Abstract Title Page
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Title: Effects of Teacher Credentials, Coursework, and Certification on Student Achievement in Math and Reading in Kindergarten: An ECLS-K Study

Author(s):

James A. Leak
Department of Education
University of California, Irvine

George Farkas
Department of Education
University of California, Irvine

Abstract Body

Limit 5 pages single spaced.

Background / Context:

Description of prior research and its intellectual context.

Kindergarten is the first time many U.S. children experience a classroom setting with a sharp instructional focus. Moreover, kindergarten performance has proven to be a key predictor of outcomes later in a child's educational trajectory (Claessens, Duncan, and Engel, 2009; LaParo & Pianta, 2000). The fact that the beginning of a child's school career is so important to later educational outcomes makes it essential that children have quality teachers that can positively affect their achievement growth in during kindergarten (Darling-Hammond 2000; Hanushek & Rivkin, 2006).

The goal of efforts by the federal government to increase teacher quality is ultimately to boost student achievement, and many studies have linked teacher quality to student achievement (Darling-Hammond, 2000; Hanushek, 1971; Nye, Konstantopolous, & Hedges, 2004; Wayne & Youngs, 2003; Rothstein 2007). It has also been shown that teachers can have significant effects in producing gains in reading and math achievement early on in a child's formal education (Rivkin, Hanushek, & Kain, 2005; Guarino, Hamilton, Lockwood, & Rathbun, 2006).

While teacher educational background characteristics may vary across the country, they are easier to identify and measure than other, more abstract indicators of teacher quality. Degree level, coursework, and certification level are all aspects that have been looked at as components of teacher quality that could help to explain changes in student achievement. Degree level signals time that teachers have spent learning content knowledge and pedagogical skills, coursework shows the development of content knowledge in a specific area, and certification shows that teachers have met certain standards that are accepted and agreed upon by administrators, researchers, and expert teachers.

There is an implicit understanding that teachers who have high qualifications and educational backgrounds will be high quality teachers that produce student achievement gains and promote student learning. High qualifications are signals to administrators that a teacher has invested time in being trained, and that she has the necessary skills to be an effective teacher. However, research on teacher educational background characteristics and their effects on student achievement is mixed (Clotfelter, Ladd, and Vigdor,2007; Croninger, Rice, Rathbun, and Nishio, 2007; Goldhaber and Brewer, 2000), and lacking, especially in the case of Kindergarten, which is an important, formative time in a child's educational career. It is unclear whether these measures of teacher quality actually promote student achievement gains, even when controlling for factors that account for the non-random assignment of children to teachers and other teacher characteristics such as age and years of experience.

In light of the strong correlation between Kindergarten performance and later cognitive and achievement outcomes, this paper investigates the link between student achievement and the educational background characteristics of Kindergarten teachers.

Purpose / Objective / Research Question / Focus of Study:

Description of the focus of the research.

This study will utilize the Early Childhood Longitudinal Study Kindergarten Cohort (ECLS-K), a nationally representative dataset, in order to address the following questions:

1) Does a teacher having a master's degree or higher have a positive effect on student achievement gains in reading and math in kindergarten compared to teachers with only a bachelor's degree?
2) Are there effects of teacher coursework in reading, math, and child development on student achievement gains in kindergarten? If so, do impacts of coursework on reading and math scores vary by number of courses taken?
3) Do regular and highest certification levels for teachers have a different effect on student achievement gains than no certification or alternative certification? Does being certified as an early elementary school teacher matter for student achievement?

Additionally, this study will analyze students who score in the bottom 25% of all students on the initial tests of reading and math to see whether teacher educational background characteristics make a differential impact on students that begin school at the bottom of the achievement spectrum.

Setting:
Description of the research location.

The Early Childhood Longitudinal Study Kindergarten cohort (ECLS-K) is a nationally representative sample of students starting at Kindergarten and followed throughout their school years. Random sampling occurred in different regions around the country, schools within regions, and students and teachers within schools.

Population / Participants / Subjects:
Description of the participants in the study: who, how many, key features or characteristics.

The ECLS-K started to track students in the 1998-1999 school year and tracks them through eighth grade. However, for the purposes of this study, the data will only be looked at for the Kindergarten year of 1998-1999 where tests and surveys were administered in the Fall of 1998 and Spring of 1999. Initially 21,260 children were selected to participate in the study, which decreased to 17,487 by the time of data collection.

