	15.5
% FTEs not certified 2003	7.2	7.4	8.1	10.3	12.4	16.0	9.5	12.5	12.5	16.4
% FTEs not certified 2006	6.6	7.8	4.7	6.7	7.2	14.3	4.2	5.5	7.3	12.5
% FTEs in-field 2003	91.0	7.8	89.9	10.5	85.9	16.7	88.6	13.8	83.1	19.9
% FTEs in-field 2006	90.6	10.9	92.0	8.5	88.8	16.9	92.3	9.8	85.9	17.8
FTE: % turnover 03 to 04	16.9	12.0	19.1	12.6	21.2	12.2	20.6	11.5	25.8	20.6
FTE: % turnover 05 to 06	19.5	11.4	17.2	14.8	16.0	9.6	16.0	11.0	17.6	15.2
% tchrs failing cert exams 2003	27.5	14.7	26.6	14.2	32.1	17.4	31.2	13.7	31.7	13.5
% tchrs failing cert exams 2006	26.9	15.2	26.5	14.7	28.6	13.1	30.1	13.3	31.8	15.2
Principal Characteristics										
Average age in 2003	43.2	7.6	44.6	7.7	43.2	7.9	42.4	7.4	41.9	7.3
Yrs of education experience	16.8	7.1	16.8	7.3	15.3	6.9	15.6	7.4	15.5	6.7
Failed any cert exam	19.4	39.8	17.1	38.0	26.6	44.5	18.2	38.9	19.4	39.8
Failed principal cert exam	10.6	31.0	8.7	28.4	11.1	31.7	6.1	24.0	3.1	17.4
Top 10% on principal cert exam	19.7	40.1	20.3	40.5	12.7	33.6	21.2	41.2	16.9	37.8
White	71.6	45.4	65.7	47.8	66.2	47.7	62.7	48.7	67.2	47.3
female	68.7	46.7	68.6	46.8	80.0	40.3	74.6	43.8	82.1	38.6
UCEA affiliation	25.4	43.8	30.0	46.2	23.4	42.7	13.4	34.4	16.4	37.3
years as teacher in 1995 thru 2003	3.9	2.6	3.5	2.3	3.9	2.6	3.7	2.5	4.3	2.6

Model 1: Relationship between Teacher Team Attributes and School Outcomes

The means and standard deviations are presented in Table 4.

Table 4: Means and Standard Deviations for variables in Model 1

Variables	All Schools			Elementary Schools		
	N Valid	Mean	Std. Dev.	N Valid	Mean	Std. Dev.
2003 % students eco dis	617	55.18	27.12	360	62.00	26.83
CHG: % eco dis 2003 to 2006	617	3.98	6.69	360	3.54	6.74
2003 % students black	617	12.62	18.04	360	13.94	19.49
2003 % students bilingual	617	13.45	17.82	360	19.53	20.53
school size 2005	617	619.80	463.67	360	536.83	207.10
urban distrct	657	11.57	3.20	385	15.84	3.66
rural dist	657	17.66	3.82	385	10.10	3.02
% Econ Disadv Not Tested	655	3.10	3.06	383	2.48	2.90
% novice (< 3 yrs) tchr FTEs 03	616	20.02	14.46	359	21.10	15.93
CHG % novice teachers 2003-2006	615	-0.24	16.24	358	-1.10	17.59
FTE: % turnover 0304	613	21.00	13.48	359	20.57	14.20
CHG: % turnover 2003-2006	613	-2.74	16.03	359	-3.64	16.55
% FTEs not certified 03	616	10.98	13.20	359	9.93	12.98
CHG: % not certified 03 to 06	615	-3.72	12.61	358	-3.97	13.81
% cert exams failed 2003 for all teachers	617	33.29	14.29	360	29.66	14.81
% tchrs who failed at least one cert exam 2003	617	33.30	14.29	360	29.65	14.81
Principal years of experience	657	16.22	7.05	385	16.10	7.10
employed as principal pre-2004	657	32.00	4.67	385	25.45	4.36
White principal	657	69.71	4.60	385	64.67	4.78
Female principal	657	59.66	4.91	385	74.28	4.30
Carnegie 21	657	61.50	4.87	385	59.74	4.91
UCEA affiliation	656	21.49	4.11	384	21.87	4.14

The results for model 1 are shown in Table 5. In all steps of the ordinary least squares regression analysis, both the percentage of economically disadvantaged students and the change in the percentage of economically disadvantaged students were statistically significant and negatively associated with gains in student achievement. Thus, an increase in the percentage of economically disadvantaged students was negatively associated with gains in the percentage of students passing all TAKS examinations at all grade levels in 2006. In addition, schools whose student enrollment was greater than 15% of African American were negatively associated withy gains in achievement. Finally, schools in urban areas were negatively associated with gains in student achievement.

