Is There a Relationship Between No Child Left Behind Indicators of Teacher Quality and The Cognitive and Social Development of Early Elementary Students?

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Introduction

Research has shown that teachers are one of the most important contributors to student learning in school, beyond what students learn at home (see Ferguson, 1998; Darling-Hammond, 2000; Goldhaber 2002; Hanushek, Kain & Rivkin, 1999; Wright, Horn, & Sanders, 1997). For historically disadvantaged students whose home environments provide them with little social capital, the contribution of teachers to learning in school is even more influential. Yet high poverty, high minority and urban schools are more likely to be staffed by unqualified teachers (Ingersoll, 2002). The improvement of teacher quality and student achievement of disadvantaged students is one objective of the No Child Left Behind Act of 2001. In specifying the definition of a highly qualified teacher, No Child Left Behind (NCLB) requires that teachers must hold full state certification, hold at least a bachelor's degree from a four-year institution, and demonstrate competence in their subject area[1]. Under this legislation, states are required to place a "highly qualified" teacher in every classroom by the end of this 2005-06 school year.[2] The extent to which this major piece of educational legislation will accomplish its intended goals will not be known for some time. However, it is evident that its impact on schools, teachers and students will be substantial.[3]

In this paper, I present findings from an analysis that examines the relationship of the NCLB-mandated teacher quality characteristics to the cognitive achievement and socio-emotional development among early elementary students.

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[1] This definition of a highly qualified teacher is specified in Title IX, Section 9101 of the No Child Left Behind Act.

[2] School systems across the country have had difficulty in meeting this deadline, and in October 2005, the U.S. Department of Education indicated that states making a "good faith" effort to implement the highly qualified teacher plan will be allowed to meet the NCLB requirement by the end of the 2006-07 school year.

[3] By 2002, thirty-one states required that teachers pass a subject knowledge test for a beginning license. Three states required middle and high school teachers to have a major in the subject they teacher. Three states require both a subject knowledge test for a beginning license and a major in subject for middle /high school teachers (Education Week, 2002, p. 19). More recently, teachers who do not possess NCLB qualifications are now being "let go" (Boston Globe, 2006, p. A18).

Literature Review

The research on teacher quality is vast, controversial, and not limited to the characteristics outlined by NCLB. Although there is little agreement among educators and researchers about which teacher characteristics, or what combination of characteristics, are associated with desired educational outcomes for students, the notion of teacher quality is often understood as a vector of inputs, that includes a teacher's educational credentials, certification status, and content knowledge expertise – among many other characteristics (Rice, J.K., 1999). (A review of research on teacher quality is beyond the scope of this paper. Rather, I provide a brief review of characteristics specified by NCLB.)

Certification

The notion that certifying teachers ensures a certain standard of quality has long been part of the American educational system but requirements for attaining certification vary significantly from state to state. In addition, most states have different classifications of certification (e.g., standard/full/highest; provisional/probationary; emergency/waiver) and different certification structures. Since virtually all states require some level of certification, especially now under No Child Left Behind mandates, the focus of educational research has been on the differential impact of certification on student learning.

For example, Goldhaber and Brewer (2000) found that students of certified teachers outperformed students of uncertified teachers[4]. They also found no differences in mathematics and science achievement among students who had either traditionally (standard) certified or alternatively certified teachers. A critique and reanalysis of the Goldhaber and Brewer study by Darling-

[4] Goldhaber and Brewer were unable to determine from data the difference between uncertified teachers and teachers who were not certified to teach in their subject. They make the assumption that since most public school teachers are certified that "uncertified" in this data set most likely implies uncertified in subject they teach.

Hammond, Berry and Thoreson (2001) suggested that reliance on a small sample of alternatively certified teachers with very similar characteristics to traditionally certified teachers, prevented the detection of differences that do exist between traditionally and alternatively certified teachers.

Educational Credentials

Another aspect of teacher quality is the educational credential of the teacher. NCLB specifies that teachers must hold at least a bachelor's degree from a four-year institution. The majority of teachers already hold a baccalaureate degree (Greenberg et al., 2004) but many teachers hold a higher degree than this. One area of research focuses on whether an academic credential beyond a bachelor's degree is associated with greater student achievement. One finding is that greater educational attainment is related to greater achievement among students (Greenwald et al, 1996) while other research suggests that an advanced degree is a poor predictor of teacher quality (Goldhaber, 2003; Hanushek, 1997), at best having a modest association with teaching effectiveness (see Knapp et al., 1991 for a review of this literature).

Subject area competence

Although many states now administer teacher tests that are subject-specific, this is a relatively new phenomenon – and there is no body of research that examines the relationship between teacher knowledge as assessed by these tests and student outcomes. Rather, researchers commonly use undergraduate or graduate course work or degree as a proxy for subject matter competence. Some researchers have reported that course work or degrees in the subject area is related to greater gains in achievement for students (Goldhaber & Brewer, 2000; Wenglinsky, 2000; Monk, 1994) while others have found that pedagogical courses are more related to student learning

than academic content courses (see Ashton & Crocker, 1987 for a review of these findings; Darling-Hammond, 1990).