As a result of the vast amount of data collected by the ECLS-K it is rare that participants have full data on all of the measures. As a result, in order to insure an adequate sample size, an adjustment using dummy variables for missing values of several control variables was applied to the regression models. However, to try to insure that imputation was not relied on too heavily, individuals were required to have full data on the teacher educational background characteristics of interest variables such as race, gender, SES, test scores for fall and spring of Kindergarten. If individuals were missing any of these key variables they were dropped from the sample. The resulting sample used for this analysis consisted of 16,138 Kindergarten students. See Table 1 for descriptive statistics on the sample.

Intervention / Program / Practice:
Description of the intervention, program or practice, including details of administration and duration.

ECLS-K data collectors administered surveys to teachers in the fall of 1998 when children were entering Kindergarten. Additionally surveys and test of achievement in reading and math were administered to children and their families in the fall of 1998 and spring of 1999.

Research Design:
Description of research design (e.g., qualitative case study, quasi-experimental design, secondary analysis, analytic essay, randomized field trial).

This study utilizes a quasi-experimental design to try and better understand the effects of teacher credentials, coursework, and certification on student achievement in Kindergarten. This study uses OLS regression and fixed effects models to estimate the effects of teacher educational background characteristics on student achievement in Kindergarten.

Data Collection and Analysis:
Description of the methods for collecting and analyzing data.

Variables

Student level variables include demographic variables, prior test scores, measures of a child's home environment, attention, and social skills. Teacher level control variables include years teaching, age, gender, and race. School level variables include public or private school, full or half-day Kindergarten program, racial composition of school, and number of students on Free and Reduced lunch. Variables for teacher educational background characteristics including degree level, coursework, and certification are the key independent variables of interest. The dependent variables for this study consist of reading and math IRT scale scores from the spring of 1999 (See Table 1).

Models

In this study, regression analysis is used to answer the key questions surrounding teacher background characteristics and their effects on student achievement. A lagged model is used for all analyses where the spring IRT test score in math or reading is the dependent variable and the fall IRT test score in math or reading is added as a key control variable. Also, included in analyses are controls for student, school, and teacher characteristics. In Table 2 and Table 3, Model 1 only includes student and school level controls. School level controls are included in models, but listed in Table 1. Models 1 and 2 are represented by the following equation:

$$Y_i \text{ (IRT Test Scores)} = B_{0i} + B_1(\text{Control Variables})_i + B_2(\text{Teacher Educational Characteristics})_i + \boldsymbol{a_i} + u_i$$

where…

Y_i is IRT Reading and Math Scores
B_0 is a constant
B_1 stands for all of the control variables including the lagged test scores
B_2 are the teacher educational background characteristics of interest
u_i is an error term

For all other models, complete student, school, and teacher level controls are included, unless noted to be school fixed effects models. Models 3 and 4 replace the school controls with a school fixed effects model. The school fixed effects model is incorporated to capture the variation within schools and account for possible unobserved characteristics within schools. All

coefficients are standardized for ease of comparison. Models 3 and 4 are represented by the following equation:

$$Y_i \text{ (IRT Test Scores)} = B_{0i} + B_1(\text{Control Variables})_i + B_2(\text{Teacher Educational Characteristics})_i + \boldsymbol{a_i} + u_i$$

a_i is a school fixed effects term to account for unobserved time invariant characteristics of schools

Models incorporating school-level variables and school fixed effects provide two approaches to isolating the effects of teacher educational background characteristics on student achievement. The school-level variables approach enables us to test specific characteristics that may influence effects of teacher characteristics on student achievement gains, while the school fixed effects approach enables us to eliminate the confounding effects of unchanging, unobserved characteristics that may confound estimated effects of teacher education on student achievement gains.

Findings / Results/ Conclusions:

Description of the main findings with specific details. / Description of conclusions, recommendations, and limitations based on findings.

This study explores the relationship between teacher educational background characteristics and student achievement in Kindergarten in reading and math. The ECLS-K dataset provided a nationally representative sample of students and teachers. While this study cannot go so far as to make causal inferences, there are a few significant associations between teacher background characteristics and student achievement outcomes.

The findings of this study suggest that most teacher credentials, or degrees, appear to have little impact on student achievement in reading or math in Kindergarten with some small significant effects (See Tables 2 and 3). This is consistent with the findings of others (Darling-Hammond, Berry, and Thoreson, 2001; Goldhaber and Brewer 1997). However, some previous studies such as Clotfelter, Ladd, and Vigdor (2007a) actually found negative effects of high-level degrees on student achievement, which was not the case in this study.