With respect to teacher quality and turnover, four variables were statistically significant and negatively associated with gains in student achievement across all steps of the analysis. These four variables included: the percentage of teacher FTEs not fully certified in 2003, the change in the teacher turnover rate from 2003-04 to 2005-06, and the percentage of teacher FTEs at the school in 2003 failing any certification examination at any time.

With respect to principal characteristics, there were 5 characteristics that were statistically significant and positively related to gains in student achievement. These 5 variables included: the principal failed at least on certification examination at any point

in time, the education experience of the principal was less than 10 years, the principal was employed as a principal in some year between 1995 through 2003, the principal was White, the principal was female, the principal graduated from a [principal preparation program with a Carnegie classification of regional comprehensive university. In addition, graduation from a principal preparation program that was a UCEA institution was negatively related to gains in student achievement.

Table 5
OLS estimates of school level outcomes (TAKS 2006)

	School Characteristics			*School and Teacher Aggregate Characteristics*			*Aggregate Characteristics with Principal Attributes*			*Aggregate Characteristics with Principal Attributes &*		
	Coef.	Std. Error	Sig.	Coef.	Std. Error	Sig.	Coef.	Std. Error	Sig.	Coef.	Std. Error	Sig.
School Characteristics												
% Economic Disadvantage 2003	-0.288	0.027	*	-0.242	0.029	*	-0.243	0.029	*	-0.113	0.030	*
Change in % Disadvantaged 2003 to 2006	-0.306	0.081	*	-0.306	0.078	*	-0.275	0.076	*	-0.191	0.068	*
% Black 2003 > 15%	-3.437	1.225	*	-2.938	1.187	*	-2.432	1.185	*	-1.913	1.053	**
% Bilingual 2003 > 20%	-0.645	1.452		0.043	1.416		0.474	1.396		0.719	1.239	
School size < 400	1.158	1.511		1.071	1.489		1.305	1.467		1.244	1.302	
School size > 750	0.012	1.477		-0.048	1.418		0.184	1.432		-0.922	1.277	
Urban District	-5.788	1.509	*	-5.692	1.485	*	-4.830	1.503	*	-3.120	1.347	*
Rural District	-1.885	2.017		-1.756	2.000		-3.408	2.009	**	-2.156	1.788	
Campus 2006 TAKS Participation[a]	0.226	0.186		0.255	0.182		0.244	0.180		0.230	0.160	
School Aggregate Teacher Composition												
% novice (< 3 yrs) tchr FTEs 03				-0.009	0.062		-0.011	0.061		0.041	0.054	
CHG % novice teachers 2003-2006				0.025	0.047		0.024	0.046		0.043	0.041	
FTE: % turnover 0304				-0.063	0.059		-0.075	0.058		-0.033	0.051	
% FTEs not certified 03				-0.154	0.076	*	-0.127	0.075	**	-0.111	0.067	**
CHG: % turnover 2003-2006				-0.158	0.049	*	-0.172	0.048	*	-0.147	0.043	*
CHG: % not certified 03 to 06				-0.119	0.062	**	-0.109	0.061	**	-0.098	0.054	**
% cert exams failed 2003 for all teachers				-0.119	0.044	*	-0.107	0.044	*	-0.076	0.039	**
Principal Attributes												
Failed one or More Certification Exams							3.886	1.303	*	2.529	1.165	*
Principal in ???							3.992	1.214	*	3.055	1.082	*
Principal Experience in 2004 > 20yrs							1.316	1.267		-0.013	1.134	
Years as prinicpal in 1995 thru 2003							2.579	1.216	*	2.238	1.080	*
White							2.801	1.291	*	3.056	1.146	*
Female							2.198	1.206	**	2.867	1.073	*
Certified at Regional Comprehenisve College (Carnegie 1994 = 21)							2.030	1.173	**	2.126	1.041	*
Certified at UCEA Graduate Program in Educational Administration							-1.277	1.331		-2.237	1.185	**
Lagged TAKS 2003										0.362	0.040	*
CONSTANT	96.519	1.561	*	98.776	1.801	*	90.684	2.762	*	59.270	4.226	*
R-Squared		0.478			0.535			0.571			0.663	
Adj. R-Squared		0.464			0.511			0.537			0.635	

*p<.05, **p<.10
[a] Econ Disadv Not Tested - Total Rate

Model 2: Relationship between Leadership Attributes and Teacher Team Attributes

In Table 6 and Table 7, we report our regression analyses where the dependent variables are teacher team characteristics, including turnover and quality measures. In all 6 analyses, we controlled for the beginning measure of teacher quality or turnover by including the measure from 2003.