In general, the research on various aspects of teacher quality as described above tends to support the theory that teacher qualities such as certification, educational credential, and subject matter competence have positive influences on student learning under certain conditions, but their differential impact on achievement is difficult to measure because it varies according subject area, grade level, and student and school characteristics.

Limitations of previous research

The majority of research highlighted above has focused on teacher quality at the middle and secondary school levels. There is an absence of teacher quality effects research at the earlier grades, especially research that examines achievement longitudinally as students progress through school. Croninger et al (2003) is a notable exception and reports research and results that are very similar to those that I will describe in this paper.

In addition, the notion that greater educational attainment and certification level should be positively related to the academic achievement and social well-being of children in the earliest grades should not be accepted categorically. In the absence of data supporting the contention of a straightforward relationship, educational and psychology theory might more likely to suggest that none of these factors might be related or conceivably that the relationship might be negative. The hypothesis that an extremely well-educated, professorial level teacher would be effective among five year old children is not something that would be expected to be easily confirmed empirically, and in fact, the results of the Croninger noted above and the results reported here suggest otherwise.

Data and Methodology

Data from the Early Childhood Longitudinal Study-Kindergarten Class of 1998-99 (ECLS-K) provide the basis for examining the relationship of teacher quality (as defined by NCLB) to the cognitive and socio-emotional development of kindergarten, first and third grade children. ECLS-K is a complex multi-stage sample that began in the fall of 1998 with a nationally representative sample of approximately 22,000 children enrolled in kindergarten in about 1,000 programs (schools). However, this larger sample is reduced considerably when first and third grade data are added and certain restrictions are made as described below. An important component of ECLS-K is the assessment of children for a range of outcomes, including cognitive development. In kindergarten, first, and third grades, children demonstrate their competency in reading and mathematics through one-on-one un-timed sessions with a trained child assessor. Another set of elements of ECLS-K is the availability of data on teacher characteristics and classroom practices. Teachers were also asked to provide assessments on the socio-emotional development of children in each of these years.

The overall design for ECLS-K calls for spring testing only, except that the kindergarten and first grade were also scheduled for fall testing. In the first grade, however, fall testing is limited to a 30 percent sample of schools. In this paper, I have limited the analyses to public school children only since NCLB applies to public schools only. I also selected first time kindergarteners, and students who were in the same school in kindergarten, first and third grades. In kindergarten, I further limit the sample to students who had the same teacher for the entire year.[5]

Weighting

In order to approximate population characteristics and to adjust for the complex sampling procedures which utilizes both clustering (increased standards errors) and stratifying (decreased

[5] Data about whether children remained with the same teacher during the school year is available only in kindergarten – not in first or third grades.

standard errors), analysis of ECLS-K must weight the sample by one of several weights made available by NCES (2000a). In my analysis, I use the weight that is appropriate for the analysis of kindergarten, first and third grade public-use data employing child assessment data along with teacher data, which is the case in this paper. In this case, the weight is c1_5fc0.

The use of this weight produces estimates of the population (rather than the sample) with extremely small and incorrect standards errors. To correct for this, an adjusted weight was computed by dividing the weight for each case by the sample weight mean [(c1_5fc0)/mean of the weights)].[6]

Research Question

This study began last year with an anlaysis of the 30 percent subsample described above, in which I examined the relationship between teacher characteristics (as defined by NCLB and measured by ECLS-K) and student gains in mathematics and reading during kindergarten and first grades through a series of bivariate correlations. The findings of this investigation suggested that there was no systematic relationship between any of the teacher quality variables and student achievement in these grades. In particular, the analysis at kindergarten yielded null or negative significant relationships between teacher quality variables and student achievement in either mathematics or reading. At that time, I also included a series of variables on coursework that had been taken by teachers at anytime from the bachelor's degree to present time.

In this paper, I took a different approach. Rather than to assume that there is some relationship between NCLB indicators of teacher quality and student achievement, I pose the more basic question: Is there a relationship between No Child Left Behind indicators of teacher quality and the cognitive and social development of early elementary students?

[6] This procedure is endorsed by NCES with the use of their datasets.

The first purpose of this paper was to test a series of models that use the full sample of children, rather than the 30 percent subsample that I used last year, and that examines learning gains from kindergarten through the third grade. The second purpose was to add more analysis to the examination of children's achievement between the fall and spring of kindergarten, with the aim of confirming the null results from last year's analysis by adding some additional outcomes and some additional predictor variables. In this more detailed examination at the kindergarten level, I examined the relationship between teacher quality and a set of socio-emotional development indicators, called social rating scales in ECLS-K. I also examined the relationship between approximately 50 measures of classroom pedagogical activities in mathematics. The rationale for each of these follows.