The quantity of teacher coursework had mixed effects on student achievement (See Table 4). Teacher coursework in reading had no significant effects on student test scores in reading, while teacher coursework in child development appears to have positive effects on reading test scores in Kindergarten. The effects of child development coursework are consistent with Pianta, et al. (1999) and the relationship they found between teacher knowledge of child development and student achievement. However, the non-effects of increased teacher reading courses on student reading achievement are puzzling. Perhaps some teachers did not understand which courses were reading when answering the survey for the ECLS-K; alternatively, perhaps they were taught techniques in reading courses that were counterproductive to teaching reading at the Kindergarten level. Once again, there may be an issue of selection bias where less skilled teachers are completing more reading courses.

Regarding math achievement, teacher coursework in math and child development appeared to have no significant effects on math test scores. While the school level variable model does show significant results for math courses on student achievement, the school fixed effects model does not, suggesting that there are unobserved characteristics of schools that are not being accounted for in the school-level variable model. These findings are consistent with

Croninger, et al. (2007) findings of no effects of teacher coursework on math achievement. The findings also suggest that the math and child development courses taken by kindergarten teachers are need improvement. Perhaps math courses in teacher education programs are not useful for kindergarten teachers if teachers from many grades are taught together.

Teacher certification also appears to have a mixed effect on student achievement (See Table 5). Highest and temporary levels of certification appear to have a negative effect on reading and math test scores. However, the fixed effects models show no effects of highest or temporary certification on reading and math, but the direction of the coefficient is still negative. The findings also suggest that alternative certification has no effect on math scores, which contradicts the findings of Lutz and Hutton (1989).

Elementary certification has a significant positive effect on student math scores. Certification in other education levels may not touch upon aspects of behavior, development, and other skills that are especially important in Kindergarten. This relationship of elementary education certification and math should be explored further to help identify the aspects of elementary education certification that may have an impact on teaching students math in Kindergarten.

The mixed results regarding certification are to be taken with some caution, as there are different policies for certification across states. State certification is separate from National Board certification, for example, and can differ greatly in rigor. A potential analysis would be to group teachers by state and evaluate the policies for certification across states. However, the findings of this study are not wholly inconsistent with other studies in showing minimal impacts of certification.

Focusing on those students in the bottom 25th percentile in reading or math, teacher educational background characteristics failed to show any significant differential effects for this group. This is troubling, since these students need the most help.

The school fixed effects models suggest that some findings regarding teacher educational background characteristics may be the result of unobserved characteristics of the school. One possible explanation for the difference in the school-level control models and the school fixed effects models is that the school fixed effects models better capture non-random assignment of students to teachers. Despite the loss of significant findings in the area of teacher certification, the school fixed effects models still show similar direction of effects. Of course, while they are reliable for kindergarten, these findings cannot be generalized to other grade levels.

This study is one of the first to show the effects of teacher degree levels, coursework and certification on student achievement in Kindergarten across a national dataset. While it is important to continue research in this area, these findings present a good starting place for research on this topic in Kindergarten.

Appendices

Not included in page count.

Appendix A. References

References are to be in APA version 6 format.

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Appendix B. Tables and Figures

Not included in page count.

Table 1: Descriptive Statistics

	M	SD
Test Scores:		
Reading		
Fall K Reading	22.58	8.58
Spring K Reading	32.55	10.39
Math		
Fall K Math	20.00	7.34
Spring K Math	28.22	8.75
Student Level Variables:		
Race		
White	0.61	0.49
Black	0.16	0.36
Hispanic	0.13	0.34
Asian	0.05	0.21
Other	0.05	0.23
Other Demographic and Family Characteristics		
Male	0.51	0.49
Bottom 20% SES	0.15	0.35
Age of Entry into Kindergarten (in months)	65.60	4.25
Mother's Age	33.41	6.57
Father's Age	36.38	6.90
Family Income (in dollars)	54784.15	56988.80
Mother Employed	0.65	0.47
Father Employed	0.71	0.45
Single Parent Household	0.25	0.43
Attended Pre-K	0.58	0.49
Child Received WIC Benefits	0.40	0.49
Family Received AFDC/TANF assistance in last 12 months	0.10	0.29
Family Speaks Language other than English in Home	0.08	0.26
Parent Reads Child Books	0.98	0.09
Number of Books in Home	78.06	59.47