The results of these analyses are shown in Tables 6 and 7 below.

Percentage of Novice Teachers

Only one principal attribute was statistically significantly related to the percentage of novice teachers in a school: years of education experience of the principal. More

novice principals, per se, or those with less experience were in schools with the greatest shares of novice teachers. It is difficult to discern causality. But, our models are estimated such that this particular relationship indicates an increase (over prior rates of novice teachers) in novice teachers associated with less experienced principals.

Teacher Turnover from 2005 to 2006

Only one principal characteristic was statistically significantly related to teacher turnover in this analysis. Specifically, the greater the years of education experience of the principal, the lower the turnover rate, given prior turnover rate. That is, less experienced principals were in schools that experienced a reduction in turnover rate, but increase in share of novice teachers.

Percentage of Teachers Not Certified

Two principal characteristics were statistically significantly associated with the percentage of teachers not fully certified in the school. First, principals who had failed at least one certification examination had a greater percentage of teachers who were not fully certified. Second, the greater the years of education experience of the principal, the lower the percentage of teachers who were not fully certified.

Again, because prior levels of teacher certification were included in the model, these models to some extent measure whether percentages not certified have increased in the presence of certain principals. The model suggests that rates of teachers not certified increased in schools with principals who themselves had failed certification exams, and in schools with less experienced principals.

Table 5: Analyses of Factors Associated with Measures of Teacher Quality and Teacher Turnover

	% Novice Teachers 2006			*% Turnover 2005-06*			*% Not Certified 2006*		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
Lagged Teacher Measure (2003)	0.162	0.038	*	0.154	0.036	*	0.253	0.032	*
Principal Attributes									
Failed one or More Cert Exams	1.016	1.126		1.470	1.094		1.566	0.842	**
Degree from RU or Doc. U.	-1.035	1.523		2.246	1.473		0.524	1.137	
Principal Experience	-0.213	0.074	*	-0.141	0.072	**	-0.161	0.056	*
Teacher btw. 1995 & 2003	0.123	0.200		-0.037	0.193		-0.040	0.149	
School Demographics									
% LEP 2004	0.160	0.045	*	0.125	0.043	*	0.026	0.034	
% Econ. Disadv. 2004	0.030	0.030		-0.011	0.029		0.019	0.022	
% Black 2004	0.089	0.036	*	0.080	0.035	*	0.070	0.027	*
School Grade Level (0=Elem)									
Comprehensive	4.121	2.788		6.846	2.820	*	7.650	2.142	*
Middle	3.582	1.345	*	3.914	1.302	*	2.198	1.014	*
Secondary	2.618	1.481	**	6.523	1.443	*	3.983	1.136	*
Constant	17.140	3.260	*	8.126	3.222	*	5.265	2.425	*
R-Squared		0.227			0.144			0.291	
Adj. R-Squared		0.187			0.099			0.255	

Includes fixed effect for each of 20 regions (labor markets)

*p<.05, **p<.10

Percentage of Teachers Assigned In-Field

Two principal characteristics were statistically significantly related to the percentage of teachers FTEs assigned in-field in a school. First, principals who had failed at least one certification examination had a lower percentage of teacher FTEs assigned in-field, though only marginally statistically significant (p<.10). Second, the greater the years of education experience of the principal, the greater the percentage of teacher FTEs assigned in-field in the school.

Percentage of Teachers Failing at Least One Certification Examination

Only one principal characteristic was statistically significantly related to the percentage of teachers who had failed at least one certification examination in a school. Specifically, principals who themselves failed one or more certification exams were in schools with larger shares of teachers who failed one or more certification exams, controlling for prior teacher failure rates.

Analysis 6: Percentage of Teachers Scoring in the Top 10% of Test-Takers on the Pedagogy Certification Examination

None of the principal characteristics were statistically significantly related to the percentage of teachers with pedagogy examination scores in the top 10%.