Given the lack of relationship between teacher quality characteristics and academic achievement (as defined by measures in the ECLS-K data) among kindergarteners in the analysis last year, I developed a hypothesis that teacher quality might be more related to the socio-emotional development of students and that perhaps gains in social-emotional development would be associated with later gains in academic achievement. In the ECLS-K data, a 26 item social rating instrument was used that asked teachers to rate each child in their class on a set of socio-emotional attributes. These 25 items were then factored into five distinct variables (by Westat) to measure social and emotional development: self-control; approaches to learning; interpersonal skills, internalizing behavior and externalizing behavior. The ECLS-K teacher assessments of socio-emotional development described above were made in both the fall and the spring of the kindergarten year. In first and third grades, these assessments were made in the spring only.

There is some basis for believing that readiness for school is a function of social and emotional qualities. According to an NCES (1993) survey of public school kindergarten teachers about their views on school readiness in the 1992-93 school year, approximately 60 percent of

teachers placed importance on the ability of children to follow directions, not be disruptive in class, be sensitive to other children's feelings, and the ability to take turns and share. Of less importance but still highly ranked by teachers was the ability to sit still and pay attention (42 percent) and finishing tasks (42 percent).

The literature is sparse, however, on the relationship between social readiness and cognitive achievement, with much of the literature focused within domains, linking either social readiness with later social outcomes or academic readiness with later academic outcomes (Duncan et al., 2005). In this paper, my purpose was to describe how teacher quality attributes were related to the social rating score gains rather than relationship to later achievement.

In addition to examining how teacher quality might be related to socio-emotional development, I also examined a set of activities practiced by teachers with regard to mathematics learning. The purpose here was to determine if there are any types of pedagogical practices (beyond the NCLB teacher qualification variables) that might influence mathematics learning in kindergarten. Although these data are available for reading as well, I limited my analysis to mathematics for this paper. There are two types of pedagogical variables available in the ECLS-K data – all of them dealing with the teaching of mathematics. One set takes the form "How frequently do children in this classroom do the following activity" (e.g., math worksheets; solve real life math problems) with 18 items of this format. A second set of items took another form as follows. "For this year as a whole, how frequently are the following math skills taught in your classroom?" (e.g., counting one to ten and naming geometric shapes) with 29 items of this format.

Analytic strategy

The analytic strategy was to use multiple regression analyses to model mathematics and reading achievement among kindergarten, first and third grade children while controlling for teacher

quality variables and student background variables. The dependent variables in these models were the spring reading and mathematics achievement scores in kindergarten, first and third grades. In kindergarten, children were also assessed at the beginning of the school year, providing a pretest score which was used to control for prior achievement. As described earlier in the paper, children were also assessed at the beginning of the first grade, but I decided not to use the pretest score because doing so reduced the sample size by almost 70 percent. (This reduction reflects the ECLS-K design to use a 30 percent subsample of students who were tested in both fall and spring of first grade.) Therefore, to control for prior achievement, I used the achievement score at the end of kindergarten (spring assessment). Similarly, in third grade – where there was no assessment administered at the beginning of the school year – I used the achievement score at end of first grade assessment (spring assessment) to control for prior achievement. While this approach does not account for learning growth during the summer in first and third grades, or during the entire second grade, as well as learning occurring while in school before and after the assessments, these fine-tuning adjustments are not likely to change the pattern of null results that are described in the results section of the paper.

Teacher level variables in the ECLS-K dataset measuring certification status and educational attainment were chosen as indicators of NCLB definition of teacher quality[7]. These teacher variables included: level of certification (none, alternative, temporary/probational, regular certification, and highest certification available)[8]; type of certification (early childhood certificate and elementary education certificate); and educational attainment (bachelor's degree; at least one year

[7] The coursework variables described used in last year's analysis are not included in this paper because (1) there were null findings in kindergarten, (2) these course taking questions seemed like inadequate proxies for subject matter knowledge, and (3) subject matter competence is not as emphasized for elementary teachers under NCLB as they are for middle and high school teachers.

[8] Although the ECLS-K teacher survey did include categories of "not certified" and "alternative program certified," there were too few cases in each category to include in the analysis. These cases were coded as missing.

beyond a bachelor's degree, master's degree, and education beyond the master's degree). In last year's analysis, I examined the relationship of educational attainment and type of certificate to achievement by treating these two variables at the ordinal level even though the simple descriptive evidence did not suggest a strong linear ordering. In this paper, I take a more conservative approach, treating each teacher's certification and educational credential as a dummy variable. These teacher quality variables are shown below in Table 1 which provides descriptive results of the variability across ECLS-K variables measuring different types of certification and educational attainment.

Two additional teacher variables were included as controls: total years teaching experience as well as teaching experience at grade level (either kindergarten, first or third grade). A number of student background variables were used as controls in the regression model: previous achievement (mathematics and reading), socio-economic status, and race (entered as dummies with whites as the omitted category). In addition to controlling for previous achievement, I also controlled for age (in months) of child at the first assessment and time (in months) between the previous and current assessment. In kindergarten, an additional control variable was added to control for the number of months between the age of entry and the first assessment. A complete list of independent and dependent variables used in the regression analysis can be found in Appendix A.