Table 1: Descriptive Statistics (Continued)

	M	SD
Teacher Ratings of Student Behavior		
Approaches to Learning (Attention)	2.99	0.67
Self-Control	3.08	0.61
Interpersonal Skills	2.99	0.62
Externalizing Behavior	1.62	0.63
Internalizing Behavior	1.53	0.52
School Level Variables:		
Public School	0.77	0.42
Large School	0.43	0.49
25% or > Minority Students in School	0.46	0.50
Full Day School	0.56	0.49
% Free Lunch	0.28	0.27
Teacher Level Variables:		
Years Teaching Kindergarten	9.19	7.72
Minority Teacher	0.15	0.35
Teacher Age (yrs)	41.79	9.36
Male Teacher	0.02	0.12
Teacher Degree Level:		
Credential	0.30	0.45
Masters or higher	0.31	0.46

Table 1: Descriptive Statistics (Continued)

	M	SD
Teacher Courses:		
Reading		
No Courses	0.03	0.15
1 to 2 Courses	0.40	0.48
3 to 5 Courses	0.33	0.46
6 or More Courses	0.24	0.40
Math		
No Courses	0.05	0.20
1 to 2 Courses	0.48	0.49
3 to 5 Courses	0.30	0.45
6 or More Courses	0.17	0.32
Child Development		
No Courses	0.03	0.13
1 to 2 Courses	0.37	0.46
3 to 5 Courses	0.35	0.46
6 or More Courses	0.25	0.43
Teacher Certification Types:		
No Certification	0.03	0.16
Temporary Certification	0.09	0.28
Alternative Certification	0.03	0.12
Regular Certification	0.22	0.41
Highest Certification	0.63	0.49
Elementary Education Certification	0.80	0.40

Table 2: Regression Coefficients for Credentials and Masters Effects on Math Scores

	(1)	(2)	(3)	(4)
Spring K Math Score				
Fall K Math Score	0.721***	0.721***	0.702***	0.702***
	(0.006)	(0.006)	(0.006)	(0.006)
Male	0.054***	0.054***	0.067***	0.067***
	(0.009)	(0.009)	(0.009)	(0.009)
Black	-0.170***	-0.167***	-0.122***	-0.122***
	(0.015)	(0.015)	(0.018)	(0.018)
Hispanic	-0.033*	-0.033*	-0.047**	-0.047**
	(0.015)	(0.015)	(0.017)	(0.017)
Asian	0.040	0.041	0.013	0.013
	(0.023)	(0.023)	(0.024)	(0.024)
Other	-0.050*	-0.049*	-0.046*	-0.046*
	(0.020)	(0.020)	(0.022)	(0.022)
Bottom 20% SES	-0.069***	-0.069***	-0.057***	-0.057***
	(0.014)	(0.014)	(0.014)	(0.014)
Years Teaching K		-0.012*		-0.008
		(0.005)		(0.007)
Minority Teacher		-0.020		0.001
		(0.014)		(0.019)
Teacher Age		0.007		0.003
		(0.005)		(0.007)
Male Teacher		-0.093**		-0.024
		(0.030)		(0.049)
Credential		0.011		-0.003
		(0.011)		(0.016)
Masters or higher		0.008		0.026
		(0.011)		(0.016)
w/ School Controls	X	X	----	----
w/School Fixed Effects	----	----	X	X
_cons	-0.124**	-0.128**	-0.064	-0.070
	(0.045)	(0.045)	(0.052)	(0.052)
N	16138	16138	16138	16138
R^2	0.685	0.685	0.643	0.643
Rho	----	----	0.197	0.197

Standard errors in parentheses. Full sets of student controls are included in all models. For a full list of student controls see Table 1. School controls are included in Models 1 and 2. See Table I for a full list.
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 3: Regression Coefficients for Credentials and Masters Effects on Reading Scores