Table 6: Analyses of Factors Associated with Measures of Teacher Quality and Teacher Turnover

	% In Field 2006			*% Failed Cert Exam 2005*			*% Top 10% Cert Exam 2005*		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
Lagged Teacher Measure (2003)	0.370	0.033	*	0.662	0.028	*	0.669	0.030	*
Principal Attributes									
Failed one or More Cert Exams	-1.830	0.997	**	1.199	0.709	**	0.332	0.522	
Degree from RU or Doc. U.	-1.785	1.349		-1.273	0.960		0.832	0.706	
Principal Experience	0.137	0.066	*	0.076	0.046		-0.042	0.034	
Teacher btw. 1995 & 2003	-0.133	0.176		0.203	0.125		-0.011	0.092	
School Demographics									
% LEP 2004	-0.169	0.040	*	0.003	0.028		-0.014	0.021	
% Econ. Disadv. 2004	-0.002	0.026		0.061	0.019	*	-0.038	0.014	*
% Black 2004	-0.073	0.032	*	0.046	0.023	*	-0.001	0.017	
School Grade Level (0=Elem)									
Comprehensive	-10.115	2.575	*	5.323	1.809	*	-0.772	1.302	
Middle	-9.160	1.285	*	3.333	0.923	*	-1.501	0.632	*
Secondary	-8.836	1.417	*	4.777	1.025	*	-2.061	0.696	*
Constant	58.257	4.446	*	6.724	2.225	*	6.312	1.536	*
R-Squared		0.464			0.730			0.573	
Adj. R-Squared		0.436			0.716			0.551	

Includes fixed effect for each of 20 regions (labor markets)

*p<.05, **p<.10

Conclusions and Policy Implications

Due to the preliminary nature of the findings and analyses herein, we will not be so bold as to draw major conclusions at this time, especially relating to potential direction of causality in the consistently identified relationships. What we do know from the analyses herein, is that there appears to be a pattern of association of higher teacher turnover and lower student outcomes, coupled with less experienced principals. Further, there appears to be a pattern of greater numbers of un-certified teachers or out of field teachers in schools with lower student outcomes, coupled with principals who themselves were likely to have failed certification exams. We suspect, to some extent, that these relationships identified herein merely reflect the ongoing churning of less qualified and less experienced staff in underperforming, higher poverty and high minority concentration schools in Texas, despite our attempts to control separately for school characteristics.

Future investigations with the Texas micro-data will explore in much greater detail how the school level composition of teacher teams changes under stable versus less stable principal leadership and under the leadership of principals with varied educational and experiential backgrounds. Further, future analyses will attempt to construct alternative measures of school aggregate performance, and propose alternative measures of teacher team composition, based on the relationship between team attributes and performance outcomes.

References

Abernathy, T.C., Forsyth, A. & Mitchell, J. (2001). The Bridge from Student to Teacher: What Principals, Teacher Education Faculty and Students Value in a Teaching Applicant. *Teacher Education Quarterly 28* (4), 109-119

Angrist, J. & Guryan, J. (2003). Does teacher testing raise teacher quality? Evidence from state certification requirements. NBER working paper #9545

Antonio, A., Venezia, A. & Kirst, M. (2004). Addressing the Development of College Knowledge. http://www.stanford.edu/group/bridgeproject/EAQ%201-31-04.pdf. Accessed 2/1/04

Ballou (1996). Do public schools hire the best teachers? *Quarterly Journal of Economics 111* (1), 97-133.

Ballou, D. & Podgursky, M. (2000). "Gaining Control of Professional Licensing and Advancement," in Tom Loveless (ed.) 69 – 109, *Conflicting Missions? Teachers Unions and Educational Reform* Washington, DC: The Brookings Institution Press

Ballou, D., & Podgursky, M. (1995). Recruiting smarter teachers. *Journal of Human Resources, 30*(2), 326-338.

Bitsa, M.B. & Glasman, N.S. (1998). Principals' approaches to leadership, their antecedents and student outcomes. *Journal of School Leadership 8*(2), 109-136

Boyd, D., Loeb, S., Lankford, H. & Wyckoff, J. (2003). Analyzing the Determinants of the Matching of Public School Teachers to Jobs: Estimating Compensating Differentials in Imperfect Labor Markets. Working Paper. Education Finance Research Consortium. Rockefeller Institution of Public Policy. State University of New York at Albany.