Results

Table 1 shows remarkable similarity among teachers of students in the sample. Approximately 25% of kindergarten, first and third grade teachers held bachelors degrees, approximately one third of teachers had completed at least one year of coursework beyond a bachelor's degree and another third held masters degrees. Not surprisingly, only about 8 percent held a degree or had completed coursework beyond a master's degree. Virtually all kindergarten,

first and third grade teachers held some type of certification (i.e., no teachers held "none"). Approximately 1 percent of the sample of teachers had been certified through alternative routes and approximately 7 percent reported holding a temporary certificate. Among kindergarten children, approximately 20 percent of their teachers held what was characterized as "regular certification" (less than highest) compared to 71 percent who held what was characterized as the "highest certification available." However, in both first and third grades, 81 percent of the teachers reported holding regular certification while only 10 percent of the teachers reported holding the highest certification available. This noticeable change from the kindergarten to first and third grades may reflect the movement of states in the late 1990s to tighten certification policies. Finally, and not surprising, more kindergarten teachers held an early childhood certification (52 percent) than either first or third grade teachers (28 percent and 20 percent, respectively) but the overwhelming majority of teachers in this sample held an elementary certificate (89 percent of kindergarten, 94 percent of first grade and 96 percent of third grade teachers).

Table 1. Descriptive statistics for teacher quality variables

Teacher Quality Variables	Kindergarten (mean)	First Grade (mean)	Third Grade (mean)
Not certified	.00	.00	.00
Temporary/Probational certification	.08	.07	.07
Alternative program certification	.01	.01	.01
Regular certification, less than highest	.20	.81	.82
Highest certification available	.71	.10	.10
Certification area: elementary education	.89	.94	.96
Certification area: early childhood education	.52	.28	.20
Bachelor's degree	.25	.25	.24
At least one year beyond bachelor's degree	.35	.33	.31
Master's degree	.34	.33	.37
Doctorate	.06	.08	.08

Cognitive outcomes

Tables 2 and 3 provide results of multiple regression analyses modeling mathematics and reading achievement among kindergarten, first and third grade children. Compared to kindergarten students whose teachers hold only a bachelor's degree (omitted category), a significant, negative relationship in the data indicates that mathematics achievement is actually lower for students whose teachers held at least one year of education beyond a bachelor's degree, compared to students whose teachers held only a bachelor's degree. In first and third grades, there was no significant relationship between educational attainment and mathematics achievement.

Level of certification (temporary/probational, regular, and highest) did not have any significant relationship to mathematics achievement in any of the grades. In general, there was also no significant relationship between type of certification (early childhood or elementary education) and mathematics achievement in the three grades. The exception to this was a significant, negative relationship between early childhood certification and mathematics achievement in first grade, suggesting that students whose teachers held an early childhood certificate did not gain as much in mathematics compared to students whose teachers who did not hold this type of certificate.

An examination of reading achievement in kindergarten, first and third grades showed only a small number of significant findings. Compared to students whose teachers held only a bachelor's degree, there was a negative, significant relationship between reading scores in kindergarten and teachers who held either a master's degree or had completed at least one year beyond a bachelor's degree. There was a positive, significant coefficient in the first and third grades related to regular certification. The other educational categories (at least one year beyond a bachelor's degree and education beyond a master's degree) are negative, though not significant. This may suggest however, holding a master's degree the optimal educational attainment, at least for kindergarten teachers.

There were not any significant relationships between educational attainment and reading achievement in first or third grades.

In terms of certification level, third grade students whose teacher held a regular certification gained approximately 2 more points in reading achievement compared to those who held a temporary certificate (omitted variable). The magnitude of this relationship is the largest among all the relationships between teacher quality and cognitive gains. At the same time, however, it pales in comparison to most of the racial variables shown below in the table in the third grade where for example, black students score 7 points below white students. Although unrelated to the paper directly, it is worth noting that the data show the familiar increasing gap between blacks and whites that occurs in reading and mathematics with every passing year in school, even controlling for the quality of their teachers (which is the focus of the paper).

The two additional teacher controls did produce some statistically significant findings. The number of years teaching at grade level was positively related to mathematics achievement in first grade but there is a significant negative coefficient in kindergarten. There are significant positive coefficients in first and third grades related to reading achievement. With regard to the total years of teaching experience the findings are consistently negative or null (this variable not available in kindergarten). Once again, it appears that in general, that there is no systematic relationship between certification, education and teaching experience --- and mathematics and reading achievement in kindergarten, first or third grades.