	(1)	(2)	(3)	(4)
Spring K Reading Score				
Fall K Reading Score	0.739***	0.739***	0.716***	0.716***
	(0.006)	(0.006)	(0.005)	(0.005)
Male	-0.038***	-0.038***	-0.027**	-0.027**
	(0.009)	(0.009)	(0.009)	(0.009)
Black	-0.110***	-0.107***	-0.064***	-0.063***
	(0.016)	(0.017)	(0.018)	(0.018)
Hispanic	0.028	0.028	-0.005	-0.005
	(0.016)	(0.016)	(0.017)	(0.017)
Asian	0.165***	0.165***	0.103***	0.102***
	(0.026)	(0.026)	(0.024)	(0.024)
Other	-0.033	-0.031	-0.024	-0.025
	(0.021)	(0.021)	(0.023)	(0.023)
Bottom 20% SES	-0.088***	-0.087***	-0.067***	-0.067***
	(0.015)	(0.015)	(0.014)	(0.014)
Years Teaching K		-0.002		0.001
		(0.005)		(0.007)
Minority Teacher		-0.018		-0.006
		(0.015)		(0.020)
Teacher Age		0.011		0.012
		(0.006)		(0.008)
Male Teacher		0.036		-0.023
		(0.039)		(0.049)
Credential		0.003		-0.010
		(0.011)		(0.016)
Masters or higher		0.001		0.020
		(0.011)		(0.017)
w/ School Controls	X	X	----	----
w/School Fixed Effects	----	-----	X	X
_cons	-0.114*	-0.115*	0.017	0.016
	(0.055)	(0.055)	(0.053)	(0.053)
N	16138	16138	16138	16138
R^2	0.667	0.667	0.640	0.640
Rho	----	----	0.252	0.252

Standard errors in parentheses. Full sets of student controls are included in all models. For a full list of student controls see Table 1. School controls are included in Models 1 and 2. See Table I for a full list.
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 4: Regression Coefficients for Teacher Reading, Math, and Child Development Courses Effects on Kindergarten Students for Reading and Math

	Spring of Kindergarten Reading Test Scores (w/School Controls)	Spring of Kindergarten Reading Test Scores (w/ School Fixed Effects)	Spring of Kindergarten Math Test Scores (w/ School Controls)	Spring of Kindergarten Math Test Scores (w/ School Fixed Effects)
Teacher Reading Courses				
1 to 2 Courses	0.016 (0.020)	-0.041 (0.030)	--------	--------
3 to 5 Courses	-0.001 (0.020)	-0.045 (0.030)	--------	--------
6 or More Courses	-0.020 (0.022)	-0.054 (0.031)	--------	--------
Teacher Math Courses				
1 to 2 Courses	--------	--------	0.025 (0.017)	0.001 (0.025)
3 to 5 Courses	--------	--------	0.038* (0.018)	-0.019 (0.027)
6 or More Courses	--------	--------	0.042* (0.021)	-0.006 (0.030)
Teacher Child Development Courses				
1 to 2 Courses	-0.002 (0.020)	0.074** (0.028)	-0.004 (0.018)	0.033 (0.026)
3 to 5 Courses	0.018 (0.020)	0.065* (0.028)	-0.019 (0.018)	0.015 (0.026)
6 or More Courses	0.024 (0.021)	0.053 (0.029)	-0.034 (0.019)	0.015 (0.027)
School Fixed Effects	--------	Yes	--------	Yes

Note: All of the controls used in the previous regression in model 2 of Table 2 are used in this analysis. Reference Groups are No courses taken. Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Regression Coefficients for Teacher Certification Levels and Types

	Spring of Kindergarten Reading Test Scores (w/ School Controls)	Spring of Kindergarten Reading Test Scores (w/ School Fixed Effects	Spring of Kindergarten Math Test Scores (w/School Controls)	Spring of Kindergarten Math Test Scores (w/ School Fixed Effects)
Levels of Certification				
Temporary Certification	-0.051* (0.024)	-0.042 (0.034)	-0.051* (0.022)	0.049 (0.034)
Alternative Certification	-0.038 (0.045)	0.015 (0.064)	-0.052 (0.041)	0.012 (0.063)
Regular Certification	-0.046* (0.020)	-0.006 (0.030)	-0.033 (0.019)	0.029 (0.030)
Highest Certification	-0.068*** (0.019)	-0.033 (0.028)	-0.047** (0.018)	-0.008 (0.028)
Types of Certification				
Elementary Education Certification	0.020 (0.012)	0.013 (0.017)	0.049*** (0.012)	0.043* (0.017)
School Fixed Effects		Yes		Yes

Note: All of the controls used in the previous regression in model 2 of Table 2 are used in this analysis. Reference Groups are "No Certification" and Non-Elementary Certification. Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$