Brewer, D.J. (1993). Principals and Student Outcomes: Evidence from U.S. High Schools. *Economics of Education Review 12*(4), 281-292

Brewer, D.J., Furhman, S., Linn, R. & Villegas, A.M. (2003) Synthesis of Reviews of "The Value-Added Achievement Gains of NBPTS-Certified Teachers in Tennessee: A Brief Report" Education Commission on the States. http://www.ecs.org/ecsmain.asp?page=/html/special/nbpts/letter.htm Accessed 2/1/04

Byrne, D. (1961). Interpersonal attraction and attitude similarity. *Journal of Abnormal and Social Psychology 62*(3), 713-715.

Conley, D.T. & Brown, R.S. (2003). Comparing State High School Assessments to Standards for Success in Entry Level University Courses. Unpublished Manuscript. University of Oregon.

Darling-Hammind, L., Berry, B. & Thoreson, A. (2001). Does Teacher Certification Matter? Evaluating the Evidence. *Educational Evaluation and Policy Analysis 23* (1) 57-78.

Decker, P.T., Mayer, D.P. & Glazerman, S. (2004). The Effects of Teach for America on Students. Princeton, NJ: Mathematica Policy Research, Inc. http://www.mathematica-mpr.com/publications/pdfs/teach.pdf. Accessed July 8, 2004.

Ehrenberg, R.G. & Brewer, D.J. (1995). Did teachers verbal ability and race matter in the 1960's? Coleman revisited. *Economics of Education Review 14*(1), 1 – 21.

Ehrenberg, R.G. & Brewer, D.J. (1994). Do School and Teacher Characteristics Matter? Evidence from High School and Beyond. *Economics of Education Review 13*(1), 1-17.

Emley, K. & Ebmeier, H. (1997). The Effect of Employment Interview Format on Principals' Evaluations of Teachers. *Journal of Personnel Evaluation in Education 11*(1), 39-56.

Ferguson, R.F. (1991). Paying for public education: New evidence on how and why money matters. *Harvard Journal of Legislation 28*, 465-498.

Ferguson, R.F. (1998) Can Schools Narrow the Black-White Test Score Gap? In Christopher Jencks and Meredith Phillips (eds), *The Black-White Test Score Gap.* Washington, DC: The Brookings Institution.

Figlio, D.N. (1997). Teacher Salaries and Teacher Quality. *Economics Letters 55*(August), 267-271.

Figlio, D.N. (2002). Can Public Schools Buy Better-Qualified Teachers?" *Industrial and Labor Relations Review 55*(4), 686-699

Hallinger, P. & Heck, R.H. (1996). Reassessing the Principal's Role in School Effectiveness: A Review of Empirical Research 1980 – 1995. *Educational Administration Quarterly 32*(1), 5-44.

Heck, H.R. (1992). Principals' instructional leadership and school performance: Implications for Policy Development. *Educational Evaluation and Policy Analysis 14*(1), 21-34.

Heck, H.R., Larsen, T. & Marcoulides, G. (1990). Principal leadership and school achievement: the validation of a causal model. *Educational Administration Quarterly 26*(2), 96-145.

Goldhaber, D. & Anthony, E. (2004). Can Teacher Quality Be Effectively Assessed? Seattle: Center for Reinventing Education. http://www.crpe.org/workingpapers/pdf/NBPTSquality_report.pdf

Goldhaber, D. & Brewer, D.J. (2000). Does teacher certification matter? High school teacher certification status and student achievement. *Educational Evaluation and Policy Analysis 22*(2), 129-145.

Goldhaber, D. & Brewer, D.J. (2001). Evaluating the Evidence on Teacher Certification: A Rejoinder. *Educational Evaluation and Policy Analysis 23*(1), 79 – 86.

Gordon, G. (1999). Teacher Talent and Urban Schools. *Phi Delta Kappan 81*(4), 304-307

Hanushek, E.A., Kain, J.F. & Rivken, S.G. (2001). Why Public School Lose Teachers. Working Paper 8599. National Bureau of Economic Research.

Hanushek, E.A., Kain, J.F. & Rivken, S.G. (1999). Do higher salaries buy better teachers? NBER working paper #7082.National Bureau of Economic Research.

Hanushek, E.A., Kain, J.F. & Rivken, S.G. (1998). Teachers, schools and academic achievement. NBER Working Paper #6691.National Bureau of Economic Research.

Imazeki, J. (2001). Moving On or Moving Out? Determinants of Job and Career Changes for Teachers. Working Paper, Department of Economics, San Diego State University.