The student background variables produced significant findings where expected. In general, the controls for previous achievement and socio-economic status were significant. In addition, several of the dummy race variables (with white as the omitted category) produced significant results. The most consistent finding is that black students gain less in both reading and mathematics compared to white students in each year examined, and that the gap more than doubles in

mathematics and triples in reading between kindergarten and third grade. For example, black kindergarten students gain 1.14 fewer points in mathematics than white students, and by third grade the difference is 7.13 points. It is also noteworthy that the time in months between assessments are significant at all grades, suggesting that children are learning something in school even though we cannot seem to relate that to differences in teachers. In sum, the control variables confirm what is already known about the relationship between demographic factors and achievement.

Table 2..OLS regression models predicting student gains in mathematics during kindergarten (1998-99), first (1999-2000), and third grade (2001-02)

Independent Variables	Kindergarten		First Grade		Third Grade	
	b	SE	b	SE	b	SE
Level of certification						
Regular certification, less than highest	.312	.354	.158	.512	.419	.561
Highest certification available	.179	.329	1.087	.658	-1.181	.737
Type of certification						
Certification area: early childhood education	.214	.172	**-.613***	.293	-.019	.379
Certification area: elementary education	.179	.267	.396	.561	.068	.774
Educational attainment						
At least one year a beyond bachelor's degree	**-.768*****	.226	.186	.344	.431	.401
Master's degree	-.398	.232	.653	.354	.477	.407
Education beyond master's degree	.667	.365	-.491	.533	.302	.621
Years teaching experience						
Years teaching at grade level	**-.033****	.012	**.057****	.022	-.008	.027
Years been a school teacher	--	--	**-.063*****	.018	.011	.020
Student variables						
Previous mathematics achievement	**1.020*****	.012	**1.007*****	.013	**.821*****	.011
Time (in months) prior to first assessment	**-.294***	.141	--	--	--	--
Age (in months) at first assessment	**.214*****	.022	.012	.033	-.068	.038
Time (in months) between assessments	**.179*****	.142	**1.342*****	.196	**1.094*****	.208
Socio-economic status	**.430*****	.125	**1.754*****	.188	**2.861*****	.219
American Indian	.032	.549	**-1.804***	.814	**-2.620****	.999
Asian	.683	.511	-.485	.793	**1.733***	.860
Black	**-1.867*****	.255	**-2.713*****	.391	**-4.959*****	.452
Hispanic	**-.928*****	.237	.212	.368	-.258	.424
More than one race	2.148	1.772	-3.123	2.521	-4.252	3.036
Pacific Islander	-.534	.851	**-2.736***	1.253	-.313	1.421

*p=< .05; ** p=< .01; *** p=< .001

Omitted categories: level of certification (temporary/provisional); educational attainment (bachelor's degree); race (white)
Note: In level of certification variable, "not certified" and "alternative certified" are treated as missing

Table 3. OLS regression models predicting student gains in reading during kindergarten (1998-99), first (1999-2000), and third grade (2001-02)

Teacher Quality Characteristic	Kindergarten		First Grade		Third Grade	
	b	SE	b	SE	b	SE
Level of certification						
Regular certification, less than highest	.056	.412	**1.405***	.680	**1.901****	.696
Highest certification available	.078	.386	.989	.864	.261	.913
Type of certification						
Certification area: early childhood education	.206	.197	.140	.379	-.223	.469
Certification area: elementary education	-.086	.302	.553	.740	-.406	.958
Educational attainment						
At least one year a beyond bachelor's degree	**-.709****	.257	-.432	.444	-.350	.499
Master's degree	**-.599***	.264	-.060	.456	-.320	.504
Education beyond master's degree	.379	.410	.668	.687	-.483	.768
Years teaching experience						
Years teaching at grade level	-.012	.013	**.121*****	.029	**.072***	.033
Years been a school teacher	--	--	**-.055***	.024	-.011	.025
Student variables						
Previous reading achievement	**1.102*****	.001	**1.101*****	.014	**.647*****	.010
Socio-economic status	.239	.142	**2.451*****	.241	**3.889*****	.271
Time (in months) prior to first assessment	**-.818*****	.166	--	--	--	--
Age (in months) at first assessment	.016	.025	.029	.042	.052	.046
Time (in months) between assessments	**1.704*****	.164	**2.100*****	.254	**1.120*****	.258
American Indian	.394	.609	**-4.743*****	1.066	**-4.725*****	1.239
Asian	**1.924*****	.566	.043	.968	**-4.169*****	1.059
Black	**-1.136*****	.281	**-3.105*****	.491	**-7.129*****	.553
Hispanic	.244	.296	-.575	.500	**-1.694****	.537
More than one race	3.733	1.951	-5.092	3.090	2.195	3.732
Pacific Islander	.265	.945	-.335	1.587	-2.993	1.746

*p=< .05; ** p=< .01; *** p=< .001

Omitted categories: level of certification (temporary/provisional); educational attainment (bachelor's degree); race (white)
Note: In level of certification variable, "not certified" and "alternative certified" are treated as missing

Socio-emotional outcomes

The null set of findings for the teacher quality variables led to the hypothesis that the broadly defined set of qualities required by NCLB might not be relevant for teachers of early elementary students as it relates to cognitive achievement, but that these teacher quality attributes might have some significant relationship to socio-emotional development in the early years of schooling.

Tables 4 though 6 show results which in most ways are consistent with results in Tables 2 and 3, especially in first and third grades. The clearest result in each of these tables is in the substantial number of blank cells indicating null results, which dominate in all of these tables. In addition to the negative findings, in kindergarten and first grade (in Tables 4 and 5), virtually all of the significant relationships are negative, that is more highly qualified teachers are negatively related to children's achievement in these grades. All of this points again to the need to reexamine the NCLB definitions of a highly qualified teacher in kindergarten and first grade. In third grade however, (Table 6), there appears to emerge a pattern that these NCLB teacher qualifications may have positive, rather than negative or null effects on the socio-emotional development of children.

In addition – compared to very sporadic and random results in Tables 2 and 3 with respect to early childhood and elementary certificates, there does appear to be a more systematic relationship in Tables 4 through 6 between early childhood and elementary education certificates and the social development outcomes. However, not much should be read into this since the majority of findings are null in the same ways as in Tables 2 and 3.

A methodological caveat must be added. Unlike the cognitive assessments which are conducted by an independent trained assessor, the social rating scales are made by teachers of each of their individual students. Thus, there is room for unreliability in how each teacher makes these assessments, and in fact the reliabilities for these assessments are lower than the reliabilities

associated with the cognitive assessments (for example, in kindergarten the fall and spring reliabilities for the social rating scales average .85 compared to an average reliability of .92 for the cognitive assessments in kindergarten). Secondly, these socio-emotional behaviors measured by these scales are themselves unstable, subject to the whims of childhood growth and development. Finally, the range of the scales (1-4) may be too narrow to accurately measure these behaviors at any given time.

Table 4. The relationship between teacher quality variables and socio-emotional outcomes among kindergarten children

Teacher Quality Variable	Self Control		Approaches to Learning		Interpersonal Skills		Externalizes Problems		Internalizes Problems	
	b	SE	b	SE	b	SE	b	SE	b	SE
Level of certification										
Regular certification, less than highest										
Highest certification available										
Type of certification										
Certification area: early childhood education					-.038**	.014	-.027*	.012	-.040***	.012
Certification area: elementary education	-.056**	.020	-.074***	.020	-.078***	.022			-.042*	.018
Educational attainment										
At least one year a beyond bachelor's degree										
Master's degree	-.038*	.018								
Education beyond master's degree	-.054*	.028								
Years teaching experience										
Years teaching at grade level										
Years been a school teacher										

*p<=.05; **p<=.01; *** p<=.001

Omitted categories: level of certification (temporary/provisional); educational attainment (bachelor's degree); race (white)
Note: In level of certification variable, "not certified" and "alternative certified" are treated as missing
Student variable coefficients (SES, race, etc. are not included in this table).
All blank cells represent insignificant coefficients

Table 5. The relationship between teacher quality variables and socio-emotional outcomes among first grade children

	Self Control		Approaches to Learning		Interpersonal Skills		Externalizes Problems		Internalizes Problems	
Teacher Quality Variable	b	SE	b	SE	b	SE	b	SE	b	SE
Level of certification										
Regular certification, less than highest							.061*	.028	.068**	.027
Highest certification available										
Type of certification										
Certification area: early childhood education			.044**	.018	.042*	.018				
Certification area: elementary education	-.082**	.033	-.012**	.035	-.091**	.035	-.100**	.031	-.074**	.030
Educational attainment										
At least one year a beyond bachelor's degree										
Master's degree										
Education beyond master's degree									-.058*	.028
Years teaching experience										
Years teaching at grade level										
Years been a school teacher										

*p<=.05; **p<=.01; *** p<=.001

Omitted categories: level of certification (temporary/provisional); educational attainment (bachelor's degree); race (white)
Note: In level of certification variable, "not certified" and "alternative certified" are treated as missing
Student variable coefficients (SES, race, etc. are not included in this table).
All blank cells represent insignificant coefficients

Table 6. The relationship between teacher quality variables and socio-emotional outcomes among third grade children

	Self Control		Approaches to Learning		Interpersonal Skills		Externalizes Problems		Internalizes Problems	
Teacher Quality Variable	b	SE	b	SE	b	SE	b	SE	b	SE
Level of certification										
Regular certification, less than highest										
Highest certification available					-.101*	.043				
Type of certification										
Certification area: early childhood education	.054**	.020	.061**	.020	.043*	.022	.040*	.018		
Certification area: elementary education										
Educational attainment										
At least one year a beyond bachelor's degree										
Master's degree	.061**	.022	.045*	.022	.061**	.023	.044*	.020	.039*	.020
Education beyond master's degree	.087**	.033					.067*	.030		
Years teaching experience										
Years teaching at grade level										
Years been a school teacher										