Imazeki, J. (2001). School Revenue Limits and Teacher Salaries: Evidence from Wisconsin. Working Paper. Department of Economics. San Diego State University**.**

Jackson, B. L. & Kelley, C. (2003). Exceptional and Innovative Programs in Educational Leadership. National Commission on Excellence in Educational Administration. University Council on Educational Administration. http://www.ncaelp.org/Jackson%20&%20Kelley%20Draft.RTF

Laczko-Kerr, I., & Berliner, D.C. (2002). The effectiveness of "Teach for America" and other under-certified teachers on student academic achievement: A case of harmful public policy," *Education Policy Analysis Archives*, *10*(37). Retrieved 2/1/2004 from http://epaa.asu.edu/epaa/v10n37/.

Lankford, H., Loeb, S. & Wyckoff, J. (2002). Teacher sorting and the plight of urban schools. *Educational Evaluation and Policy Analysis 24*(1) 37-62

Loeb, S. (2000). How Teachers' Choices Affect What a Dollar Can Buy: Wages and Quality in K-12 Schooling. Working Paper. Education Finance Research Consortium. Rockefeller Institution of Public Policy. State University of New York at Albany.

Loeb, S. & Page, M. (2000). Examining the link between teacher wages and student outcomes: the importance of alternative labor market opportunities and non-pecuniary variation. *Review of Economics and Statistics 82* (3), 393-408

Loeb, S. & Page, M. (1998). Examining the link between wages and quality in the teacher workforce. Department of Economics, University of California, Davis.

Murnane, R.J. & Olsen, R. (1989). The effects of salaries and opportunity costs on length of state in teaching. Evidence from Michigan. *Review of Economics and Statistics 71* (2) 347-352

Papa, F., Lankford, H. & Wyckoff, J. (2002). *The Attributes and Career Paths of Principals: Implications for Improving Policy.* University at Albany. Albany, NY.

Reback, R. (2002). The impact of college course offerings on the supply of academically talented public school teachers. Working Paper. National Bureau of Economic Research.

Reich, R. (2003). *Bridging Liberalism and Multiculturalism in American Education*. Chicago, IL: University of Chicago Press.

Rivken, S., Hanushek, E. & Kain, J.F. (2000). Teachers, Schools and Academic Achievement. Working Paper 6691. National Bureau of Economic Research.

Sanders, W. L. & Rivers, J. C. (1996). *Research project report: Cumulative and residual effects of teachers on future student academic achievement.* University of Tennessee Value-Added Research and Assessment Center. http://www.mdkl2.org/practices/ensure/tva/tva_2.html

Slosson, J. (1999) Hiring the Right People. *High School Magazine 7* (2) 26-30.

Stone, J.E. (2002). The Value-Added Achievement Gains of NBPTS-Certified Teachers in Tennessee: A Brief Report. http://www.education-consumers.com/briefs/stoneNBPTS.shtm

Strauss, R.P. (2003). *The Preparation and Selection of Public School Administrators in Pennsylvania: Supply and Demand and the Effects on Student Achievement.* Paper

presented at the annual meeting of the American Education Finance Association. Orlando, FL.

Strauss, R.P. & Sawyer, E. (1986). Some New Evidence on Teacher and Student Competencies. *Economics of Education Review 5* (1) 41-48.

Strauss, R.P., Bowes, L.R., Marks, M.S. & Plesko, M.R. (2000). Improving Teacher Preparation and Selection: Lessons from the Pennsylvania Experience. *Economics of Education Review, 19* (4), 387-415.

Trimble, S. (2001). The Teacher Applicant Pool: What Top Administrators Seek. *Principal Leadership 1* (7), 44-47.

Young, I.P. & Allison, B. (1982). Effects of candidate age and teaching experience on school superintendents and principals in selecting teachers. *Planning and Changing 13*(2), 245-256.

Young, I.P., Place, A.W., Rinehart, J.S., Jury, J.C. & Baits, D.F. (1997). Teacher Recruitment: A Test of the similarity-attraction hypothesis for race and sex. *Educational Administration Quarterly 33*(1), 86-106

Young, I.P., Rinehart, J.S. & Place, A.W. (1989). Theories for teacher selection: Objective, Subjective and critical contact. *Teaching and Teacher Education 5*(3), 329-336

Zehr, M.A. (2002 – October 2) ECS Review Discounts Study Critical of Teaching Board. Education Week.