*p<=.05; **p<=.01; *** p<=.001

Omitted categories: level of certification (temporary/provisional); educational attainment (bachelor's degree); race (white)
Note: In level of certification variable, "not certified" and "alternative certified" are treated as missing
Student variable coefficients (SES, race, etc. are not included in this table).
All blank cells represent insignificant coefficients

Relationship between teacher quality to pedagogical activities in classroom

Having shown in Tables 2 through 6 a set of null and often negative effects of NCLB teacher quality variables on cognitive and socio-emotional outcomes in first and third grades, and especially in kindergarten, I began to explore whether a set of pedagogical activities might be related to cognitive achievement in mathematics. At each grade in ECLS-K, measures are obtained from teachers of the frequency and types of activities they employ in teaching both mathematics and reading. In this paper, I limit this analysis to kindergarten and to mathematics.

The pedagogical questions are of two types as described earlier under the research questions. I took the sum of each of the two categories of these questions to create two indices of teachers' mathematical activities in the classrooms. Both measures of these activities on their own are strongly related to mathematical achievement but once again, the relationship between teacher certification and educational credentials are related in an inconsistent manner. There are some positive significant effects but just as many negative significant effects. This analysis is not shown in this paper but is available from the author upon request.

Conclusions

Overall, these findings present a troubling picture about the relationship between teacher quality, as defined by NCLB, and mathematics and reading gains among early elementary students. In the regression model using mathematics assessment score as the dependent variable, the only significant relationships to the teacher quality variables were negative. But to put this in the context of the larger picture, most of the relationships were not significant. Out of 21 teacher quality relationships tested, only two were significant – and they were negative. In sum, the findings from this analysis suggest that teacher quality – at least as defined by NCLB and measured by ECLS-K – has no relationship to mathematics gains among early elementary students.

In terms of reading growth in these grades, there were an equally small number of significant relationships. Out of the four significant findings, half were negative, suggesting that there is no clear pattern to conclude that teacher quality variables were systematically related to gains in reading among early elementary children. To place another gloss on Tables 2 and 3, the analysis examined comparisons for three levels of schools for two subject areas, and seven NCLB measures of teacher quality, that is, that produced a total of 42 coefficients. Thirty six of these coefficients are null (most are not even close to being significant), four others are significant and negative. Given the size of the sample (which differs by grade 5,322 – 5,600), it is highly unlikely that any significant relationships between teacher quality and achievement have not been detected.

With respect to socio-emotional development and teacher quality, it may not be surprising that these measures of socio-emotional development would decrease during kindergarten and first grade. After all, individual attributes such as are measured here – self control, approaches to learning, interpersonal skills, reductions in inappropriate behavior and reduction in internalizing problems – might be expected to not change as children come to school in kindergarten and first grade where 'the rubber meets the road' and children may be too quickly expected to be exemplary citizens with a fine tuned degree of self control, a mature internal and external clock, a positive attitude toward learning, and a developed set of interpersonal skills.

Thus, within this context, it seems credible that a highly qualified teacher, specifically a teacher with high educational attainment might be even more likely than their counterparts to expect these behaviors to be enforced and competency in these areas. Of course, an optimist of the teacher education system might reasonably expect that certified and highly educated teachers more sensitive to the issues I note above. That is the manifest function of pre-service and in-service teacher education and of the policy makers who endorsed NCLB. But the ECLS-K data do not support this view.

The highly qualified teacher mandate by NCLB may be relevant to middle and high school teachers, but the findings of this paper seem to suggest less relevance to children in kindergarten, first and third grades. The data support this in terms of lack of relationship between teacher quality and cognitive achievement and socio-emotional development, as well as just about anything that the teacher does in the classroom related to mathematics and mathematics achievement.

The implementation of NCLB implies increased accountability of both teachers, and is manifested in the removal of teachers from schools who lack the credentials defined in the statute. This additional path of departure of teachers from the profession exacerbates an already persistent problem of teacher attrition.

Appendix A.

Descriptive statistics of variables used in regression models for Kindergarten

List of Variables	Minimum	Maximum	Mean	SD
Math score fall K	6.16	74.03	21.85	8.35
Reading score fall K	12.94	105.07	27.00	9.06
Math score spring K	7.33	85.03	32.28	10.88
Reading score spring K	14.69	124.40	38.48	12.19
SRS: self control fall K	1	4	3.16	.59
SRS: approaches to learning fall K	1	4	3.07	.65
SRS: interpersonal skills fall K	1	4	3.06	.62
SRS: externalizing problems fall K	1	4	3.43	6.07
SRS: internalizing problems fall K	1	4	3.49	.51
SRS: self control spring K	1	4	3.24	.60
SRS: approaches to learning spring K	1	4	3.18	.66
SRS: interpersonal skills spring K	1	4	3.18	.62
SRS: externalizing problems spring K	1	4	3.38	.62
SRS: internalizing problems spring K	1	4	3.46	.50
Temp/Prov certificate	0	1	.07	.25
Regular certificate	0	1	.21	.41
Highest certificate	0	1	.72	.45
Bachelor's degree	0	1	.26	.44
One year beyond BA	0	1	.32	.47
Master's degree	0	1	.35	.48
Education beyond MA	0	1	.07	.26
Early childhood cert.	0	1	.54	.50
Elementary ed cert.	0	1	.88	.32
Years experience at grade	1	30	9.44	7.62
Time (months) prior to school entry and assessment	-8.39	3.38	1.49	.68
Age (months) at assessment	57.69	82.38	67.30	3.93
Time (months) between assessments	3.91	8.58	6.09	.70
SES	-4.75	2.67	.01	.73
American Indian	0	1	.03	.16
Asian	0	1	.03	.17
Black	0	1	.14	.35
Hispanic	0	1	.12	.32
More than one race	0	1	.00	.048
Pacific Islander	0	1	.01	.099
White	0	1	.76	.430

Listwise number of cases = 5,454

Descriptive statistics of variables used in regression models for first grade

List of Variables	Minimum	Maximum	Mean	SD
Math score spring K	8.44	87.80	32.28	10.88
Reading score spring K	14.62	124.40	38.48	12.19
Math reading score spring 1st	9.12	102.60	56.02	14.95
Reading score spring 1st	17.71	141.36	69.07	18.74
SRS: self control spring K	1	4	3.24	.60
SRS: approaches to learning spring K	1	4	3.18	.66
SRS: interpersonal skills spring K	1	4	3.18	.62
SRS: externalizing problems spring K	1	4	3.38	.62
SRS: internalizing problems spring K	1	4	3.46	.50
SRS: self control spring 1st	1	4	3.22	.61
SRS: approaches to learning spring 1st	1	4	3.08	.70
SRS: interpersonal skills spring 1st	1	4	3.14	.64
SRS: externalizing problems spring 1st	1	4	3.37	.64
SRS: internalizing problems spring 1st	1	4	3.43	.50
Temp/Prov certificate	0	1	.07	.25
Regular certificate	0	1	.83	.37
Highest certificate	0	1	.10	.30
Bachelor's degree	0	1	.26	.44
One year beyond BA	0	1	.31	.46
Master's degree	0	1	.34	.47
Education beyond MA	0	1	.09	.28
Early childhood cert.	0	1	.29	.46
Elementary ed cert.	0	1	.94	.23
Years experience at grade	0	30	8.93	8.09
Years total experience	1	35	15.10	10.16
Age (months) at assessment	57.53	82.38	67.37	3.94
Time (months) between assessments	9.66	14..60	11.93	.64
SES	-4.75	2.67	.02	.74
American Indian	0	1	.03	.16
Asian	0	1	.30	.17
Black	0	1	.14	.35
Hispanic	0	1	.13	.33
More than one race	0	1	.00	.05
Pacific Islander	0	1	.01	.10
White	0	1	.75	.43
Listwise number of cases = 5,446				

Descriptive statistics of variables used in regression models for third grade

List of Variables	Minimum	Maximum	Mean	SD
Math reading score spring 1st	9.12	102.60	55.56	15.13
Reading score spring 1st	17.71	141.36	68.34	18.85
Math reading score spring 3rd	34.23	120.42	86.06	17.06
Reading score spring 3rd	42.63	148.95	108.84	19.15
SRS: self control spring 1st	1	4	3.23	.60
SRS: approaches to learning spring 1st	1	4	3.09	.69
SRS: interpersonal skills spring 1st	1	4	3.15	.63
SRS: externalizing problems spring 1st	1	4	3.38	.63
SRS: internalizing problems spring 1st	1	4	3.43	.50
SRS: self control spring 3rd	1	4	3.21	.61
SRS: approaches to learning spring 3rd	1	4	3.06	.67
SRS: interpersonal skills spring 3rd	1	4	3.09	.65
SRS: externalizing problems spring 3rd	1	4	3.31	.60
SRS: internalizing problems spring 3rd	1	4	3.37	.53
Temp/Prov certificate	0	1	.08	.27
Regular certificate	0	1	.82	.38
Highest certificate	0	1	.10	.30
Bachelor's degree	0	1	.25	.43
One year beyond BA	0	1	.30	.46
Master's degree	0	1	.36	.48
Education beyond MA	0	1	.08	.28
Early childhood cert.	0	1	.20	.40
Elementary ed cert.	0	1	.96	.19
Years experience at grade	1	27	7.87	7.20
Years total experience	1	35	14.99	10.19
Age (months) at assessment	57.53	81.69	67.26	3.91
Time (months) between assessments	21.40	25.94	23.83	.70
SES	-4.75	2.67	.02	.73
American Indian	0	1	.02	.15
Asian	0	1	.03	.17
Black	0	1	.13	.34
Hispanic	0	1	.14	.34
More than one race	0	1	.00	.05
Pacific Islander	0	1	.01	.10
White	0	1	.76	.43

Listwise number of cases = 5,309

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